SM1540-D
SM7020-D
SM3004-D

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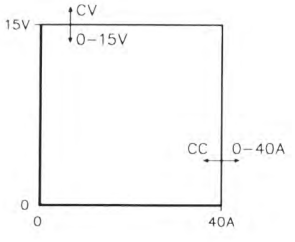
CE

SWITCHED MODE DC POWER SUPPLIES

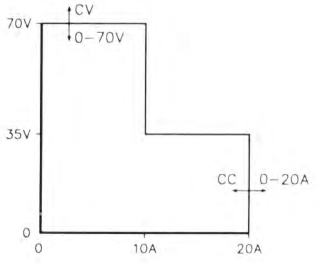
SM 1540-D

* **600 W**
* **0 - 15 V 0 - 40 A**



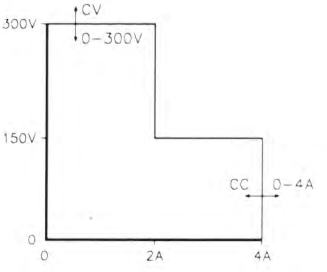
SM 7020-D

* **700 W**
* **AUTORANGING**
  0 - 35 V 0 - 20 A
  35 - 70 V 0 - 10 A



SM 3004-D

* **600 W**
* **AUTORANGING**
  0 - 150 V 0 - 4 A
  150 - 300 V 0 - 2 A



- 100 kHz power conversion technique.
- Efficiency 90 %.
- Weight only 7.4 kgs.
- Natural convection cooling, no blower, no noise.
- Designed for long life at full power
- Remote programming of voltage and current by analog voltages 0 - 5 V.
- **IEEE 488** or **RS232** programming with external interface PSC 44M or PSC232 (pin compatible).
- Master / Slave parallel and series operation with equal current and voltage sharing.
- Input / output insulation 3750 V rms.
- 10 turn potentiometers, 0.03% resolution
- 48 hours burn-in

	SM 1540-D	SM 7020-D	SM 3004-D
Output			
voltage range	0 - 15 V	0 - 70 V	0 - 300 V
current range	0 - 40 A	0 - 20 A	0 - 4 A
max. output power	600 W	700 W	600 W
AUTORANGING (2 ranges)	no	yes	yes
max. output **current** / volt. range	40 A / 0 - 15 V -	20 A / 0 - 35 V 10 A / 35 - 70 V	4 A / 0 - 150 V 2 A / 150 - 300 V
Input			
AC input, 50 - 60 Hz 110 V range	90 - 132 V	95 - 132 V	95 - 132 V
230 V range	185 - 265 V	192 - 265 V	192 - 265 V
current (110 V AC)	8.4 A rms	9.6 A rms	8.3 A rms
current (230 V AC)	3.9 A rms	4.5 A rms	3.9 A rms
DC input	215 - 350 V	215 - 350 V	220 - 350 V
fuses 230 / 110 V	8 AT / 16 AT	8 AT / 16 AT	8 AT / 16 AT
standby input power (V_o=I_o=0)	7.5 W	7.5 W	7.5 W
standby input power (V_o=$V_{max.}$)	13.5 W	16.5 W	21.5 W
Efficiency			
DC input, full load	88 %	90 %	90 %
AC input, full load	87 %	89 %	88 %
Regulation			
Load 0 - 100% **CV**	5 mV	5 mV	20 mV
Line 190 - 265 V AC **CV**	5 mV	5 mV	20 mV
Load 0 - 100% **CC**	25 mA	12 mA	3 mA
Line 190 - 265 V AC **CC**	25 mA	12 mA	3 mA
Ripple + noise, rms / p-p **CV**	2 / 10 mV	3 / 15 mV	10 / 50 mV
CC	10 / 25 mA	5 / 15 mA	1 / 3 m A
Temp. coeff., per °C **CV**	5.10^{-5}		
CC	1.10^{-4}		
Stability			
during 8 hrs after **CV**	3.10^{-4}		
1hr warm-up and t_{amb} = 25 ± 1 °C **CC**	1.10^{-3}		

Analog Programming	**CV**	**CC**
Programming inputs		
input range	0 - 5 V	0 - 5 V
accuracy	± 0.2% + 0 mV ... + 8 mV	± 0.5% + 0 mV ... + 20 mV
temp. coeff. offset	10 µV / °C	150 µV / °C
input impedance	1 MOhm	1 MOhm
Monitoring output		
output range	0 - 5 V	0 - 5 V
accuracy	± 0.2% − 3 mV ... + 11 mV	± 0.5% − 5 mV ... + 0 mV
temp. coeff. offset	10 µV / °C	150 µV / °C
output impedance	20 Ohm	20 Ohm

Reference voltage	
on prog. connector V_{ref}	5.165 ± 31 mV
TC	typical 12 ppm / max. 30 ppm
Status outputs	
CC-status	5V / 10 mA = logic 1
OVP-status	5V / 10 mA = logic 1
Remote shutdown	with + 5V or relay contact

Programming speed	SM 1540-D		SM 7020-D		SM 3004-D	
programming UP						
settling within	50 mV	500 mV	50 mV	1 V	200 mV	5 V
output voltage step	0 → 15 V	0 → 15 V	0 → 35 V	0 → 35 V	0 → 150 V	0 → 150 V
time, (100 % load)	30 ms	18 ms	50 ms	12 ms	50 ms	14 ms
time, (10 % load)	30 ms	10 ms	50 ms	12 ms	40 ms	12 ms
output voltage step	-	-	0 → 70 V	0 → 70 V	0 → 300 V	0 → 300 V
time, (100 % load)	-	-	100 ms	40 ms	100 ms	60 ms
time, (10 % load)	-	-	100 ms	12 ms	60 ms	16 ms
programming DOWN						
settling within	50 mV	500 mV	50 mV	1 V	200 mV	5 V
output voltage step	15 → 0.5 V	15 → 0.5 V	35 → 2 V	35 → 2 V	150 → 10 V	150 → 10 V
time, (100 % load)	30 ms	20 ms	50 ms	10 ms	50 ms	14 ms
time, (10 % load)	200 ms	200 ms	200 ms	100 ms	180 ms	120 ms
output voltage step	-	-	70 → 2 V	70 → 2 V	300 → 10 V	300 → 10 V
time, (100 % load)	-	-	100 ms	55 ms	100 ms	70 ms
time, (10 % load)	-	-	800 ms	120 ms	800 ms	700 ms
Programming bandwidth						
small signal	50 Hz		50 Hz		50 Hz	
large signal, 100 % load	50 Hz		50 Hz		50 Hz	
large signal, 10 % load	5 Hz		5 Hz		5 Hz	

	SM 1540-D	SM 7020-D	SM 3004-D
Recovery time			
recovery within	50 mV	50 mV	300 mV
di/dt of load step	4 A/µs	2 A/µs	0.5 A/µs
time, @ 50 - 100% load step	100 µs	150 µs	100 µs
max. deviation (high / low outp. range)	200 mV	80 / 150 mV	450 / 900 mV
Noise suppression			
line - line ⇒ output	88 dB	82 dB	75 dB
line - earth ⇒ output	88 dB	88 dB	75 dB
Output impedance			
CV, 0-100 kHz	< 40 mOhm	< 60 mOhm	< 700 mOhm
Pulsating load			
max. tolerable AC component of load current			
f > 1 kHz	10 A rms	5 A rms	1 A rms
f < 1 kHz	40 A peak	20 / 10 A peak	4 / 2 A peak

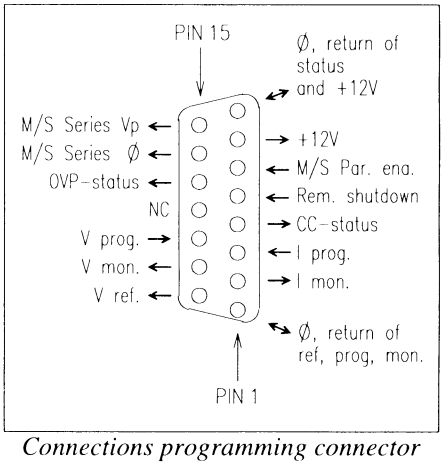
Insulation	
input / output	3750 Vrms (1 min.)
creepage / clearance	8 mm
input / case	2500 Vrms (1 min.)
output / case	600 V DC
Safety	EN 60950 / IEC 1010
EMC **Emission**	**EN50081-1**, EN55022B, VDE 0871B, EN61000-3-2, EN61000-3-3
Immunity	**EN50082-1, EN50082-2**, EN61000-4-2-lv3, EN61000-4-4-lv4, ENV50140-lv3, ENV50141-lv3, ENV50204-lv3, EN61000-4-5-lv3-diff-mode-on-output, EN61000-4-5-lv2-comm-mode-on-output, EN61000-4-5-lv4-on-input, EN61000-4-11 (lv=level)
Operating Temperature at full load	– 20 to + 50 °C
Humidity	max. 95% RH, non condensing, up to 40 °C max. 75% RH, non condensing, up to 50 °C
Storage temperature	– 40 to + 85 °C
Thermal protection	Output shuts down in case of insufficient cooling
MTBF	500 000 hrs

Hold-Up time	
100% load Vin = 220V AC	20 ms
50% load Vin = 220V AC	45 ms
Turn on delay	
after mains switch on	500 ms
Inrush current	30 A @ 230V AC input

	SM 1540-D	SM 7020-D	SM 3004-D
Series operation			
max. total voltage	600 V	600 V	600 V
Master / Slave operation	yes	yes	yes
Parallel operation			
max. total current	no limit	no limit	no limit
Master / Slave operation	yes	yes	yes
Remote sensing			
max. voltage drop per load lead	2 V	2 V	not available
OVP			
trip range	0 - 17 V	0 - 80 V	0 - 350 V

Potentiometers			
front panel control with knobs	standard	standard	standard
resolution	0.03 %	0.03 %	0.03 %
screwdriver adjustment			
at front panel	option P001	option P001	option P001
at rear panel	option P002	option P002	option P002
Meters			
digital	digital / 3.5 digit	digital / 3.5 digit	digital / 3.5 digit
scale voltage / current	0 - 15.00 V / 0 - 40.0 A	0 - 70.0V / 0 - 20.0 A	0 - 300 V / 0 - 4.00 A
accuracy	0.5% + 2 digits	0.5% + 2 digits	0.5% + 2 digits

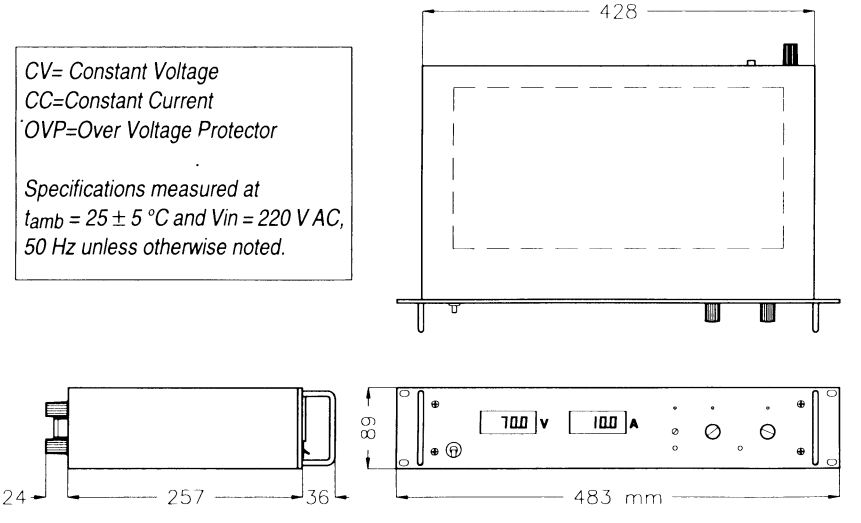
Input Terminals	10 Amp / 65 °C Euro-connector		
input connections	at rear panel		
Output Terminals			
at rear panel	M8 bolts	6 mm bind post	4 mm bind post
Programming connector	15 pole D-connector at rear panel		
Cooling	convection cooling		
Enclosure			
degree of protection	IP20		
Dimensions			
behind front panel	428 x 89 x 257 mm		
front panel	483 x 89 mm (19", 2 U)		
Weight	7.4 kg		



Connections programming connector

CV= Constant Voltage
CC=Constant Current
OVP=Over Voltage Protector

Specifications measured at
t_{amb} = 25 ± 5 °C and Vin = 220 V AC, 50 Hz unless otherwise noted.



DESCRIPTIONS

1) OUTPUT

The SM7020-D and SM3004-D feature an AUTORANGING faciliy where the power supply automatically switches over between two current ranges. This switching, which is unnoticeable the user, results in a versatile power supply with **twice the output voltage range**. This means for the SM7020-D: the maximum output power (700W) is available at both 35V and 70V. For the SM3004-D: 600W at both 150V and 300V. Fig. 2 - 1 shows the output ranges.

Note: the voltage and current settings will never be altered by the AUTORANGING, only the maximum attainable current will change. E.g. on the SM3004-D, with an initial setting of 1.5A. When the voltage is decreased from 200V to 150V the max. current output remains 1.5A as originally set.

◦ DISPLAY CV/CC SETTING FUNCTION

The setting of the voltage and current control can be observed on the front panel meters by pressing the Display CV/CC Setting button. This allows the current limit to be set when operating in the CV mode without shorting the output terminals, and the voltage limit to be set when operating in the CC mode without opening the load leads.

◦ 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. The 2 ranges (110V / 220V) are selectable with a switch on the rearpanel, see fig. 2 - 2. In the 220V position the units can also be used as a DC/DC converter.

◦ nonstandard line input voltage

The units will still operate at a line input voltage lower than standard, but with a reduction in output power. Fig. 2 - 3 shows the max. output current as a function of output voltage with AC or DC line input voltage as a parameter.
Example: When the required output voltage is 12.5 V at a line input voltage of 150 V AC.
Fig. 2 - 4 shows the maximum current for the SM1540-D to be 32.8 A.

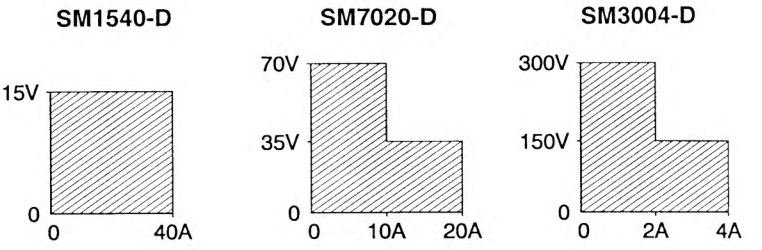


fig. 2 - 1
the output ranges
every point in hatched area can be used

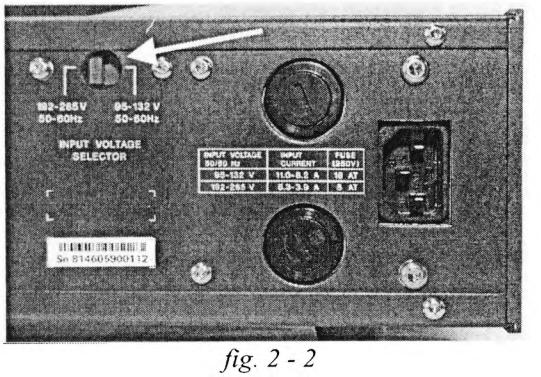
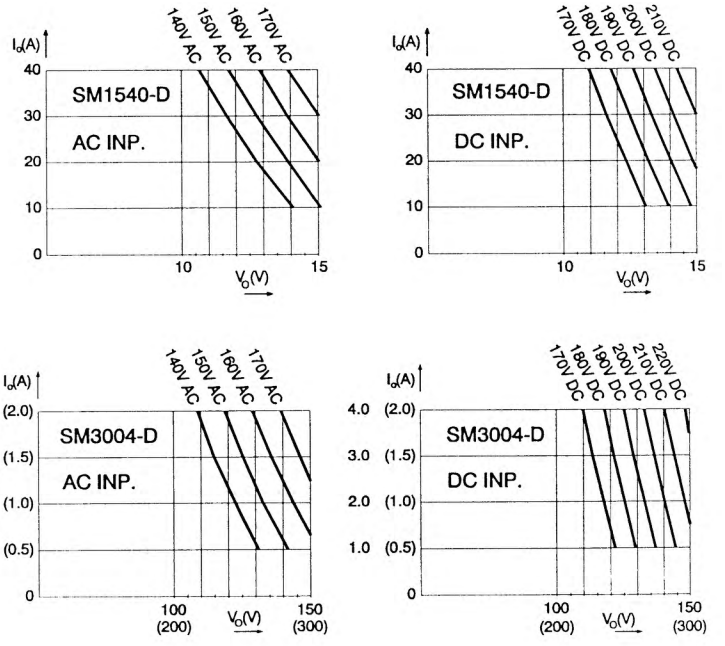


fig. 2 - 2
input voltage selector at rearpanel



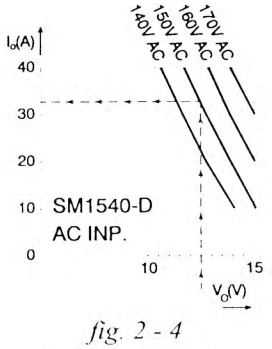


fig. 2 - 4
example how to use the graph

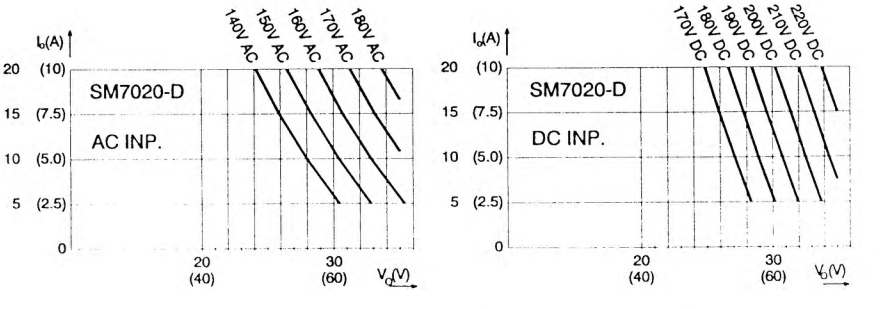


fig. 2 - 3
max. output current vs output voltage with AC or DC line input voltage as a parameter

3) INPUT CURRENT

The input circuit has a large series choke to improve the waveform. The result is: a lower rms input current, less mains distortion and no large peak currents. The units also have an inrush current limiter and a soft start circuit, for smooth switch on.

- FUSES- At 220V: 8A Slow blow, at 110V: 16A Slow blow.

4) STANDBY INPUT POWER

The unit consumes very little power when in standby. This makes it possible to leave the input power on and use the Remote ShutDown input (pin 5 on prog. connector rear panel) to disable the output.

5) EFFICIENCY

The efficiency is very high and constant over a wide output current range, see fig. 2 - 5. High efficiency also means low power loss and low heat generation.

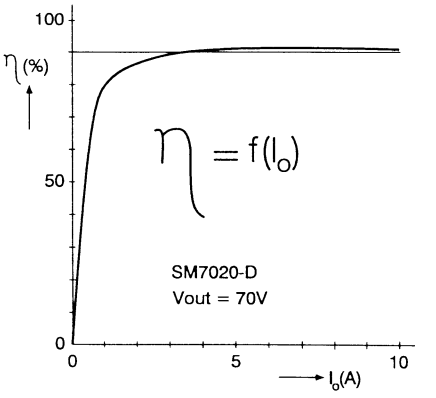


fig. 2 - 5
efficiency vc output current, SM7020-D DC input, Vout = 70 V

6) REGULATION

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

7) 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. 2 - 6 and fig. 2 - 7.

- LOW TEMPERATURE

At –20 °C the CV ripple increases to the following values:

	SM1540-D	SM7020-D	SM3004-D
CV ripple (rms/pp) @ –20 °C	6 / 20 mV	10 / 35 mV	no change

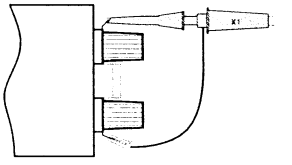


fig. 2 - 6
measuring ripple voltage WRONG !

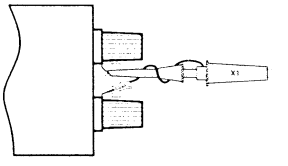


fig. 2 - 7
measuring ripple voltage RIGHT !

8) PROGRAMMING INPUTS

The output voltage and current can be programmed by an external analog voltage. This programming is very accurate and linear, (non-linearity < 0.15 %). The levels are all standardised on 5V. Always use a **shielded cable** for programming.

The inputs have a protection circuit formed by a series resistor and a parallel zener, see fig. 2 - 8. The capacitor limits the speed to a safe value. Note that the analog inputs (and outputs) are **not floating, but the common is connected to the negative output terminal.** Wrong connection of Ø can cause earth loops which can trip the fuse. After removing the fault, the fuse will reset (PTC-fuse). To prevent earth loops, use isolated programming with the **ISO AMP MODULE (δ-product).**

The programming mode (program and manual) can be selected by means of the prog. switches which are situated below the programming connector, see fig. 2 - 10.

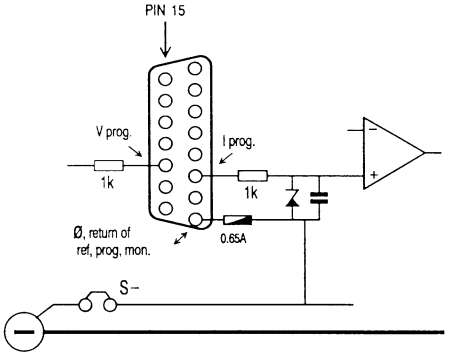


fig. 2 - 8
programming inputs (internal circuit)

9) IEEE 488 / RS232 PROGRAMMING

The prog. connector on the power supply is both pin and level compatible with the external interfaces **PSC44M** and **PSC232 (both δ-products).**

Voltage and current can easily be programmed and read back, also the CC and OVP status can be read by the computer. Always use a **shielded cable** for programming.

10) MONITORING OUTPUTS

The monitor outputs give a voltage 0 - 5 V proportional to the output current or voltage. The output current can easily be measured without an external shunt using the I monitor, see fig. 2 - 9. The monitor outputs are buffered by op-amp's and protected by series resistors and parallel zeners see fig. 2 - 11. The table in fig. 2 - 12 shows the impedance levels of the monitoring outputs.

Note: in case of a **pulsating load**, the I monitor voltage will not exactly

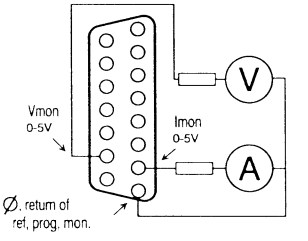


fig. 2 - 9
external meters using monitor outputs

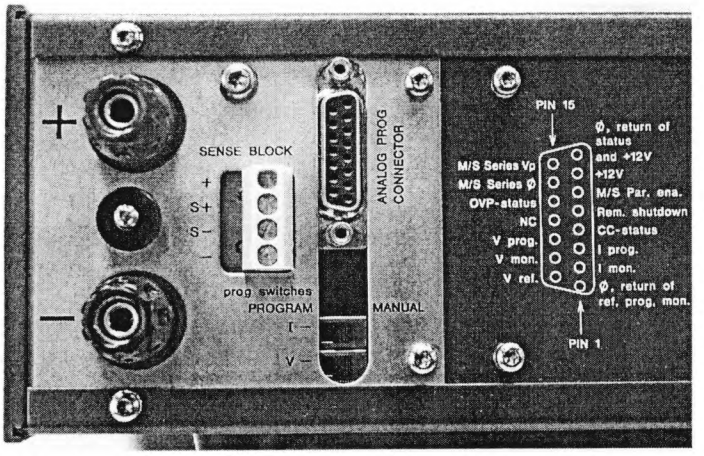


fig. 2 - 10 location of output terminals, sense block, analog prog. connector and PROG. / MAN. switches on rear panel (SM3004-D has no sense block).

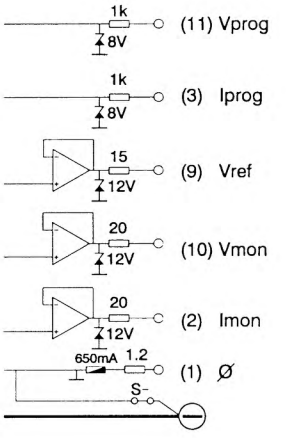


fig. 2 - 11 buffered monitor outputs (internal circuit)

Output	pin	Ro	Io max
Vref	9	15 Ohm	10 mA
Vmon	10	20 Ohm	10 mA
Imon	2	20 Ohm	10 mA
+12V	7	500 Ohm	25 mA
Ø	1	1.2 Ohm	

fig. 2 - 12 outputs on programming connector

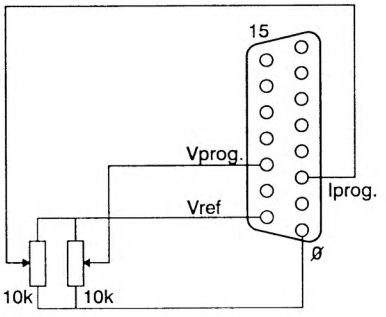


fig. 2 - 14 external potmeters

match the output current. This is mainly caused by the current through the output capacitors. Remote sensing will worsen this effect.

11) STATUS OUTPUTS

The status outputs have an open output voltage of 5 V and a short circuit current of 10 mA. This makes it possible to drive directly: an opto-coupler, a TTL gate or a CMOS gate (put leakage resistor to Ø).

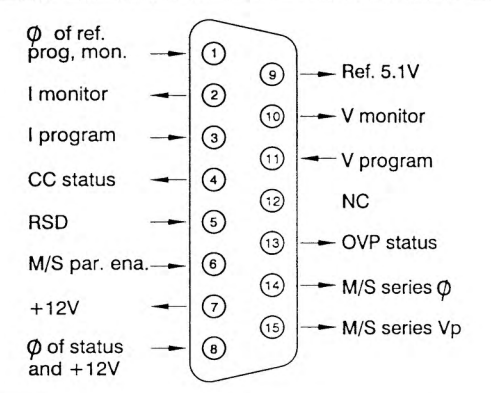
12) REMOTE SHUTDOWN (RSD)

A voltage of +5V on the Remote ShutDown input on the programming connector will switch off the power circuit of the unit. In standby mode the power supply consumes very little power.

It is also possible to use a relay contact or a switch to shut down the unit: connect a switch between Vref and Rem. Shutd. (pin 9 and 5). Note: The Remote ShutDown will also cause the OVP-led to burn and the OVP-status will be high.

13) PROGRAMMING RESPONSE TIME

The response time is measured with a step waveform at the CV prog. input. Programming from a low to a high output voltage is nearly load independent, but programming down to a low voltage takes more time



pin	description
1	Ø, return of reference, prog. inputs and monitor outputs.
2	current monitor output (0 - 5V)
3	current programming input (0 - 5V)
4	CC status output, logic 1 = CC mode (5 V / 10 mA)
5	Remote shutdown
6	M/S parallel, slave enable (only for autoranging)
7	+12 V output (Ri = 500 Ohm)
8	Ø, return of status outputs, +12 V and remote shutdown
9	reference voltage 5.1 V
10	voltage monitor output (0 - 5V)
11	voltage programming input (0 - 5V)
12	NC
13	OVP status output, logic 1 = OVP mode (5 V / 10 mA)
14	M/S series, output for slave (Ø)
15	M/S series, output for slave (prog.)

fig. 2 - 13 connections ANALOG PROG. CONN.

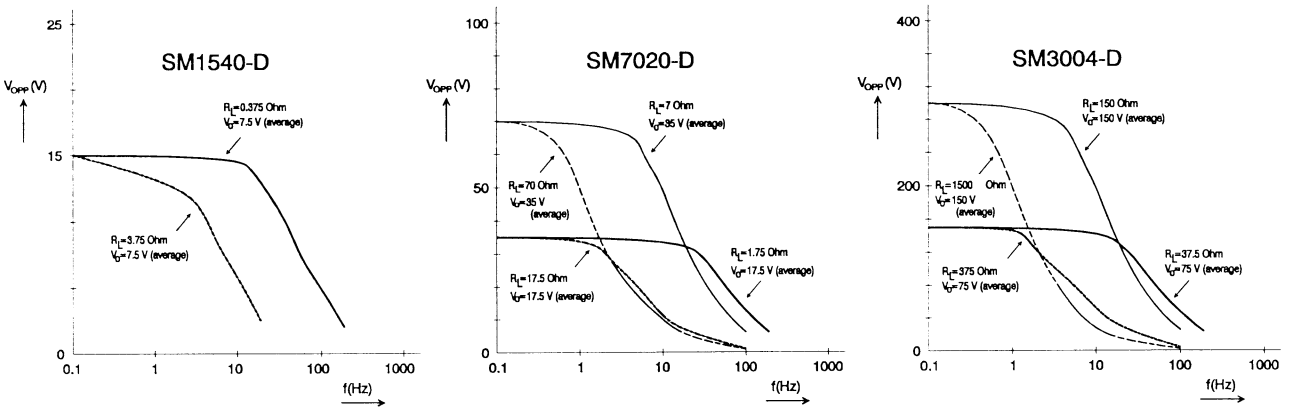


fig. 2 - 15
max. peak to peak output voltage swing vs frequency

on lighter loads. This is caused by the output capacitors, which can only be discharged by the load because the power supply cannot sink current.

14) PROGRAMMING BANDWIDTH

For small signals the bandwidth is 50 Hz, but for large signals there is a limitation in the maximum amplitude of the output waveform. The output capacitors limit the max. slew rate. Fig. 2 - 15 shows the maximum peak to peak output voltage swing as a function of frequency, with the load as a parameter. The higher the load resistance the lower the max. amplitude. The measurements were carried out using a sine wave. The DC level of the output is 50 % of the max. output voltage. On the SM7020-D and SM3004-D measurements were also carried out at 25 % of the max. output voltage.

15) RECOVERY TIME

Fig. 2 - 16 shows the recovery time for the SM7020-D at 25 °C, a 50 – 100 % load step and at maximum output voltage. At –20 °C the recovery time increases by 100 µs.

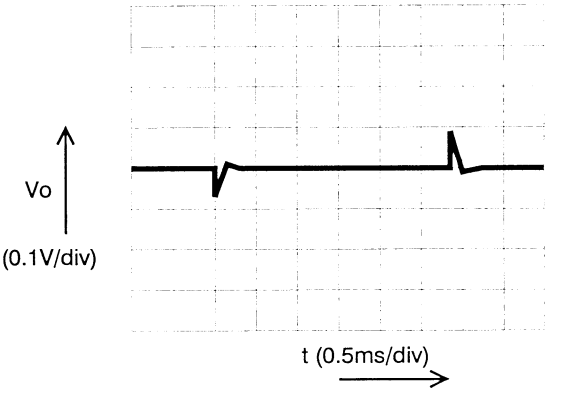


fig. 2 - 16
recovery time SM7020-D
50 - 100 % load step, Vo = 70 V

16) NOISE SUPPRESSION (input / output)

The input / output noise suppression is measured with a pulse generator (a) in series with the line input or (b) between input and case (earth). The generator should produce a high energy pulse of about 300 V. If there is an electrical connection between the output and the input through the oscilloscope, you will get a false reading. The suppression for the SM3004-D is lower, but the relative disturbance on the output is comparable to the SM1540-D.

17) PULSATING LOAD

To avoid overheating the output capacitors, the AC component of the load current should be limited. See fig. 2 - 17.

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 so that the capacitor in combination with the lead inductance will not form a series resonant circuit!

	SM1540-D	SM7020-D	SM3004-D
AC-level max.	10 A rms	5 A rms	1 A rms

When using **remote sensing** on a pulsating load (for instance a DC-motor), use a capacitor between S+ and + and between S- and - and a series resistor in the sense leads. See fig. 2 - 18. Like this the AC-component caused by the voltage drop across the load leads, is filtered.

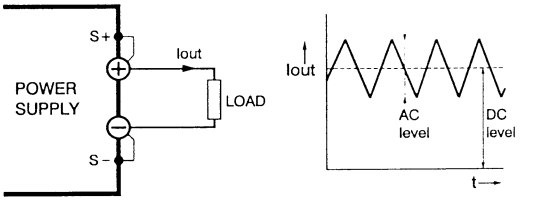


fig. 2 - 17
pulsating load current

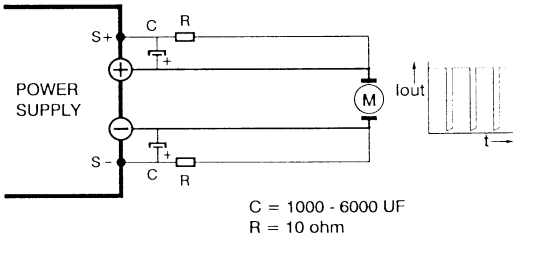


fig. 2 - 18
remote sensing on a pulsating load

18) 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 assembling.

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 fig. 2 - 19.

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

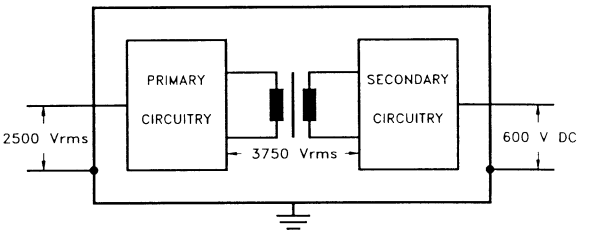


fig. 2 - 19
insulation test voltages

19) 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.

20) OPERATING TEMP

At full power the operating temperature range is –20 to +50 °C. From 50 to 75 °C the output current has to be derated linearly to 20 % at 75 °C. See fig. 2 - 20. These temperatures hold for normal use, i.e. the air must be able to pass freely vertically along and through the unit.

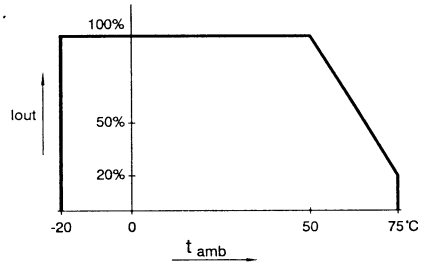


fig. 2 - 20
operating temperature ranges

21) THERMAL PROTECTION

A thermal switch shuts down the output in case of insufficient cooling. After cooling down the unit will start working again. In this condition the OVP led on the frontpanel will burn, and the OVP status output will be high.

22) HOLD - UP TIME

The hold - up time depends on the load, output voltage and line input voltage. A lighter load, a lower output voltage or a higher line input voltage all result in a longer hold - up time, see fig. 2 - 21. For example: the SM1540-D at 220 VAC input and 12 V / 40 A output will have a hold-up time of 50 ms.

23) TURN ON DELAY

The output voltage is available 0.5 sec after mains switch on.

24) INRUSH CURRENT

The inrush current is limited by a 50 Ohm PTC resistor, resulting in a very low current during switch on. The input current during switch on will be lower than during operation at full load.

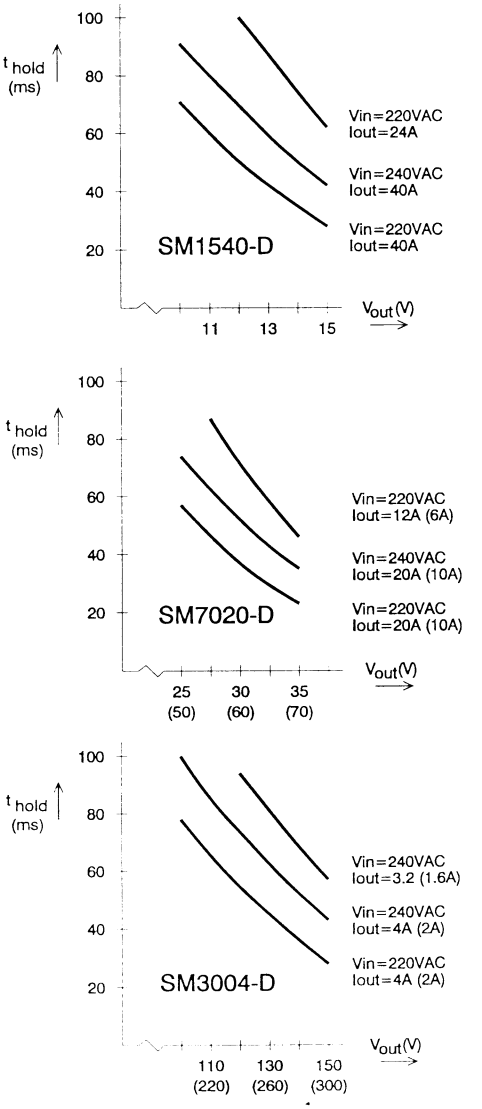


fig. 2 - 21
holdup time vs Vout with line input and Iout as parameter

25) SERIES OPERATION

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

For easier control, Master / Slave operation is recommended (fig. 2- 23).

By using the *Master / Slave - Series* feature a **dual tracking** power supply can be made with one unit as master and one as slave. See fig. 2- 22 (detailed descriptions in chapter "operations").

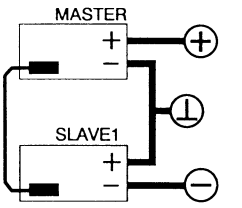


fig 2 - 22
Dual tracking power supply

26) PARALLEL OPERATION

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

For easier control, Master / Slave operation is recommended (fig. 2 - 24).

Note: Master / Slave parallel operation is not recommended for more than 4 units, consult factory for a solution with more than 4 units.

27) MASTER / SLAVE OPERATION

The Master / Slave feature makes it possible to use the power supplies as building blocks to form one large unit, see fig. 2 - 23 and 24.

Mixed parallel - series operation is also possible (fig. 2 - 25), to a maximum of 600V.

The resulting combination of units behaves like one power supply and can be programmed on the master. In the Master / Slave mode the autoranging feature still works. Fig. 2 - 26 shows a computer controlled M / S parallel combination.

The slaves will follow the master. The result is true **current or voltage sharing** in the parallel or series mode respectively.

For series and mixed parallel - series operation the **MASTER / SLAVE SERIES ADAPTER (δ-product)** is recommended. Without this ADAPTER it is also possible but it often gives problems. For parallel operation connections can easily be made on the analog programming connector.

In series mode the master controls one slave, which in turn controls the second slave and so on. In parallel mode the master controls all the slaves.

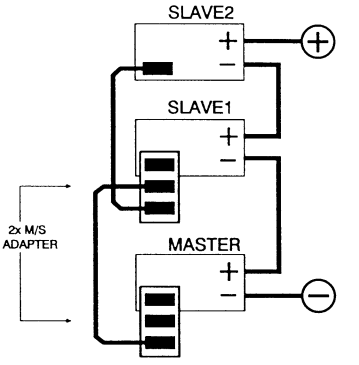


fig 2 - 23
Master / Slave Series operation

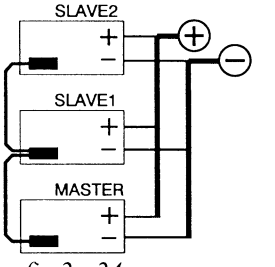


fig 2 - 24
Master / Slave Parallel operation

28) REMOTE SENSING

The voltage at the load can be kept constant by remote sensing. This feature is not recommended for normal use but only when the load voltage is not allowed to vary a few millivolts. Always use a **shielded cable** for sensing. Note that the SM3004-D has no remote sensing.

In order to compensate for the voltage drop across the load leads, the unit will have to supply a higher voltage: Uout = (voltage drop across each lead) + (voltage across the load), see fig. 2 - 27. The **OVP** reads the voltage directly at the output and the setting must be increased by the total voltage drop across the load leads.

The voltmeter is connected to the sense leads and therefore reads the voltage across the load and **not** the voltage on the output terminals.

The sense leads are protected for **accidental interruption**, in which case the output voltage will go to a max. of 115% of the set value.

Warning: Do not interrupt the minus lead while the S– lead is still connected to the load, during operation. It is possible that the capacitor C808 on P385 or P386 will be damaged.

For sensing on a **pulsating load** see par.17) of this chapter.

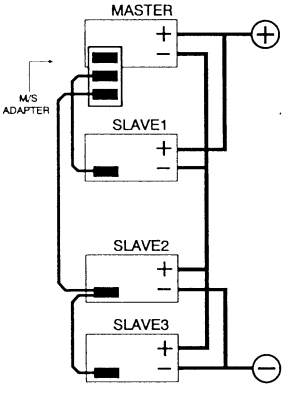


fig. 2 - 25
Master / Slave mixed Series-Parallel

29) OVP

The Over Voltage Protector will protect your circuit from unwanted high voltages.

A high output voltage could be caused by accidental interruption of leads, accidentally turning up the voltage potmeter or a defect in the power supply. The OVP circuit uses a separate voltage devider connected directly to the output terminals.

The OVP limits the output voltage to a value whcih can be set by the OVP potmeter on the front panel. While doing this, press the DISPLAY OVP SETTING button to read the limit value in the left display. The led on the front panel will indicate whether the OVP has reached the limit. The OVP status output will give a logic 1 (+5 V)

Note: The Thermal Shutdown and Remote Shutdown will also cause the OVP-led to burn and the OVP-status will be high.

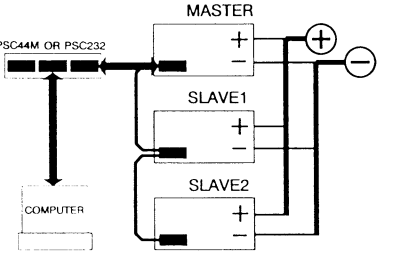


fig. 2 - 26
the Master / Slave combination can also be programmed with the interfaces PSC44M or the PSC232

When the OVP status output is used as an indication for accidental interruption of leads, a defect in the power supply etc., it is recommended to set the limit well above the working output voltage to avoid accidental limiting. The recommended OVP set voltages can be read from the following table:

Unit:	SM1540-D	SM7020-D range 0 - 35 V	SM7020-D range 35 - 70 V	SM3004-D range 0-150 V	SM3004-D range 150-300 V
Vovp	Vout + 2V	Vout + 3V	Vout + 5V	Vout + 10V	Vout + 25V

Example: For a SM7020-D set at 24V output voltage it is recommended to set the OVP on 24 + 3 = 27V.

30) POTENTIOMETERS

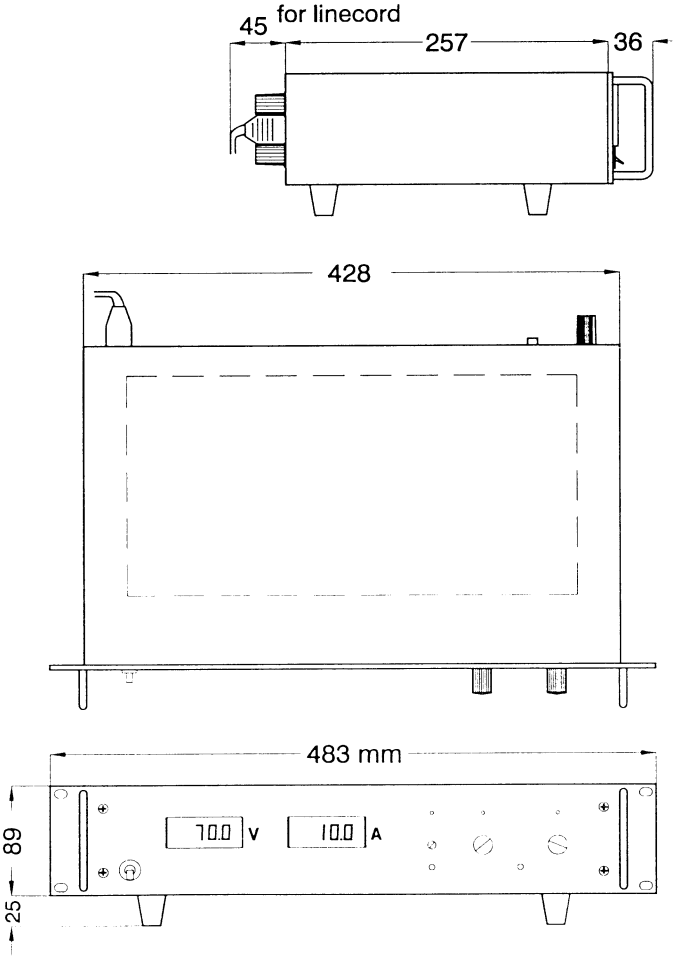
- Standard: - CV and CC potentiometers with knobs at front panel, OVP potentiometer with screwdriver adjustment at the front panel.
- Option P001: - Screwdriver adjustment for CV, CC and OVP at the front panel, fig. 2 - 28.
- Option P002: - Screwdriver adjustment for CV, CC and OVP at the rear panel (no potentiometers at front panel), fig. 2 - 29.

31) COOLING

The cooling is by natural convection, **no noisy blowers** are present. The unit should have sufficient free space to let the air flow vertically through the unit. See fig. 2 - 30. A distance of minimum 5 cm around the unit is recommended.

For long life the temperature of the air entering the unit, should be below *35* °C under normal conditions.
Under extreme conditions it should be below *50* °C.

32) DIMENSIONS



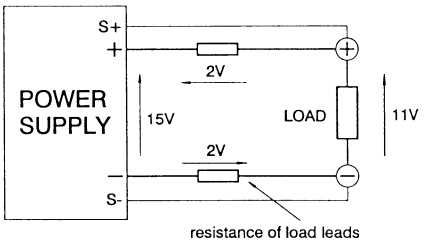


fig. 2 - 27
remote sensing, voltage drop in load leads subtracts from max. output

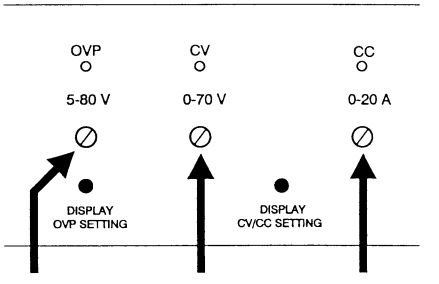


fig. 2 - 28
optional screwdriver adjustment at front panel

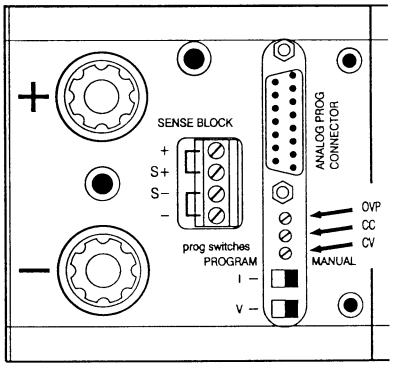


fig. 2 - 29
optional screwdriver adjustment at rearpanel

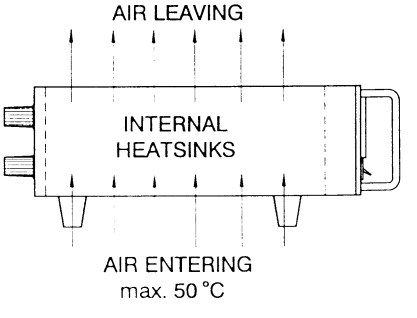


fig. 2 - 30
vertical airflow through the unit

CIRCUIT DESCRIPTION

The 220 V AC line voltage is rectified by a bridge rectifier and smoothed by a large electrolytic capacitor. The 50 Hz choke in the input circuit improves the waveform of the input, so that no low frequency distortion is produced on the line voltage.

Carefully designed RFI filters protect the line and the load from the high frequency interference produced inside the power supply.

When the unit is switched on, the electrolytic capacitor is charged via the resistor of the SOFT START circuit, so no large inrush current will flow. As soon as the voltage is sufficiently high the power supply starts working and the series resistor is bypassed by a triac.

The operating switching frequency of 100 kHz has many advantages like small size, light weight, low ripple and fast regulation.

The rectified 220 V (300 V DC) is chopped by the transistors and transformed to a lower voltage. This 100 kHz power converter is of the feed forward type. The regulation is achieved by pulse width modulation.

Careful design, over-rating of vital components, several built-in protections and cool operation (because of the very high efficiency) make the SM series very reliable power supplies which can be used continuously at maximum rating.

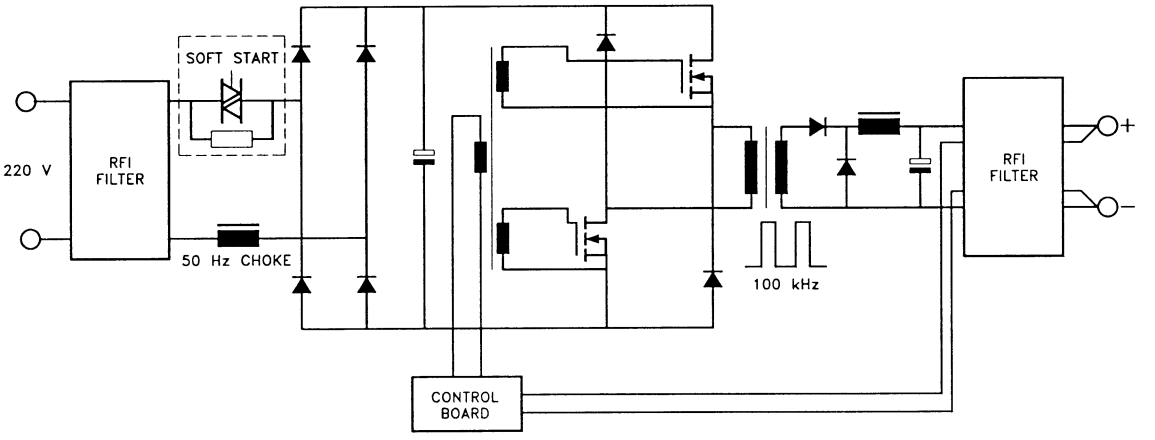


fig. 2 - 31 simplified functional diagram of SM1540-D, SM7020-D, SM3004-D

OPERATING MANUAL

1) OPERATING THE UNIT FOR THE FIRST TIME

- Set the **input voltage selector** switch found on the rear panel to the required input voltage (110/230V). A wrong setting can seriously damage the unit. Do **not** switch the selector switch when the unit is in use.
- Check input fuses. For 110 V operation fuses have to be replaced. See text at rear panel.
- Check that there is no condensation on the unit. If there is, allow some time to dry.
- Set the prog. switches on the rear panel on MANUAL.
- Check that there is a link between + and S+ and between – and S– on the SENSE BLOCK (on rear panel).
  SM3004-D has no remote sensing!
- Set OVP potentiometer (on front panel) to maximum (fully clockwise), Use a screwdriver to set the OVP voltage.
- With **high output current** (SM1540-D!) make sure to use low resistive connections between the power supply and the load:
  - Mount the cable lugs between the two nuts and washers .
  - Only use nuts and washers supplied with the unit (tinned brass).
  - Never use extra washers, spring washers , serrated locks etc.
- Switch on unit.
- Turn both the CV and CC potentiometer a few turns clock wise. A voltage should now be present on the output.
- By pressing the DISPLAY CV/CC SETTING button the meters will show the setting of the CV and CC potentiometer.
- By pressing the DISPLAY OVP SETTING button the volt meter will show the setting of the OVP potentiometer.
- When the power supply is used on a fixed output voltage it is highly recommended to set the Over Voltage Protector. As set out in the following table:

SM1540-D	SM7020-D range 0 - 35 V	SM7020-D range 35 - 70 V	SM3004-D range 0 - 150 V	SM3004-D range 150 - 300 V
Vout + 2V	Vout + 3V	Vout + 5V	Vout + 10V	Vout + 25V

Example: For a SM7020-D set at 24V output voltage it is recommended to set the OVP on 24 + 3 = 27V.

- Check that the cooling of the unit is not obstructed.

2) ANALOG PROGRAMMING

- Put the appropriate switch(es) in the position PROGRAM.
- Connect the programming voltage source(s) (0 - 5 V) to the ANALOG PROG. CONNECTOR on the rear panel. See fig. 3 - 1 and fig. 3 - 2. Always use a **shielded cable** for programming.
- If only the voltage is programmed, the maximum current can still be set with the CC potentiometer and vice versa. If this is not desirable the CC or CV can be set with an external potentiometer, in order to have a fixed setting.
- **CAUTION**: The analog inputs are not isolated from the output. The Ø of the prog. input (pin 1) is internally connected to the S–, the S– is connected to the negative output. To protect the internal wiring a 650 mA self-resetting fuse is connected in series (F600 on P385, P386 or P387), see fig. 3 - 4.
  For isolated analog programming the **ISO AMP MODULE** (**δ-product**) is recommended to avoid earth loops.
- To avoid hum or noise, the programming cable may have to be twisted in some cases.
- To program the unit by current instead of voltage, simply use a parallel resistor as a current to voltage converter.

3) IEEE 488 / RS232 PROGRAMMING

- With the external IEEE 488 /RS232 interface **PSC44M / PSC232 (both δ-products)** simply connect the prog. connector of the power supply with the mating connector of the PSC44M / PSC232 (pin compatible). Always use a **shielded cable**.
- Set both prog. switches to the position program.
- Both CV and CC can be programmed and read back. The CC and OVP status can also be read by the computer.

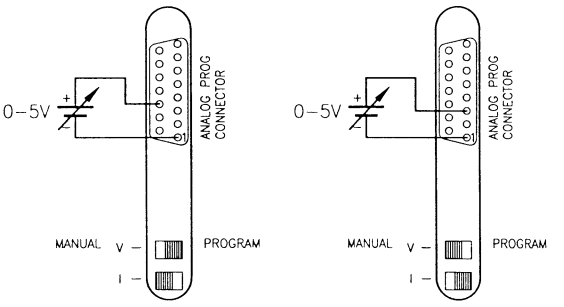


fig. 3 - 1
programming by voltage
left voltage -, right current programming

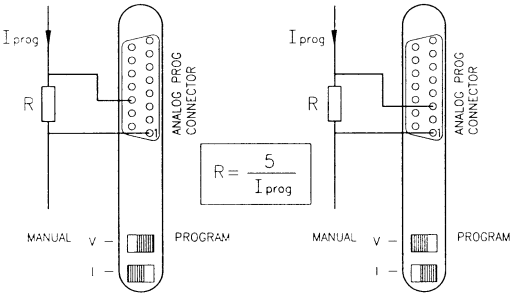


fig. 3 - 2
programming by current
left voltage -, right current programming

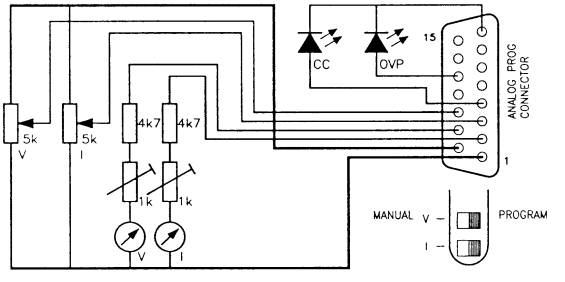


fig. 3 - 3
remote control

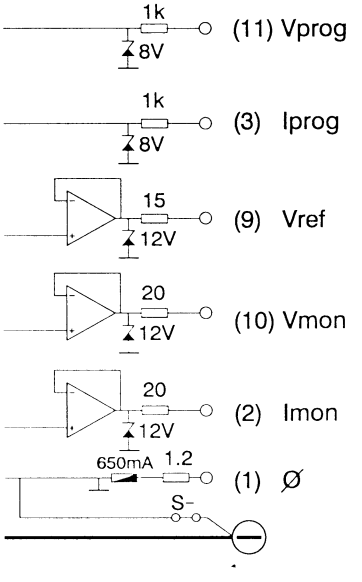


fig. 3 - 4
internal circuit of programming inputs and outputs

4) MONITORING OUTPUTS

- The 5 V level is compatible with most interfaces.
- The monitoring outputs can drive a meter directly, fig. 3 - 3.

5) STATUS OUTPUTS

- The status outputs have a separate Ø connection (pin 8) to avoid unwanted offsets in the programming. This pin is protected with a 650 mA fuse (F601 on P385, P386 or P387).

6) REMOTE SENSING

- Not available on SM3004-D.
- Remove the links on the SENSE BLOCK (on rear panel) and connect sense leads (thin **shielded** measuring wires) to S+ and S–. See fig 3 - 5 and fig. 3 - 6.
- With remote sensing the voltage on the load can be kept constant. The voltage drop in the load leads will be compensated. This feature is not recommended for normal use, because it can easily give problems.
- Max. 2 V per load lead can be compensated. Note that the voltage drop in the leads decreases the max. output voltage rating. In fig. 3 - 7 it can be seen that on a 15V power supply only 11V will be available on the load when 2x 2V compensation is used.
- In order to prevent interference it is advisable to twist the sense leads. To minimise the inductance in the load leads keep the leads close to each other. The inductance of the loads leads could give a problem with pulsating loads. In this case a large electrolytic capacitor in parallel with the load will help. Check that the capacitor in combination with the load leads does not form a resonant circuit resulting in a large AC current flowing in the leads.
- Since the **voltmeter** is internally connected to the sensing terminals, it will automatically indicate the **voltage on the load**. Note that the voltage measured on the load will be lower than on the output terminals.
- The Over Voltage Protector measures the voltage on the output terminals, so the OVP setting should be increased by the total voltage drop in the load leads.

7) BATTERY CHARGER

- The CV / CC regulated power supplies are ideal battery chargers. Once the output is set at the correct voltage the battery will charge constantly without overcharging. This can be useful for emergency power systems.
- **Protective measures**
  Use a CIRCUIT-BREAKER in series in order to protect the power supply from **accidental reverse connection**, see fig. 3 - 8. The circuit-breaker should have a DC voltage rating 2x the battery voltage. Use the very fast type (Z), a type meant for protecting semiconductors.
  The unit has a reverse diode in parallel with the output, this diode and the wiring cannot withstand the thousands of amperes supplied by a wrongly connected battery.

Suggested Circuit Breakers for protection power supply			
Model	Type number Circuit Breaker	Brand	Remarks
SM1540-D	S281 UC-Z 40	ABB	
SM7020-D	S281 UC-Z 20	ABB	**extra parallel diode on output =OPTION P021**
SM3004-D	S282 UC-Z 4	ABB	2 poles in series, **extra parallel diode on output =OPTION P022**

- **Remote sensing** cannot be recommended, because it easily causes defects inside the power supply in case of wrong connection.
  If you really need remote sensing, please use the circuit in fig. 3 - 9 . The internal circuit can be protected by relatively small

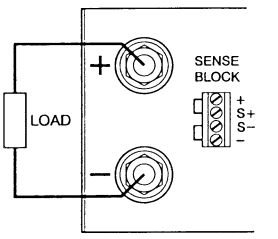


fig. 3 - 5
local sensing

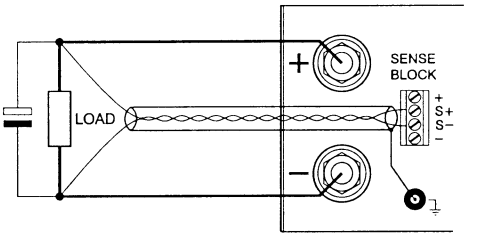


fig. 3 - 6
remote sensing with shielded wires

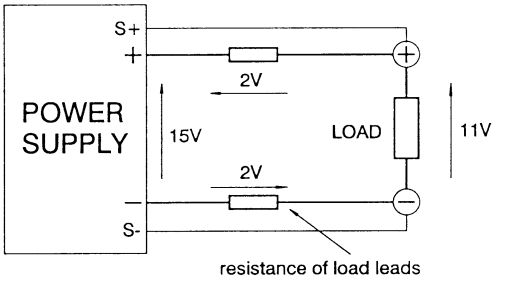


fig. 3 - 7
remote sensing, voltage drop in load leads subtracts from max. output

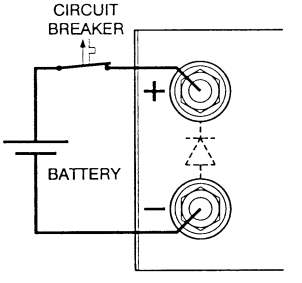


fig. 3 - 8
charging battery with a circuit-breaker in series

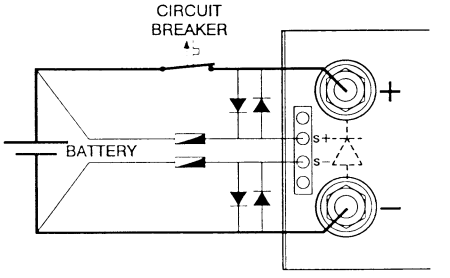


fig. 3 - 9
protecting sense wires with diodes

anti-parallel diodes. To protect the anti-parallel diodes, please connect the fuses in series as indicated in fig. 3 - 9 . A practical choice for the fuses is 250mA, the diodes can be any normal 3 or 5A type.

- Note: The **SM7020-D and SM3004-D** need an extra parallel diode on the output, without this diode the internal diode will still blow. The diode should have a surge current rating of resp. 2000 and 3000 amps during 1msec (I_{FSM} = 2000 / 3000 A). For the SM7020-D 2x BYT52PI200 and for the SM3004-D 2x BYT261PIV400 from ST will work. The SM7020-D with option P021 and the SM3004-D with option P022 have an extra diode built-in.

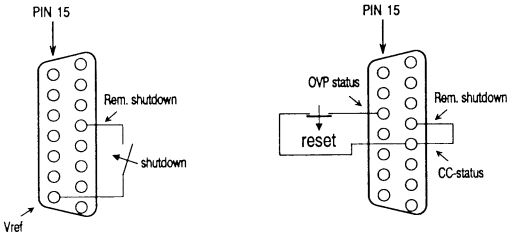


fig. 3 - 10
left: remote shutdown with switch,
right: Over Current Trip

8) REMOTE SHUTDOWN / OVER CURRENT TRIP

- The remote shutdown can be operated with +5V or a relay contact, fig. 3 - 10.
- Using the remote shutdown input, an **Over Current Trip** could be made., fig. 3 - 10.

9) MASTER / SLAVE SERIES OPERATION

- For series operation the **MASTER / SLAVE SERIES ADAPTER (δ-product)** is recommended. The advantage is that the masters position can be the upper or the lower unit (in particular for higher voltages, e.g. 150V and 300V). Other advantages are the fast and easy way of connecting.
- First, connect output terminals and test system in **normal series** operation. Ensure that all (output) power connections are reliable. An interruption of one of the power leads can cause a fuse to blow in the unit, see "trouble shooting".
- The voltage drop in the connecting leads between the units should be kept < 10 mV.
- Second, switch off all units. When using the **M / S SERIES ADAPTER** connect units as shown in fig. 3 - 11. Use standard 15 pole (1:1) **shielded cables**.
  Without the ADAPTER, plug in prog. connectors with the connections according to fig. 3 - 12. Both prog. switches of the slaves should be in the position PROGRAM. Always use **shielded cables**. The shielding must be connected to the case of the supply.
- Do not forget the jumper on the slaves between pin 3 and pin 9 of the prog. connector. This jumper sets the current limit of the slaves at maximum.
- The max. number of slaves is only limited by the max. total voltage of 600 V.
- The AUTORANGING feature still works.
- **WARNING when <u>not</u> using the M / S SERIES ADAPTER:** the master must always be on the positive (=upper) side of the combination. Wrong connection can damage the power supplies.

10) MASTER / SLAVE PARALLEL OPERATION

- **Note: Master / Slave parallel is not recommended for more than 4 units, consult factory for using more than 4 power supplies in parallel.**
- First connect output terminals and test system in **normal parallel** operation. Ensure that all power connections are reliable. An interruption of one of the (output) power leads can cause a fuse to blow in the unit, see "trouble shooting".

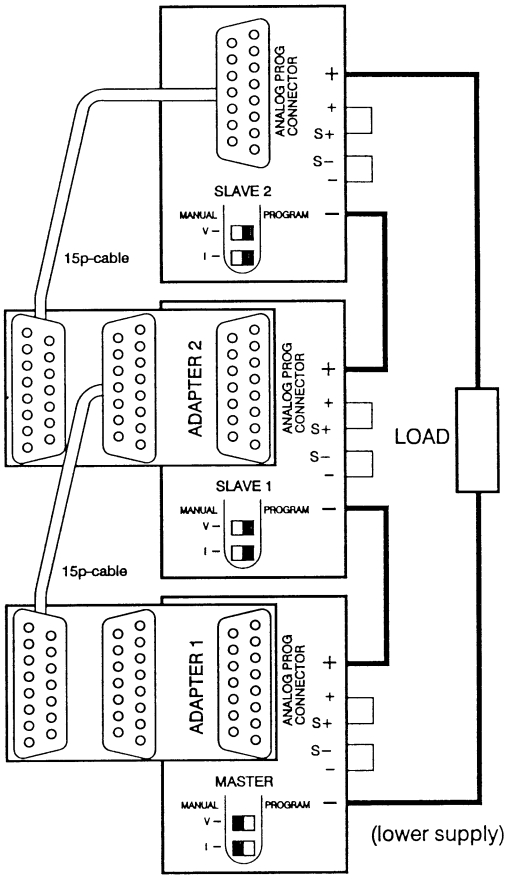


fig. 3 - 11
*master slave series connection with two **M / S SERIES ADAPTERS***

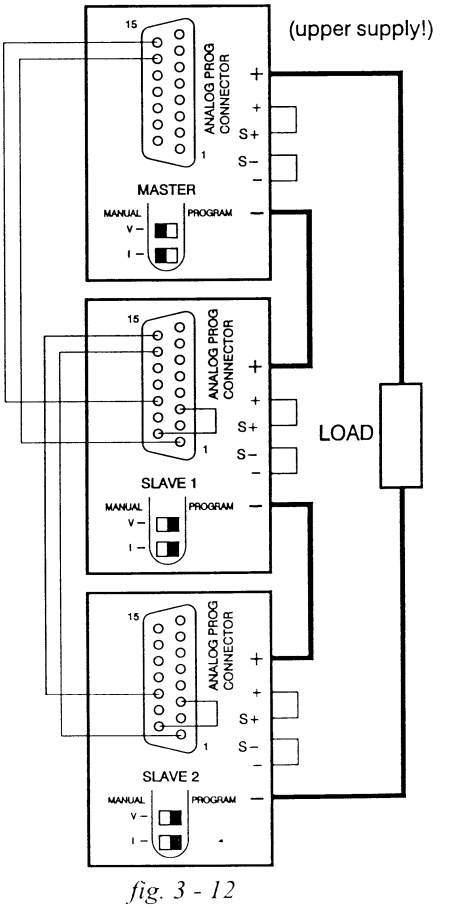


fig. 3 - 12
master slave series connection

- Second, switch off all units. Plug in prog. connectors with the connections according to fig. 3 - 13 (buss bar topology). Always use a **shielded cable**. The shielding must be connected to the case of the supply.
  Disconnect the links between the S– and – **of the slaves only**. If not removed the current sharing will not be proportional.
  Both prog. switches of the slaves should be in the position PROGRAM.
- The purpose of the link between pin 9 and 11 is to set the voltage limit of the slaves at maximum.
- an extra link on the slaves (between pin 6 and 8) is needed for the AUTORANGING feature.
- Keep the load close to the master. Keep wiring between master and slaves short. The voltage drop between a unit and the buss bar should be kept < 10mV.
- Accidental interruption of a negative load lead of a unit during operation will cause fuse F600 to blow, see section 'trouble shooting'.
- The S- and S+ could be connected to the load if desired, but this is not recommended because of the complexity.

12) MASTER / SLAVE MIXED SERIES / PARALLEL OPERATION

- For complex combinations as mixed series - parallel always use the **MASTER / SLAVE SERIES ADAPTER** (δ-**product**).
- See fig. 3 - 14 for an example of how to connect 2 units in series in parallel with 2 units in series, controlled by 1 master.
- Note: A Master / Slave combination can always be programmed, also with the **IEEE488 / RS232** controller (**PSC 44M / PSC232** (**both** δ-**products**)).

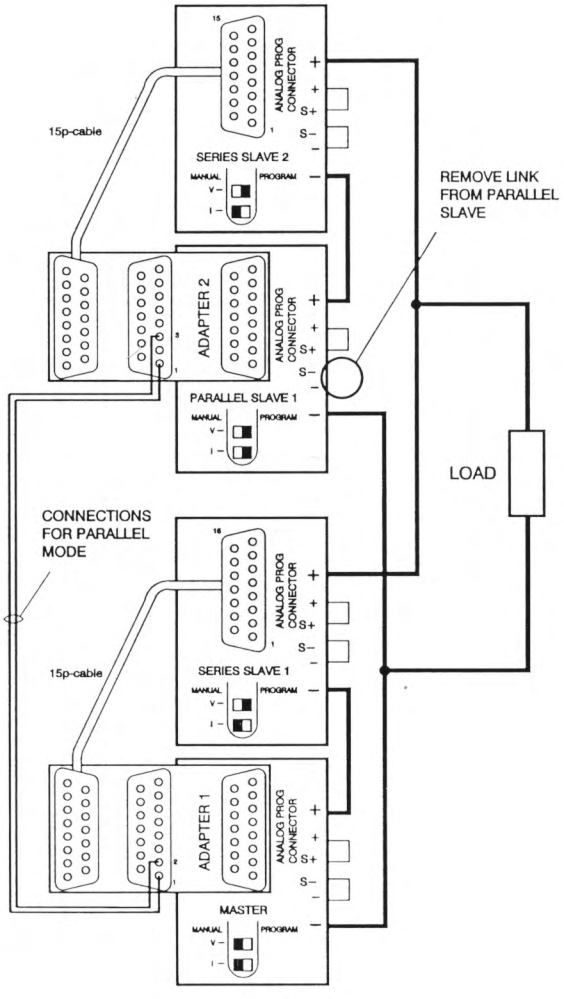


fig. 3 - 14
*master slave mixed series - parallel connections with two **M / S SERIES ADAPTERS***

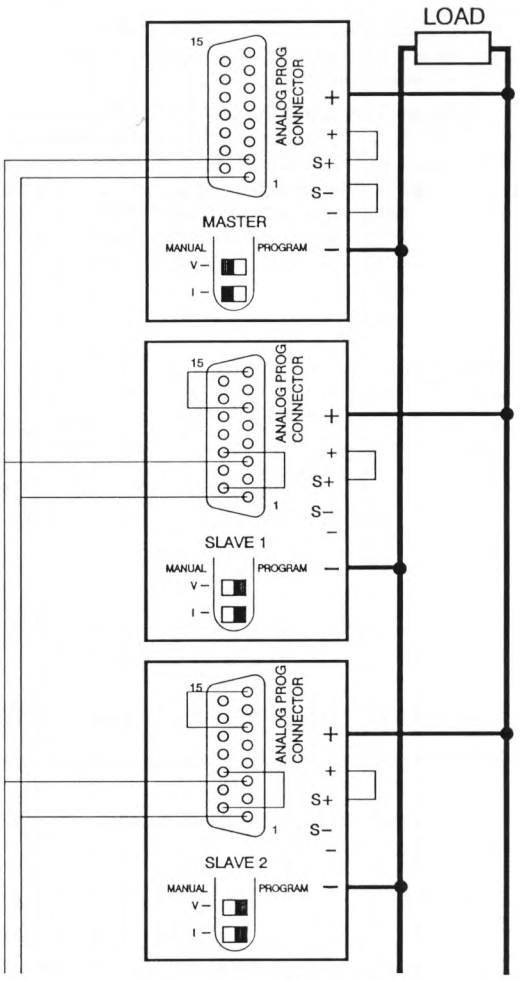


fig. 3 - 13
master slave parallel connections

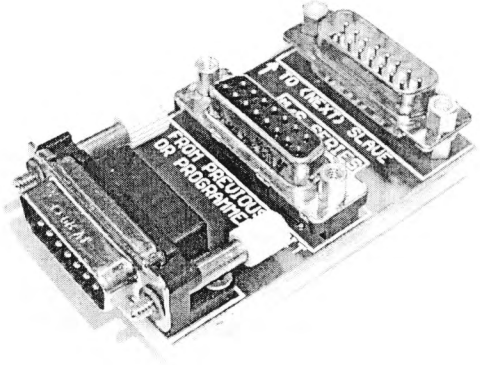


fig 3 - 15
The Master / Slave Series Adapter

OPERATING AND STORAGE CONDITIONS

1) TEMPERATURE

- The operating temperature range at full load is -20 to +50 °C. But this temperature range only holds when the perforated bottom and cover are unobstructed and the temperature of the air entering is not higher than +50 °C. See fig. 3 - 16.
- **Please note: a lower temperature extends the life of the power supply.**
- When the power supply is **mounted in a cabinet** please note that the temperature of the air entering should be kept low. Also avoid a short circuit in the airflow i.e. hot air leaving the perforated cover entering the bottom again.
- 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 decreasing .
  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.

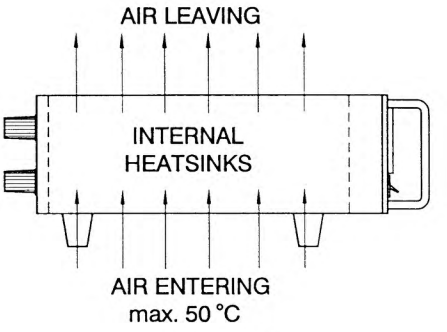


fig. 3 - 16
leave enough space below and above the unit the let the air flow through it.

MAINTENANCE

1) GENERAL

- The SM-series power supplies normally need no maintenance or calibration. Only care must be taken that the cooling of the unit is not obstructed.

TROUBLE SHOOTING

1) GENERAL

- In case you need assistance for repairing the unit, please first fill in the Problem Report (also in this manual) and fax it to us.

2) NO OUTPUT (normal operation)

- Check input voltage selector at rear panel. Wrong selection can cause serious damage to the unit. Do not operate the selector switch when the unit is switched on.
- Check input fuses. For 11 V operation fuses have to be replaced. See text at rear panel for values.
- Check position of prog. switches at the rear panel, they should be on MANUAL.
- Check the connections on the SENSE BLOCK (at rear panel), there should be a link between + and S+ and between – and S–.
- Set OVP potentiometer (at front panel) at maximum (fully clock wise).
- Switch on unit.
- Turn both the CV and CC potentiometer a few turns clock-wise. A voltage should be present on the output.

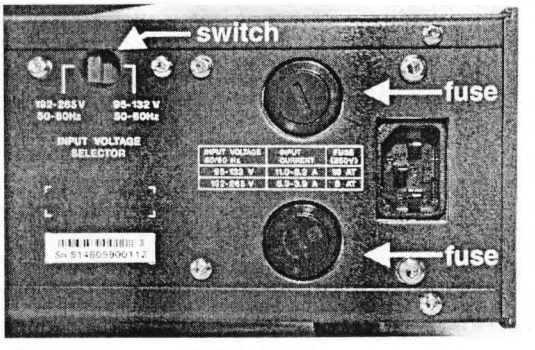


fig 3 - 17
Location of the input Selector Switch and the input fuses at the rear panel

3) PROGRAMMING DOES NOT WORK OK

- Check position of prog. switches at rear panel.
- **The unit works OK in manual control,** but in programming mode the output voltage / current has a large error.
  Probably the fuse in series with Ø (pin 1) of prog. connector tripped, the fuse (F600 = 650 mA) is a self-resetting type. See fig.3 - 18.
- To check the fuse (F600) measure the voltage between Ø and the minus output, during the fault condition. The voltage should only be a few mV, a high voltage means that an unwanted current is flowing through pin 1 of the prog. connector.
  Please check why current is flowing through pin 1, see also next paragraph 'programming offsets' and fig. 3 - 19.

fig. 3 - 18 location of programming fuses on output board P385, P386 or P387.

4) PROGRAMMING OFFSETS

- **Unwanted offsets in the programming can be caused by earth loops.**
  Fig. 3 - 19 shows a typical earthing problem. In case the load has a connection to earth and the programming source as well, problems could occur. Improper choice of the earthing point of the load can give a voltage drop of ΔV1. Connecting the minus or zero to a separate earth connection can give a voltage drop of ΔV2. Because the internal wires of the programming input are thin, the voltage drops ΔV1 and ΔV2 will be accross the internal wiring as well. Resulting in a error voltage in series with the programming voltage.
- The best **solution** for this is using a floating programming source with the help of the **ISO AMP MODULE (δ-product)** or a floating load.

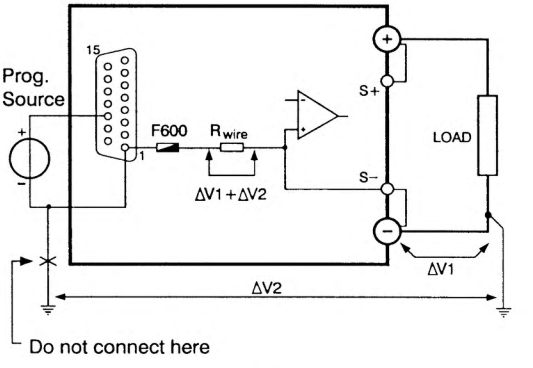


fig. 3 - 19
unwanted programming offsets

5) STATUS OUTPUTS FAIL

- Check fuse F601 in series with Ø (pin 8), see fig. 3 - 18. To check the fuse (F601) measure the resistance between Ø and the minus output, an open circuit means a blown fuse. F601 = 650 mA.

6) MASTER / SLAVE PARALLEL PROBLEMS

- Accidental interruption of a minus lead of a unit during operation will cause fuse F600 to blow. See fig. 3 - 18. To check the fuse (F600) measure the resistance between Ø (pin 1 of prog. conn.) and the minus output, the fuse is a self resetting type.
  F600 = 650 mA
- AUTORANGING behaves abnormally. Check link between pin 6 and 8 on the prog. connector of the **slaves.**
- Check link between pin 9 and 11 on the prog. connector of the **slaves**
- Current sharing is not ok. Probably the links between S– and – of the **slaves** are not removed.

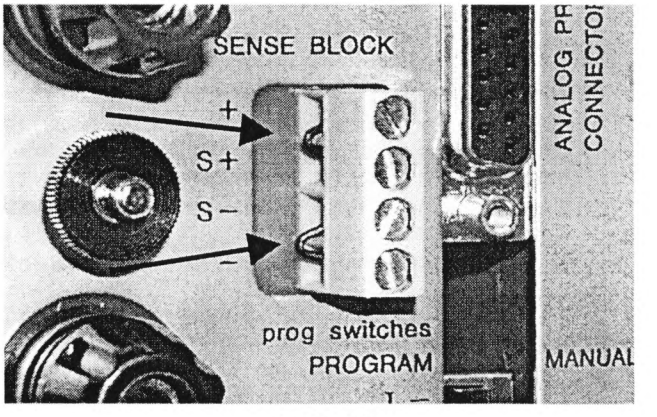


fig. 3 - 20
for normal operation links should be connected between S+ and + and between S- and -

7) OUTPUT VOLTAGE IS HIGHER THAN SET VALUE

- Check connections on SENSE BLOCK (on rear panel), For normal operation there should be a link between + and S+ and between – and S–. See also fig. 3 - 20. When remote sensing is used, check the wires of the sensing.

8) OVP LED burns.

- Check OVP setting.
- Overheating also causes the OVP led to burn (see fig 3 - 22), cooling down will reset the thermal protection.
- You are using Remote Sensing.
  Even a short voltage pulse >3V between – and S – causes the OVP circuit to limit the output voltage.
- Remote Shutdown voltage is applied to the prog. connector.

9) NO LEDS burn.

- Overheating can be the cause, cooling down will reset the thermal protection.
- Check input power and input fuses (on rear panel)

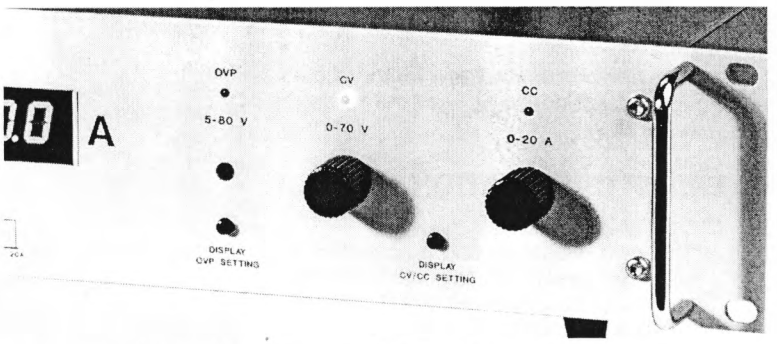
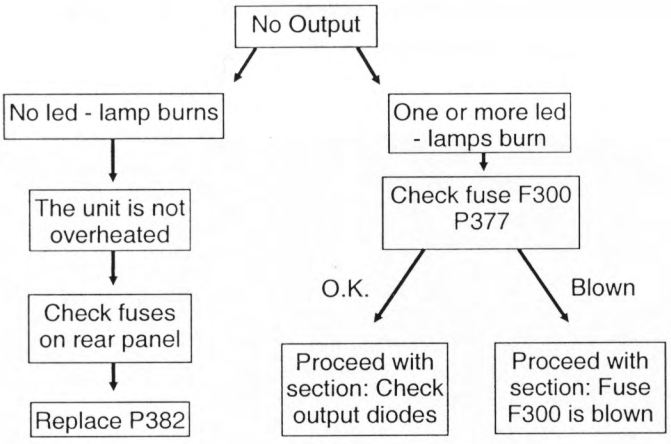


fig 3 - 22 Location of OVP, CV and CC LED's

10) CHECK POINTS IN CASE OF A SERIOUS FAILURE



- Check output diodes.
  Defective diodes give a short.
  SM1540-D Check diodes D400 - D403
  SM7020-D Check diodes D400 and D402 on P380
  SM3004-D Check diodes D400 - D404, D410 - D414, D420 - D424, D440 - D434 on P381
  Replace defective parts.
- Fuse F300 is blown.
  Do not replace F300 until unit is repaired.
  Probably defect on P378.
  First check output diodes, see above.
- Repairing P378.
  Check diodes D301 - D308, check transistors Q300 - Q303.
  When defective they usually give a short. Replace defective components.
- If necessary, send P378 for repair.

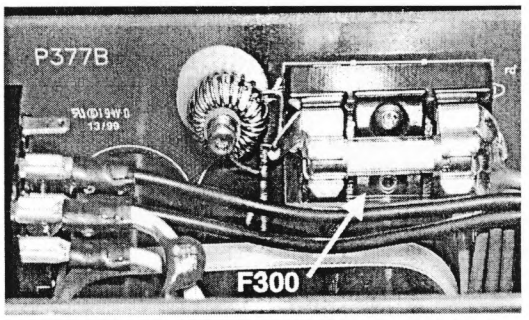


fig. 3 - 21 Location of F300 on P377

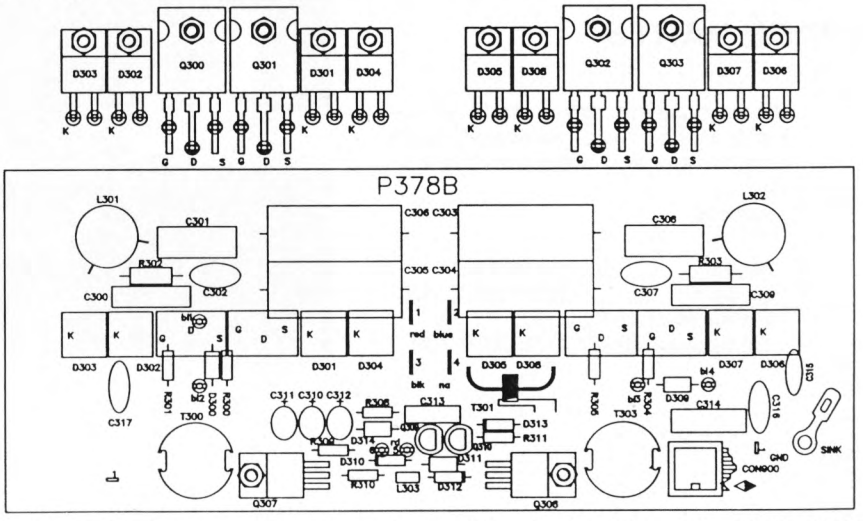


fig 3 - 23 P378: indicated are the polarity of the diodes (K) and the FET's (G/D/S)

CALIBRATION

1) GENERAL

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

2) METER CALIBRATION

- DIGITAL METERS
  The zero indication can be calibrated with R712 and R716, the full scale indication can be calibrated with R706 and R708 on P388 (fig. 3 - 24).

3) SPECIAL CALIBRATIONS

- The following calibrations must be done by qualified personnel only. Wrong calibration causes malfunction. These calibrations are only needed after special repairs.
  Warning ! Damage caused by wrong calibration is not warranted.

- CALIBRATING MAX. CURRENT RANGE or CALIBRATING CC MONITOR FULL SCALE.
  The max. output current can be calibrated with R686. R686 is located on P385, P386 or P387. See fig. 3 - 25.
  Program CC input with exactly 5.00 V. Set output voltage to a low value, ensuring the power supply is in CC mode. Measure the output current with an accurate shunt. Calibrate the current with R686 exactly on the rated max. current.
  Warning! Wrong calibration can damage the unit.

- CALIBRATING THE CC MONITOR OFFSET.
  With R652 on P384 the offset of the CC monitor voltage can be calibrated. See fig. 3 - 26. The unit has to be unloaded, the output voltage set on a low value. Measure the offset voltage of the CC monitor on the prog. connector. Calibrate the offset on a negative value between –10 mV and zero mV.
  Warning! wrong calibration can damage the unit.

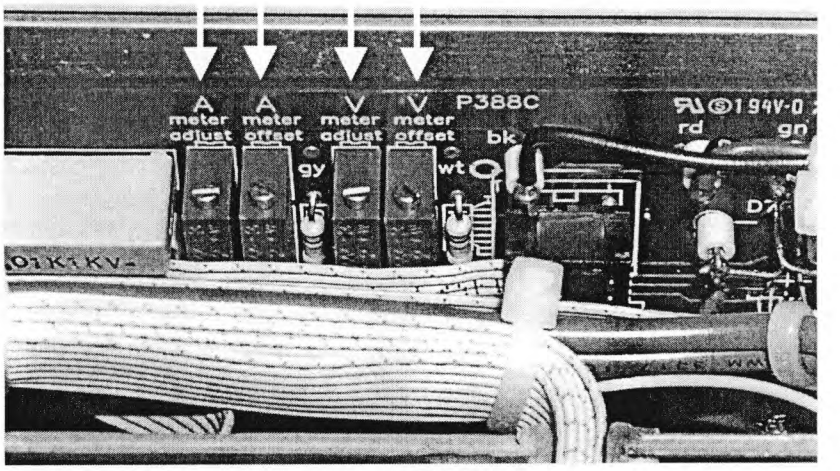


fig. 3 - 24 Meter calibration with 25-turn potmeters on P388

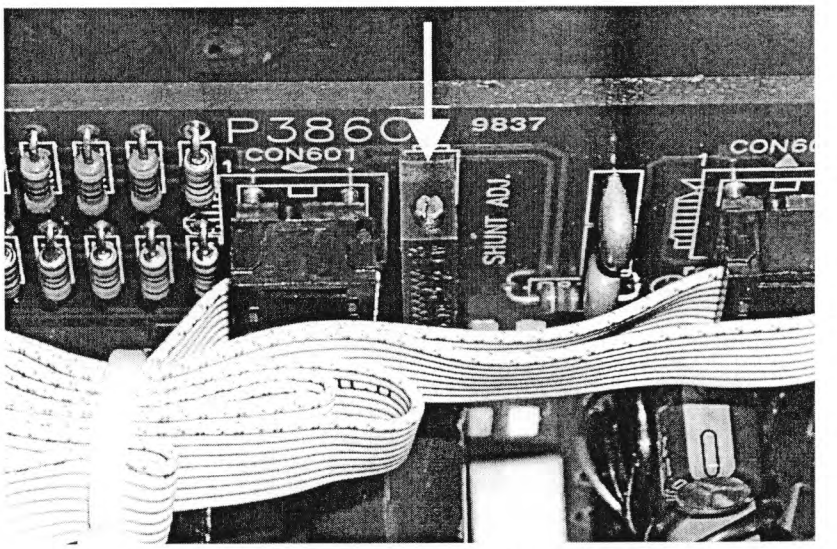


fig 3 - 25 calibrating max current P385, P386 or P387

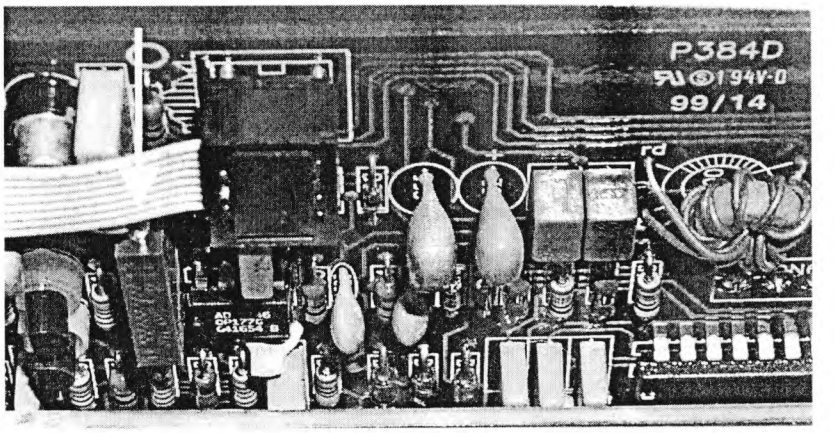


fig. 3 - 26 After lifting P384, CC monitor can be calibrated

SPARE PARTS

- When ordering spare parts please state: Model, Serial number, Component number and Component description.
  example:

  Model SM7020-D
  Serial no.....814605900112
  Component no. D402
  Component descr..BYV52-PI-200

DELTA ELEKTRONIKA BV

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4300 AA ZIERIKZEE
NETHERLANDS
TEL.+31 111 413656
FAX+31 111 416919
www.DeltaPowerSupplies.com

From:

.....

.....

.....

.....

PROBLEM REPORT

Type number .....
Serial number .....

Date .....

CONDITIONS BEFORE OR DURING FAULT	
Output voltage, Output current	
Ambient temperature, Input voltage	
Programming used, Remote sense used	
Master / Slave used (parallel or series mode)	
Setting of Prog. Switches and setpoint of OVP	

FAULT DESCRIPTION	
Output voltage present	
Max. Output power available	
Problem continuous or intermittend	
Which LED-lamps are burning, which are not	
+12 V on programming connector present	

Remarks:

.....

.....

.....

.....

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RECOMMENDED SPARE PARTS

FOR USE IN A SERVICE DEPARTMENT

Note: The listed spare parts are mainly modules.

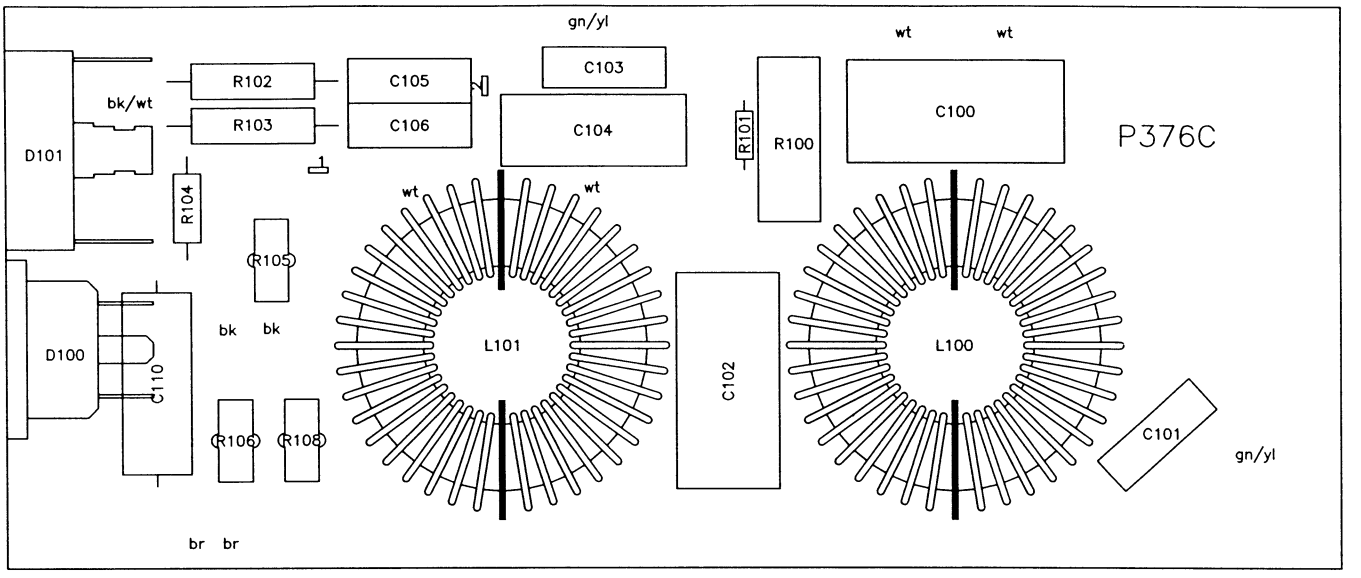
In case of a problem:
Please first fill in the problem report (also in this manual) and fax it to us.
We will then assist you with the repair of the unit.
Defective modules can be send to us for repair.

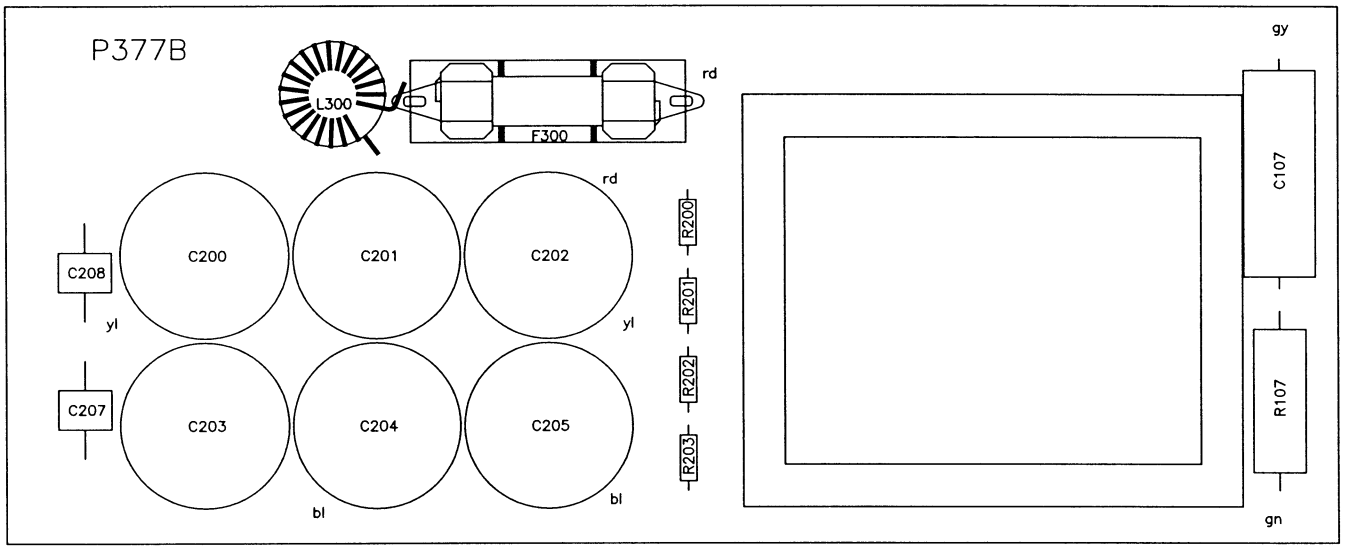
Quantity	Order code	Description
5	FUSE PTC .65	fuse for programming input
4	FUSE 5X20 8T (230V) FUSE 5X20 16T (110V)	input fuses
5	JUMP 0830 DIP	8 pole flat cable, with dip connectors
1	SKB 25-06	input bridge rectifier
2	16ER 15	15 ohm resistors for inrush current limiter
3	10SL 5K	potmeter, 5 kOhm, 10 turns
1	P378 + FUSE 6X32 6.3FF	switch unit + special fuse
1	P384	analog control board
1	P383	digital control board
1	P382	auxiliary power supply

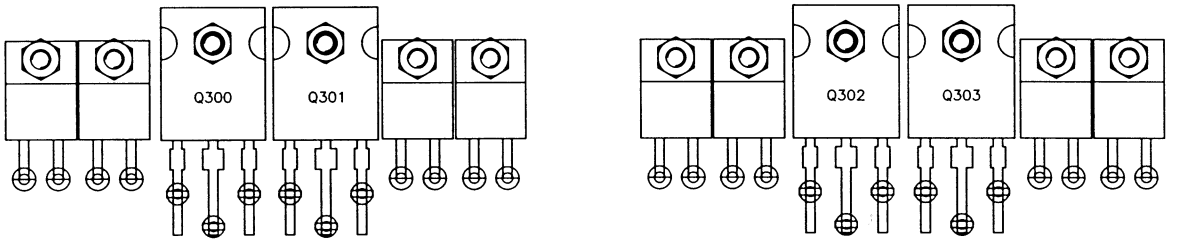
Only for SM1540		
Quantity	Order code	Description
4	60HQ100	output rectifiers

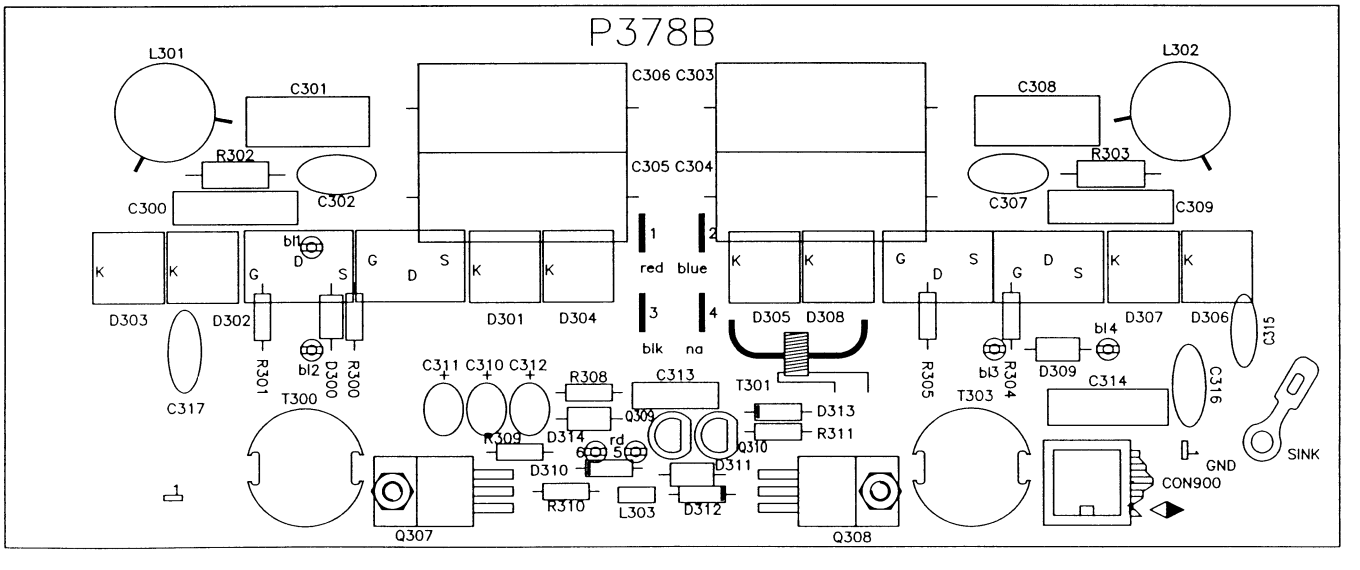
Only for SM7020		
Quantity	Order code	Description
1	P380	output rectifier board, SM7020-D

Only for SM3004		
Quantity	Order code	Description
1	P381	output rectifier board, SM3004-D


P376C
gn/yl
wt
wt
bk/wt
R102
R103
C105
C106
C103
C104
R101
R100
C100
D101
R104
R105
bk
bk
wt
wt
L101
L100
C102
D100
C110
R106
R108
C101
gn/yl
br
br


P377B
L300
F300
rd
gy
C107
rd
C200
C201
C202
C208
yl
yl
C207
C203
C204
C205
bl
bl
R200
R201
R202
R203
R107
gn


Q300
Q301
Q302
Q303


P378B
L301
C301
R302
C300
C302
C306 C303
C305 C304
L302
C308
R303
C307
C309
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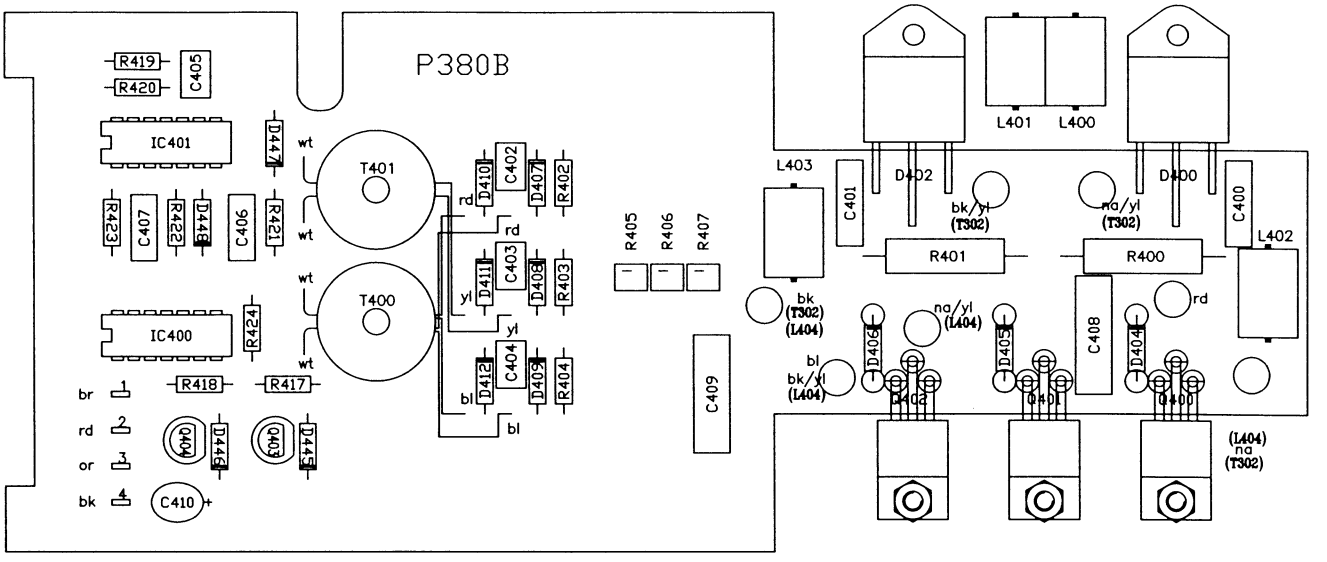
K
K
G
D
S
G
D
S
K
K
red
blue
K
K
G
D
S
G
D
S
K
K
D303
D302
D301
D304
D305
D308
D307
D306
C315
3
4
blk
na
bl4
bl2
bl3
R301
D300
R300
C317
T300
C311
C310
C312
R308
C313
T301
R305
R304
T303
D309
C314
C316
Q309
D313
R311
R309
D314
rd
6
5
Q310
D310
D311
GND
SINK
CON900
R310
L303
D312
Q307
Q308


P380B
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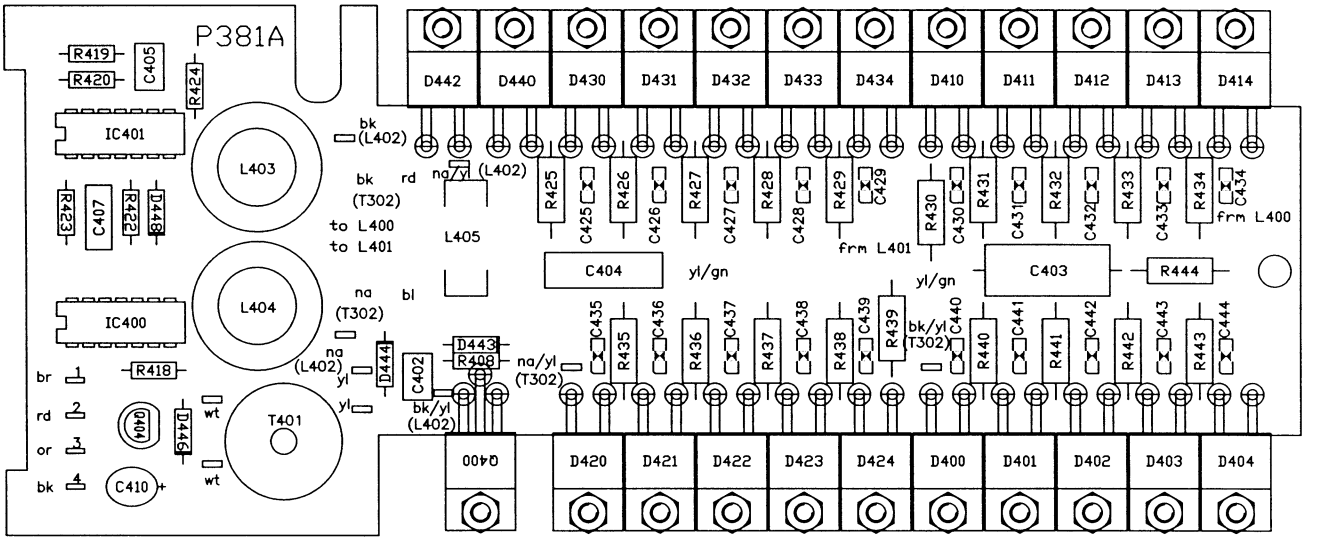
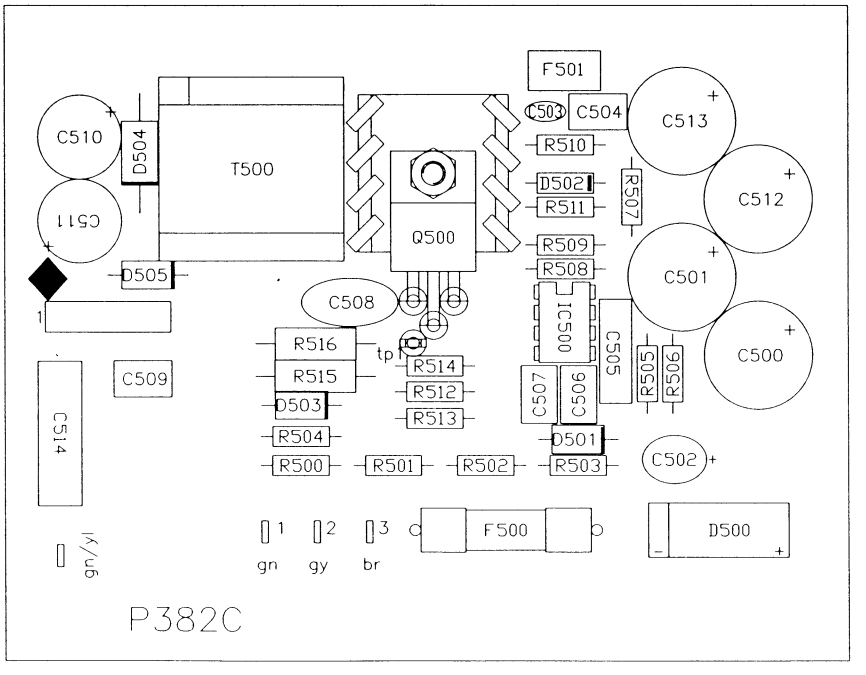
R420
C405
IC401
D447
T401
wt
D410
C402
D407
R402
rd
C403
D411
D408
R403
yl
T400
IC400
R424
R418
R417
br
rd
or
bk
Q404
D446
Q403
D445
C410
R405
R406
R407
C409
L401
L400
L403
C401
D402
D400
bk/yl
(T302)
na/yl
(T302)
C400
L402
R401
R400
bk
(T302)
(L404)
na/yl
(L404)
C408
D406
D405
D404
bl
bk/yl
(L404)
Q402
Q401
Q400
(L404)
na
(T302)


P381A
R419
R420
C405
R424
IC401
L403
R423
C407
R422
D448
IC400
L404
br
rd
or
bk
R418
Q404
D446
C410
T401
wt
bk
(L402)
bk
(T302)
rd
na
yl
(L402)
to L400
to L401
L405
na
bl
(T302)
na
(L402)
yl
D444
C402
D443
R408
na/yl
(T302)
bk/yl
(L402)
D442
D440
D430
D431
D432
D433
D434
D410
D411
D412
D413
D414
R425
C425
R426
C426
R427
C427
R428
C428
R429
C429
frm L401
R430
C430
R431
C431
R432
C432
R433
C433
R434
C434
frm L400
C404
yl/gn
yl/gn
C403
R444
R435
C435
R436
C436
R437
C437
R438
C438
R439
C439
bk/yl
(T302)
R440
C440
R441
C441
R442
C442
R443
C443
R444
C444
Q400
D420
D421
D422
D423
D424
D400
D401
D402
D403
D404


F501
C510
D504
T500
C511
C503
C504
C513
R510
D502
R511
R507
C512
Q500
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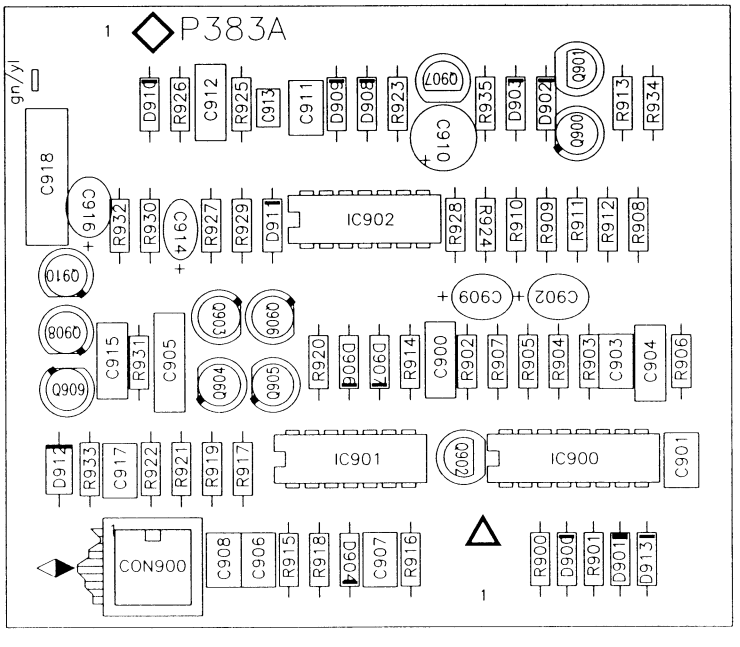
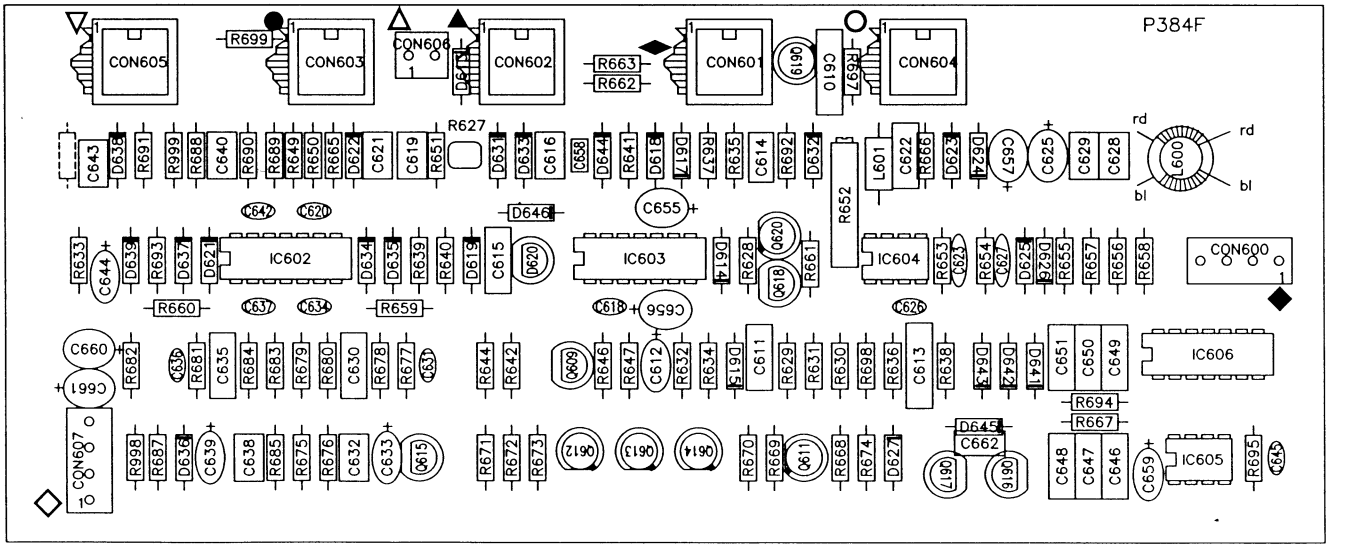
C501
D505
C508
IC500
C505
C500
R516
tp
R514
R515
R512
C509
C507
C506
R505
R506
C514
D503
R513
R504
D501
C502
R500
R501
R502
R503
1
2
3
gn
gy
br
F500
D500
yl/gn
P382C

MAIN SECTION

C100 = 1UF 250V RMS X2
C101 = 4700PF 250V Y2 VISHA
C102 = 1UF 250V RMS X2
C103 = 3300PF 250V Y2 VISHA
C104 = 0.22UF 250V RMS X2
C105 = 22NF 630V POLYPROP
C106 = 22NF 630V POLYPROP
C107 = 1.5UF 250V MET POLYES
C108 = 470PF 400V RMS SAFETY
C109 = 68NF 250V RMS X2
C110 = 0.33UF 400V MET POYES
C200 = 680UF200 CHEM-CON
C201 = 680UF200 CHEM-CON
C202 = 680UF200 CHEM-CON
C203 = 680UF200 CHEM-CON
C204 = 680UF200 CHEM-CON
C205 = 680UF200 CHEM-CON
C207 = N81-A230 SIEMENS
C208 = N81-A230 SIEMENS
C300 = 2.7NF 1000V POLYPROP
C301 = 10NF 630V POLYPROP
C302 = 100PF 1000V CERAMIC
C303 = 1UF 400V MET POLYES
C304 = 1UF 400V MET POLYES
C305 = 1UF 400V MET POLYES
C306 = 1UF 400V MET POLYES
C307 = 100PF 1000V CERAMIC
C308 = 10NF 630V POLYPROP
C309 = 2.7NF 1000V POLYPROP
C310 = 15UF 16V SOLID ALU
C311 = 15UF 16V SOLID ALU
C312 = 15UF 16V SOLID ALU
C313 = 0.22UF 63V MET POLYES
C314 = 10NF 1000V MET POLYES
C315 = 2200PF 250V CERAMIC
C316 = 470PF 400V RMS SAFETY
C317 = 33PF 400V RMS SAFETY
C500 = 22UF 250V CHEMI-CON
C501 = 22UF 250V CHEMI-CON
C502 = 22UF 16V SOLID ALU
C503 = 100PF 1000V CERAMIC
C504 = 2200PF 100V POLYPROP
C505 = 10NF 630V MET POLYES
C506 = 2200PF 100V POLYPROP
C507 = 2200PF 100V POLYPROP
C508 = 100PF 1000V CERAMIC
C509 = 1000PF 100V POLYPROP
C510 = 220UF 35V ERO
C511 = 220UF 35V ERO
C512 = 22UF 250V CHEMI-CON
C513 = 22UF 250V CHEMI-CON
C514 = 10NF 1000V MET POLYES
C610 = 0.22UF 63V MET POLYES
C611 = 10NF 250V MET POLYES
C612 = 2.2UF 25V SOLID ALU
C613 = 0.22UF 63V MET POLYES
C614 = 330NF 50V MULT LAYER
C615 = 47NF 250V MET POLYES
C616 = 2200PF 100V POLYPROP
C618 = 100PF 1000V CERAMIC
C619 = 1000PF 100V POLYPROP
C620 = 100PF 1000V CERAMIC
C621 = 470PF 100V POLYPROP
C622 = 22NF 250V MET POLYES
C623 = 47PF 1000V CERAMIC
C625 = 15UF 16V SOLID ALU
C626 = 470PF 500V CERAMIC
C627 = 47PF 1000V CERAMIC
C628 = 2200PF 100V POLYPROP
C629 = 2200PF 100V POLYPROP
C630 = 22NF 250V MET POLYES
C631 = 100PF 1000V CERAMIC
C632 = 470PF 100V POLYPROP
C633 = 2.2UF 25V SOLID ALU
C634 = 100PF 1000V CERAMIC
C635 = 10NF 250V MET POLYES
C636 = 100PF 1000V CERAMIC
C637 = 100PF 1000V CERAMIC
C638 = 2200PF 100V POLYPROP
C639 = 2.2UF 25V SOLID ALU
C640 = 470PF 100V POLYPROP
C642 = 100PF 1000V CERAMIC
C643 = 470PF 100V POLYPROP
C644 = 2.2UF 25V SOLID ALU
C645 = 15PF 500V CERAMIC
C646 = 10NF 250V MET POLYES
C647 = 10NF 250V MET POLYES
C648 = 10NF 250V MET POLYES
C649 = 10NF 250V MET POLYES
C650 = 10NF 250V MET POLYES
C651 = 10NF 250V MET POLYES
C655 = 15UF 16V SOLID ALU
C656 = 15UF 16V SOLID ALU
C657 = 15UF 16V SOLID ALU
C658 = 0.01UF 100V MULT LAYER
C659 = 2.2UF 25V SOLID ALU
C660 = 15UF 16V SOLID ALU
C661 = 15UF 16V SOLID ALU
C662 = 330NF 50V MULT LAYER
C702 = 10NF 1000V MET POLYES
C703 = 2.2UF 25V SOLID ALU
C704 = 2.2UF 25V SOLID ALU
C705 = 2.2UF 25V SOLID ALU
C706 = 2.2UF 25V SOLID ALU
C707 = 330NF 50V MULT LAYER
C708 = 330NF 50V MULT LAYER
C850 = 220NF 100V MULT LAYER
C852 = 220NF 100V MULT LAYER
C853 = 220NF 100V MULT LAYER
C854 = 220NF 100V MULT LAYER
C855 = 220NF 100V MULT LAYER
C857 = 220NF 100V MULT LAYER
C858 = 220NF 100V MULT LAYER
C859 = 220NF 100V MULT LAYER
C860 = 220NF 100V MULT LAYER

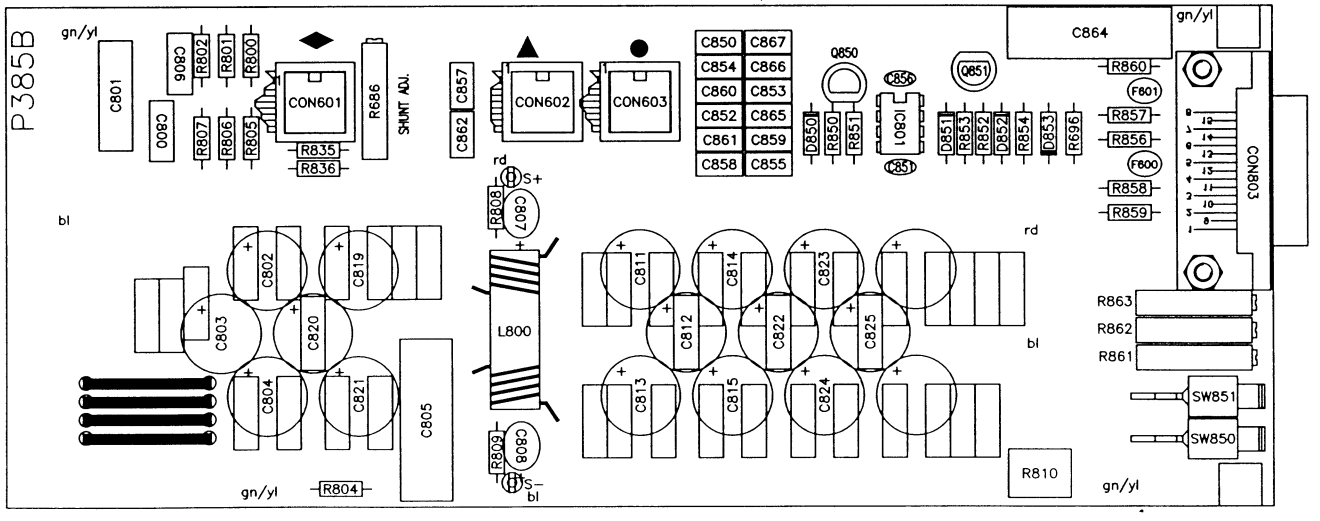


C861	=	220NF 100V	MULT LAYER
C862	=	220NF 100V	MULT LAYER
C864	=	0.22UF 250V RMS	X2
C865	=	220NF 100V	MULT LAYER
C866	=	220NF 100V	MULT LAYER
C867	=	220NF 100V	MULT LAYER
C900	=	47NF 250V	MET POLYES
C901	=	1000PF 100V	POLYPROP
C902	=	15UF 16V	SOLID ALU
C903	=	1000PF 100V	POLYPROP
C904	=	10NF 250V	MET POLYES
C905	=	0.22UF 63V	MET POLYES
C906	=	150PF 100V	POLYPROP
C907	=	220PF 100V	POLYPROP
C908	=	2200PF 100V	POLYPROP
C909	=	15UF 16V	SOLID ALU
C910	=	47UF 63V	ERO
C911	=	1000PF 100V	POLYPROP
C912	=	22NF 250V	MET POLYES
C913	=	0.1UF 100V	MULT LAYER
C914	=	2.2UF 25V	SOLID ALU
C915	=	47NF 250V	MET POLYES
C916	=	15UF 16V	SOLID ALU
C917	=	4700PF 63V	POLYPROP
C918	=	10NF 1000V	MET POLYES
D100	=	BTA 25-700B	ST
D101	=	GPBC35-10	GEN.INSTR.
D300	=	SA13CA	
D301	=	STTA 806 DI	ST
D302	=	STTA 806 DI	ST
D303	=	STTA 806 DI	ST
D304	=	STTA 806 DI	ST
D305	=	STTA 806 DI	ST
D306	=	STTA 806 DI	ST
D307	=	STTA 806 DI	ST
D308	=	STTA 806 DI	ST
D309	=	SA13CA	
D310	=	1N4148	PHILIPS
D311	=	1N5818	MOTOROLA
D312	=	ZPY20	ITT
D313	=	BZX55-C15	ITT
D314	=	1N5818	MOTOROLA
D500	=	SKB2-12L5A	SEMIKRON
D501	=	BYV26B	PHILIPS
D502	=	1N4148	PHILIPS
D503	=	BYV26B	PHILIPS
D504	=	BYV28-200	PHILIPS
D505	=	BYV26B	PHILIPS
D613	=	BZX85-C5V6	ITT
D614	=	1N4148	PHILIPS
D615	=	1N4148	PHILIPS
D617	=	1N4148	PHILIPS
D618	=	BZX55-C12	ITT
D619	=	ZPD 8.2	ITT
D620	=	TL431ILP	TEXAS
D621	=	1N4148	PHILIPS
D622	=	BZX55-C12	ITT
D623	=	BAS45	PHILIPS
D624	=	BAS45	PHILIPS
D625	=	1N4148	PHILIPS
D626	=	1N4148	PHILIPS
D627	=	BZX85-C5V6	ITT
D631	=	1N4148	PHILIPS
D632	=	1N4148	PHILIPS
D633	=	1N4148	PHILIPS
D634	=	1N4148	PHILIPS
D635	=	1N4148	PHILIPS
D636	=	ZPD 8.2	ITT
D637	=	1N4148	PHILIPS
D638	=	BZX55-C12	ITT
D639	=	ZPD 8.2	ITT
D641	=	BZX85-C12	ITT
D642	=	BZX85-C12	ITT
D643	=	BZX85-C12	ITT
D644	=	ZPD 8.2	ITT
D645	=	BZX55-C12	ITT
D646	=	ZPY 5.1	ITT
D700	=	LED 3MM GREEN	
D701	=	LED 3MM RED	TELEFUNKEN
D702	=	LED 3MM GREEN	
D900	=	1N4148	PHILIPS
D901	=	ZPD 6.2V	ITT
D902	=	BZX55-C10	ITT
D903	=	ZPD 8.2	ITT
D904	=	1N4148	PHILIPS
D906	=	1N4148	PHILIPS
D907	=	1N4148	PHILIPS
D908	=	1N4148	PHILIPS
D909	=	1N4148	PHILIPS
D910	=	1N4148	PHILIPS
D911	=	1N4148	PHILIPS
D912	=	BYV26B	PHILIPS
D913	=	1N825	CDI
F100A	=	FUSE 5X20 8T	220V
F100B	=	FUSE 5X20 16T	110V
F101A	=	FUSE 5X20 8T	220V
F101B	=	FUSE 5X20 16T	110V
F300	=	FUSE 6X32 6.3FF	
F500	=	FUSE 5X20 1T	SCHURT
F501	=	FUSE 0.5A/450VDC	BUSS
F600	=	FUSE PTC 0.65A	BOURNS
F601	=	FUSE PTC 0.65A	BOURNS
IC500	=	UC3842	UNITRODE
IC602	=	TL084BCN	TEXAS
IC603	=	TL084BCN	TEXAS
IC604	=	OP177GP	AD
IC605	=	REF02HP	
IC606	=	TL084BCN	TEXAS
IC700	=	TL084BCN	TEXAS
IC701	=	L7805CV	ST
IC702	=	L7905CV	ST
IC900	=	HEF4046 BP	PHILIPS
IC901	=	HEF4011BD	PHILIPS
IC902	=	HEF4069UBD	PHILIPS
L100	=	XL257	DELTA
L101	=	XL257	DELTA
L102	=	XL258A	DELTA

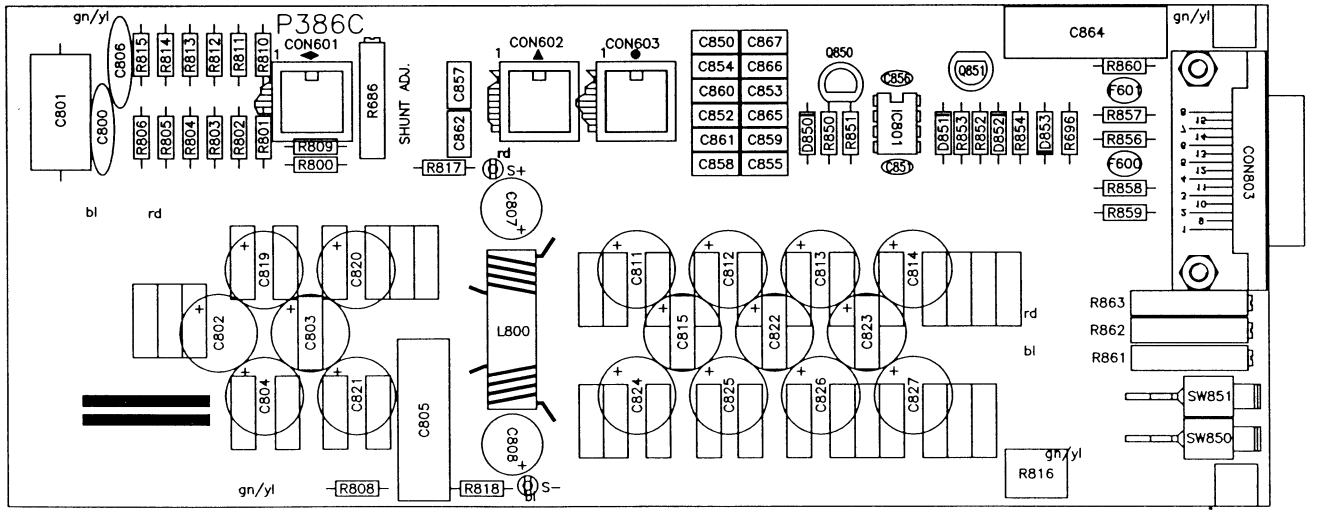


L300	=	XL259	DELTA
L301	=	XL260	DELTA
L302	=	XL260	DELTA
L303	=	XL237	DELTA
L600	=	XL245	DELTA
L601	=	15UH	SIEMENS
M1	=	3.5 DIGIT LED DPM	
M2	=	3.5 DIGIT LED DPM	
Q300	=	STH18NB40FI	
Q301	=	STH18NB40FI	
Q302	=	STH18NB40FI	
Q303	=	STH18NB40FI	
Q307	=	IRF9520	IR
Q308	=	IRF510	IR
Q309	=	BST100	PHILIPS
Q310	=	BST70	PHILIPS
Q500	=	STP3NB80FP	IR
Q609	=	BS170	ITT
Q611	=	PH2907A	PHILIPS
Q612	=	PH2222A	PHILIPS
Q613	=	PH2222A	PHILIPS
Q614	=	PH2222A	PHILIPS
Q615	=	BS170	ITT
Q616	=	BS170	ITT
Q617	=	BS170	ITT
Q618	=	BS250	ITT
Q619	=	PH2222A	PHILIPS
Q620	=	PH2907A	PHILIPS
Q900	=	PH2222A	PHILIPS
Q901	=	BS170	ITT
Q902	=	BS170	ITT
Q903	=	PH2907A	PHILIPS
Q904	=	PH2222A	PHILIPS
Q905	=	PH2222A	PHILIPS
Q906	=	PH2907A	PHILIPS
Q907	=	BS250	ITT
Q908	=	PH2222A	PHILIPS
Q909	=	PH2222A	PHILIPS
Q910	=	PH2907A	PHILIPS
R100	=	TNR23G471K	
R101	=	1M	MF/0.25W/1600V
R102	=	3.3	MF/3.0W/750V
R103	=	3.3	MF/3.0W/750V
R104	=	120	MF/2.0W/500V
R105	=	PTC 150	B754 SIEMENS
R106	=	PTC 150	B754 SIEMENS
R107	=	47	WW/6.0W/200V
R108	=	PTC 150	B754 SIEMENS
R200	=	39.2K	MF/0.6W/350V
R201	=	39.2K	MF/0.6W/350V
R202	=	39.2K	MF/0.6W/350V
R203	=	39.2K	MF/0.6W/350V
R300	=	6.81	MF/0.6W/350V
R301	=	6.81	MF/0.6W/350V
R302	=	150	MF/2.0W/500V
R303	=	150	MF/2.0W/500V
R304	=	6.81	MF/0.6W/350V
R305	=	6.81	MF/0.6W/350V

R308	=	2.21	MF/0.6W/350V
R309	=	4.75K	MF/0.6W/350V
R310	=	2.21	MF/0.6W/350V
R311	=	10K	MF/0.6W/350V
R500	=	33.2K	MF/0.6W/350V
R501	=	33.2K	MF/0.6W/350V
R502	=	33.2K	MF/0.6W/350V
R503	=	33.2K	MF/0.6W/350V
R504	=	6.81	MF/0.6W/350V
R505	=	68.1K	MF/0.6W/350V
R506	=	15K	MF/0.6W/350V
R507	=	392K	MF/0.6W/350V
R508	=	8.25K	MF/0.6W/350V
R509	=	CR	MF/0.6W/250V
R510	=	681K	MF/0.6W/350V
R511	=	475	MF/0.6W/350V
R512	=	221	MF/0.6W/350V
R513	=	10K	MF/0.6W/350V
R514	=	5.62	MF/0.6W/350V
R515	=	2.2K	MF/2.0W/500V
R516	=	2.2K	MF/2.0W/500V
R628	=	562K	MF/0.6W/350V
R629	=	10K	MF/0.6W/350V
R630	=	12.1K	MF/0.6W/350V
R631	=	100K	MF/0.6W/350V
R632	=	10K	MF/0.6W/350V
R633	=	56.2K	MF/0.6W/350V
R634	=	10K	MF/0.6W/350V
R635	=	332	MF/0.6W/350V
R636	=	22.1	MF/0.6W/350V
R637	=	681	MF/0.6W/350V
R638	=	681	MF/0.6W/350V
R639	=	2.21K	MF/0.6W/350V
R640	=	6.81K	MF/0.6W/350V
R641	=	1K	MF/0.6W/350V
R642	=	1K	MF/0.6W/350V
R644	=	4.75K	MF/0.6W/350V
R646	=	10K	MF/0.6W/350V
R647	=	4.75K	MF/0.6W/350V
R649	=	4.75K	MF/0.6W/350V
R650	=	4.75K	MF/0.6W/350V
R651	=	82.5K	MF/0.6W/350V
R652	=	10K TRIMPOTM 20 TURNS	
R653	=	100K	MF/0.6W/350V
R654	=	100K	MF/0.6W/350V
R655	=	825	MF/0.6W/350V
R656	=	825	MF/0.6W/350V
R657	=	10	MF/0.6W/350V
R658	=	10	MF/0.6W/350V
R659	=	10K	MF/0.6W/350V
R660	=	10K	MF/0.6W/350V
R661	=	10K	MF/0.6W/350V
R662	=	1K	MF/0.6W/350V
R663	=	4.75K	MF/0.6W/350V
R665	=	332	MF/0.6W/350V
R666	=	825	MF/0.6W/350V
R667	=	10K	MF/0.6W/350V
R668	=	1K	MF/0.6W/350V



R669	=	10K	MF/0.6W/350V
R670	=	2.21K	MF/0.6W/350V
R671	=	2.21K	MF/0.6W/350V
R672	=	2.21K	MF/0.6W/350V
R673	=	2.21K	MF/0.6W/350V
R674	=	2.21K	MF/0.6W/350V
R675	=	475	MF/0.6W/350V
R676	=	10K	MF/0.6W/350V
R677	=	3.32K	MF/0.6W/350V
R678	=	4.75K	MF/0.6W/350V
R679	=	4.75K	MF/0.6W/350V
R680	=	4.75K	MF/0.6W/350V
R681	=	6.81K	MF/0.6W/350V
R682	=	2.2M	MF/0.25W/1600V
R683	=	4.75K	MF/0.6W/350V
R684	=	4.75K	MF/0.6W/350V
R685	=	2.21K	MF/0.6W/350V
R686	=	10K TRIMPOTM 20 TURNS	
R687	=	1K	MF/0.6W/350V
R688	=	150K	MF/0.6W/350V
R689	=	4.75K	MF/0.6W/350V
R690	=	4.75K	MF/0.6W/350V
R691	=	10M	MF/0.25W/1600V
R692	=	332	MF/0.6W/350V
R693	=	1K	MF/0.6W/350V
R694	=	10K	MF/0.6W/350V
R695	=	26.7K	MF/0.6W/350V
R696	=	475	MF/0.6W/350V
R697	=	1K	MF/0.6W/350V
R698	=	47.5	MF/0.6W/350V
R699	=	47.5K	MF/0.6W/350V
R700	=	5K POTM 10 TURNS	
R701	=	5K POTM 10 TURNS	
R702	=	5K POTM 10 TURNS	
R703	=	1K	MF/0.6W/350V
R704	=	4.75K	MF/0.6W/350V
R705	=	3.92K	MF/0.6W/350V
R706	=	2K TRIMPOTM 20 TURNS	
R707	=	3.92K	MF/0.6W/350V
R708	=	2K TRIMPOTM 20 TURNS	
R709	=	CR	MF/0.6W/250V
R710	=	1K	MF/0.6W/350V
R711	=	1M	MF/0.25W/1600V
R712	=	10K TRIMPOTM 20 TURNS	
R713	=	CR	MF/0.6W/250V
R714	=	1K	MF/0.6W/350V
R715	=	1M	MF/0.25W/1600V
R716	=	10K TRIMPOTM 20 TURNS	
R717	=	562	MF/0.6W/350V
R718	=	562	MF/0.6W/350V
R719	=	100	MF/0.6W/350V
R720	=	100K	MF/0.6W/350V
R721	=	100	MF/0.6W/350V
R722	=	100K	MF/0.6W/350V
R856	=	12.1	MF/0.6W/350V
R857	=	12.1	MF/0.6W/350V
R858	=	12.1	MF/0.6W/350V
R859	=	12.1	MF/0.6W/350V
R860	=	12.1	MF/0.6W/350V
R861	=	5K TRIMPOT	OPTION
R862	=	5K TRIMPOT	OPTION
R863	=	5K TRIMPOT	OPTION
R900	=	100	MF/0.6W/350V
R901	=	332	MF/0.6W/350V
R902	=	332	MF/0.6W/350V
R903	=	56.2K	MF/0.6W/350V
R904	=	CR	MF/0.6W/250V
R905	=	12.1K	MF/0.6W/350V
R906	=	12.1K	MF/0.6W/350V
R907	=	12.1K	MF/0.6W/350V
R908	=	10K	MF/0.6W/350V
R909	=	10K	MF/0.6W/350V
R910	=	10K	MF/0.6W/350V
R911	=	10K	MF/0.6W/350V
R912	=	10K	MF/0.6W/350V
R913	=	475	MF/0.6W/350V
R914	=	475	MF/0.6W/350V
R915	=	1.82K	MF/0.6W/350V
R916	=	2.21K	MF/0.6W/350V
R917	=	18.2	MF/0.6W/350V
R918	=	6.81K	MF/0.6W/350V
R919	=	1K	MF/0.6W/350V
R920	=	1K	MF/0.6W/350V
R921	=	3.32K	MF/0.6W/350V
R922	=	3.32K	MF/0.6W/350V
R923	=	100	MF/0.6W/350V
R924	=	10K	MF/0.6W/350V
R925	=	12.1K	MF/0.6W/350V
R926	=	100	MF/0.6W/350V
R927	=	8.25K	MF/0.6W/350V
R928	=	18.2	MF/0.6W/350V
R929	=	12.1K	MF/0.6W/350V
R930	=	2.21K	MF/0.6W/350V
R931	=	1K	MF/0.6W/350V
R932	=	1K	MF/0.6W/350V
R933	=	3.32	MF/0.6W/350V
R934	=	10K	MF/0.6W/350V
R935	=	56.2K	MF/0.6W/350V
R998	=	8.2M	MF/0.25W/1600V
R999	=	8.2M	MF/0.25W/1600V
SW100	=	SWITCH DPST 15A TGL	
SW101	=	VOLTAGE SELECT 110/220V	
SW600	=	SWITCH THERM 90 DEGR C	
SW700	=	SWITCH DPDT 1A PUSH	
SW701	=	SWITCH DPDT 1A PUSH	
SW850	=	SWITCH SPDT 3A SLVE	
SW851	=	SWITCH SPDT 3A SLVE	
T300	=	XT265	DELTA
T301	=	XT242	DELTA
T303	=	XT265	DELTA
T500	=	XT239	DELTA

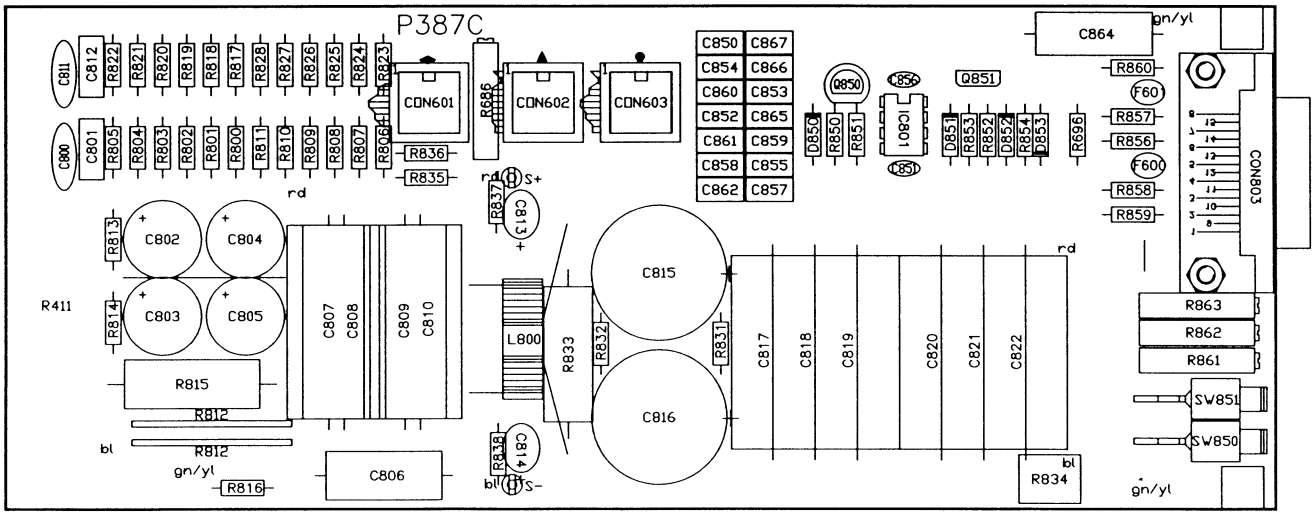


OUTPUT SECTION SM1540

C400	=	2.7NF 1000V	POLYPROP
C401	=	10NF 1000V	MET POLYES
C402	=	10NF 1000V	MET POLYES
C403	=	10NF 1000V	MET POLYES
C800	=	10NF 250V	MET POLYES
C801	=	10NF 1000V	MET POLYES
C802	=	1000UF 25V	CHEMI-CON
C803	=	1000UF 25V	CHEMI-CON
C804	=	1000UF 25V	CHEMI-CON
C805	=	0.22UF 250V RMS	X2
C806	=	10NF 250V	MET POLYES
C807	=	15UF 16V	SOLID ALU
C808	=	15UF 16V	SOLID ALU
C809	=	0.1UF 630V	MET POLYES
C810	=	0.1UF 630V	MET POLYES
C811	=	1000UF 25V	CHEMI-CON
C812	=	1000UF 25V	CHEMI-CON
C813	=	1000UF 25V	CHEMI-CON
C814	=	1000UF 25V	CHEMI-CON
C815	=	1000UF 25V	CHEMI-CON
C816	=	330NF 50V	MULT LAYER
C817	=	330NF 50V	MULT LAYER
C818	=	330NF 50V	MULT LAYER
C819	=	1000UF 25V	CHEMI-CON
C820	=	1000UF 25V	CHEMI-CON
C821	=	1000UF 25V	CHEMI-CON
C822	=	1000UF 25V	CHEMI-CON
C823	=	1000UF 25V	CHEMI-CON
C824	=	1000UF 25V	CHEMI-CON
C825	=	1000UF 25V	CHEMI-CON
C851	=	100PF 1000V	CERAMIC
C856	=	100PF 1000V	CERAMIC
D400	=	60HQ100	IR
D401	=	60HQ100	IR
D402	=	60HQ100	IR
D403	=	60HQ100	IR
D850	=	BZX55-C3V3	ITT
D851	=	1N4148	PHILIPS
D852	=	1N4148	PHILIPS
D853	=	ZPD 8.2	ITT
IC801	=	LM358	ST
L400	=	XL270	DELTA
L401	=	XL298	DELTA
L402	=	XL488	DELTA
L403	=	XL488	DELTA
L404	=	XL488	DELTA
L800	=	XL275	DELTA
L801	=	XL279	DELTA
Q850	=	BS170	ITT
Q851	=	BSS92	PHILIPS
R400	=	56	MF/3.0W/750V
R401	=	56	MF/3.0W/750V
R402	=	56	MF/3.0W/750V
R403	=	56	MF/3.0W/750V
R404	=	PTC 70	C880 SIEMENS
R405	=	PTC 70	C880 SIEMENS
R406	=	PTC 70	C880 SIEMENS
R800	=	2.74K	MF/0.1%/TC=25
R801	=	2.74K	MF/0.1%/TC=25
R802	=	2.74K	MF/0.1%/TC=25
R803	=	0.137 R/M	
R804	=	1.0	MF/0.6W/350V
R805	=	2.74K	MF/0.6W/350V
R806	=	2.74K	MF/0.6W/350V
R807	=	2.74K	MF/0.6W/350V
R808	=	562	MF/0.6W/350V
R809	=	100	MF/0.6W/350V
R810	=	TNR12G821K	MARCON
R811	=	1.0	MF/0.6W/350V
R812	=	1.0	MF/0.6W/350V
R835	=	475K	MF/0.6W/350V
R836	=	1.0	MF/0.6W/350V
R850	=	3.32K	MF/0.6W/350V
R851	=	10K	MF/0.6W/350V
R852	=	3.32K	MF/0.6W/350V
R853	=	1K·	MF/0.6W/350V
R854	=	10K	MF/0.6W/350V
T302	=	XT264	DELTA

OUTPUT SECTION SM7020

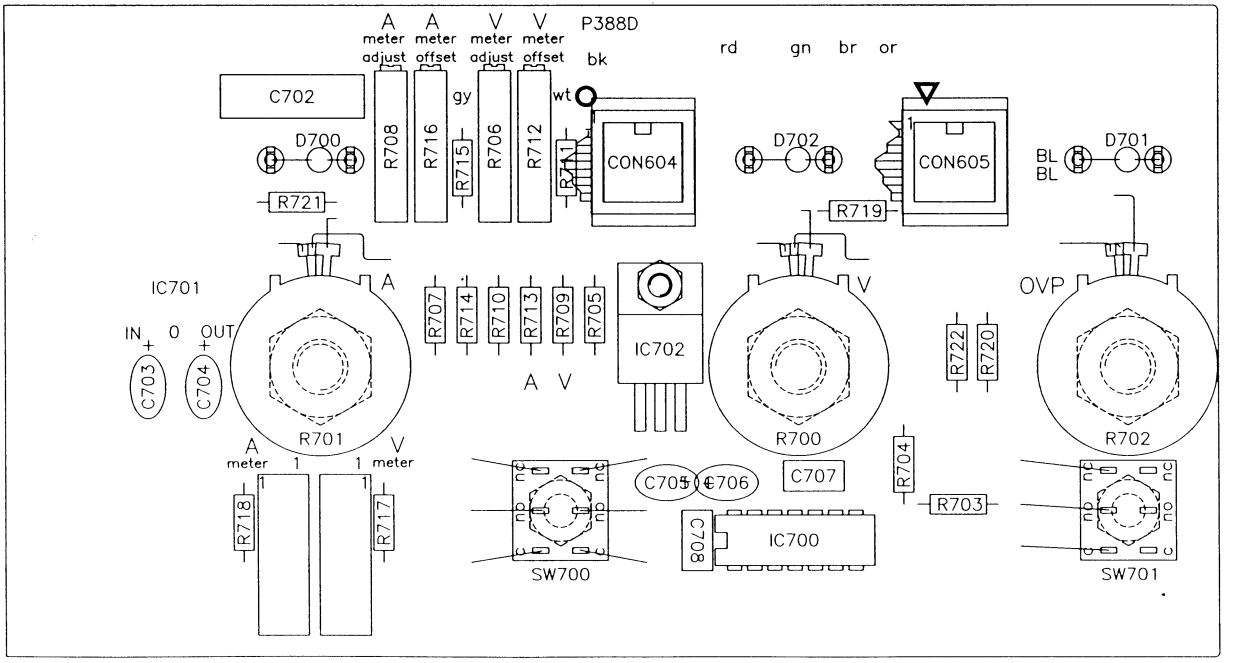
C400	=	1000PF 1600V	WIMA
C401	=	1000PF 1600V	WIMA
C402	=	4700PF 63V	POLYPROP
C403	=	4700PF 63V	POLYPROP
C404	=	4700PF 63V	POLYPROP
C405	=	220PF 100V	POLYPROP
C406	=	10NF 250V	MET POLYES
C407	=	10NF 250V	MET POLYES
C408	=	10NF 1000V	MET POLYES
C409	=	10NF 1000V	MET POLYES
C410	=	15UF 16V	SOLID ALU
C800	=	5000PF 250V	CERAMIC
C801	=	0.1UF 630V	MET POLYES
C802	=	100UF 100V	CHEM-CON
C803	=	100UF 100V	CHEM-CON
C804	=	100UF 100V	CHEM-CON
C805	=	0.22UF 250V RMS	X2
C806	=	5000PF 250V	CERAMIC
C807	=	22UF 100V	CHEMI-CON
C808	=	22UF 100V	CHEMI-CON
C809	=	0.1UF 630V	MET POLYES
C810	=	0.1UF 630V	MET POLYES
C811	=	100UF 100V	CHEM-CON
C812	=	100UF 100V	CHEM-CON
C813	=	100UF 100V	CHEM-CON
C814	=	100UF 100V	CHEM-CON
C815	=	100UF 100V	CHEM-CON
C816	=	220NF 100V	MULT LAYER
C817	=	220NF 100V	MULT LAYER
C818	=	220NF 100V	MULT LAYER
C819	=	100UF 100V	CHEM-CON
C820	=	100UF 100V	CHEM-CON
C821	=	100UF 100V	CHEM-CON
C822	=	100UF 100V	CHEM-CON
C823	=	100UF 100V	CHEM-CON
C824	=	100UF 100V	CHEM-CON



C825	=	100UF 100V	CHEM-CON
C826	=	100UF 100V	CHEM-CON
C827	=	100UF 100V	CHEM-CON
C851	=	100PF 1000V	CERAMIC
C856	=	100PF 1000V	CERAMIC
C870	=	2200PF 250V	CERAMIC
C871	=	470PF 400V RMS	SAFETY
C872	=	2200PF 250V	CERAMIC
C873	=	2200PF 250V	CERAMIC
D400	=	BYV52-PI-200	ST
D402	=	BYV52-PI-200	ST
D404	=	BZX85-C51	ITT
D405	=	BZX85-C51	ITT
D406	=	BZX85-C51	ITT
D407	=	BZX85-C15	ITT
D408	=	BZX85-C15	ITT
D409	=	BZX85-C15	ITT
D410	=	1N4148	PHILIPS
D411	=	1N4148	PHILIPS
D412	=	1N4148	PHILIPS
D445	=	BZX85-C36	ITT
D446	=	BZX85-C36	ITT
D447	=	1N4148	PHILIPS
D448	=	1N4148	PHILIPS
D850	=	BZX55-C3V3	ITT
D851	=	1N4148	PHILIPS
D852	=	1N4148	PHILIPS
D853	=	ZPD 8.2	ITT
IC400	=	HEF4011BD	PHILIPS
IC401	=	HEF4069UBD	PHILIPS
IC801	=	LM358	ST
L400	=	XL266	DELTA
L401	=	XL266	DELTA
L402	=	XL266	DELTA
L403	=	XL266	DELTA
L404	=	XL268	DELTA
L800	=	XL273	DELTA
L801	=	XL277	DELTA
Q400	=	IRFIZ44	IR
Q401	=	IRFIZ44	IR
Q402	=	IRFIZ44	IR
Q403	=	BS170	ITT
Q404	=	BS170	ITT
Q850	=	BS170	ITT
Q851	=	BSS92	PHILIPS
R400	=	68	MF/3.0W/750V
R401	=	68	MF/3.0W/750V
R402	=	1K	MF/0.6W/350V
R403	=	1K	MF/0.6W/350V
R404	=	1K	MF/0.6W/350V
R405	=	PTC 600	C884 SIEMENS
R406	=	PTC 600	C884 SIEMENS
R407	=	PTC 600	C884 SIEMENS
R417	=	10K	MF/0.6W/350V
R418	=	10K	MF/0.6W/350V
R419	=	2.21K	MF/0.6W/350V
R420	=	4.75K	MF/0.6W/350V
R421	=	6.81K	MF/0.6W/350V
R422	=	6.81K	MF/0.6W/350V
R423	=	10K	MF/0.6W/350V
R424	=	10K	MF/0.6W/350V
R800	=	1.8M	MF/0.25W/1600V
R801	=	8.25K	MF/0.6W/350V
R802	=	8.25K	MF/0.6W/350V
R803	=	6.81K	MF/0.6W/350V
R804	=	6.81K	MF/0.6W/350V
R805	=	5.62K	MF/0.6W/350V
R806	=	2.74K	MF/0.6W/350V
R807	=	0.137 R/M	
R808	=	1.0	MF/0.6W/350V
R809	=	1.0	MF/0.6W/350V
R810	=	5K62	MF/0.1%/TC=25
R811	=	7.50K	MF/0.1%/TC=25
R812	=	7.50K	MF/0.1%/TC=25
R813	=	7.50K	MF/0.1%/TC=25
R814	=	7.50K	MF/0.1%/TC=25
R815	=	2.74K	MF/0.1%/TC=25
R816	=	TNR12G821K	MARCON
R817	=	4.75K	MF/0.6W/350V
R818	=	100	MF/0.6W/350V
R850	=	3.32K	MF/0.6W/350V
R851	=	10K	MF/0.6W/350V
R852	=	3.32K	MF/0.6W/350V
R853	=	1K	MF/0.6W/350V
R854	=	10K	MF/0.6W/350V
T302	=	XT262	DELTA
T400	=	XT271	DELTA
T401	=	XT272	DELTA

OUTPUT SECTION SM3004

C402	=	4700PF 63V	POLYPROP
C403	=	68NF 250V RMS	X2
C404	=	10NF 1000V	MET POLYES
C405	=	220PF 100V	POLYPROP
C407	=	10NF 250V	MET POLYES
C410	=	15UF 16V	SOLID ALU
C425	=	VJ1206 470PF500V	VITRA
C426	=	VJ1206 470PF500V	VITRA
C427	=	VJ1206 470PF500V	VITRA
C428	=	680PF 500V NPO	VITR
C429	=	680PF 500V NPO	VITR
C430	=	VJ1206 470PF500V	VITRA
C431	=	VJ1206 470PF500V	VITRA
C432	=	VJ1206 470PF500V	VITRA
C433	=	680PF 500V NPO	VITR
C434	=	680PF 500V NPO	VITR
C435	=	VJ1206 470PF500V	VITRA
C436	=	VJ1206 470PF500V	VITRA
C437	=	VJ1206 470PF500V	VITRA
C438	=	VJ1206 470PF500V	VITRA
C439	=	VJ1206 470PF500V	VITRA
C440	=	VJ1206 470PF500V	VITRA



C441	=	VJ1206 470PF500V	VITRA
C442	=	VJ1206 470PF500V	VITRA
C443	=	VJ1206 470PF500V	VITRA
C444	=	VJ1206 470PF500V	VITRA
C800	=	2200PF 250V	CERAMIC
C801	=	47NF 250V	MET POLYES
C802	=	15UF 200V	CHEMI-CON
C803	=	15UF 200V	CHEMI-CON
C804	=	15UF 200V	CHEMI-CON
C805	=	15UF 200V	CHEMI-CON
C806	=	68NF 250V RMS	X2
C807	=	1UF 400V	MET POLYES
C808	=	1UF 400V	MET POLYES
C809	=	1UF 400V	MET POLYES
C810	=	1UF 400V	MET POLYES
C811	=	2200PF 250V	CERAMIC
C812	=	47NF 250V	MET POLYES
C813	=	15UF 16V	SOLID ALU
C814	=	15UF 16V	SOLID ALU
C815	=	220UF 200V	CHEMI-CON
C816	=	220UF 200V	CHEMI-CON
C817	=	1UF 400V	MET POLYES
C818	=	1UF 400V	MET POLYES
C819	=	1UF 400V	MET POLYES
C820	=	1UF 400V	MET POLYES
C821	=	1UF 400V	MET POLYES
C822	=	1UF 400V	MET POLYES
C823	=	68NF 250V RMS	X2
C824	=	1UF 400V	MET POLYES
C825	=	68NF 250V RMS	X2
C851	=	100PF 1000V	CERAMIC
C856	=	100PF 1000V	CERAMIC
C864	=	10NF 1000V	MET POLYES
C870	=	2200PF 250V	CERAMIC
C872	=	2200PF 250V	CERAMIC
C873	=	2200PF 250V	CERAMIC
D400	=	BYW81-PI-200	ST
D401	=	BYW81-PI-200	ST
D402	=	BYW81-PI-200	ST
D403	=	BYW81-PI-200	ST
D404	=	BYW81-PI-200	ST
D410	=	BYW81-PI-200	ST
D411	=	BYW81-PI-200	ST
D412	=	BYW81-PI-200	ST
D413	=	BYW81-PI-200	ST
D414	=	BYW81-PI-200	ST
D420	=	BYW81-PI-200	ST
D421	=	BYW81-PI-200	ST
D422	=	BYW81-PI-200	ST
D423	=	BYW81-PI-200	ST
D424	=	BYW81-PI-200	ST
D430	=	BYW81-PI-200	ST
D431	=	BYW81-PI-200	ST
D432	=	BYW81-PI-200	ST
D433	=	BYW81-PI-200	ST
D434	=	BYW81-PI-200	ST
D440	=	STTA 806 DI	ST
D442	=	STTA 806 DI	ST
D443	=	BZX85-C15	ITT
D444	=	1N4148	PHILIPS
D446	=	BZX85-C36	ITT
D448	=	1N4148	PHILIPS
D850	=	BZX55-C3V3	ITT
D851	=	1N4148	PHILIPS
D852	=	1N4148	PHILIPS
D853	=	ZPD 8.2	ITT
IC400	=	HEF4011BD	PHILIPS
IC401	=	HEF4069UBD	PHILIPS
IC801	=	LM358	ST
L400	=	XL485	DELTA
L401	=	XL485	DELTA
L402	=	XL269	DELTA
L403	=	XL280	DELTA
L404	=	XL280	DELTA
L405	=	XL300	DELTA
L800	=	XL274	DELTA
L801	=	XL279	DELTA
Q400	=	STP11NB 40FP	ST
Q404	=	BS170	ITT
Q850	=	BS170	ITT
Q851	=	ZVP 0540	ZETEX
R408	=	1K	MF/0.6W/350V
R411	=	PTC 1K1	SIEMENS
R418	=	10K	MF/0.6W/350V
R419	=	2.21K	MF/0.6W/350V
R420	=	4.75K	MF/0.6W/350V
R422	=	6.81K	MF/0.6W/350V
R423	=	10K	MF/0.6W/350V
R424	=	10K	MF/0.6W/350V
R425	=	220	MF/2.0W/500V
R426	=	220	MF/2.0W/500V
R427	=	220	MF/2.0W/500V
R428	=	220	MF/2.0W/500V
R429	=	220	MF/2.0W/500V
R430	=	220	MF/2.0W/500V
R431	=	220	MF/2.0W/500V
R432	=	220	MF/2.0W/500V
R433	=	220	MF/2.0W/500V
R434	=	220	MF/2.0W/500V
R435	=	220	MF/2.0W/500V
R436	=	220	MF/2.0W/500V
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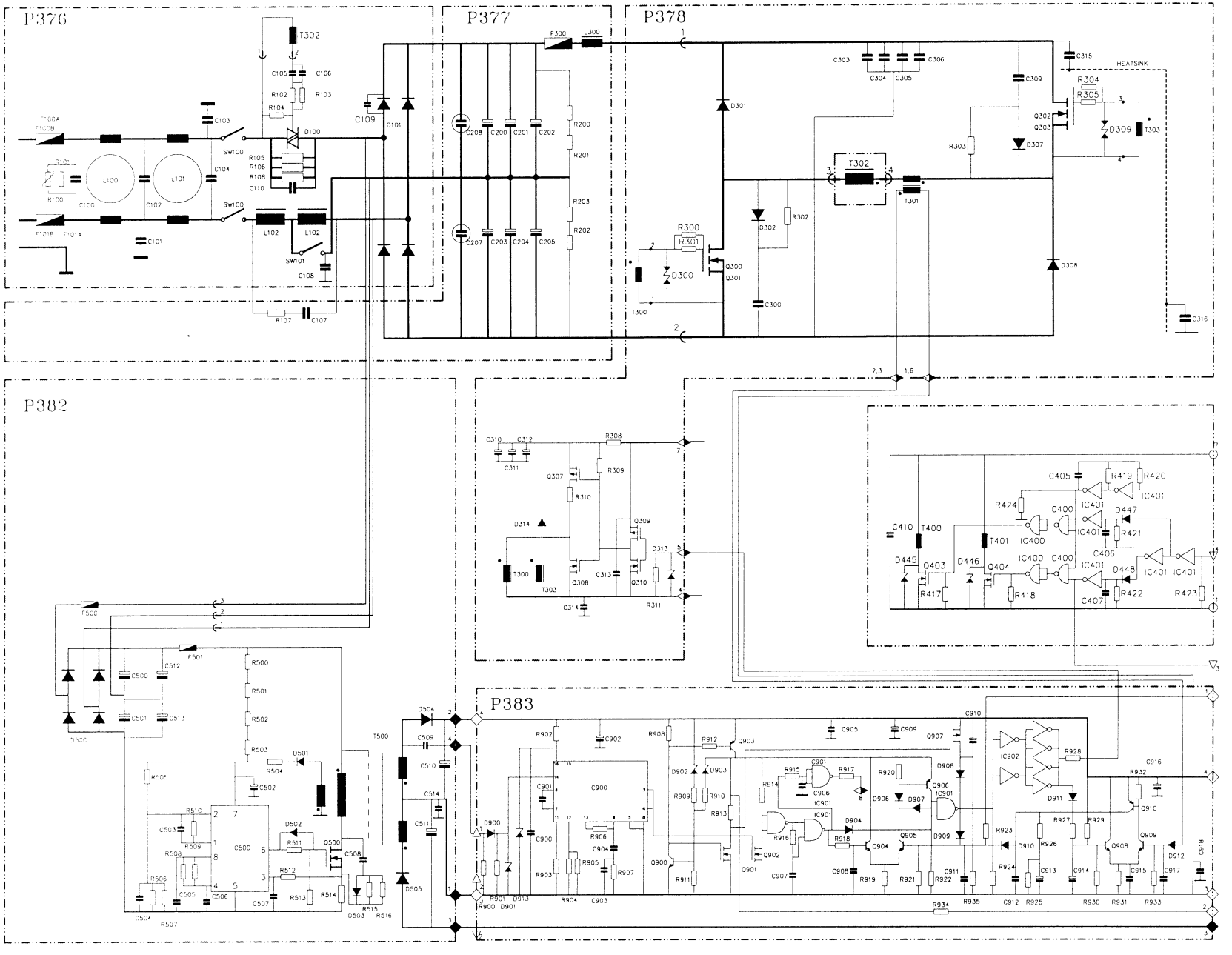
R442	=	220	MF/2.0W/500V
R443	=	220	MF/2.0W/500V
R444	=	220	MF/2.0W/500V
R800	=	15K	MF/0.6W/350V
R801	=	15K	MF/0.6W/350V
R802	=	18.2K	MF/0.6W/350V
R803	=	18.2K	MF/0.6W/350V
R804	=	18.2K	MF/0.6W/350V
R805	=	2.74K	MF/0.6W/350V
R806	=	1.82K	MF/0.6W/350V
R807	=	15K	MF/0.6W/350V
R808	=	15K	MF/0.6W/350V
R809	=	15K	MF/0.6W/350V
R810	=	15K	MF/0.6W/350V
R811	=	15K	MF/0.6W/350V
R812	=	SHUNT 50MV	DELTA
R813	=	150K	MF/0.6W/350V
R814	=	150K	MF/0.6W/350V
R815	=	0.39R	WW/6.0W/200V
R816	=	1.0	MF/0.6W/350V
R817	=	14.7K	MF/0.1%/TC=25
R818	=	14.7K	MF/0.1%/TC=25
R819	=	14.7K	MF/0.1%/TC=25
R820	=	14.7K	MF/0.1%/TC=25
R821	=	14.7K	MF/0.1%/TC=25
R822	=	2.74K	MF/0.1%/TC=25
R823	=	14.7K	MF/0.1%/TC=25
R824	=	14.7K	MF/0.1%/TC=25
R825	=	14.7K	MF/0.1%/TC=25
R826	=	14.7K	MF/0.1%/TC=25
R827	=	14.7K	MF/0.1%/TC=25
R828	=	14.7K	MF/0.1%/TC=25
R831	=	150K	MF/0.6W/350V
R832	=	150K	MF/0.6W/350V
R833	=	0.39R	WW/6.0W/200V
R834	=	TNR12G821K	MARCON
R835	=	5.6M	MF/0.25W/1600V
R836	=	1.0	MF/0.6W/350V
R837	=	8.25K	MF/0.6W/350V
R838	=	100	MF/0.6W/350V
R850	=	3.32K	MF/0.6W/350V
R851	=	10K	MF/0.6W/350V
R852	=	3.32K	MF/0.6W/350V
R853	=	1K	MF/0.6W/350V
R854	=	10K	MF/0.6W/350V
T302	=	XT263	DELTA
T401	=	XT272	DELTA


P376
P377
P378
P382
P383
T302
C105
C106
R102
R103
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SW100
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R106
R108
C110
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C102
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IC400
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Q404
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R912
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Q907
C910
IC902
R928
C916
R932
Q910
R927
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Q908
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C917
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R935
C912
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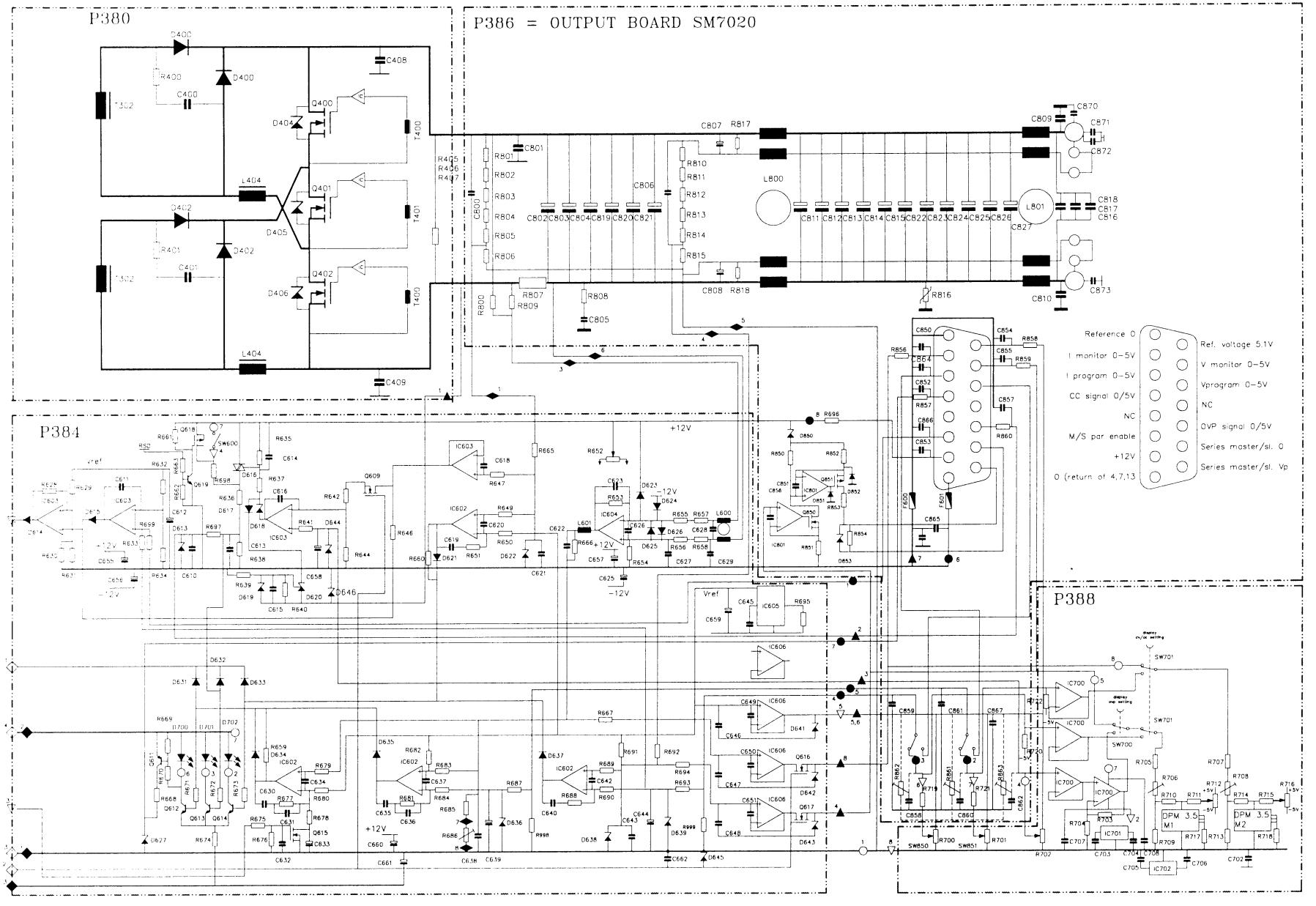
R930
R931
R933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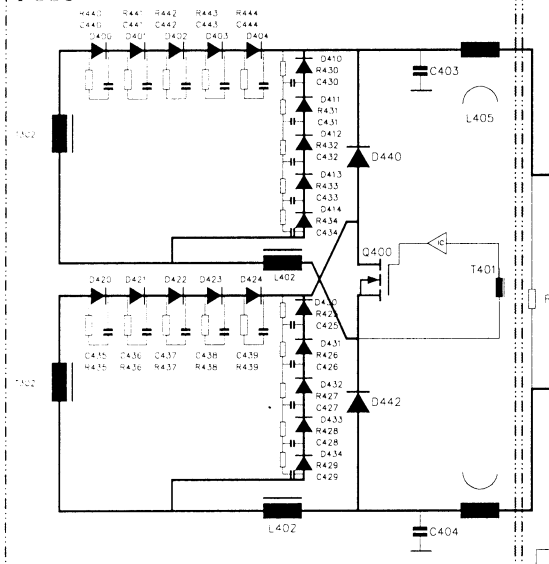
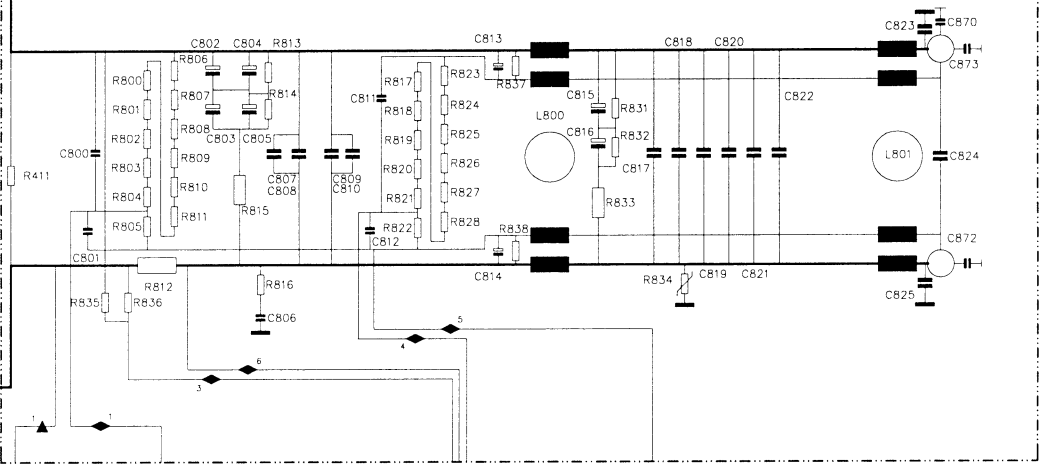
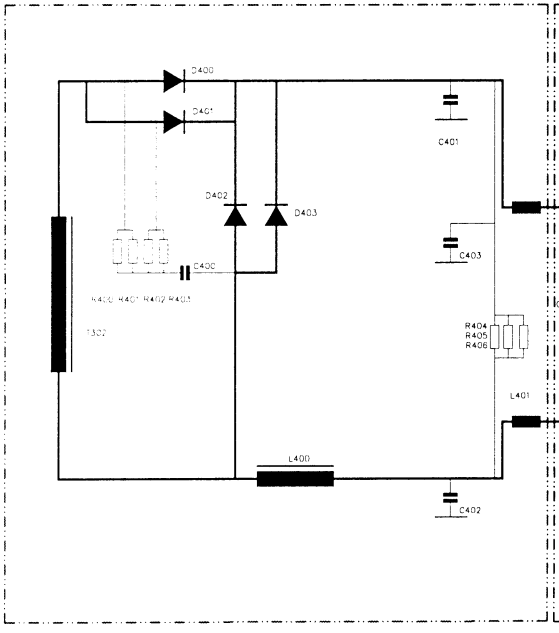
P386 = OUTPUT BOARD SM7020
P384
P388
Reference 0
I monitor 0-5V
I program 0-5V
CC signal 0/5V
NC
M/S par enable
+12V
0 (return of 4,7,13
Ref. voltage 5.1V
V monitor 0-5V
Vprogram 0-5V
NC
OVP signal 0/5V
Series master/sl. 0
Series master/sl. Vp
DPM 3.5 M1
DPM 3.5 M2

P381

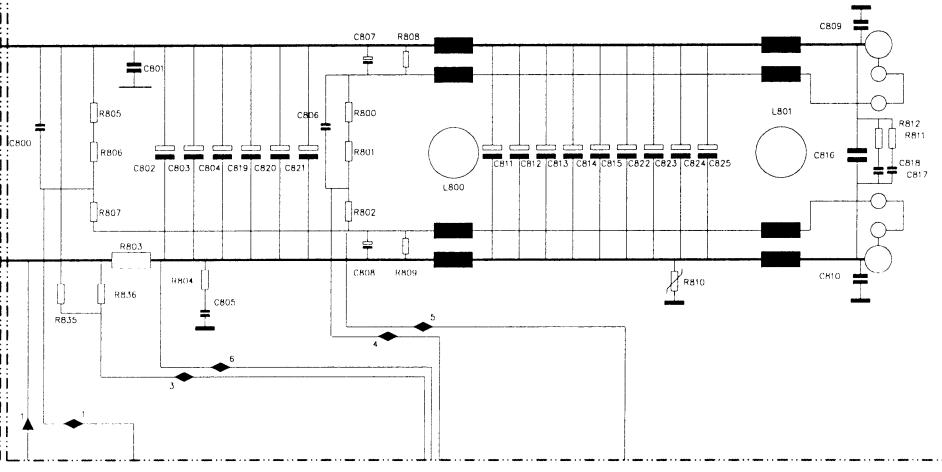


P387 = OUTPUT BOARD SM3004





P385 = OUTPUT BOARD SM1540



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EC Declaration of Conformity

We
Delta Elektronika
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The Netherlands

declare under sole responsibility that the following Power Supplies:

SM 1540-D
SM 7020-D
SM 3004-D

meet the intent of Directives 89/336/EEC; 92/31/EEC; 93/68/EEC for Electromagnetic Compatibility and
Directives 73/23/EEC; 93/68/EEC regarding Electrical Safety. (Low Voltage Directive)
Compliance was demonstrated to the following specification as listed in the official Journal of the European Communities:

EN 50081-1 Generic Emissions: (residential, light industrial)

EN 55022	Radiated, Class B
EN 55022	Conducted, Class B
EN 61000-3-2	Power Harmonics
EN 61000-3-3	Voltage fluctuation and flicker

EN 50082-1 Generic Immunity: (residential, light industrial)

EN 50082-2 Generic Immunity: (industrial environment)

EN 61000-4-2	Electrostatic Discharge	Level 3.
EN 61000-4-4	Electrical Fast Transients / Bursts	Level 4.
ENV 50140	Radiated electromagnetic fields	Level 3.
ENV 50141	Conducted electromagnetic fields	Level 3.
EN 61000-4-5	Surge on DC output	Level 3, differential mode.
EN 61000-4-5	Surge on DC output	Level 2, common mode.
EN 61000-4-5	Surge on line input	Level 4.
EN 61000-4-11	Voltage variations and dips	

EN 60950 Safety of IT equipment

IEC 1010 Safety of electrical equipment for measurement, control and laboratory use

Managing director