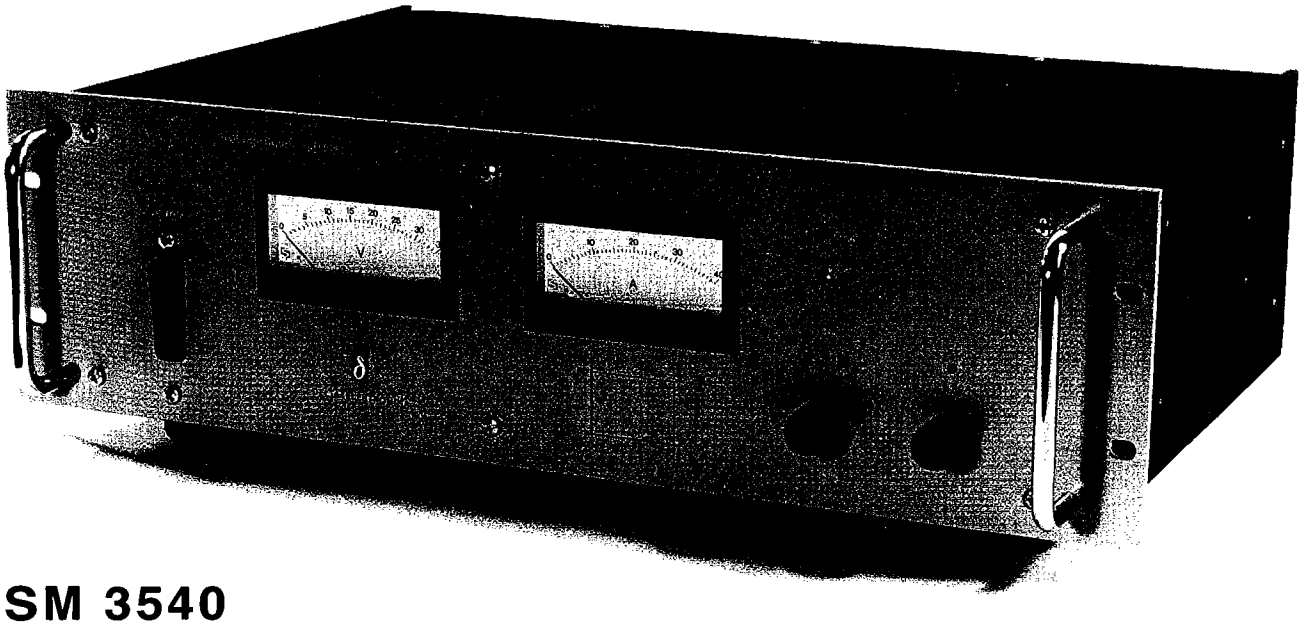
SM 3540-D
SMX 7220-D

DELTA ELEKTRONIKA BV

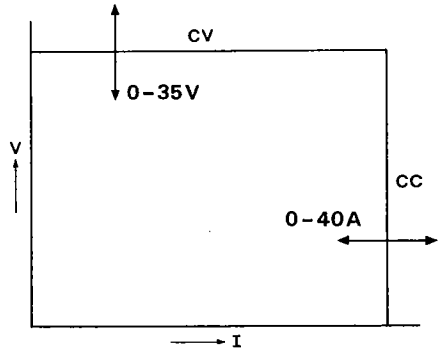
P.O. BOX 27
4300 AA ZIERIKZEE
NETHERLANDS
TEL. (01110) 13656 TLX 55349
FAX (01110) 16919



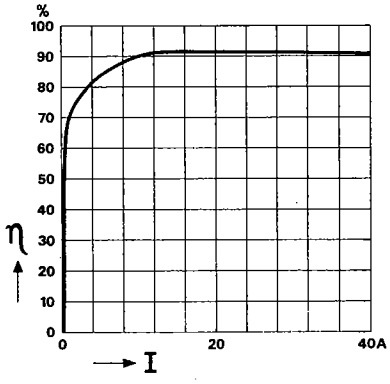
SM 3540

SWITCHED MODE POWER SUPPLY 0 – 35 V 0 – 40 A

* Input 220 V AC or DC
* 1400 Watts DC output
* New 100 kHz MOSFET power conversion technique
* **Efficiency 91%**
* **Weight only 14,5 kgs**
* Natural convection cooling, no blower, no noise
* No inrush current
* Ready for programming by computer (via PSC 625 programmer). Programming plug with all input and output levels 0-5 V
* Protected against all overload and short circuit conditions
* Equal current sharing when connected in parallel and equal voltage sharing when connected in series (master and slave connection, voltage and current control by the master).
* Modular built up, service friendly.



Constant voltage / constant current



Efficiency versus load current at 35V

Efficiency

91% at 235 V DC input and 1400 Watts output.

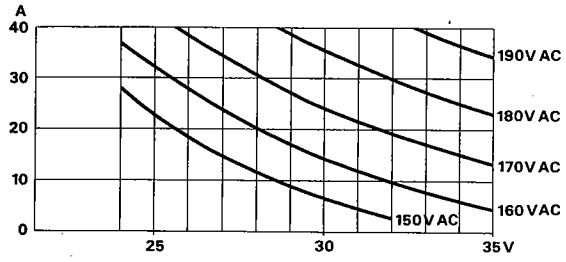
89% at 220 V AC input and 1400 Watts output.

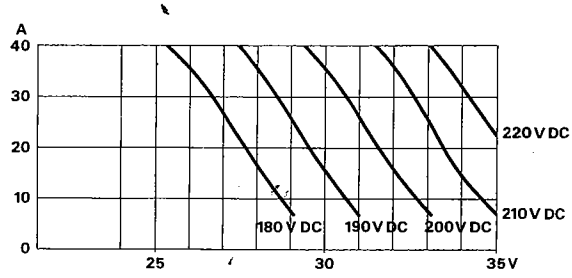
The efficiency is extremely high and constant over a large range of output current.

Input voltage

185-265 V AC 50-60 Hz or 210-350 V DC up to 30 V 40 A (1200 Watts)

198-265 V AC 50-60 Hz or 240-350 V DC up to 35 V 40 A (1400 Watts)



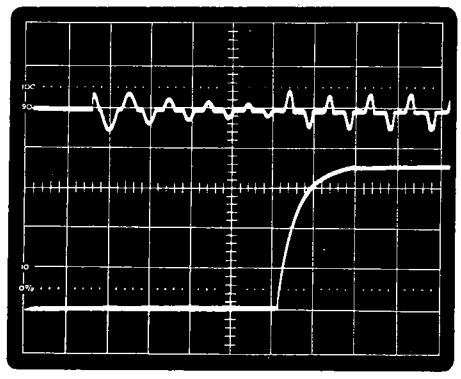


Maximum output current as function of output voltage with AC and DC line input as parameter.

Inrush current

During switch on the inrush current is limited by a special circuit and practically does not exceed the normal input current during operation at full load.

Photo: The upper diagram shows the 50 Hz AC input current (50 A/div.) during switch on at full load. The lower diagram shows the output voltage (10 V/div.), which comes up after a delay of about 120 mS.

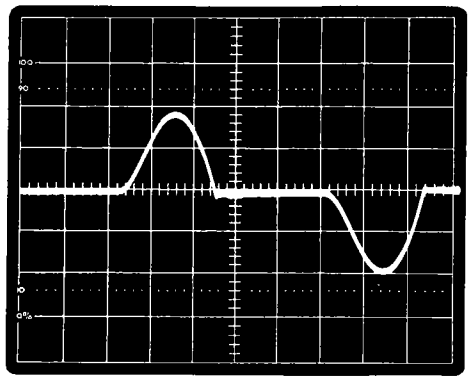


Input current

At 1400 Watts output and 220 V AC input the input current is 9.3 A rms

A 50 Hz choke in the input circuit limits sharp current peaks in order to cause no (low frequency) line voltage distortion.

Photo: 50 Hz input current at full load (10 A/div.).



Insulation

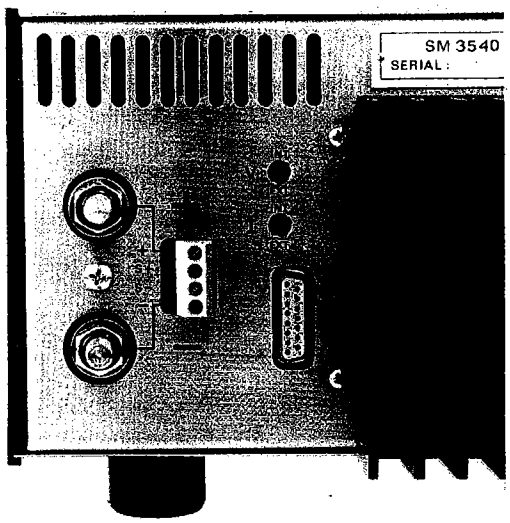
2.5 kV AC rms (1 min.) input to case and input to output. 500 V DC output to case.
Creepage distances and clearances input to output and input to case are 8 mm. Insulation resistance is better than 50 MOhm (measured at 500 V DC). Safety is in accordance with IEC 348.

RFI suppression

Practically no radio frequency interference on input and output because of carefully designed filters.
RFI suppression is in accordance with VDE 0871 level B, both on input and output.

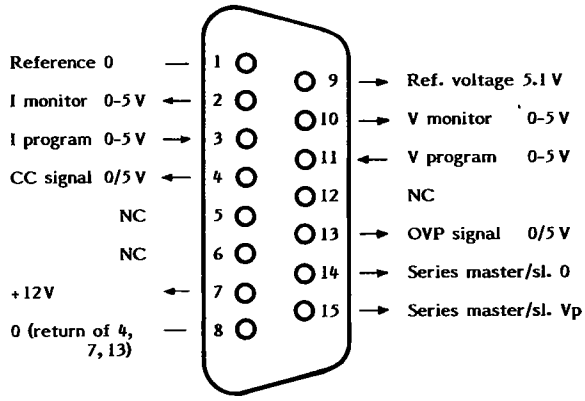
Master and slave connection

The rear panel plug has special connections to make a master and slave connection of two or more units SM3540 possible. Parallel as well as in series, with automatic equal current sharing and equal voltage sharing. Series connection is allowed up to 500 V total output.



Remote programming

Output voltage and current can be programmed by voltage. A programming voltage of 0-5 V corresponds with 0 to full range of output voltage or current. The maximum programming speed is 600 V/sec. However the output electrolytic capacitors might be overheated when a high programming amplitude is combined with a high repetition frequency. Output voltage and current can also be set by external potentiometers of 5 kOhm.

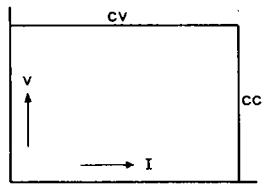


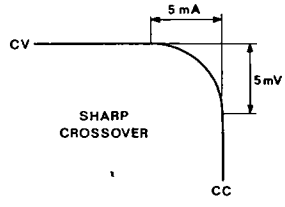
Voltage and current monitoring

At the rear plug two monitor voltages 0-5 V are available, corresponding with 0 to full range of output voltage and current. These can be used to talk back to a computer or to connect external meters. CC and OVP signal are logic signals indicating the CV/CC and OVP status.

CV/CC regulation

The SM 3540 can either be used as a constant voltage source with current limiting or as a constant current source with voltage limiting. The change of mode occurs sharply at the crossing of the voltage and current settings.





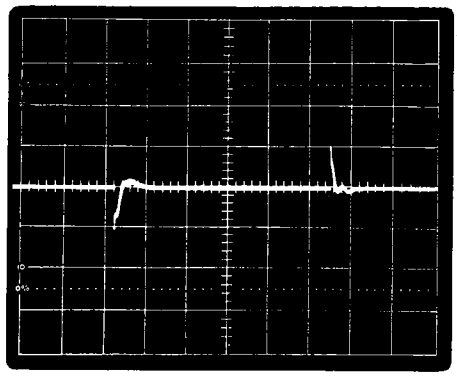
	CV	CC
Line regulation		
Input 185-265 V AC	5 mV	25 mA
Load regulation		
Load 0-100%	5 mV	25 mA
Ripple p-p	10 mV	25 mA
Temperature coefficient per °C	5.10^{-5}	1.10^{-4}
Stability		
During 8 hours after 1 hour warm up, under constant load and ambient conditions	3.10^{-4}	1.10^{-3}
Output impedance		
Up to 100 kHz, less than	0.05 Ohm	-

Recovery time

For recovery to within 0.1 V

0.5 ms for a 10% to 100% load step
0.1 ms for a 50% to 100% load step

measured at 35 V 40 A



Recovery time at 50-100% load step. Vert.: 0.2V/div. Hor.: 0.5ms/div.

Ambient temperature

-20 to +50°C up to 1400 Watts output.

Remote sensing

Normally the sensing wires are linked to the output terminals. When remote sensing is required the sense connections have to be wired to the remote load terminals in order to stabilize the voltage across the load, so compensating the voltage drop over the load leads. A maximum of 2 V per lead can be compensated. This voltage subtracts from the maximum voltage rating of the power supply.

Thermal protection

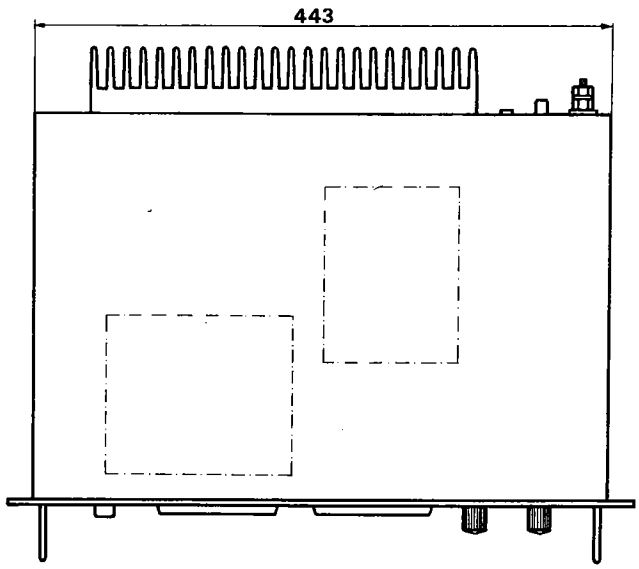
In case of insufficient cooling a thermoswitch shuts down the output voltage.

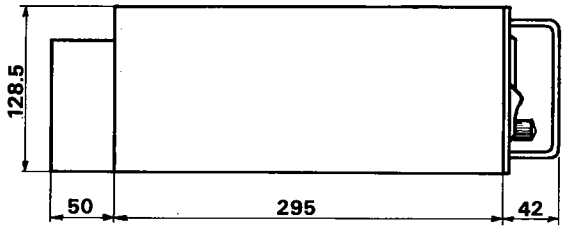
Overvoltage protection

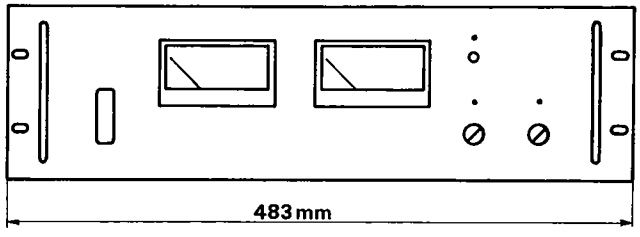
Built in over voltage protection is adjustable 7-40 V with a screwdriver through a hole in the front panel. When the output reaches the set trip level of the OVP the power supply shuts down. To reset the output it is necessary to switch off the power supply and switch it on again.
The OVP is not of the crowbar type and therefore cannot absorb power from external sources. An external voltage exceeding 50 V can damage the OVP circuit and the output capacitors.

Voltage and current controls

Voltage and current controls are by 10-turn potentiometers for reliable high resolution.

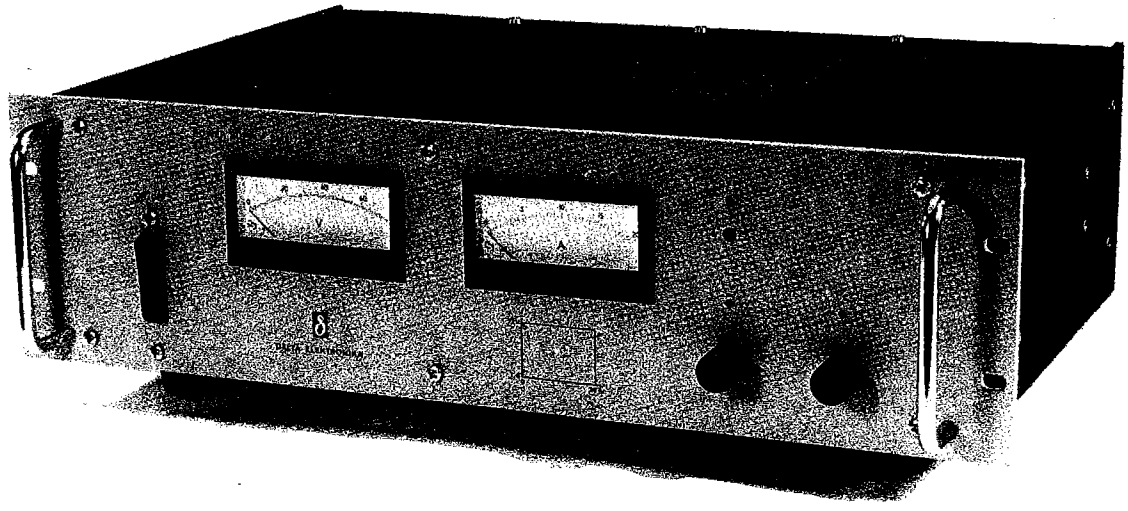






DELTA ELEKTRONIKA BV

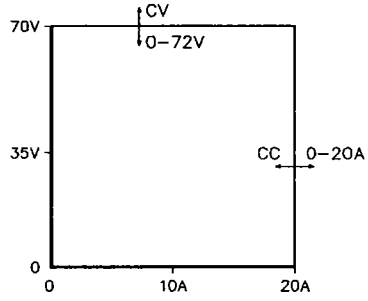
P.O. BOX 27
4300 AA ZIERIKZEE
NETHERLANDS
TEL. (01110) 13656 TLX 55349
FAX 31 1110 16919



SMX 7220

1440 W SWITCHED MODE DC POWER SUPPLY

0 - 72 V 0 - 20 A

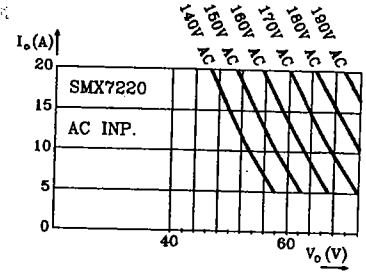


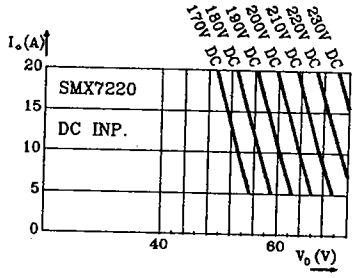
- Available with analog or digital meters. For digital meters add –D to model no.
- 100 kHz power conversion technique.
- Efficiency 91 %.
- Weight only 14.5 kgs.
- Natural convection cooling, no blower, no noise.
- Remote programming of voltage and current by analog voltages 0 - 5 V.
- Very low output ripple.
- **IEEE 488** programming with external interface PSC 44M (pin compatible).
- Master / Slave parallel and series operation with equal current and voltage sharing.
- Wide input voltage range, AC and DC.
- No inrush current during switch on.
- 50 Hz choke on input to avoid low frequency distortion on the line voltage.
- Input / output insulation 3750 V rms.
- RFI suppression according to VDE 0871 B both on input and output.
- Designed for long life at full power.
- Protection against all overload and short circuit conditions.
- Modular built-up, service friendly.
- Built-in overvoltage protection
- Voltage and current control with 10 turn potentiometers, resolution 0.03 %.
- Can also be used as a DC - DC converter.

Specifications:

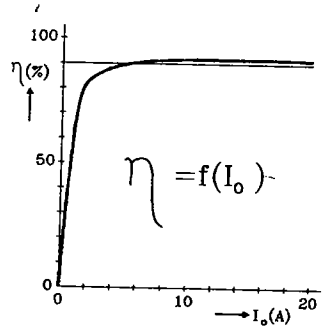
		CV	CC
Output	:	0 - 72 V	0 - 20 A
Regulation			
Load 0 - 100%	:	5 mV	15 mA
Line 198 - 265 V AC	:	5 mV	15 mA
Ripple + noise, rms/p-p	:	4 / 20 mV	4 / 12 mA
Temp. coeff., per °C	:	5.10^{-5}	1.10^{-4}
Stability during 8 hrs after 1 hr warm up	:	3.10^{-4}	1.10^{-3}
Output imp. up to 100 kHz	:	0.05 Ohm	—
Recovery time 50 - 100% load step recovery within 50mV	:	150 µs	—
Programming input impedance	:	0 - 5 V 1 MOhm	0 - 5 V 1MOhm
Monitoring output impedance	:	0 - 5 V 20 Ohm	0 - 5 V 20 Ohm

Max. programming speed	:	0 - 72 V in 60 ms
OVP trip range	:	7 - 80 V
Status output CV/CC	:	5 V / 10 mA logic 1 is CC
Status output OVP	:	5 V / 10 mA logic 1 is trip
Input	:	198 - 265 V 50 - 60 Hz 237 - 350 V DC
Input current	:	9.3 A at 220 V AC
Insulation		
Input/Output	:	3750 Vrms (1 min.) 8mm creepage/clearance
Input/case	:	2500 Vrms (1 min.)
Output/case	:	600 V DC
Safety	:	IEC 348 / IEC 380
RFI suppression	:	VDE 0871 B, input and output
Operating temp.	:	–20 to + 50 °C
Remote sensing	:	Max. 2 V per lead
Series operation	:	Max. 600 V total voltage
Standby input power	:	Only 10W
Thermal protection	:	Output shuts down in case of insufficient cooling.

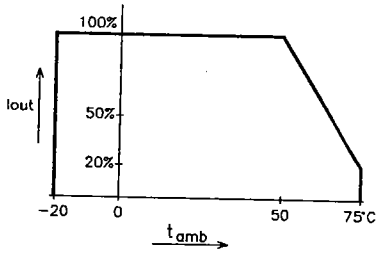




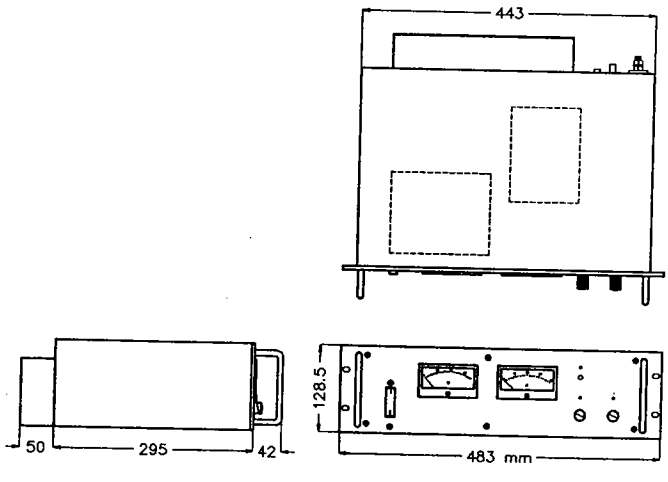
Maximum output current vs output voltage with AC or DC input voltage as a parameter

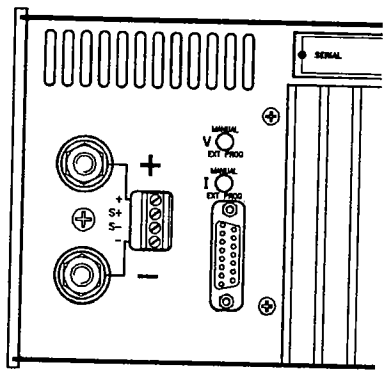


Efficiency versus load current at 72 V output, DC input



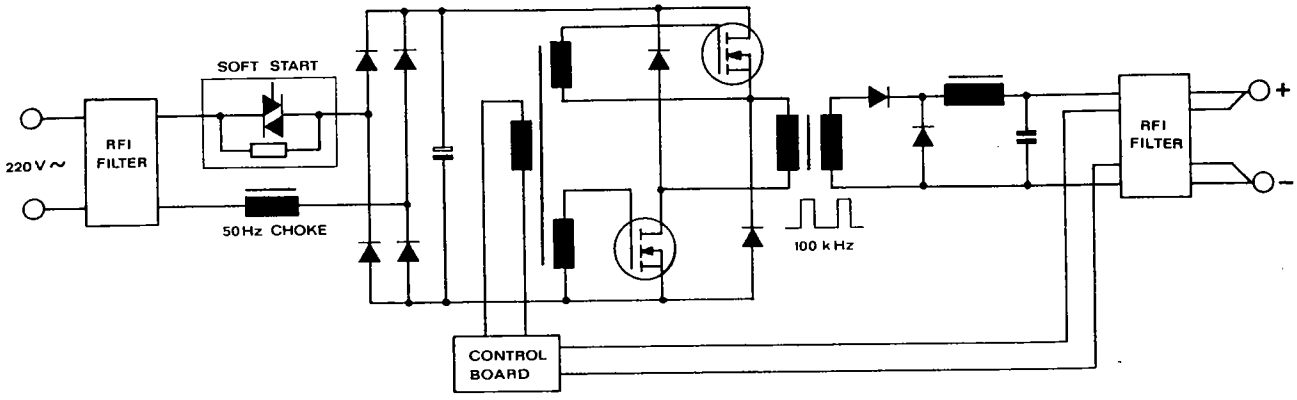
Operating temperature range





Rear panel. 15-p D connector for remote programming and master / slave operation.

Circuit description



Simplified functional diagram of SM 3540

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

The high frequency interference produced inside the power supply is prevented to go to the line or the load by carefully designed RFI filters.

When the unit is switched on the large electrolytic capacitor is charged via the resistor of the SOFT START circuit so that 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 use of powerfet's makes it possible to operate at 100kHz switching frequency with many advantages like small size, light weight, low ripple and fast regulation. The rectified 220V (300VDC) is chopped by the power mosfet and transformed to a lower voltage. This 100kHz power converter is of the feed forward type. The regulation is achieved by pulse width modulation.

Carefull design, overdimensioning of vital components, several built-in protections and cool operation (because of the very high efficiency) make the SM3540 a very reliable power supply which can continuously be used at maximum rating.

Cooling and thermal protection

The SM3540 has natural convection cooling (no fans no noise). This means that it has to be used in horizontal position so that the air can pass freely vertically along and through the unit.

To protect the unit for overheating in case of wrong use (like covering it with something or building it in with insufficient cooling) two thermo-switches are built in which can shut down the output.

One is thermally coupled to the power fets. If it is activated all led lamps go out.

The second is thermally coupled to the high frequency power diodes of the output circuit. If it is activated the led lamp of the OVP starts burning.

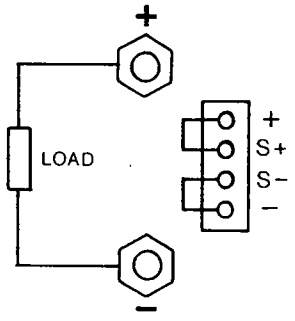
Load ripple and peak currents

Ripple currents caused by the load at frequencies below 1 kHz are compensated by the voltage regulation.
However high load ripple currents which exceed the current limit or which have strong

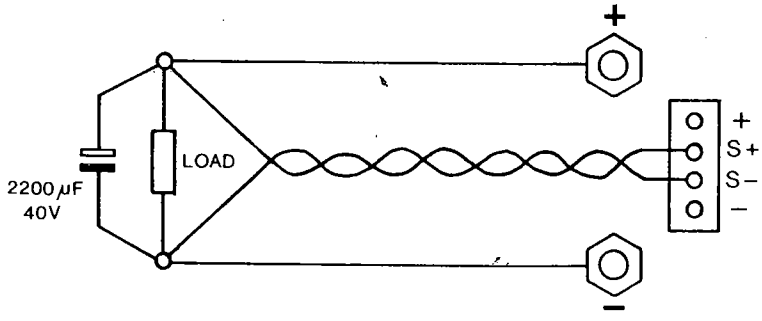
components above 1 kHz can overheat the output electrolytic capacitors. Also repetitive high peak currents, like taken by 50Hz DC-AC inverters can have this effect.
If the current limit is exceeded periodically by such high ripple current the CC led lamp will start blinking. The rms value of the current should be kept below 15A

In above cases an electrolytic capacitor of 10.000 uF as buffer parallel to the load is recommended.

Local or remote sensing



Local sensing



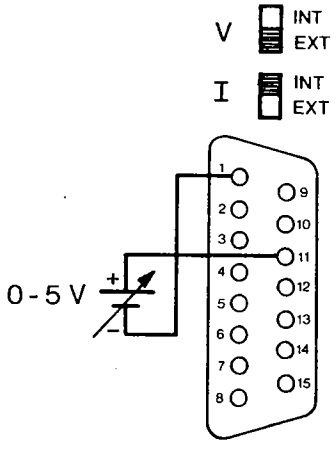
Remote sensing

For most applications the SM3540 can be used with local sensing, which means that the output voltage is kept constant at the output terminals. Local sensing is recommended because it cannot cause problems like interference or oscillating.

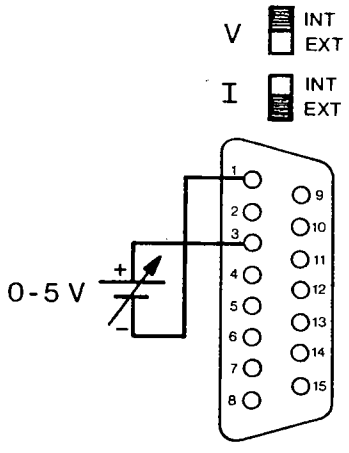
However if it is desirable to compensate the voltage drop over the leads to the load the point of stabilisation can be displaced from the output terminals to the load terminals by using sense leads (thin measuring wires) from S+ and S- to the + and - of the load.
To prevent for interference and oscillations it is advisable to twist the sense leads and to connect an extra electrolytic capacitor of 2200 uF to the load terminals.

Maximum 2V can be compensated in each load lead. Of course in that case the 4V subtracts from the maximum voltage rating.

Voltage and current programming



Voltage programming
by 0 - 5V



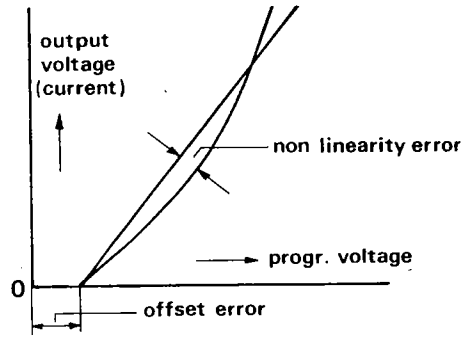
Current programming
by 0 - 5V

Both output voltage and current can be programmed by 0-5V.
To program connect as drawn above and put the switches V and I (through the holes above the connector) in the right position (at external for programming).

The programming inputs have a very high input impedance (opamp inputs). The zero of the programming inputs (pin 1 at the 15-pole D-connector at the rear of the power supply) is internally connected (through a picofuse of 250mA) to the negative power output terminal. So when connecting one has to take care that the load current will not flow through the programming zero connection and blow the picofuse.

Our IEC625/IEEE488 controllers PSC625 and PSC44M have isolated (1000V) analog outputs, so in that case there is no problem.

Programming accuracy



For the full output voltage range (or current range) the required programming input voltage is 0-5V +/-2%.

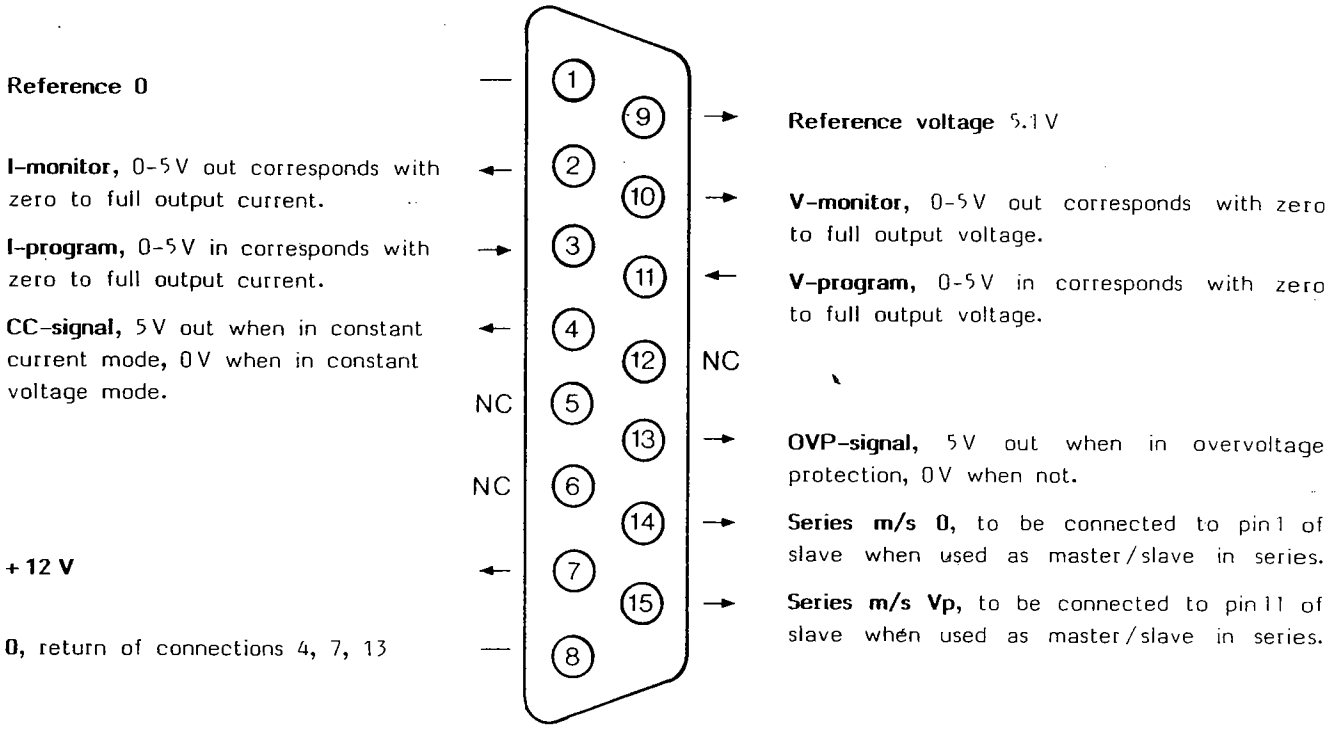
The linearity error (not including the offset error) is maximum 0.15%.

The zero offset error is always positiv and maximum 30mV for voltage- and max. 40mV for current programming.

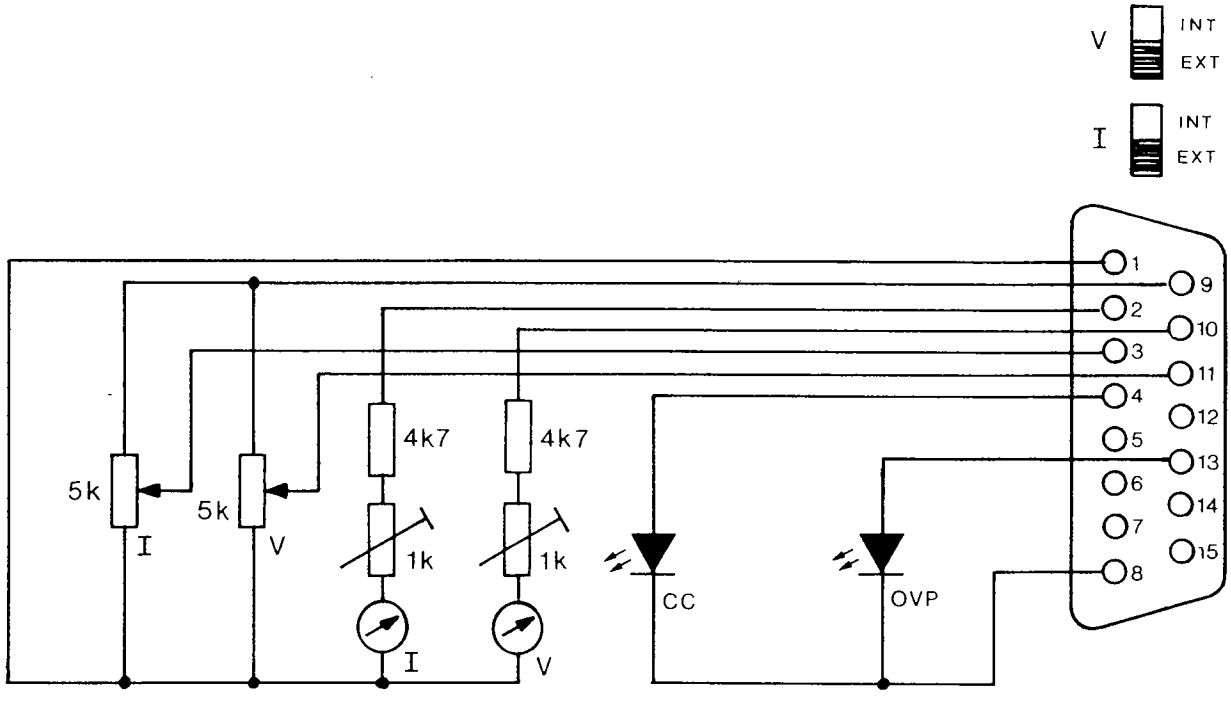
Our IEC625/IEEE488 power supply controllers PSC625 and PSC44M have trimpots at the rear to compensate for the range tolerance and zero shift of the power supply programming inputs.

Programming speed

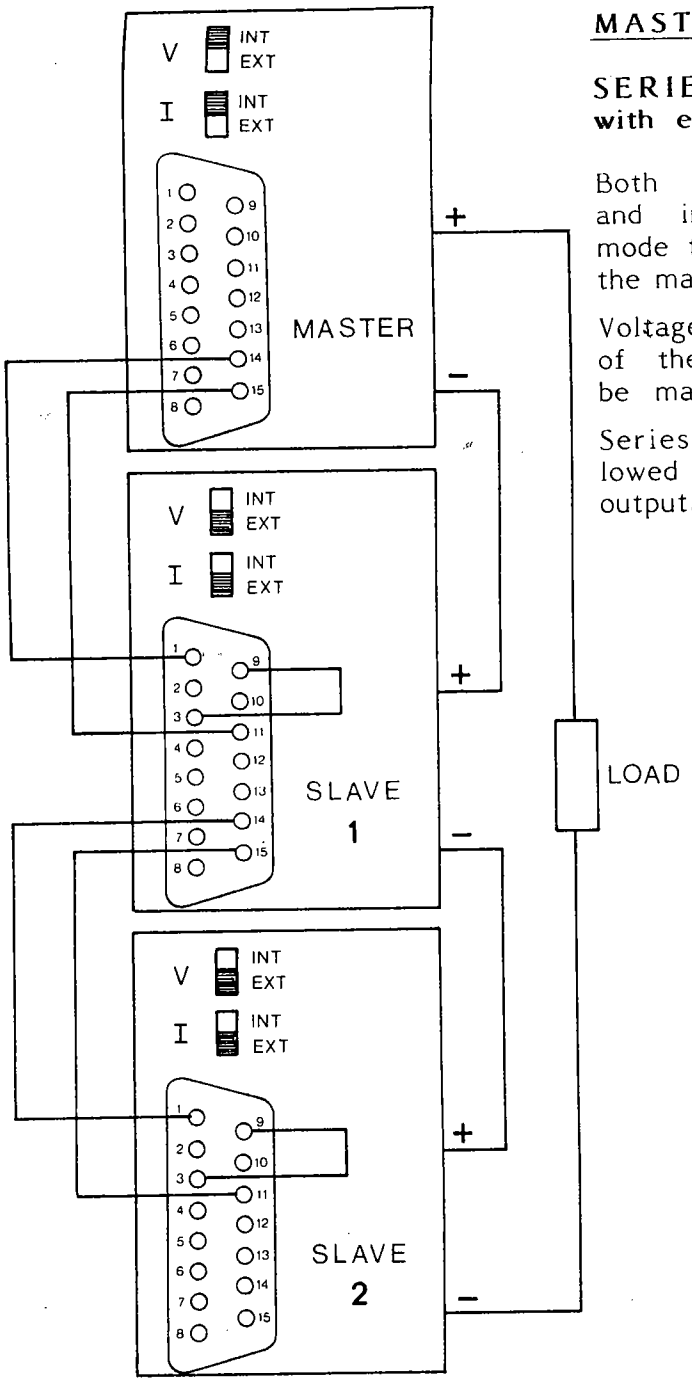
The maximum programming speed at full load (0,875 Ohm) is about 600V/sec.
With other loads higher speed is possible but to avoid overheating of the output capacitors do not exceed 1000V/sec.



Connections to 15-pole D-connector



Remote control SM3540



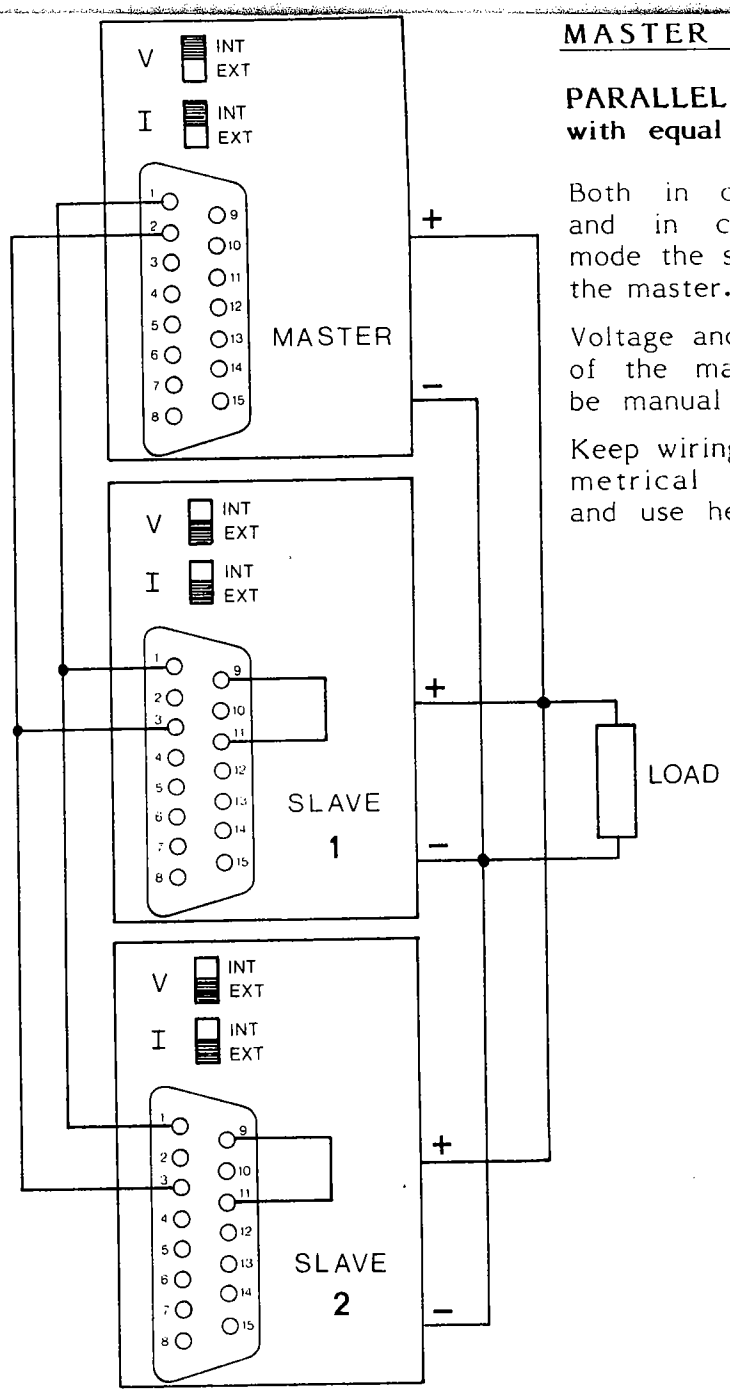
MASTER AND SLAVE

SERIES CONNECTION
with equal voltage sharing

Both in constant voltage and in constant current mode the slaves will follow the master.

Voltage and current control of the master can either be manual or programmed.

Series connection is allowed up to 500V total output.



MASTER AND SLAVE

PARALLEL CONNECTION
with equal current sharing

Both in constant voltage and in constant current mode the slaves will follow the master.

Voltage and current control of the master can either be manual or programmed.

Keep wiring short and symmetrical (equal lenghts) and use heavy gauge wire.

MASTER AND SLAVE

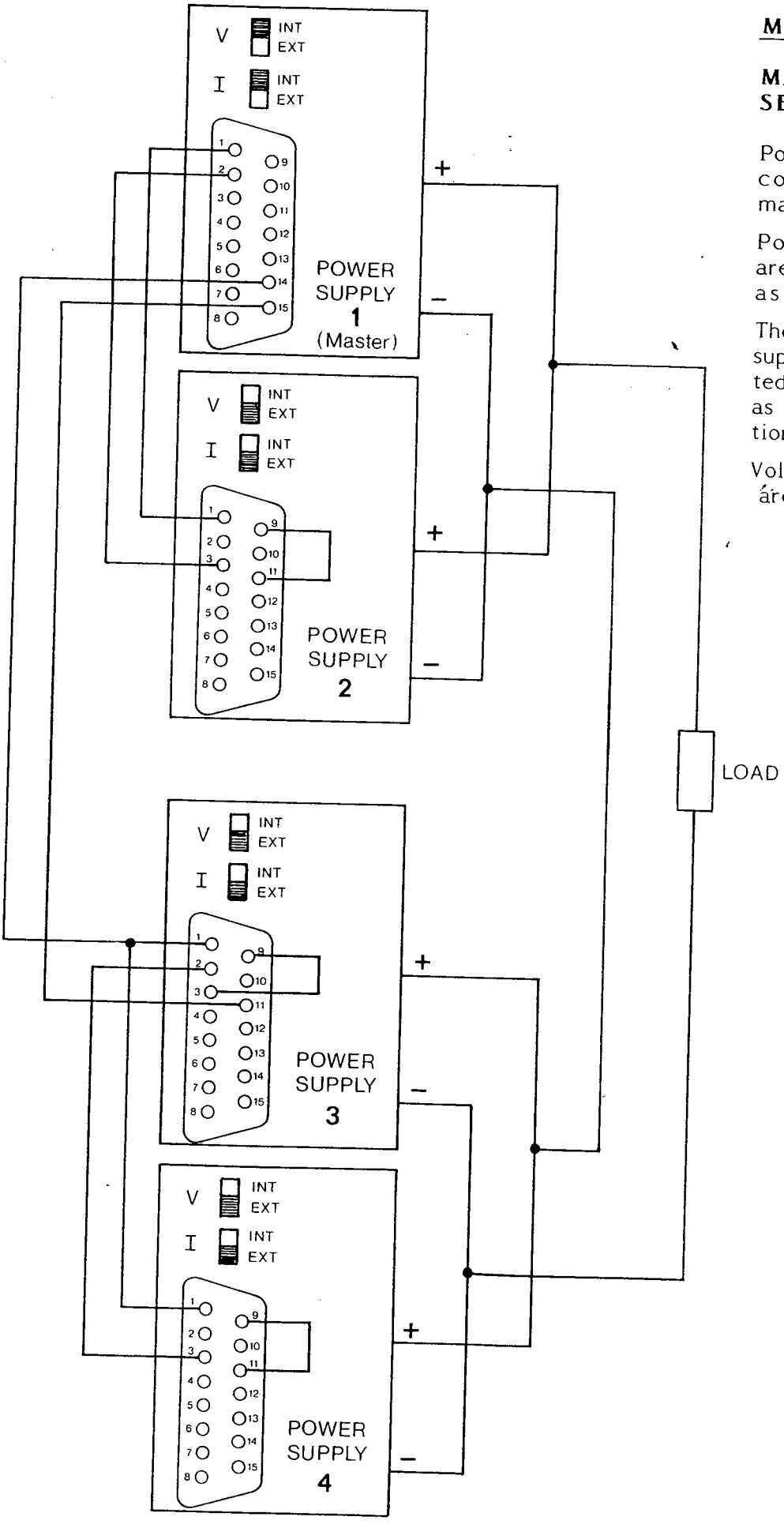
MIXED PARALLEL AND SERIES CONNECTION

Power supply 1 and 2 are connected parallel as master and slave.

Power supply 3 and 4 are also connected parallel as master and slave.

The combination of power supply 3 and 4 is connected in series with and as slave of the combination 1 and 2.

Voltage and current control are now by power supply 1.



MAIN SECTION

C001	=	0.22UF 250V RMS X2
C002	=	0.22UF 250V RMS X2
C003	=	1UF 250V RMS X2
C004	=	4700PF 400V RMS SAFETY
C005	=	4700PF 400V RMS SAFETY
C006	=	0.22UF 250V RMS X2
C007	=	1.5UF 250V MET POLYES
C008	=	0.22UF 250V RMS X2
C009	=	2200UF 450V SPRAGUE
C010	=	0.1UF 250V MET POLYES
C011	=	0.22UF 63V MET POLYES
C012	=	0.1UF 250V MET POLYES
C013	=	0.22UF 63V MET POLYES
C014	=	5100PF 1000V POLYPROP
C015	=	1UF 400V MET POLYES
C016	=	1UF 400V MET POLYES
C017	=	1UF 400V MET POLYES
C018	=	1UF 400V MET POLYES
C019	=	22NF 630V POLYPROP
C020	=	150PF 1000V CERAMIC
C021	=	10PF 400V RMS SAFETY
C022	=	10PF 400V RMS SAFETY
C023	=	150PF 1000V CERAMIC
C024	=	5100PF 1000V POLYPROP
C025	=	22NF 630V POLYPROP
C026	=	1UF 400V MET POLYES
C027	=	1UF 400V MET POLYES
C028	=	1UF 400V MET POLYES
C029	=	1UF 400V MET POLYES
C030	=	0.1UF 250V MET POLYES
C031	=	0.1UF 250V MET POLYES
C032	=	0.22UF 63V MET POLYES
C033	=	0.22UF 63V MET POLYES
C056	=	0.22UF 63V MET POLYES
C057	=	15UF 16V SOLID ALU
C058	=	0.22UF 63V MET POLYES
C059	=	0.22UF 63V MET POLYES
C060	=	47NF 250V MET POLYES
C061	=	0.22UF 63V MET POLYES
C062	=	10NF 1000V MET POLYES
C063	=	1000PF 100V POLYPROP
C064	=	10NF 250V MET POLYES
C065	=	10NF 250V MET POLYES
C066	=	100PF 400V CERAMIC
C067	=	100PF 400V CERAMIC
C068	=	15UF 16V SOLID ALU
C069	=	15UF 16V SOLID ALU
C070	=	100PF 400V CERAMIC
C071	=	100PF 400V CERAMIC
C072	=	100PF 400V CERAMIC
C073	=	2200PF 100V CERAMIC
C075	=	470PF 500V CERAMIC
C076	=	22NF 250V , MET POLYES
C077	=	2.2UF 25V SOLID ALU
C078	=	15UF 16V SOLID ALU
C079	=	15UF 16V SOLID ALU
C080	=	47PF 400V CERAMIC
C081	=	1500PF 3000V CERAMIC
C082	=	1500PF 3000V CERAMIC
C083	=	470PF 500V CERAMIC
C084	=	1000PF 100V POLYPROP
C085	=	15UF 16V SOLID ALU
C086	=	15UF 16V SOLID ALU
C087	=	10NF 1000V MET POLYES
C088	=	47PF 400V CERAMIC
C089	=	15PF 500V CERAMIC
C090	=	100PF 400V CERAMIC
C091	=	2200PF 100V CERAMIC
C092	=	2200PF 100V CERAMIC
C093	=	470PF 500V CERAMIC
C097	=	0.22UF 250V RMS X2
C099	=	2.2UF 25V SOLID ALU
C100	=	47UF 40V ERO
C101	=	47UF 40V ERO
C102	=	15PF 500V CERAMIC
C108	=	15UF 16V SOLID ALU
C109	=	10NF 250V MET POLYES
C110	=	10NF 250V MET POLYES
C111	=	10NF 250V MET POLYES
C112	=	10NF 250V MET POLYES
C113	=	10NF 250V MET POLYES
C114	=	0.1UF 630V MET POLYES
C115	=	0.1UF 630V MET POLYES
C117	=	47NF 250V MET POLYES
C118	=	47NF 250V MET POLYES
C119	=	47NF 250V MET POLYES
C120	=	47NF 250V MET POLYES
C121	=	47NF 250V MET POLYES
C122	=	47NF 250V MET POLYES
C123	=	47NF 250V MET POLYES
C124	=	47NF 250V MET POLYES
C125	=	10NF 1000V MET POLYES
C126	=	0.22UF 250V RMS X2
C127	=	10NF 1000V MET POLYES
C128	=	10NF 1000V MET POLYES
C129	=	15UF 16V SOLID ALU
C130	=	47NF 250V MET POLYES
C131	=	10NF 1000V MET POLYES
C132	=	10NF 1000V MET POLYES
C133	=	2500PF 250V CERAMIC
C200	=	22UF 250V MARCON
C201	=	22UF 250V MARCON
C202	=	22UF 250V MARCON
C203	=	22UF 250V MARCON
C204	=	0.1UF 400V MET POLYES
C205	=	2200PF 100V POLYPROP
C206	=	100PF 400V CERAMIC
C207	=	10NF 500V CERAMIC
C208	=	2200PF 100V POLYPROP
C209	=	22UF 160V ERO
C210	=	2200PF 100V POLYPROP
C211	=	150PF 1000V CERAMIC
C212	=	1000PF 100V POLYPROP
C213	=	220UF 35V ERO
C214	=	220UF 35V ERO
C215	=	220UF 35V ERO
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 40V ERO
C911	=	1000PF 100V POLYPROP
C912	=	22NF 250V MET POLYES
C913	=	0.1UF 100V MULT LAYR
C914	=	2.2UF 25V SOLID ALU
C915	=	47NF 250V MET POLYES
C916	=	15UF 16V SOLID ALU
C917	=	2200PF 100V POLYPROP
D001	=	BTA 25-700B ST
D002	=	GBPC35-08 GEN.INSTR.
D003	=	BYV26B PHILIPS
D004	=	BYV26B PHILIPS
D005	=	BYV26B PHILIPS
D006	=	TZB15CB SEMICON
D007	=	1N5818 MOTOROLA
D008	=	TZB15CB SEMICON
D009	=	BYV26B PHILIPS
D010	=	BYV26B PHILIPS
D011	=	BYV26B PHILIPS
D012	=	BYV26B PHILIPS
D013	=	BYT08PI400 ST
D014	=	BYT08PI400 ST
D015	=	BYT08PI400 ST
D016	=	BYT08PI400 ST
D017	=	BYT08PI400 ST
D018	=	BYT08PI400 ST
D019	=	BYT08PI400 ST
D020	=	BYT08PI400 ST
D021	=	BYV26B PHILIPS
D022	=	BYV26B PHILIPS
D023	=	BYV26B PHILIPS
D024	=	BYV26B PHILIPS
D025	=	TZB15CB SEMICON
D026	=	1N5818 MOTOROLA
D027	=	TZB15CB SEMICON
D028	=	BYV26B PHILIPS
D029	=	BYV26B PHILIPS
D030	=	BYV26B PHILIPS
D057	=	BZX55-C15 ITT
D058	=	1N5818 MOTOROLA
D059	=	BZX85-C20 ITT
D060	=	1N4148 PHILIPS
D061	=	BZX55-C15 ITT
D062	=	BZX85-C51 ITT
D063	=	1N4148 PHILIPS

D064	=	BZX85-C12	ITT
D065	=	1N4148	PHILIPS
D066	=	Z0104BA	TAG
D067	=	BZX85-C12	ITT
D068	=	1N4148	PHILIPS
D072	=	BZX55-C8V2	ITT
D073	=	1N4148	PHILIPS
D074	=	1N4148	PHILIPS
D075	=	1N4148	PHILIPS
D076	=	1N4148	PHILIPS
D077	=	1N4148	PHILIPS
D078	=	1N4148	PHILIPS
D079	=	BZX85-C15	ITT
D080	=	BZX85-C15	ITT
D081	=	BZX55-C12	ITT
D082	=	BZX55-C8V2	ITT
D083	=	BYW93-200U	PHILIPS
D084	=	BYW93-200U	PHILIPS
D085	=	BYW93-200U	PHILIPS
D086	=	BYW93-200U	PHILIPS
D087	=	1N4148	PHILIPS
D088	=	1N4148	PHILIPS
D089	=	1N4148	PHILIPS
D090	=	1N4148	PHILIPS
D091	=	BZX55-C12	ITT
D092	=	BZX55-C8V2	ITT
D093	=	BZX85-C12	ITT
D094	=	BZX85-C12	ITT
D095	=	BZX85-C12	ITT
D096	=	40HF10	IR
D097	=	40HF10	IR
D200	=	SKB2-08L5A	SEMIKRON
D201	=	1N4148	PHILIPS
D202	=	1N4148	PHILIPS
D203	=	BYV26B	PHILIPS
D204	=	BYV26B	PHILIPS
D205	=	BYV26B	PHILIPS
D206	=	BYV28-200	PHILIPS
D900	=	1N4148	PHILIPS
D901	=	BZX55-C6V2	ITT
D902	=	BZX55-C10	ITT
D903	=	BZX55-C8V2	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	=	1N825A	ST
F001	=	FUSE 5X20 16T	
F002	=	FUSE 5X20 16T	
F003	=	FUSE 6X32 10FF	
F006	=	FUSE 5X20 .315F	
F200	=	FUSE PICO 0.25F	
F201	=	FUSE 5X20 1T	
IC05	=	TL431ILP	TEXAS
IC06	=	TL431ILP	TEXAS
IC07	=	TL084BCN	TEXAS
IC08	=	TL084BCN	TEXAS
IC09	=	OP177GP	
IC10	=	REF02HP	
IC200	=	UC3842	UNITRODE
IC900	=	HEF4046 BP	PHILIPS
IC901	=	HEF4011BD	PHILIPS
IC902	=	HEF4069UBD	PHILIPS
L001	=	L191	DELTA
L002	=	L191	DELTA
L003	=	L192	DELTA
L004	=	L193	DELTA
L005	=	L198	DELTA
L006	=	L197	DELTA
L007	=	L196	DELTA
L008	=	L195	DELTA
L009	=	L199	DELTA
L010	=	L195	DELTA
L011	=	L196	DELTA
L012	=	L198	DELTA
L013	=	L197	DELTA
L014	=	L194	DELTA
L015	=	L194	DELTA
L016	=	L208	DELTA
L017	=	15UH	SIEMENS
L018	=	L202	DELTA
L019	=	L201	DELTA
L020	=	2X TORO 14 BLUE	

Q001	=	BST100	PHILIPS
Q002	=	BST70	PHILIPS
Q003	=	IRF9520	IR
Q004	=	IRF512	IR
Q005	=	BUZ67	SIEMENS
Q006	=	BUZ67	SIEMENS
Q007	=	BUZ67	SIEMENS
Q008	=	BUZ67	SIEMENS
Q009	=	BUZ67	SIEMENS
Q010	=	BUZ67	SIEMENS
Q011	=	BUZ67	SIEMENS
Q012	=	BUZ67	SIEMENS
Q013	=	IRF9520	IR
Q014	=	IRF512	IR
Q015	=	BST100	PHILIPS
Q016	=	BST70	PHILIPS
Q028	=	BS250	ITT
Q029	=	BS170	ITT
Q030	=	BST100	PHILIPS
Q031	=	BST70	PHILIPS
Q032	=	IRF512	IR
Q033	=	2N2907A	ST
Q034	=	2N2222A	PHIL
Q035	=	2N2222A	PHIL
Q036	=	2N2222A	PHIL
Q037	=	BSS92	PHILIPS
Q038	=	BS170	ITT
Q039	=	BS170	ITT
Q200	=	BUK444-800B	PHILIPS
Q900	=	2N2222A	PHIL
Q901	=	BS170	ITT
Q902	=	BS170	ITT
Q903	=	2N2907A	ST
Q904	=	2N2222A	PHIL
Q905	=	2N2222A	PHIL
Q906	=	2N2907A	ST
Q907	=	BS250	ITT
Q908	=	2N2222A	PHIL
Q909	=	2N2222A	PHIL
Q910	=	2N2907A	ST
R001	=	2.21M	MF/0.25W/1600V
R002	=	TNR23G471K	MARCON
R003	=	100	WW/6.0W/200V
R004	=	120	MF/2.0W/500V
R005	=	8.2	WW/9.0W/500V
R006	=	8.2	WW/9.0W/500V
R007	=	8.2	WW/9.0W/500V
R008	=	8.2	WW/9.0W/500V
R009	=	8.2	WW/9.0W/500V
R010	=	10K	MF/2.0W/500V
R011	=	10K	MF/2.0W/500V
R012	=	10K	MF/2.0W/500V
R013	=	10K	MF/2.0W/500V
R014	=	1K	MF/0.6W/350V
R015	=	1K	MF/0.6W/350V
R016	=	6.81	MF/0.6W/350V
R017	=	6.81	MF/0.6W/350V
R018	=	6.81	MF/0.6W/350V
R019	=	6.81	MF/0.6W/350V
R020	=	100	MF/2.0W/500V
R021	=	100	MF/2.0W/500V
R022	=	6.81	MF/0.6W/350V
R023	=	6.81	MF/0.6W/350V
R024	=	6.81	MF/0.6W/350V
R025	=	6.81	MF/0.6W/350V
R026	=	1K	MF/0.6W/350V
R027	=	1K	MF/0.6W/350V
R077	=	10K	MF/0.6W/350V
R078	=	4.75K	MF/0.6W/350V
R079	=	10	MF/0.6W/350V
R080	=	22.1	MF/0.6W/350V
R081	=	1K	MF/0.6W/350V
R082	=	1K	MF/0.6W/350V
R083	=	47.5	MF/0.6W/350V
R084	=	22.1	MF/0.6W/350V
R085	=	2.21K	MF/0.6W/350V
R086	=	22.1	MF/0.6W/350V
R087	=	475	MF/0.6W/350V
R088	=	1K	MF/0.6W/350V
R089	=	1K	MF/0.6W/350V
R090	=	10K	MF/0.6W/350V
R091	=	2.21K	MF/0.6W/350V
R092	=	150	MF/0.6W/350V
R093	=	681	MF/0.6W/350V
R094	=	475	MF/0.6W/350V
R096	=	267	MF/0.6W/350V
R097	=	332	MF/0.6W/350V

R098	=	2.21K	MF/0.6W/350V
R099	=	2.21K	MF/0.6W/350V
R100	=	2.21K	MF/0.6W/350V
R101	=	18.2K	MF/0.6W/350V
R102	=	18.2K	MF/0.6W/350V
R103	=	82.5K	MF/0.6W/350V
R104	=	6.81K	MF/0.6W/350V
R105	=	6.81K	MF/0.6W/350V
R106	=	2.21M	MF/0.25W/1600V
R107	=	4.75K	MF/0.6W/350V
R108	=	4.75K	MF/0.6W/350V
R109	=	4.75K	MF/0.6W/350V
R110	=	4.75K	MF/0.6W/350V
R111	=	4.75K	MF/0.6W/350V
R112	=	4.75K	MF/0.6W/350V
R117	=	681	MF/0.6W/350V
R118	=	10K TRIMPOTM 20 TURNS	
R119	=	3.32K	MF/0.6W/350V
R120	=	10K	MF/0.6W/350V
R121	=	100K	MF/0.6W/350V
R122	=	1K	MF/0.6W/350V
R123	=	68	MF/2.5W/500V
R124	=	68	MF/2.5W/500V
R125	=	68	MF/2.5W/500V
R126	=	68	MF/2.5W/500V
R127	=	10K TRIMPOTM 20 TURNS	
R128	=	100K	MF/0.6W/350V
R129	=	100K	MF/0.6W/350V
R132	=	825	MF/0.6W/350V
R133	=	68.1	MF/0.6W/350V
R134	=	825	MF/0.6W/350V
R135	=	68.1	MF/0.6W/350V
R136	=	100K	MF/0.6W/350V
R137	=	4.75K	MF/0.6W/350V
R138	=	4.75K	MF/0.6W/350V
R142	=	2.21M	MF/0.25W/1600V
R143	=	10K	MF/0.6W/350V
R144	=	1.0	MF/0.6W/350V
R150	=	475	MF/0.6W/350V
R151	=	1K	MF/0.6W/350V
R152	=	TNR12G821K	MARCON
R155	=	26.7K	MF/0.6W/350V
R157	=	1K	MF/0.6W/350V
R164	=	22.1	MF/0.6W/350V
R165	=	22.1	MF/0.6W/350V
R166	=	22.1	MF/0.6W/350V
R171	=	1K	MF/0.6W/350V
R200	=	562K	MF/0.6W/350V
R201	=	562K	MF/0.6W/350V
R202	=	1K	MF/0.6W/350V
R203	=	68.1K	MF/0.6W/350V
R204	=	15K	MF/0.6W/350V
R205	=	392K	MF/0.6W/350V
R206	=	681K	MF/0.6W/350V
R207	=	CR	MF/0.6W/250V
R208	=	8.25K	MF/0.6W/350V
R209	=	33.2K	MF/0.6W/350V
R210	=	33.2K	MF/0.6W/350V
R211	=	33.2K	MF/0.6W/350V
R212	=	33.2K	MF/0.6W/350V
R213	=	6.81	MF/0.6W/350V
R214	=	475	MF/0.6W/350V
R215	=	3.92	MF/0.6W/350V
R216	=	10K	MF/0.6W/350V
R217	=	221	MF/0.6W/350V
R218	=	2.2K	MF/2.0W/500V
R219	=	2.2K	MF/2.0W/500V
R220	=	2.2K	MF/2.0W/500V
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	=	10K	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	=	825	MF/0.6W/350V
R914	=	1K	MF/0.6W/350V
R915	=	1.82K	MF/0.6W/350V
R916	=	3.32K	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	=	10K	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	=	12.1	MF/0.6W/350V
R934	=	10K	MF/0.6W/350V
R935	=	56.2K	MF/0.6W/350V
R936	=	47.5	MF/0.6W/350V
T001	=	T204	DELTA
T002	=	T206	DELTA
T003	=	T205	DELTA
T004	=	PE 51687	P.ENG.
T200	=	XT239	DELTA

ONLY FOR SM3540

C074	=	4700PF 63V	POLYPROP
C094	=	820UF 50V	SPRAGUE
C095	=	820UF 50V	SPRAGUE
C096	=	820UF 50V	SPRAGUE
C098	=	4700PF 63V	POLYPROP
C103	=	820UF 50V	SPRAGUE
C104	=	820UF 50V	SPRAGUE
C105	=	820UF 50V	SPRAGUE
C106	=	820UF 50V	SPRAGUE
C107	=	820UF 50V	SPRAGUE
C116	=	4.7UF 63V	MET POLYES
R113	=	475	MF/0.6W/350V
R114	=	22.1K	MF/0.6W/350V
R115	=	3.92K	MF/0.6W/350V
R116	=	82.5K	MF/0.6W/350V
R130	=	PTC 120	C883 SIEMENS
R131	=	PTC 120	C883 SIEMENS
R139	=	100K	MF/0.6W/350V
R140	=	2.74K	MF/0.6W/350V
R141	=	SHUNT 40A/50MV	
R145	=	3.32K	MF/0.6W/350V
R146	=	3.32K	MF/0.6W/350V
R147	=	3.32K	MF/0.6W/350V
R148	=	3.32K	MF/0.6W/350V
R149	=	2.74K	MF/0.6W/350V
R158	=	5.62K	MF/0.6W/350V
R159	=	6.81K	MF/0.6W/350V
R160	=	1K	MF/0.6W/350V
R161	=	47.5K	MF/0.6W/350V
R162	=	8.25K	MF/0.6W/350V
R163	=	82.5K	MF/0.6W/350V

P321 FOR SM3540

C134	=	2.2UF 25V	SOLID ALU
C135	=	2.2UF 25V	SOLID ALU
C136	=	2.2UF 25V	SOLID ALU
C137	=	2.2UF 25V	SOLID ALU
C138	=	10NF 1000V	MET POLYES
C139	=	0.33UF 100V	MULT LAYR
D069	=	LED 3MM RED	PHILIPS
D070	=	LED 3MM GREEN	AEG
D071	=	LED 3MM GREEN	AEG
IC102	=	L7905CV	ST
R095	=	5K POTM 10 TURNS	
R153	=	5K POTM 10 TURNS	
R154	=	5K POTM 10 TURNS	
R167	=	2K TRIMPOTM 20 TURNS	
R168	=	3.92K	MF/0.6W/350V
R169	=	2K TRIMPOTM 20 TURNS	
R170	=	3.92K	MF/0.6W/350V
R172	=	1K	MF/0.6W/350V
R173	=	1M	MF/0.25W/1600V
R174	=	10K TRIMPOTM 20 TURNS	
R175	=	CR	MF/0.6W/250V
R176	=	562	MF/0.6W/350V

R177	=	1K	MF/0.6W/350V
R178	=	1M	MF/0.25W/1600V
R179	=	10K TRIMPOTM	20 TURNS
R180	=	CR	MF/0.6W/250V
R181	=	562	MF/0.6W/350V

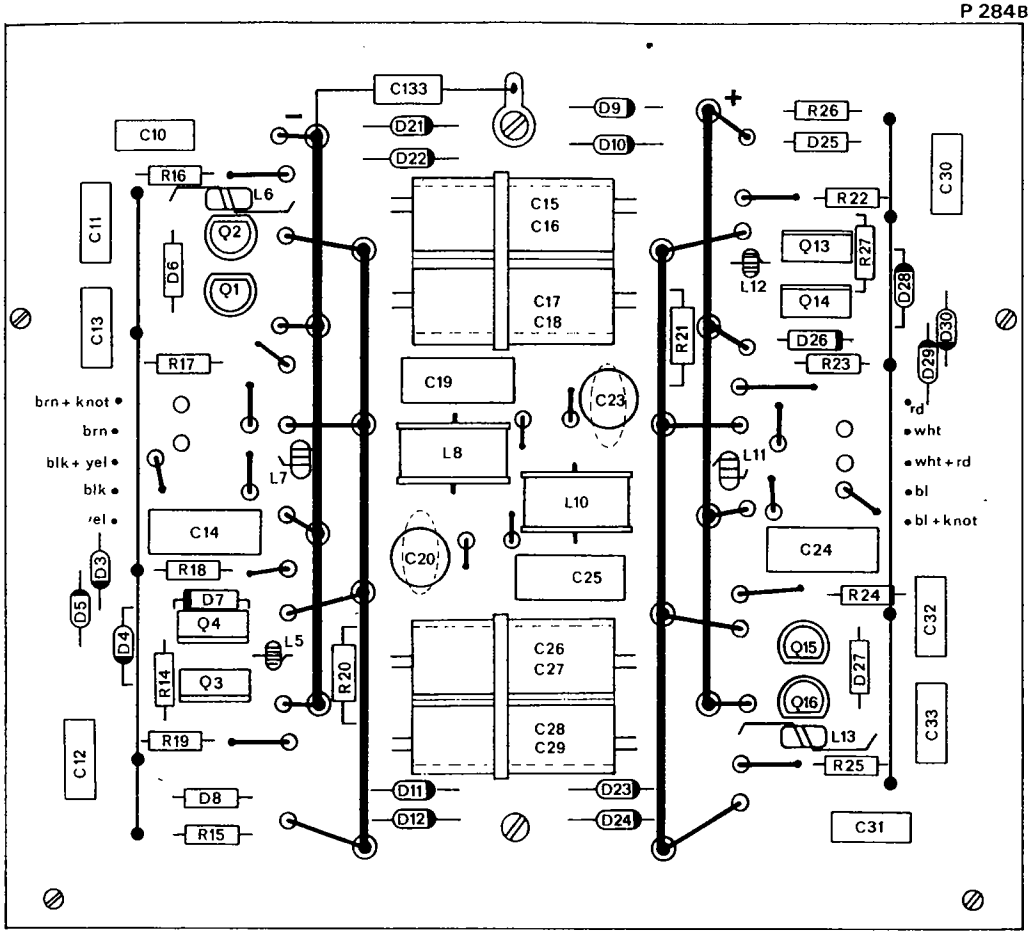
ONLY FOR SMX7220

C074	=	2500PF 250V	CERAMIC
C094	=	220UF 100V	SPRAGUE
C095	=	220UF 100V	SPRAGUE
C096	=	220UF 100V	SPRAGUE
C098	=	2500PF 250V	CERAMIC
C103	=	220UF 100V	SPRAGUE
C104	=	220UF 100V	SPRAGUE
C105	=	220UF 100V	SPRAGUE
C106	=	220UF 100V	SPRAGUE
C107	=	220UF 100V	SPRAGUE
C116	=	3.3UF 100V	MET POLYES
R113	=	475	MF/0.6W/350V
R114	=	68.1K	MF/0.6W/350V
R115	=	5.62K	MF/0.6W/350V
R116	=	56.2K	MF/0.6W/350V
R130	=	PTC 600	C884 SIEMENS
R131	=	PTC 600	C884 SIEMENS
R139	=	100K	MF/0.6W/350V
R140	=	2.74K	MF/0.6W/350V
R141	=	SHUNT 20A/50MV	
R145	=	8.25K	MF/0.6W/350V
R146	=	8.25K	MF/0.6W/350V
R147	=	6.81K	MF/0.6W/350V
R148	=	6.81K	MF/0.6W/350V
R149	=	5.62K	MF/0.6W/350V
R158	=	12.1K	MF/0.6W/350V
R159	=	12.1K	MF/0.6W/350V
R160	=	2.21K	MF/0.6W/350V
R161	=	68.1K	MF/0.6W/350V
R162	=	6.81K	MF/0.6W/350V
R163	=	22.1K	MF/0.6W/350V

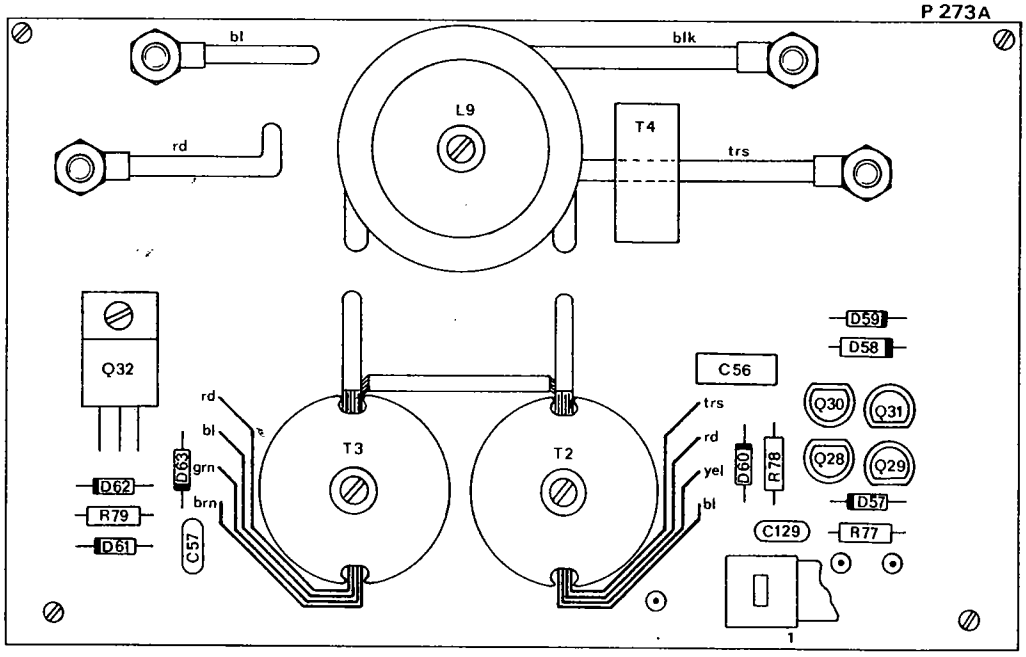
P321 FOR SMX7220

C134	=	10NF 1000V	MET POLYES
C135	=	2.2UF 25V	SOLID ALU
C136	=	2.2UF 25V	SOLID ALU
C137	=	2.2UF 25V	SOLID ALU
C138	=	10NF 1000V	MET POLYES
C139	=	0.33UF 100V	MULT LAYR
D069	=	LED 3MM RED	PHILIPS
D070	=	LED 3MM GREEN	AEG
D071	=	LED 3MM GREEN	AEG
IC102	=	L7905CV	ST
R095	=	10K POTM	10 TURNS
R153	=	5K POTM	10 TURNS
R154	=	5K POTM	10 TURNS
R167	=	22.1	MF/0.6W/350V
R168	=	4.75K	MF/0.6W/350V
R169	=	1K TRIMPOTM	20 TURNS
R170	=	4.75K	MF/0.6W/350V
R172	=	1K	MF/0.6W/350V
R173	=	1M	MF/0.25W/1600V
R174	=	10K TRIMPOTM	20 TURNS
R175	=	CR	MF/0.6W/250V
R176	=	562	MF/0.6W/350V
R177	=	1K	MF/0.6W/350V
R178	=	1M	MF/0.25W/1600V
R179	=	10K TRIMPOTM	20 TURNS
R180	=	CR	MF/0.6W/250V
R181	=	562	MF/0.6W/350V

P 284B

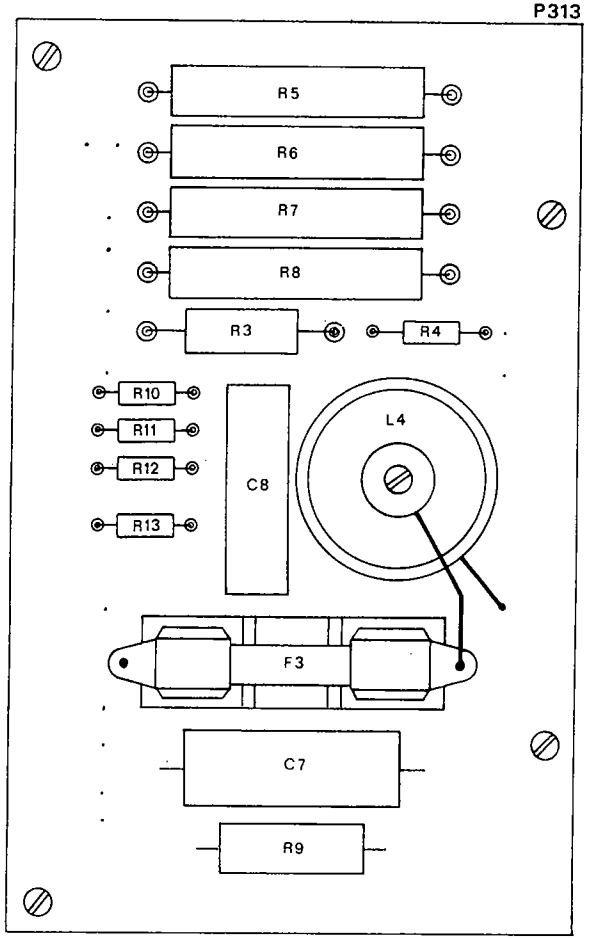


P 273A

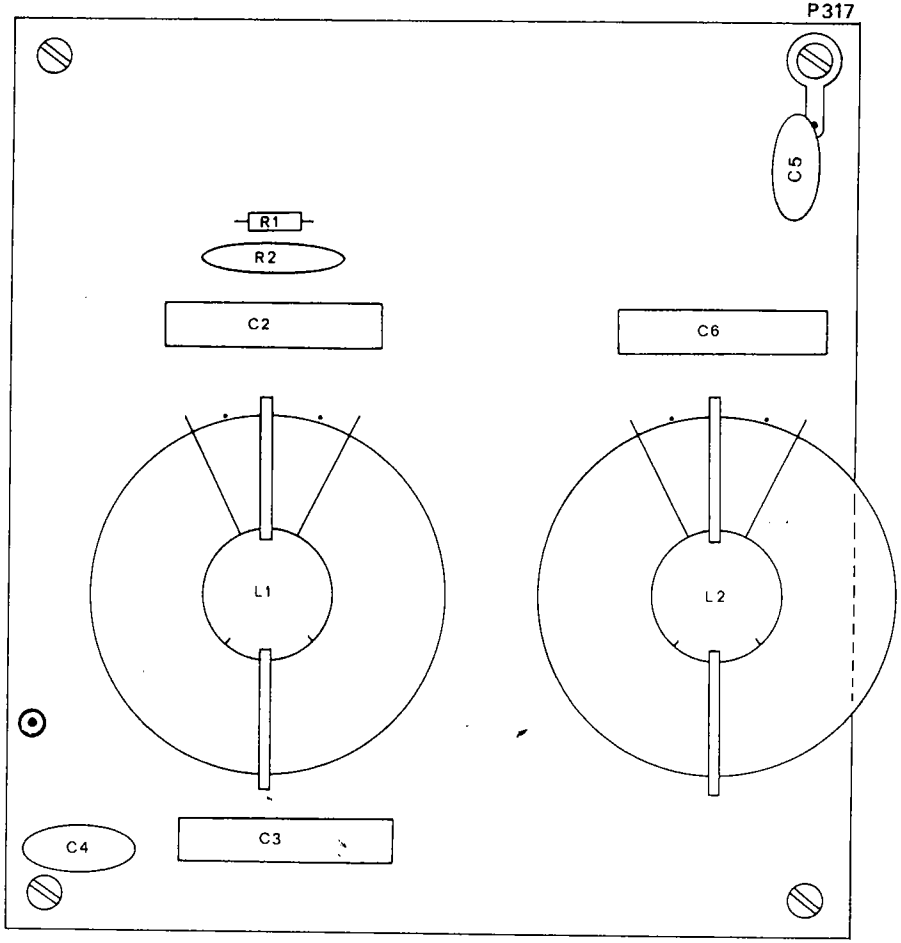


			Title: SM 3540
P284B (C20, C23	8-'88	Vr.	
Q1,2,15,16,30,31.	5-'87	Vr.	Date: 1-'85
Modifications	Date	App.	delta elektronika bv

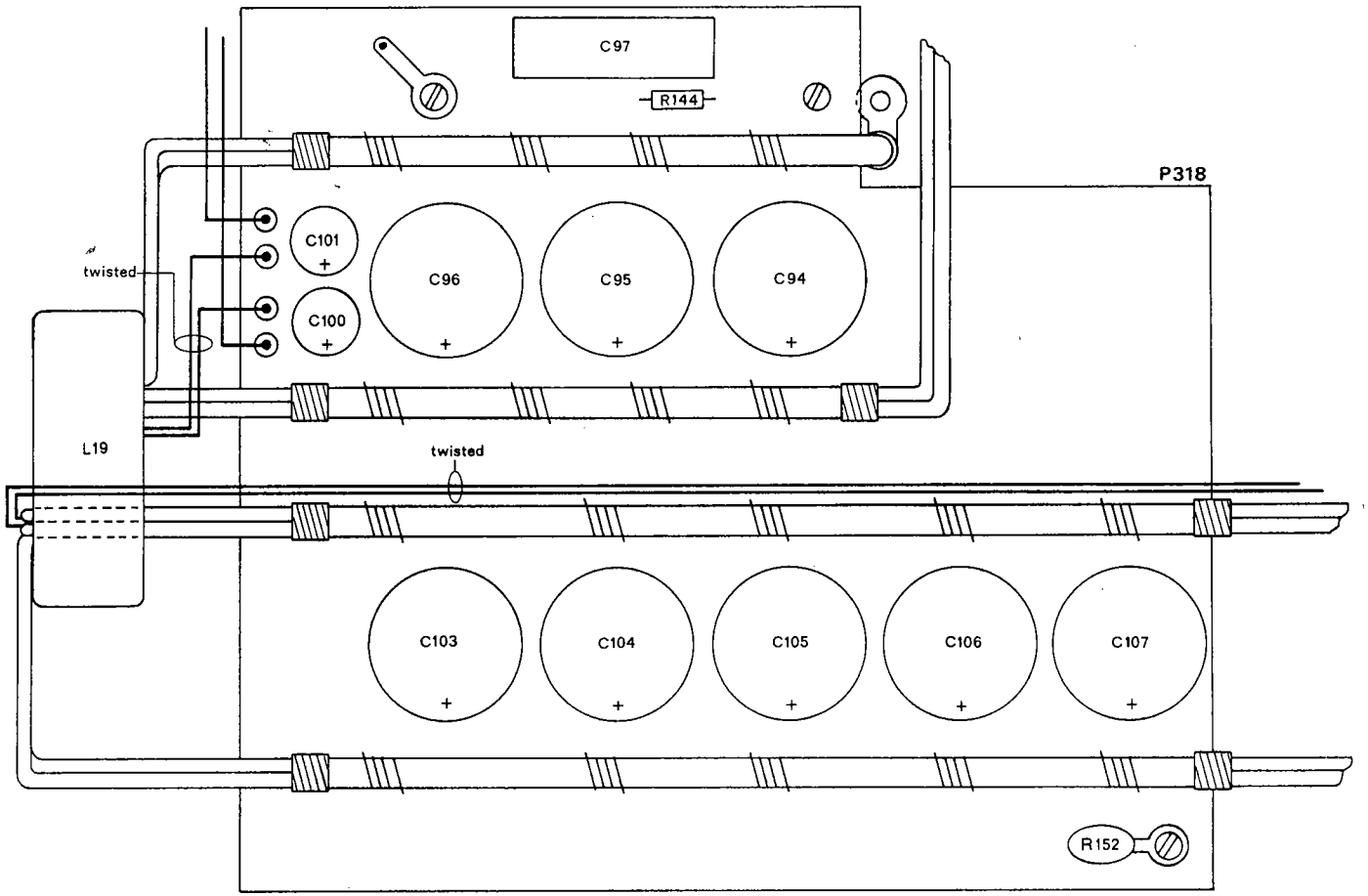
P313



P317

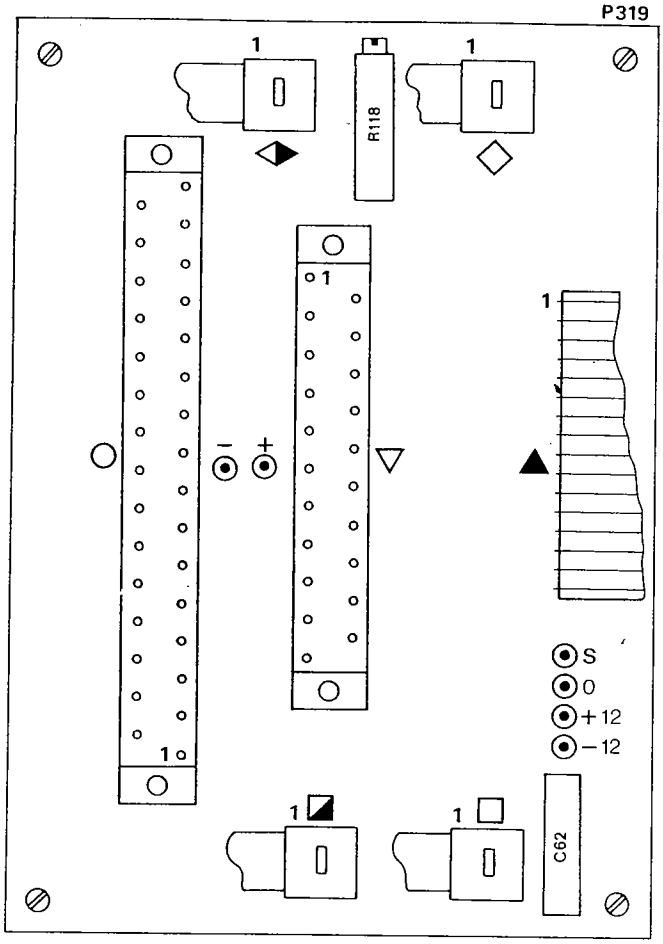


			Title: SM 3540
			Date: 1 - '85
Modifications	Date	App	delta elektronika bv

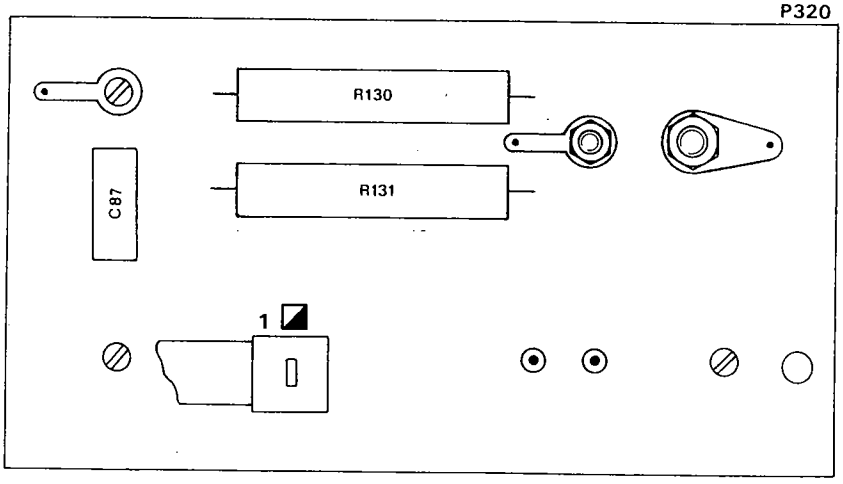


			Title: SM 3540
			Date: 1-'85
Modifications	Date	App	delta elektronika bv

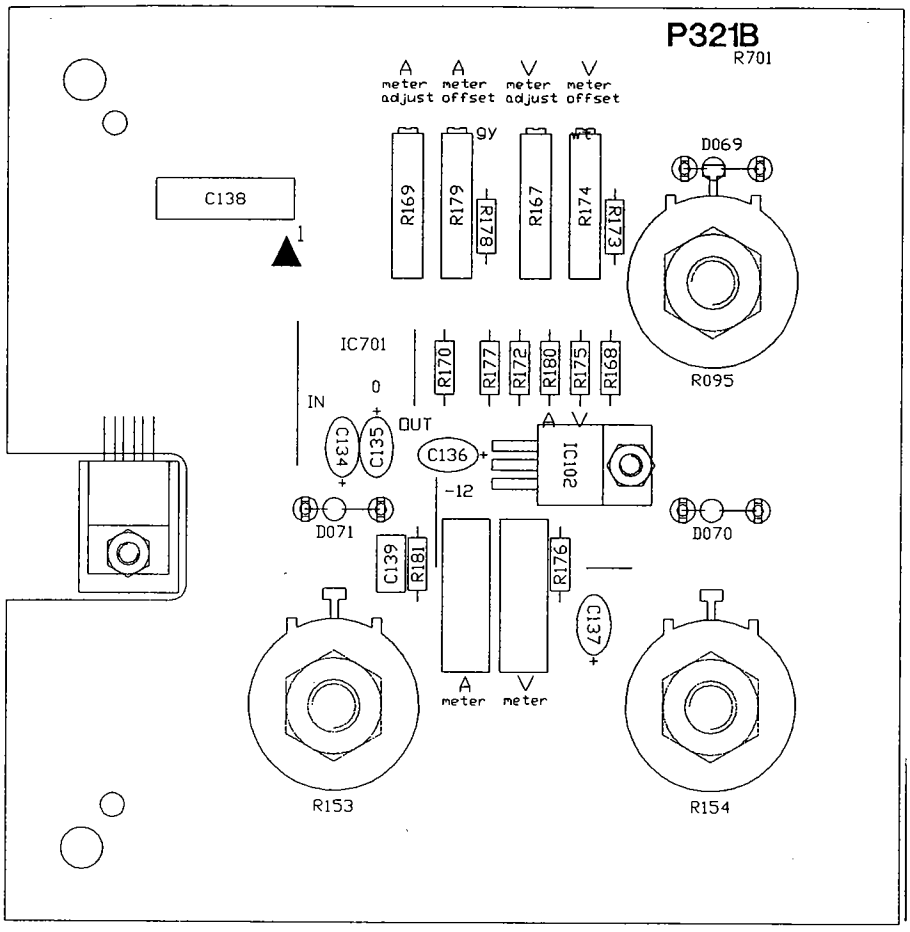
P319



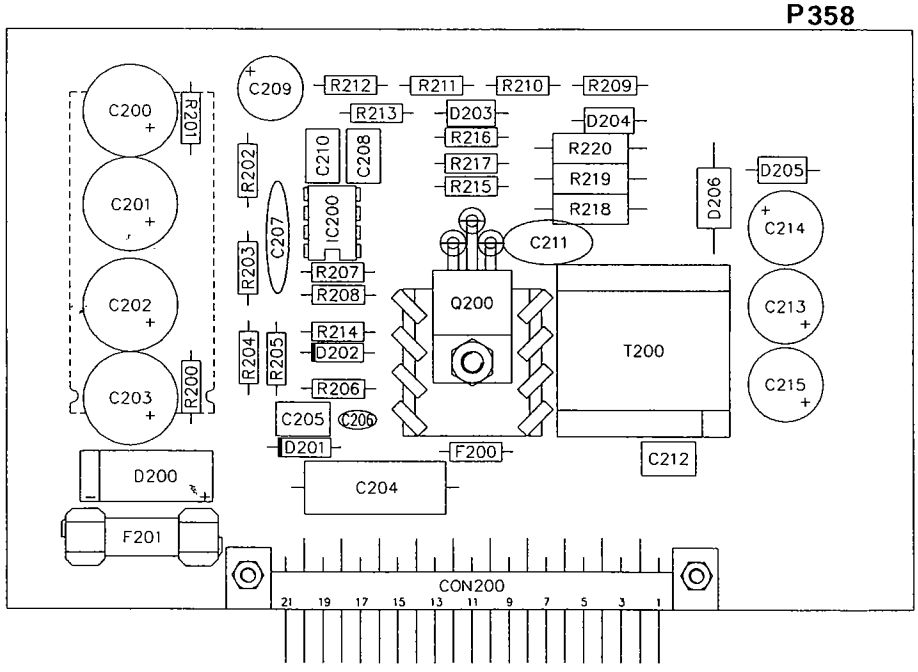
P320



			Title: SM 3540
+ R172 (P320)	5/9	Vr.	Date: 1-'85
Modifications	Date	App.	delta elektronika bv

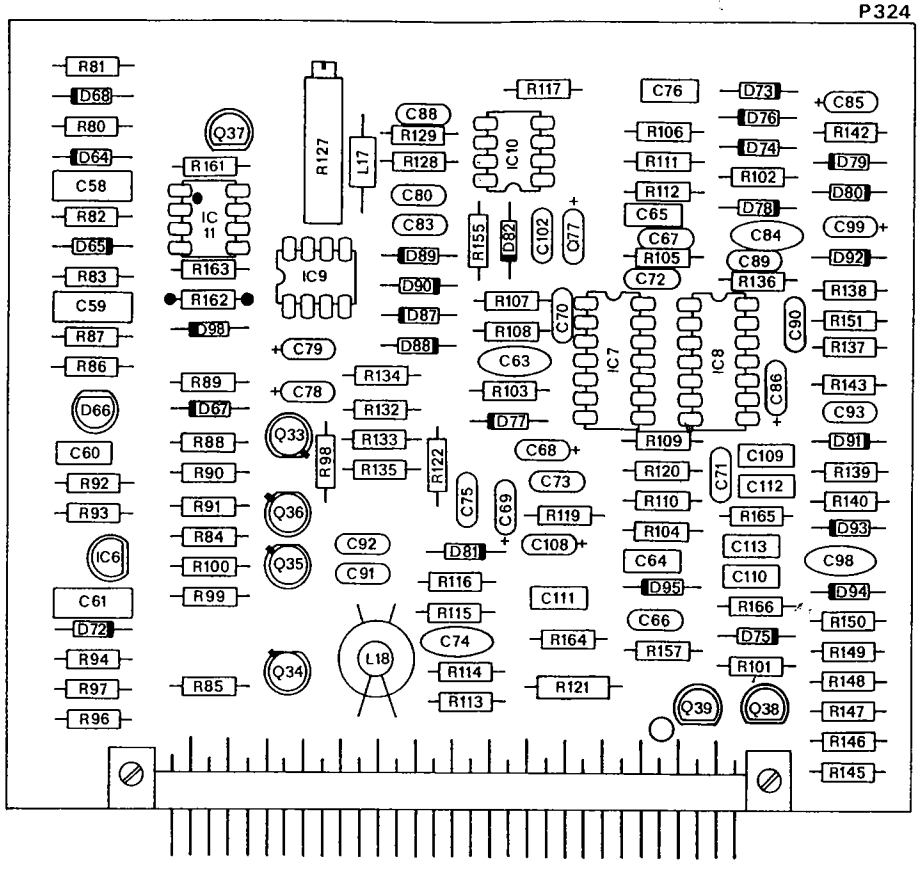


P358

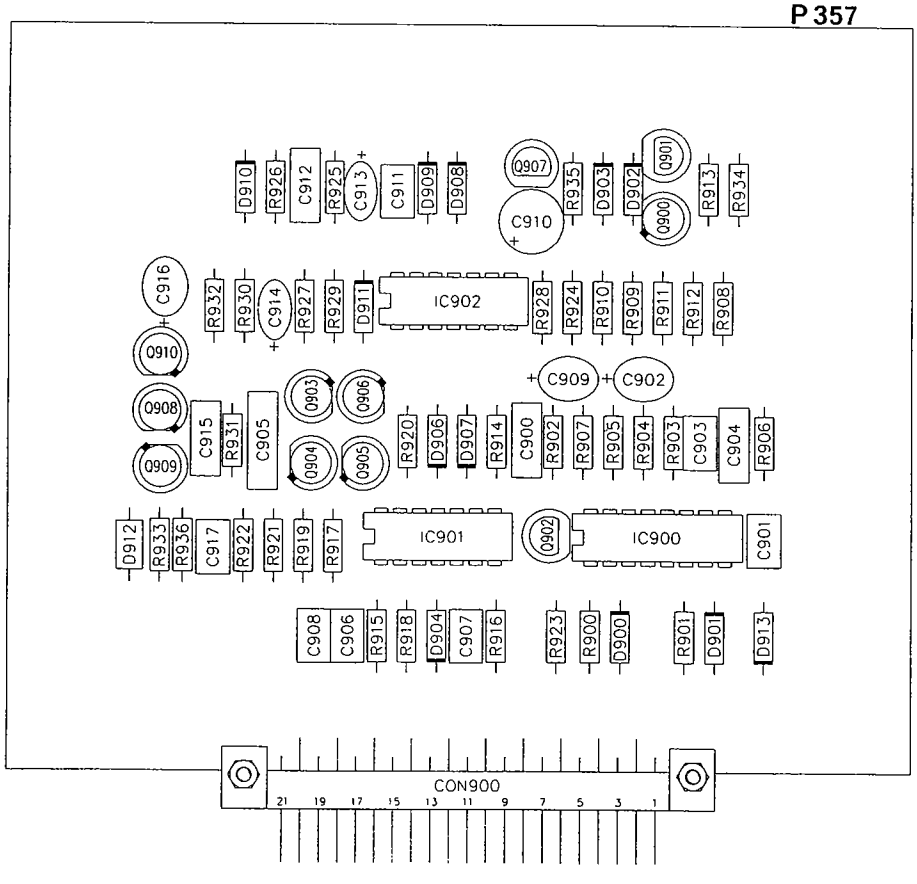


			Title: SM 3540
P322 = P358	8-'88	U.	Date: 1-'85
Modifications	Date	App.	delta elektronika bv

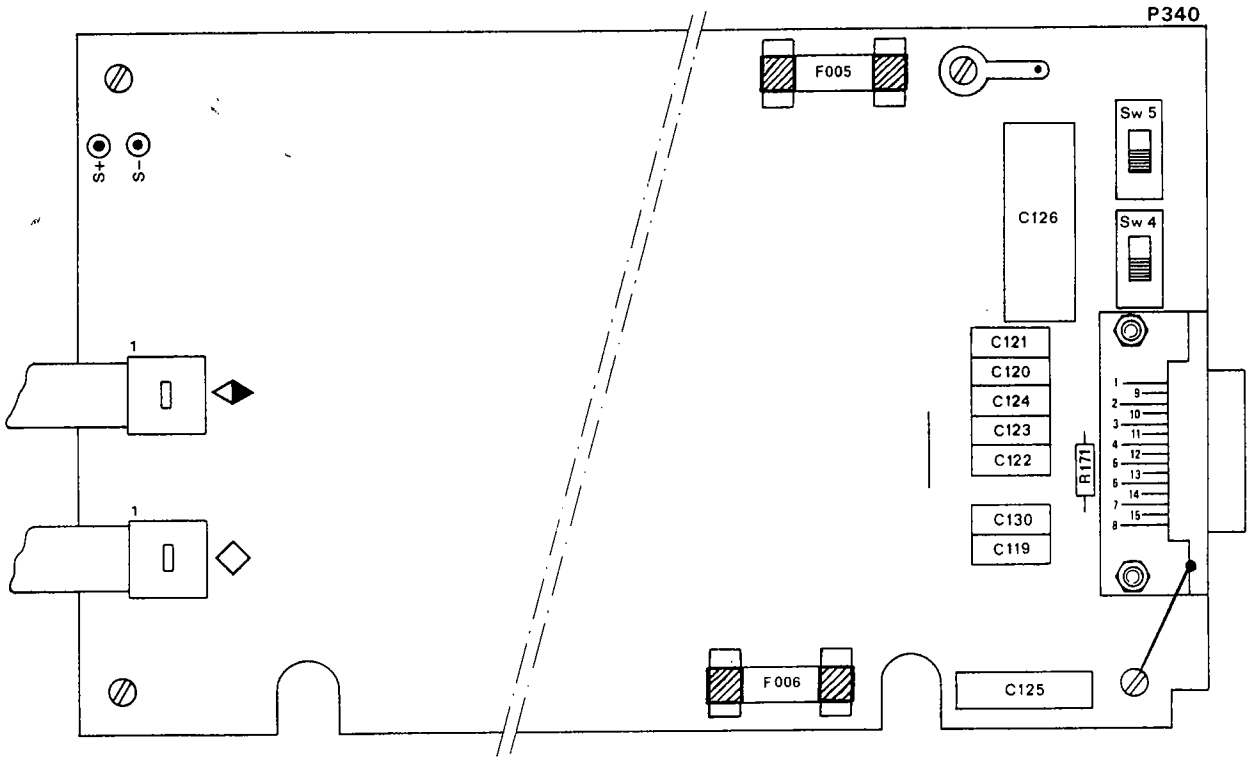
P324



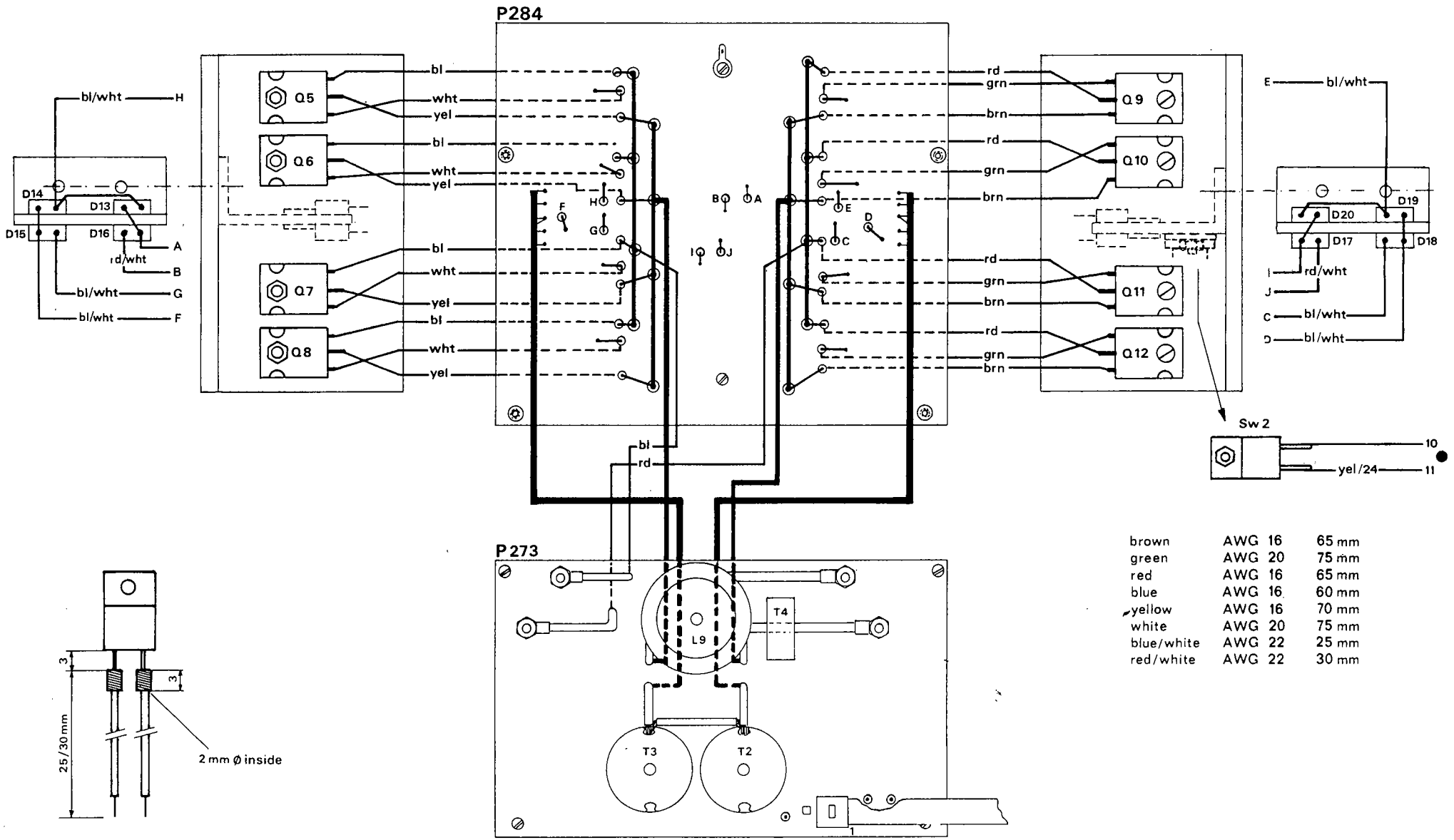
P357



P324 = c type	2/92	Vr	Title: SM 3540
P324 = b type	11/88	Vr	
P323 = P357	8/88	Vr	Date: 1-'85
Modifications	Date	App.	delta elektronika bv



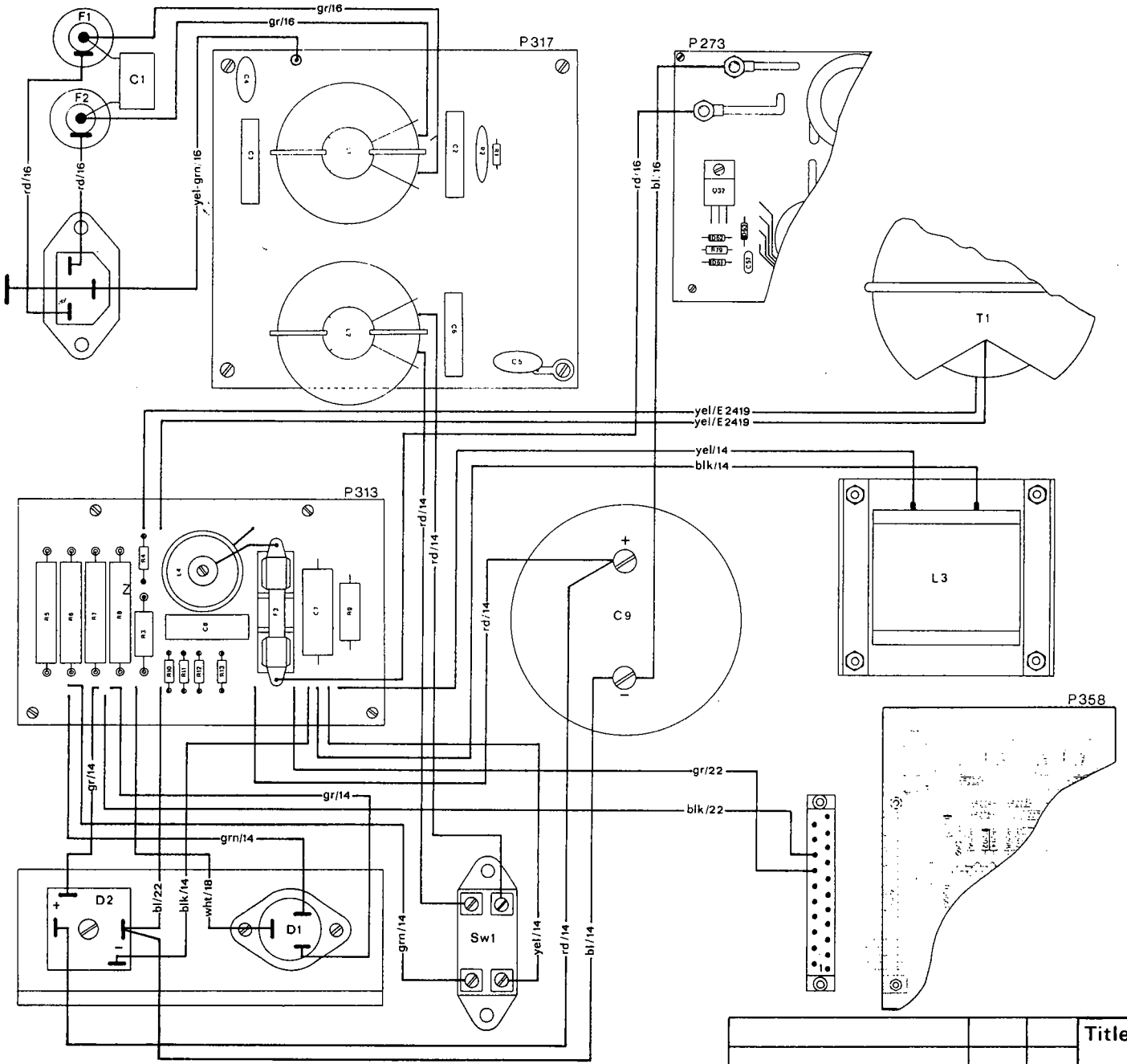
			Title: SM 3540
P340B (v.DPM)	9-91	Vr	Date: 1-'85
Modifications	Date	App	delta elektronika bv



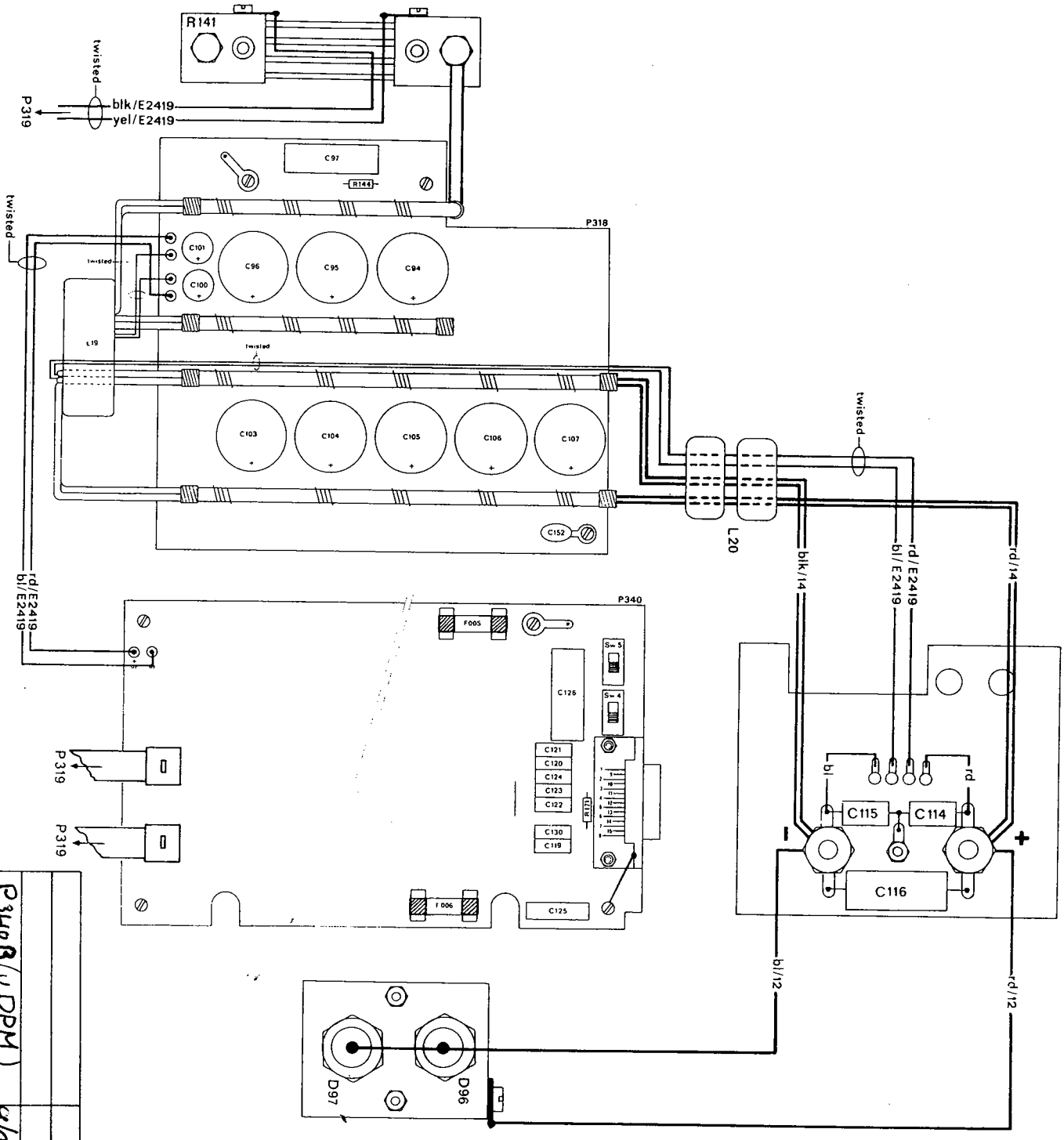
brown	AWG 16	65 mm
green	AWG 20	75 mm
red	AWG 16	65 mm
blue	AWG 16	60 mm
yellow	AWG 16	70 mm
white	AWG 20	75 mm
blue/white	AWG 22	25 mm
red/white	AWG 22	30 mm

Q5-Q12	6-'85	Vr.	Title: SM3540 SMX 7220
Sw 2	5-'91	Vr.	
			Date: 2-'85
Modifications	Date	App	delta elektronika bv

Modifications	Date	App	Date: 2-'85 delta elektronika bv



Modifications	Date	App	Title: SM 3540
			Date: 1-'85
			delta elektronika bv

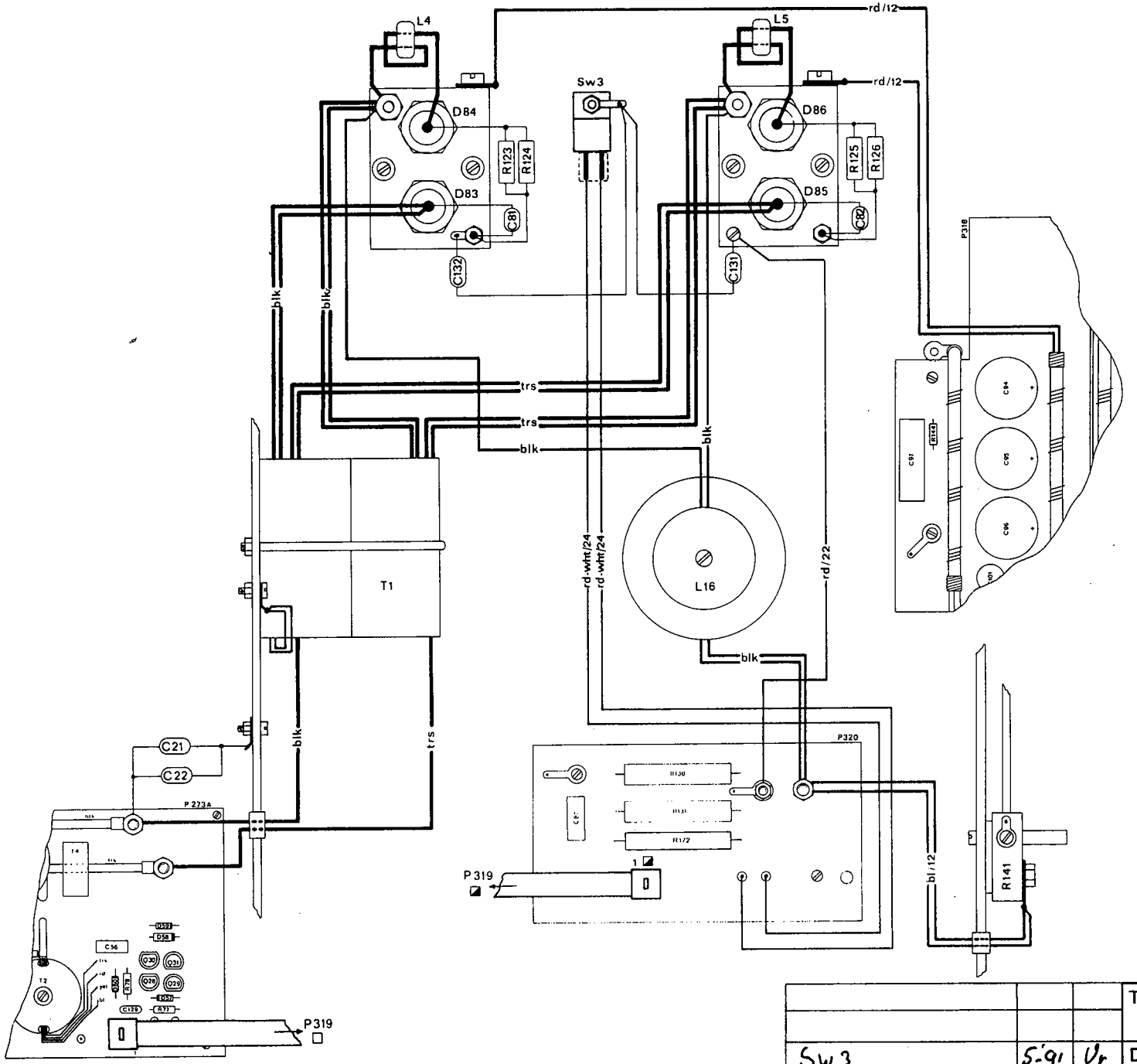


Modifications	P340B (u.DPM)		
Date	4/9/1		
App	Hr.		

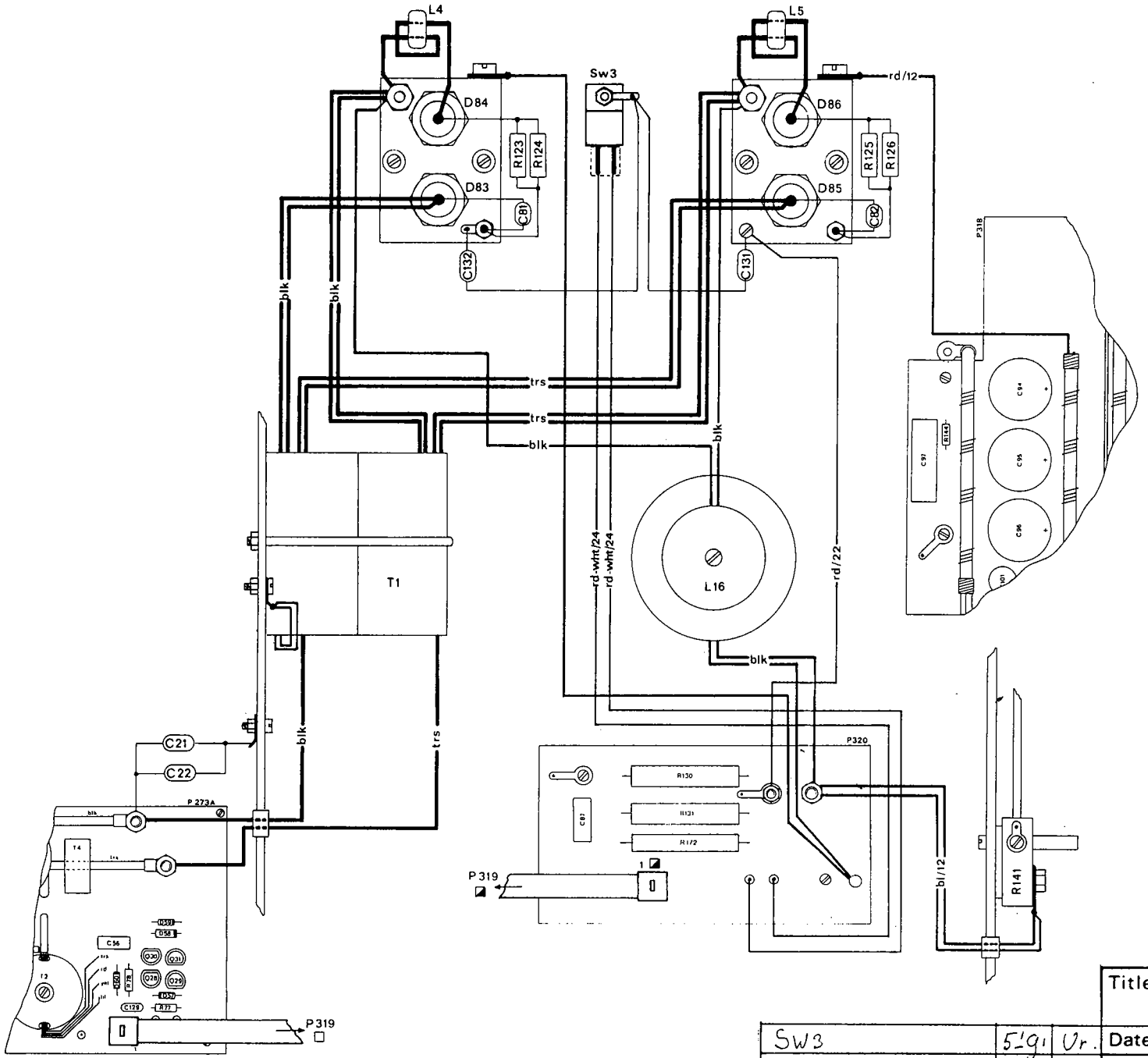
delta elektronika bv

Date: 1-'85

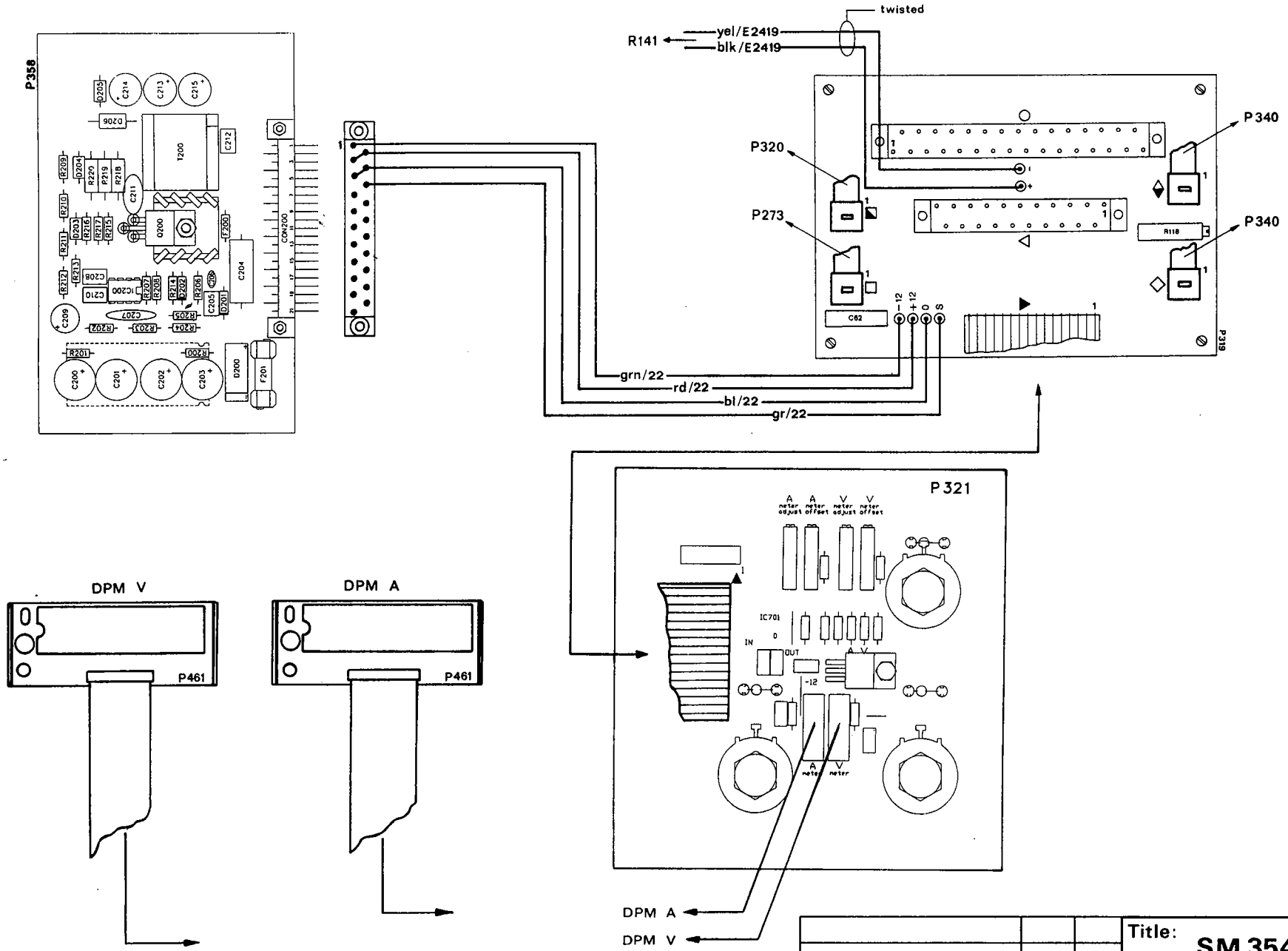
Title: SM 3540



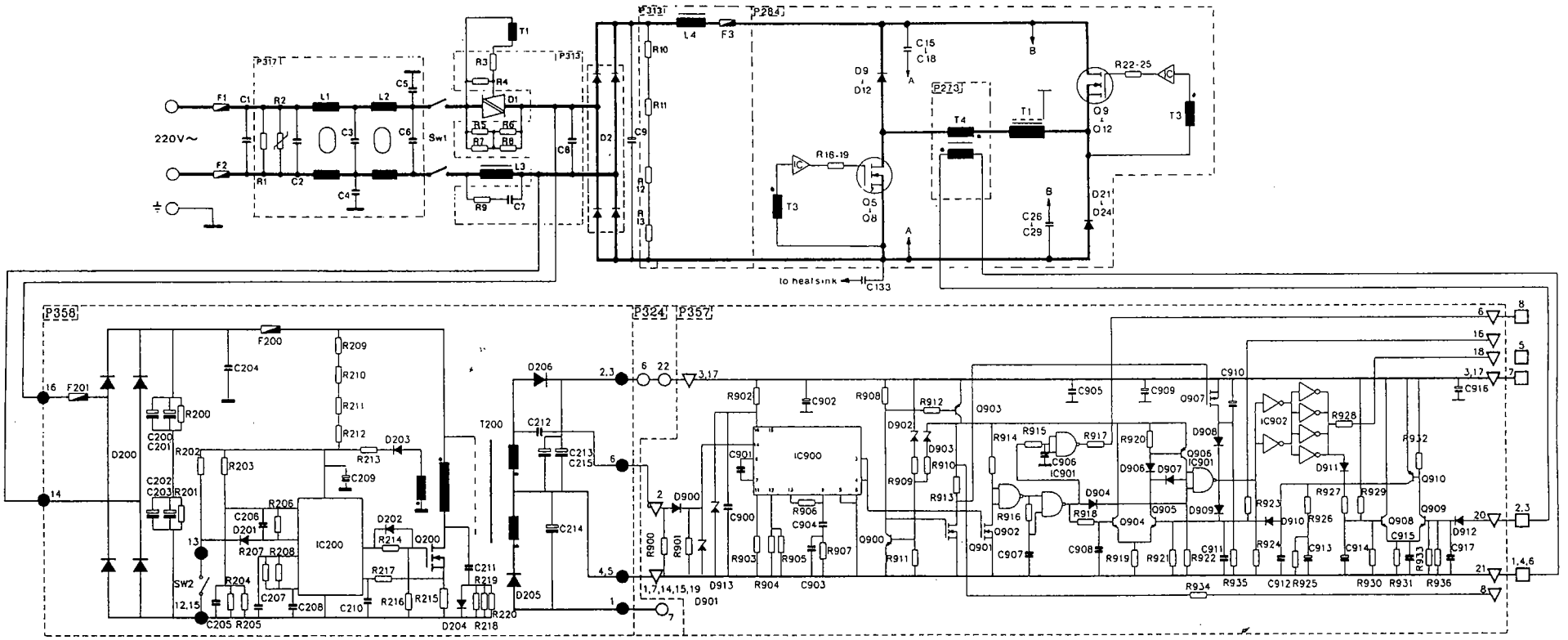
			Title: SM 3540
Sw 3	5-91	Vr	Date: 1-'85
Modifications	Date	App	delta elektronika bv

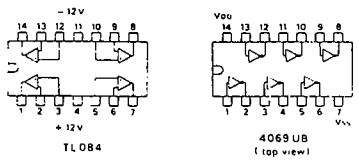


Sw3	5-91	Vr.	Title:	SMX7220
Modifications	Date	App	Date:	1-'85
			delta elektronika bv	



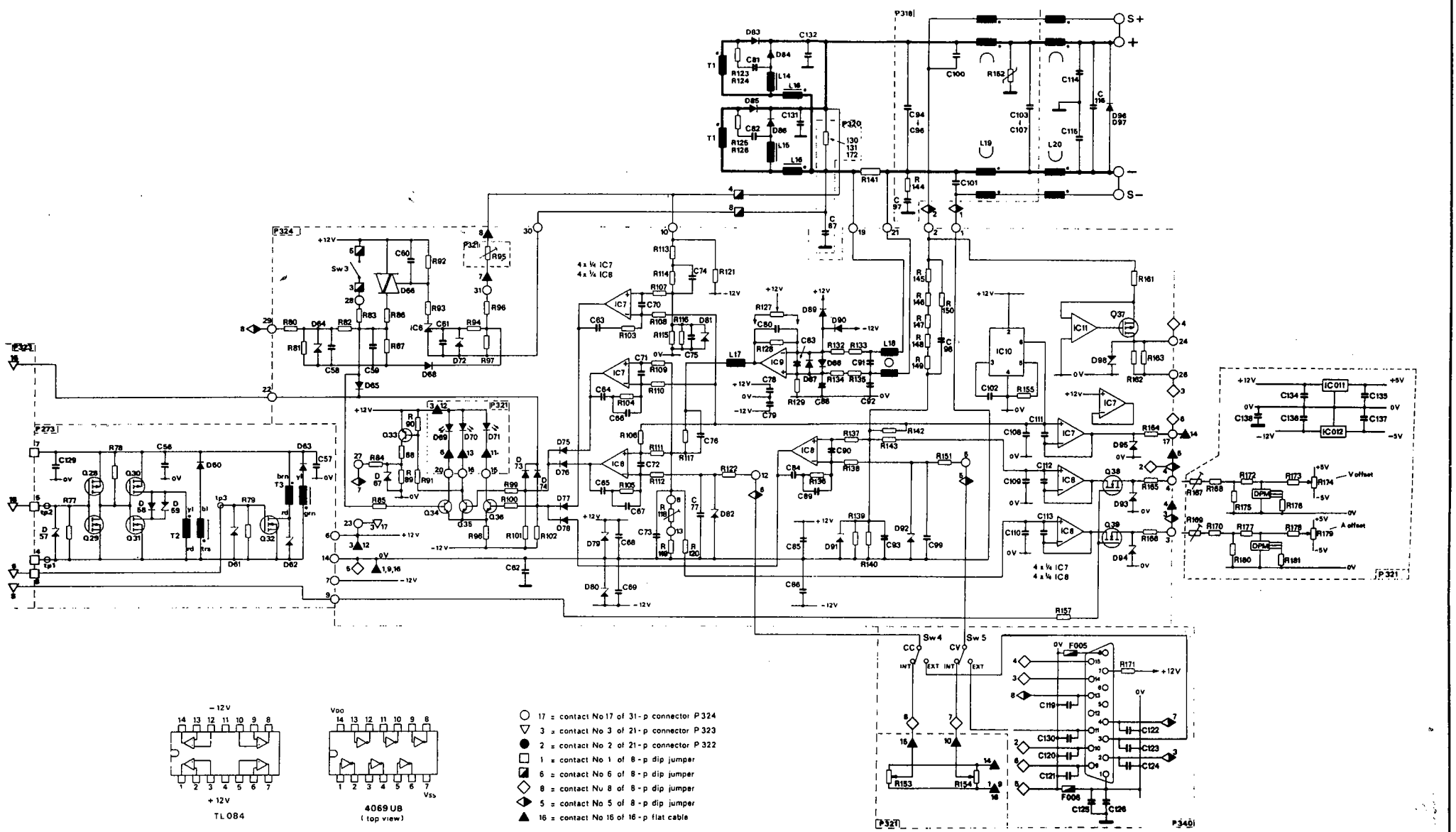
			Title: SM 3540
P321A(v.DPM)	9/9	Ur.	Date: 1-'85
Modifications	Date	App	delta elektronika bv



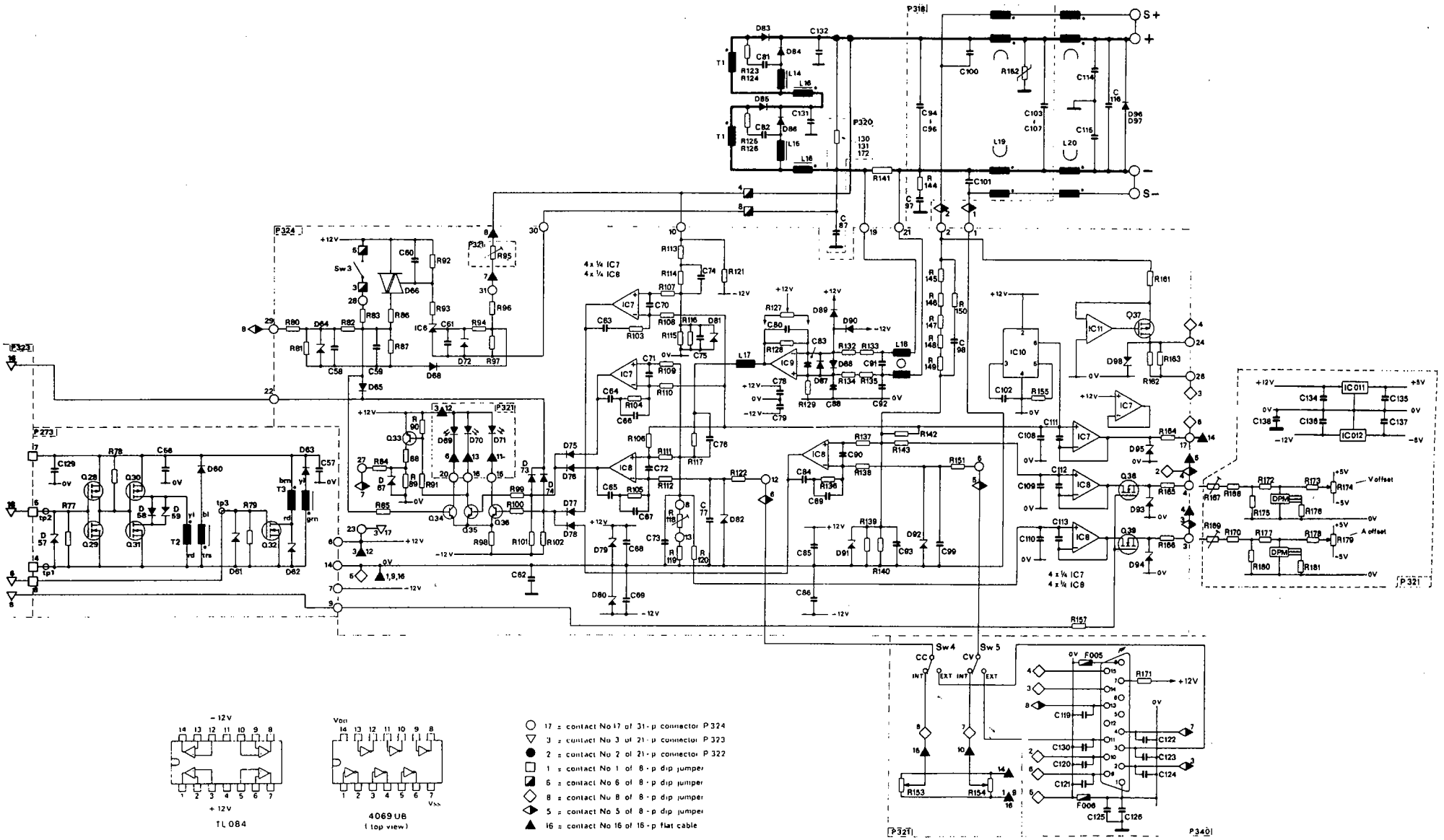


○ 17 = contact No 17 of 31-p connector P324
▽ 3 = contact No 3 of 21-p connector P323
● 2 = contact No 2 of 21-p connector P322
□ 1 = contact No 1 of 8-p dip jumper
◪ 6 = contact No 6 of 8-p dip jumper
◇ 8 = contact No 8 of 8-p dip jumper
◈ 5 = contact No 5 of 8-p dip jumper
▲ 16 = contact No 16 of 16-p flat cable

			Title: SM 3540
P357, P358	8-88	Vr.	Date: 1-'85
Modifications	Date	App	delta elektronika bv

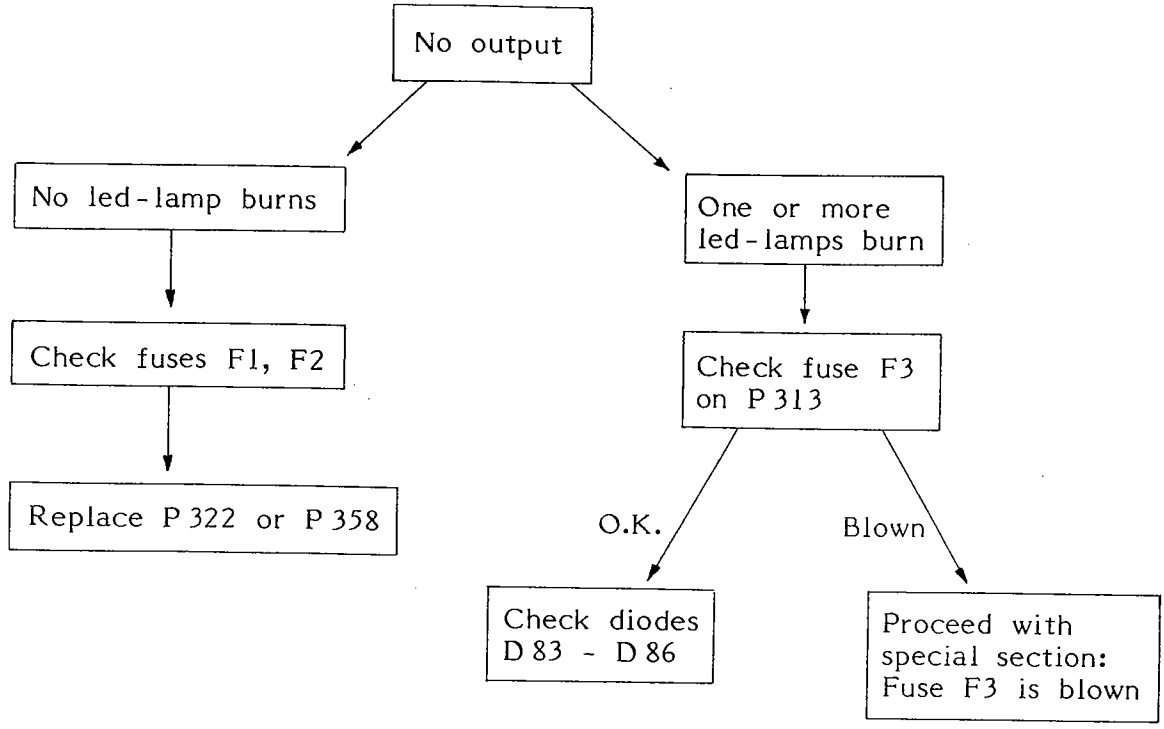


IC11, Q37, R158, 159	2-92	Vr.	Title: SM 3540
v. DPM	9/91	Vr	
R172 (P320)	5/91	Vr	Date: 1-'85
Modifications	Date	App	delta elektronika bv



IC11, Q37, R158, 159	2/92	Ur.	Title: SMX 7220
V. DPM	9/91	Ur	
+ R172 (P320)	5/91	Ur.	Date: 1-85
Modifications	Date	App	delta elektronika bv

TROUBLESHOOTING SM3540



Fuse F3 is blown

1. Check diodes D83, 84, 85, 86. (BYW 93-200, on heatsink).
2. Check all diodes on P284, defective diodes will give a short.
   You don't have to desolder to measure them.
3. When one of the transistors Q5 - Q12 (BUZ 67) is blown, also one or more resistors R16 - R19, R22 - R25 (6,8 Ohm) will be blown (open circuit).
4. Replace defective components.
5. Switch on power supply.

   If fuse F3 on P313 is blown again, replace the whole switching unit containing P273, P284 and Q5 - Q12, also replace P323.
   Send defective units for repair.

The SM3540 is a very reliable design and we expect a very low faillure rate. To check this we want to keep record of every repair and therefore ask your cooperation.

In case you repair an SM3540 please report to us:

- Serial no
- Description of defect
- Presumable cause of defect
- Replaced parts

Delta elektronika BV
P.O. Box 27
4300 AA Zierikzee, Netherlands
Tel. 31 1110 13656
Telefax 31 1110 16919
Telex 55349