



SERVICE MANUAL ES40

Stage Accompany ES 40

High Efficiency Power Amplifier

Service Manual

September 2002
Revision 04.1





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1 SAFETY AND WARRANTY

1.1 SAFETY

- Warning

Inside the ES40, AC voltages up to 240V may be present!

- Connection to the mains voltage

The ES40 chassis is connected to ground by the grounding conductor in the power cord. To avoid electrical shock, plug the power chord into a properly wired receptacle. When this ground connector is not present or interrupted, all accessible parts of the amplifier can cause an electrical shock.

- Fuses

To avoid fire hazard, only replace with fuses of the same type and value.

- Servicing

Do not perform internal service or adjustments unless there is another person present capable of rendering first aid and reanimation. Try to perform all service work with mains power off. Remove mains plug to be sure that there are no internal voltages present.

1.2 WARRANTY

- Summary

New Stage Accompany B.V. warrants to the original commercial purchaser of each new Stage Accompany product, from the date of purchase by the original purchaser until the end of the warranty period, that the product is free of defects in materials or workmanship.

- Warranty period

The warranty period on all Stage Accompany products is five years from the date of the first consumer purchase, with the exception off:

- all electrical products: three years from the date of the first consumer purchase;
- cone assemblies in the loudspeaker and diaphragms in the Compact Drivers: one year from the date of the first consumer purchase;
- movable parts, such as castors, locks, handles, hinges, fans etc. one year from the date of the first consumer purchase;
- computers and associated peripherals: six months from the date of the first consumer purchase.

- How to validate the warranty

To validate warranty, the purchaser must always keep the original receipt of purchase to establish the date of purchase.

- Items excluded from warranty

Appeal on warranty will be avoided in case:

- of defects caused by influence from the outside, accident, misuse, neglect or influence of water;
- the serial number on the warranty and/or product has been defaced, altered or removed;
- of damage due to shipment;
- of damage resulting from neglecting instructions listed in the user manual;
- of damage caused by incorrect, abnormal handling or abuse during delivery;
- the unit has been repaired (or shows signs of repair) by someone not authorised by New Stage Accompany B.V.;
- the original receipt of purchase cannot be presented whenever warranty service is required;
- the cause of damage is unknown.



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- What we will do

Shipment of the product to an authorised Stage Accompany service center is at the risk and responsibility of the customer. New Stage Accompany B.V. will pay for all labour and material expenses for all repairs covered by the warranty. New Stage Accompany B.V. will not pay for the costs of shipment to the service center or factory. However, New Stage Accompany B.V. will pay for the costs of return shipment to the customer if repairs are covered by warranty.

- Caution

Warranty work can only be performed at authorised Stage Accompany service centres or at the Stage Accompany factory. Every repair or attempted repair by a non-authorised party will void the warranty.

New Stage Accompany B.V. reserves the right to alter specifications without prior notice.

2 TAKING THE ES40 APART

The ES40 can be taken apart in the following way:

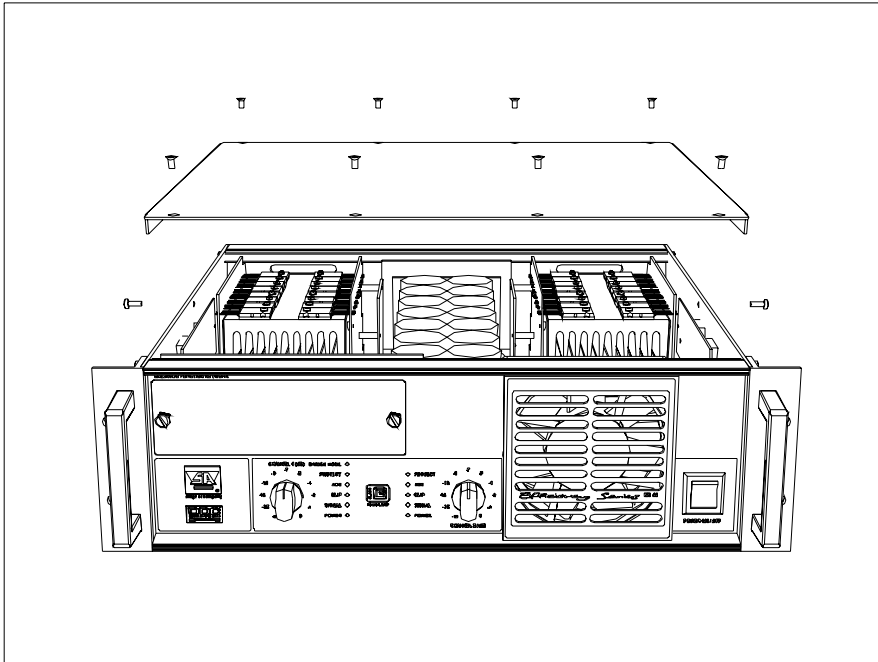


fig 2.1 Removing the lid.

Access to the electronics can be obtained by removing the top-panel. Remove the eight screws at the top and the two screws, one on the left and one on the right side of the amplifier. Then carefully lift the panel and disconnect the ground wire attached to the panel at the inside of the amplifier.

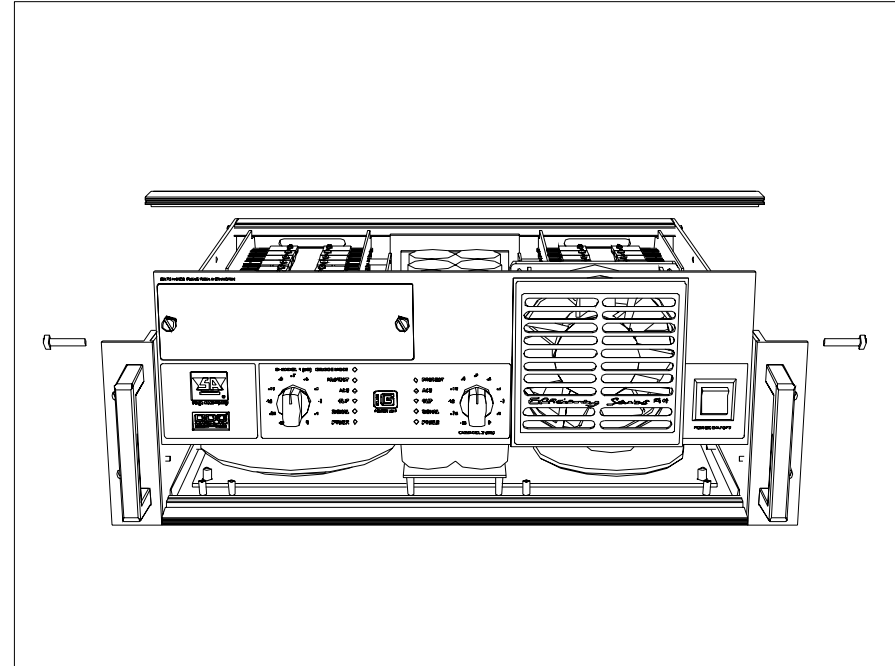


fig 2.2 Removing the front panel.

To obtain access to the frontboard, remove the bar on top of the frontpanel by removing one screw on both the left and right side of the amplifier. After removing four connectors from the front board (all connectors except for the fan connector), the ground connection and disconnecting the mains switch, the frontpanel can be taken out.

To perform servicing to the amplifier modules remove four screws from the bottom of the amplifier, (two for each channel), the top-bar on top of the rearpanel in a similar way as the bar on the frontpanel and remove eight screws from the back which hold the amplifier modules (see fig. 2.3).

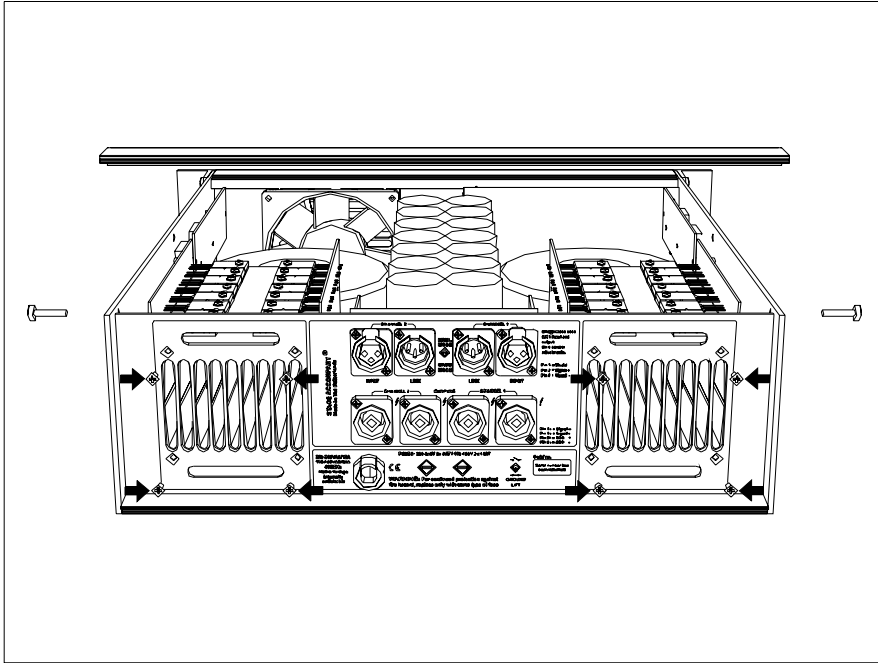


fig. 2.3 Remove top-bar and eight screws from the back.

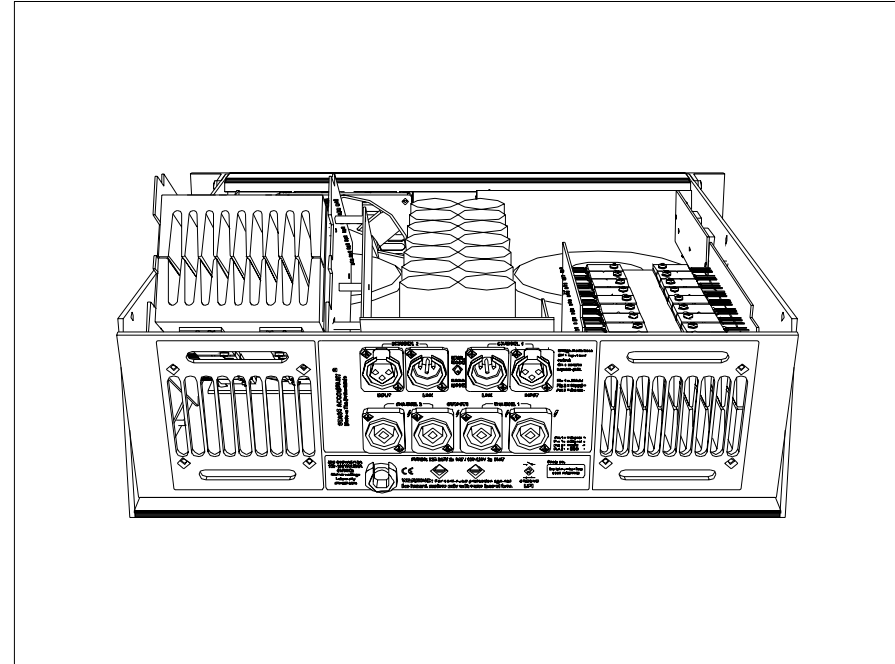


fig 2.4 Lift the module from the amplifier.

Now disconnect the flatcable from the power supply board and the signal connector from the driver board. Lift the amplifier module from the amplifier while removing the two power connectors (see fig. 2.4). To perform measurements or adjustments to the module, it must be connected to the amplifier using extension cables.



3 BASIC OPERATION OF THE ELECTRONICS

3.1 INPUT AND PROTECTION CIRCUITRY

The front board contains the electronics of the input amplifier and protection circuitry

The front board circuitry contains:

- Signal present indication
- Clip and ACE (Active Clip Eliminator) indication
- Amplifier level setting
- DC protection
- HF protection
- Thermal protection
- Fan speed control
- Bridge mode control

The input amplifier is a dedicated differential line receiver. After the debalancing stage, the input signals can be attenuated by conductive plastic potentiometers. The signals are also fed to a network that detects the presence of input signal. A LED on the frontpanel will light if the input signal exceeds -35 dBu, regardless the setting of the input attenuators. For protection purposes, each channel can be muted by a relay (RL2 and RL3).

The DC protection senses the amplifier outputs for DC and very low frequency components. The output relays (located on the relay board) are muted when more than 3V DC (positive or negative) is detected. This circuit also provides a turn on delay for the output relays and a turn off delay for the input mute relays. When DC is detected, the 'protect' LEDs will light on the front panel.

The HF protection circuits are composed around IC13a&b. The input signal is fed to a high pass filter whose output is fed to a comparator. When the input signals contain a certain amount of high frequencies, the input of the amplifier is muted.

The thermal protection senses the temperature of each power amplifier as well as both mains transformers. IC1a&b determine the appropriate fan

speed. IC11b and IC11c compare the measured temperatures to the programmed limits and activate the input mute relays and front board 'protect' LEDs if necessary. The amplifier limits are 90 °C and the transformer limits are 100 °C. The amplifier is unmuted when the temperature has dropped 5 °C. A power amplifier or power transformer thermal overload mutes only the related channel.

Clipping and limiting of the amplifiers is detected by circuits located on the amplifier's driver boards. T4 and T5 activate a LED on the frontpanel to indicate clipping with a turn off delay caused by C33 and C34, T6 and T9 activate the 'ace' LEDs.

A switch located on the connector board at the rear of the amplifier switches the amplifier into bridge mode. This is done by IC3b, e & f. IC6a mutes the inputs of the amplifier as well as the output relays during bridge mode switching. RL1 switches IC9, which acts as a phase inverter, into the CH2 signal path. RL2 and RL4 on the relay board route the output and DDC signals to the CH1 output connectors. RL1 also switches off all CH2 LED indicators on the frontpanel. All indications are routed to the channel 1 indicators during bridge mode operation.

3.2 POWER SUPPLY CIRCUIT

The power supply board and both rectifier boards contain all the electronics for rectifying and filtering 13 different supply voltages. separate ± 88 V and ± 42 V voltages feed the power amplifiers, separate ± 15 V supplies feed the front board and the low voltage circuits of the amplifier modules. And finally a +26V which supplies energy for all relays, LEDs and the fan. Inrush current reduction is obtained by NTCs SG1 and SG2 on the rectifier boards. The ES40 can internally be set to 110-120 V or 220-240 V operation. The voltage range is determined by CN8 and CN9 on both rectifier boards. The correct settings are:

110-120 V : mains connector in CN9, jumper connector in CN8

220-240 V : mains connector in CN8, jumper connector in CN9

Note that the ± 15 V voltages and the +26V voltage are protected by multifuses (F1 to F4). These devices normally have very low impedance. In case of a current overload the impedance rises to a high value, simulating a blown fuse. When this happens, turn off the amplifier and perform the needed repair. The multifuses reset automatically and do not need to be replaced.

The power supply board also contains circuitry which provides a turn on delay for the CH1 power supply relays and circuits for the output and bridge mode relays situated on the relay board.

3.3 DRIVER BOARD

The driver boards contain the preamplifiers of the ES40. The basic electronics are shown in figure 3.1.

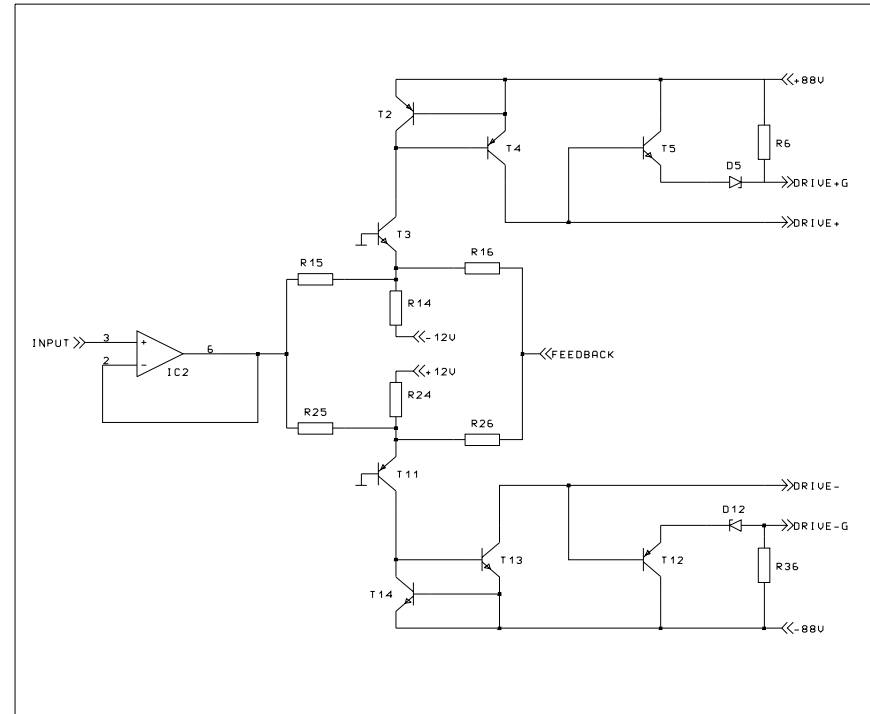


Figure 3.1 ES40 preamplifier set-up.

The input signal is fed to a conventional opamp (IC2). Because the emitters of T1 and T2 are at a constant voltage, the output voltage of IC2 is converted into a current which is reflected into the two current mirrors (T5/T6 and T9/T10). Note that this changes the phase of the signal by 180° . These current mirrors now reflect the drive currents into the transimpedance gain stage. It is here that the high output voltage is generated. Drive currents for the class G output power stage are supplied through T7 and T8. Zenerdiodes D9 and D10 are a constant voltage source of 6.2 volts that provide the necessary voltage gap for driving the class G current gain amplifier on the main amplifier board. The driver

boards also contain circuits for detecting clipping of the amplifier as well as the Active Clip Eliminator circuits.

3.4 MAIN AMPLIFIER BOARD

Figure 3.2 shows the basic set-up of the power amplifier.

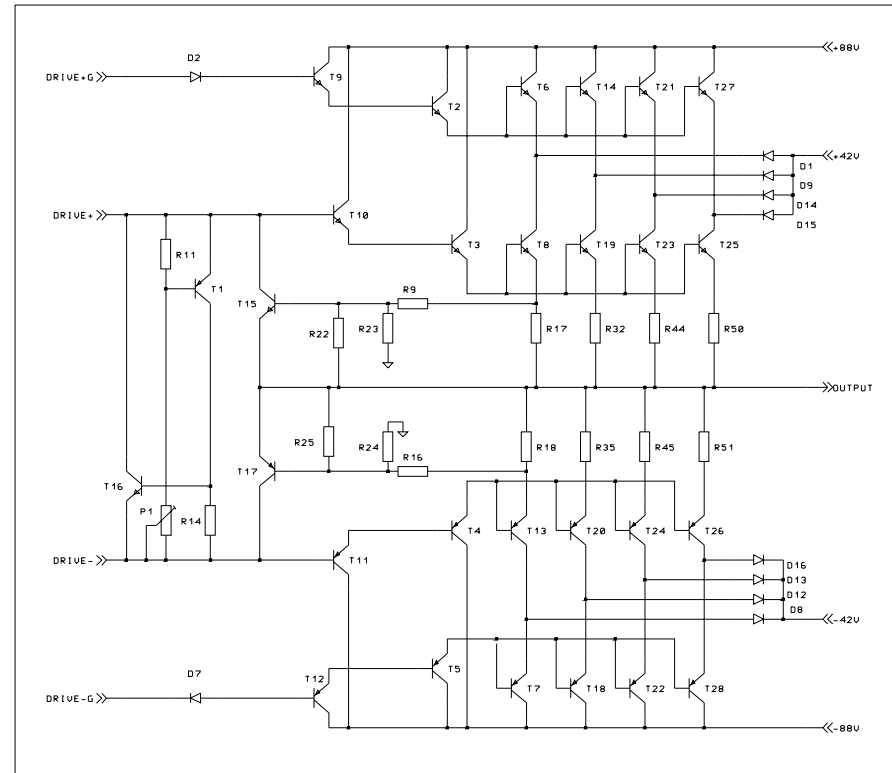


Figure 3.2 ES40 power amplifier set-up.

The driver board circuit provides four signals, drive +, drive -, drive +g and drive -g. The positive drive current (drive +) is boosted by T11 and T3 and fed to the NPN power transistors T8, T21, T25 and T27. The negative drive current (drive -) is boosted by T12 and T4 and fed to the PNP power transistors T15, T22, T26 and T28. The positive class G drive current

(drive +g) is boosted by T10 and T2 and fed to the NPN power transistors T6, T16, T23 and T29. The negative class G drive current (drive -g) is boosted by T13 and T5 and fed to the PNP power transistors T7, T20, T24 and T30. T1 and T18 are configured as a constant voltage source and provide the bias current for the amplifier output stage. The amplifier normally operates on the ± 42 V power supplies though diodes D5, D17, D19, D21 and D12, D18, D20 and D22. The collectors of T8, T21, T25 and T27 are in this case at a constant voltage of +42 V. When the output of the amplifier rises above +36 V the emitter voltages of T6, T16, T23 and T29 will rise linearly with the output voltage taking over the power supply from D5, D17, D19 and D21. Exactly the same is true for the negative side of the amplifier. Dynamic current limiting of the amplifier output stage is handled by T17 and T19. When the current drawn from the amplifier rises, the voltage across R19 and R20 rises too. At the moment that this voltage reaches 0.65 volts, T17 and T19 start conducting drive current away from the output transistors and thus limiting output current. Current limiting depends on the output voltage. At 0 V output the maximum current per transistor is 6 A rising to 15 A at 50 V. Overall feedback and DC stability of the amplifier is achieved by the DDC circuit build around IC1.

3.5 SUPPLY MODULATOR BOARD

Figure 3.3 shows the basic set-up of the supply modulator.

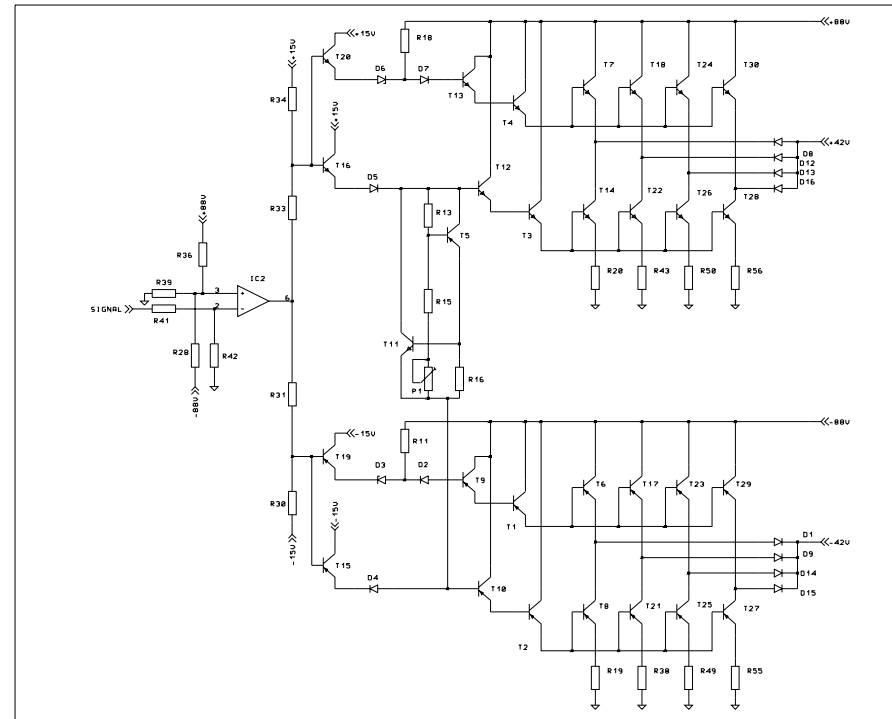


Figure 3.3 ES40 supply modulator set-up.

The input signal for the supply modulator is the output signal taken from the main amplifier. This signal is decreased in amplitude by R41 and R42 and fed to the inverting input of a conventional opamp (IC2). Because the bases of T15 and T16 are at a constant voltage, changes of IC2's output voltage force a current into T16 or out of T15, and thus into or out of the transimpedance gain stage. The supply lines are the outputs of this circuit.



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As a result of this, the supply voltages are modulated by the input signal. Feedback is arranged through the supply lines and R28 and R36.

4 ADJUSTMENTS

After repairs the amplifier's bias currents should be checked and readjusted if necessary. The main amplifier and the supply modulator each have their own bias voltage generator. The bias current for each transistor pair is approximately 50 mA ($\pm 25\%$) at 40 °C. The bias current can be checked by measuring the voltage across one of the eight emitter degradation resistors (0.33 Ohm, 5 Watt) on both boards and can be adjusted with P1 on the main amplifier board and also P1 on the supply modulator board. Turning clockwise will increase bias current.

5 FINAL TEST AFTER SERVICING

For a final test of the amplifier a signal generator and a level/distortion analyser are needed. First check the amplifier's maximum power output. Connect an 8 Ohm dummy loads to both outputs and apply a 1 kHz signal to both inputs. The output voltages should at least be 88 Vrms (with the correct mains voltage). Make sure your dummies can handle at least a 1000 Watts each!

Next check the frequency response. This can be done at an output level of approximately 10 Vrms and an 8 Ohm dummy on both outputs. The final result should be better than: 10 Hz..50 kHz -3 dB.

Next check the total harmonic distortion. The final test specifications are: $U_{out} = 60$ Vrms into 8 or 4 Ohm: THD < 0.1 @10 Hz .. 20 kHz measured in a 80 kHz bandwidth.

The total noise level of the amplifier should be approximately 110 dB(A) under 90 Vrms output level (-69 dBu). For this test the XLR input connectors are left open.

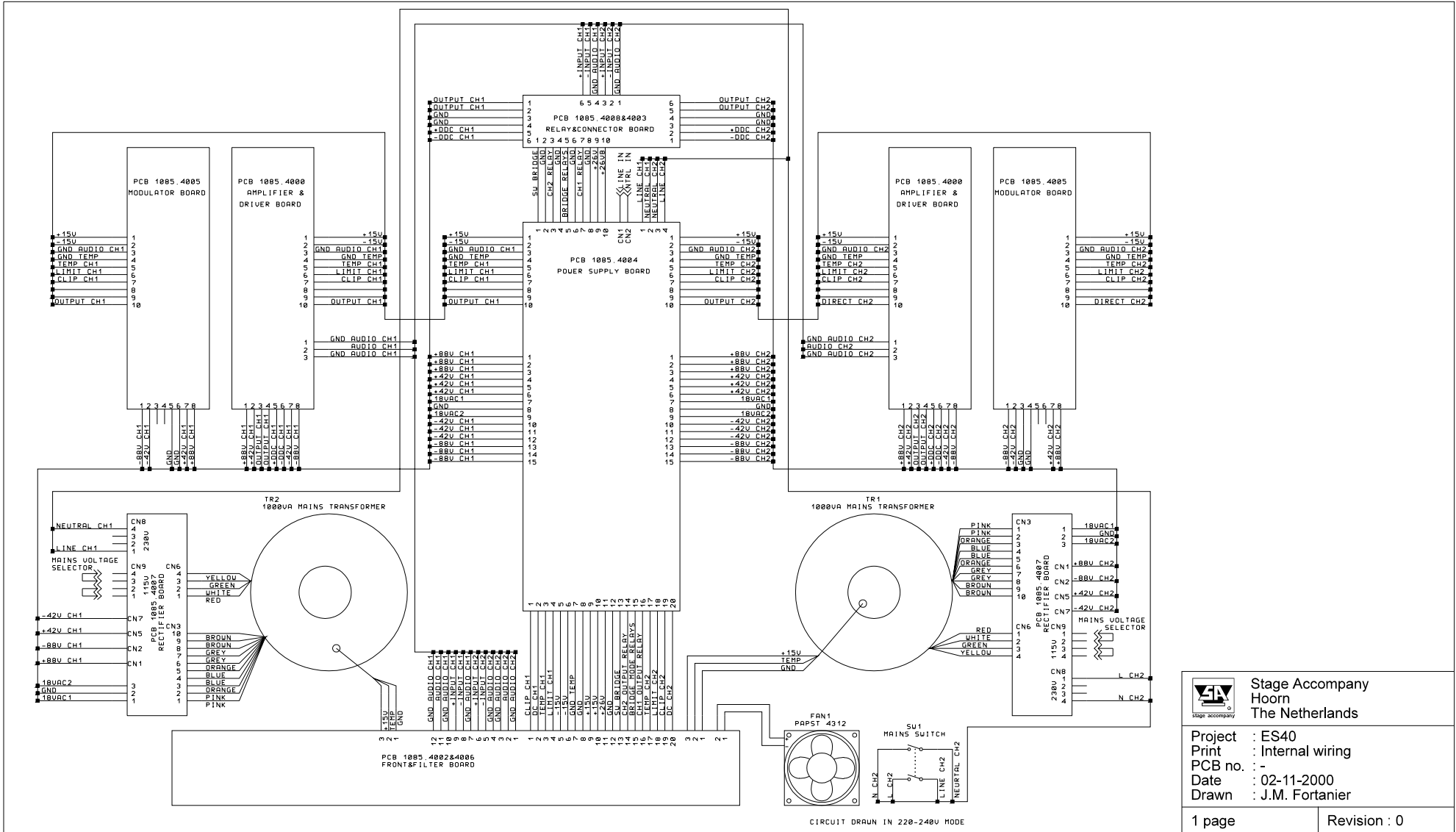


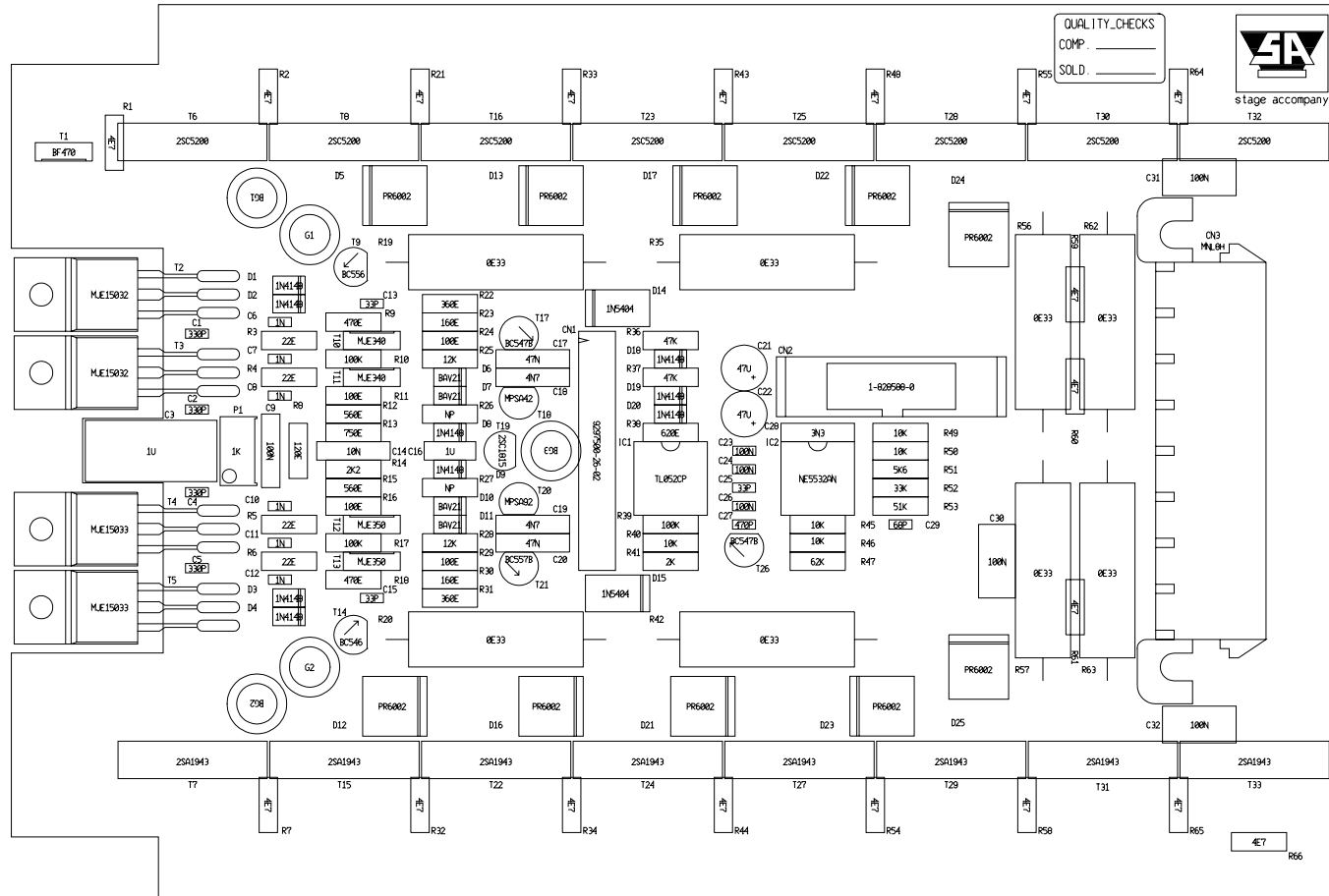
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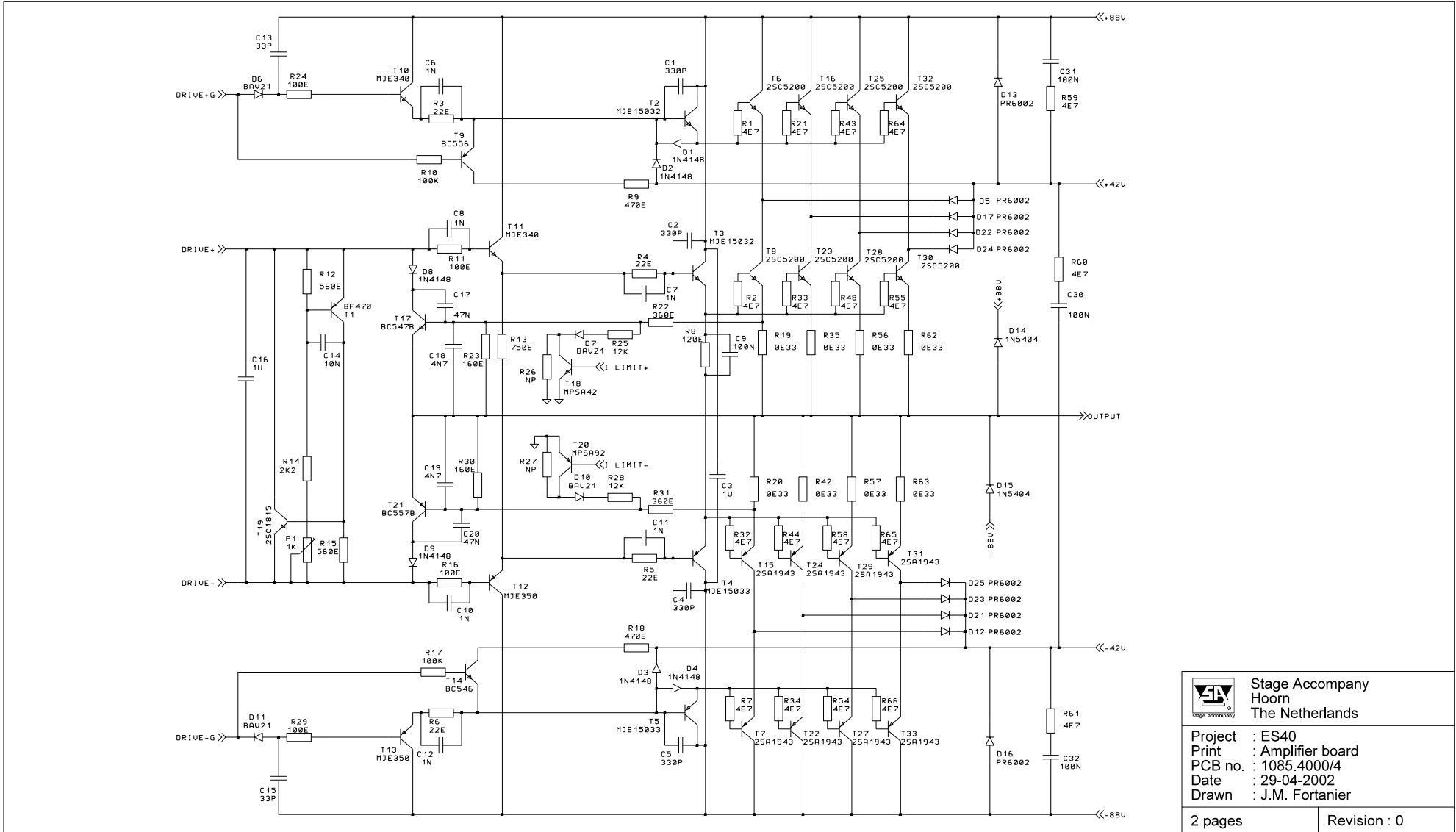
6 SPECIFICATIONS


Input sensitivity	: 1.72 Vrms (+7 dBu) for full RMS power into 4 Ohm	Power consumption	: 200 VA (standby) 2800 VA 1/8 of maximum output power pink noise in 2 Ohm
Maximum input level	: +22 dBu	Weight	: 35.2 kg, 77 lb
Input impedance	: 50 kOhm	Housing	: 19 inch rack mount 3 HU, 440 mm (17.3 in) deep behind the mounting surface (without connectors).
Common mode rejection	: > 70 dB @ 20 Hz..20 kHz > 90 dB @ < 1 kHz	Dimensions	: 133 x 482 x 445 mm (h x w x d) (5.25 x 19.0 x 17.5 in) (without connectors and rack handles)
Frequency range	: @ 100 W into 8 Ohm 10 Hz..20 kHz +0..-0.4 dB 10 Hz..55 kHz +0..-3 dB		
Gain	: 33 dB (44.7x)		
Channel separation	: > 90 dB @ 1kHz, 100 W into 8 Ohm > 75 dB @ 20 kHz, 100 W into 8 Ohm		
Total harmonic distortion	: < 0.3 % @ 20 Hz..20 kHz, more than 2 Ohm load at all powers 1 dB below clipping < 0.007 % @ 1 kHz, 100 W into 8 Ohm < 0.05 % @ 20 kHz, 100 W into 8 Ohm		
Intermodulation distortion	: @ 100 W into 8 Ohm < 0.06 % @ 200 Hz..20 kHz		
Signal to noise ratio	: > 110 dB A-weighted		
Slew rate	: > 40 V/μs		
Damping factor	: 10.000 @ 1 kHz, 8 Ohm		
Output power	: RMS / Peak @ 1 kHz, < 1 % THD 2 x 1010 / 1250 W @ 8 Ohm 2 x 1520 / 2050 W @ 4 Ohm 2 x 1930 / 2700 W @ 2 Ohm		
Output power bridged	: RMS / Peak @ 1 kHz, < 1 % THD 1 x 2020 / 2500 W @ 16 Ohm 1 x 3040 / 4100 W @ 8 Ohm 1 x 3860 / 5400 W @ 4 Ohm		
Mains supply voltage	: Stated at rear of amplifier		

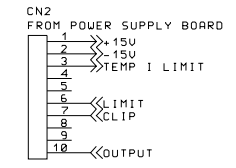
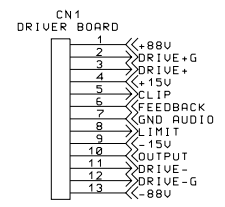
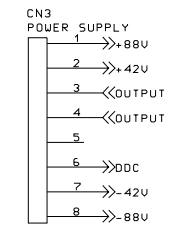
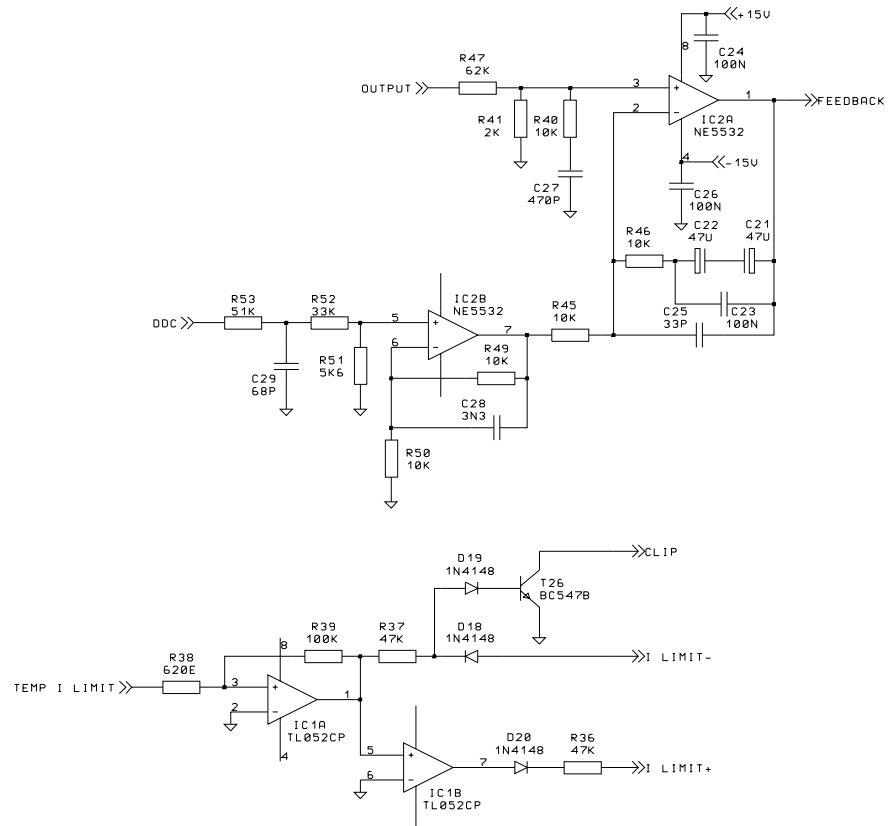
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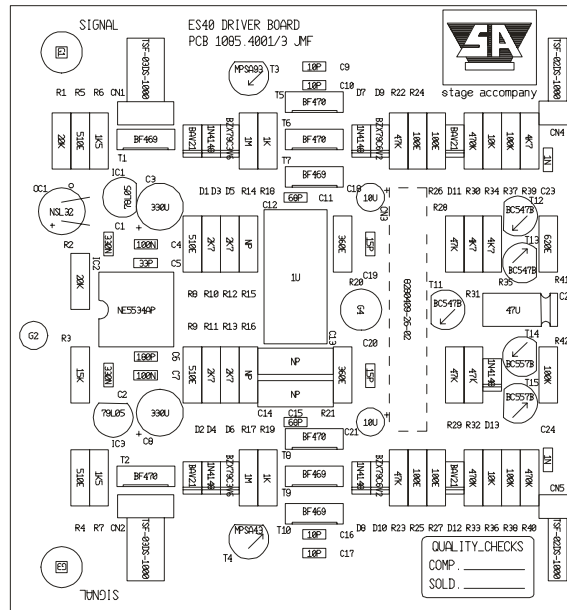





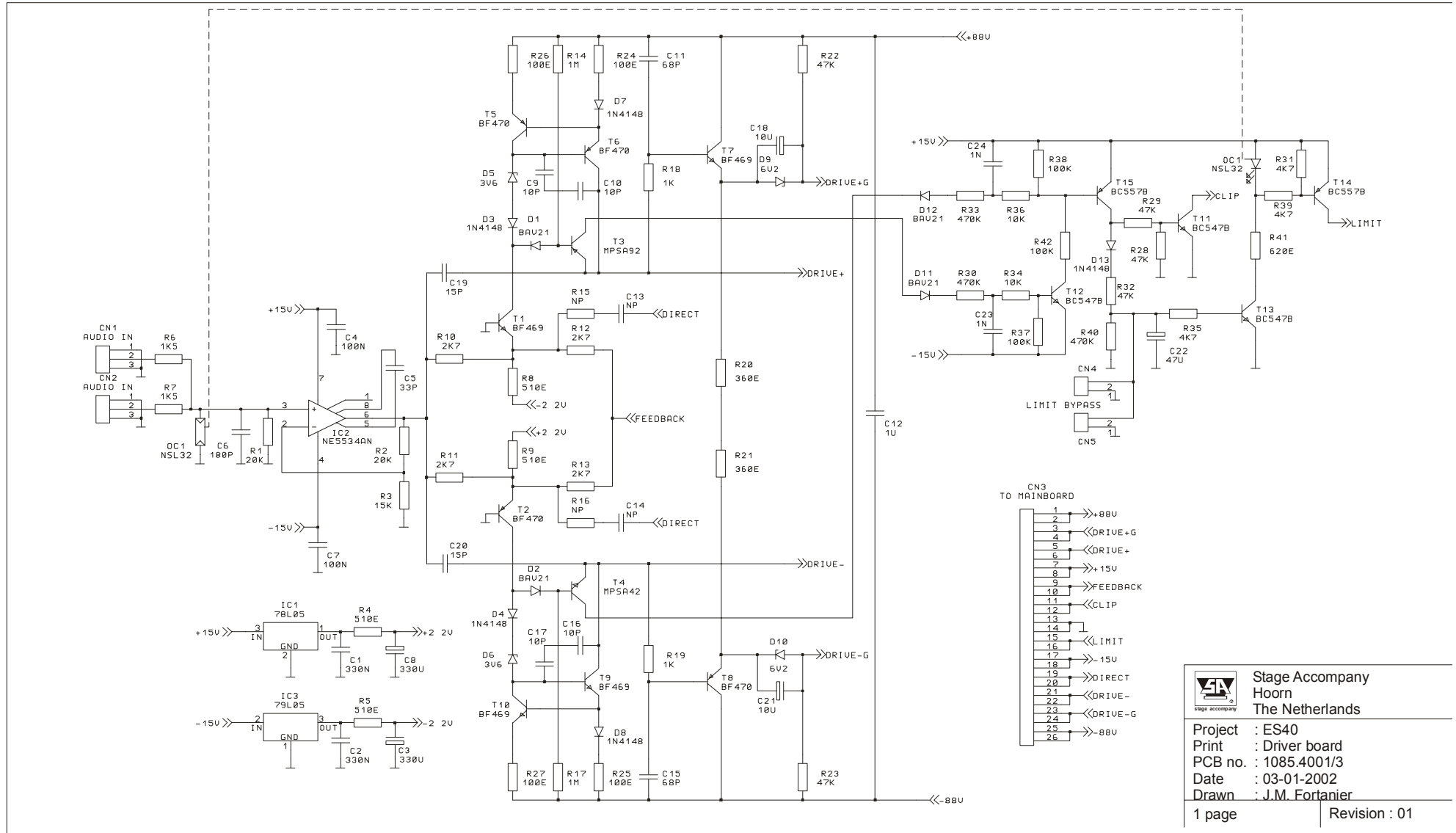
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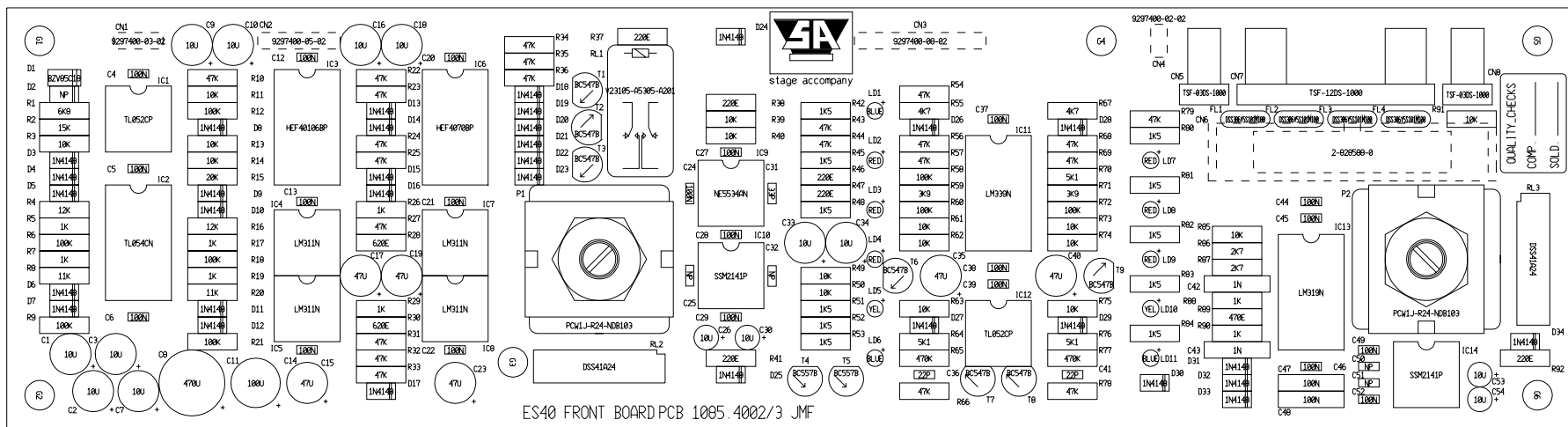
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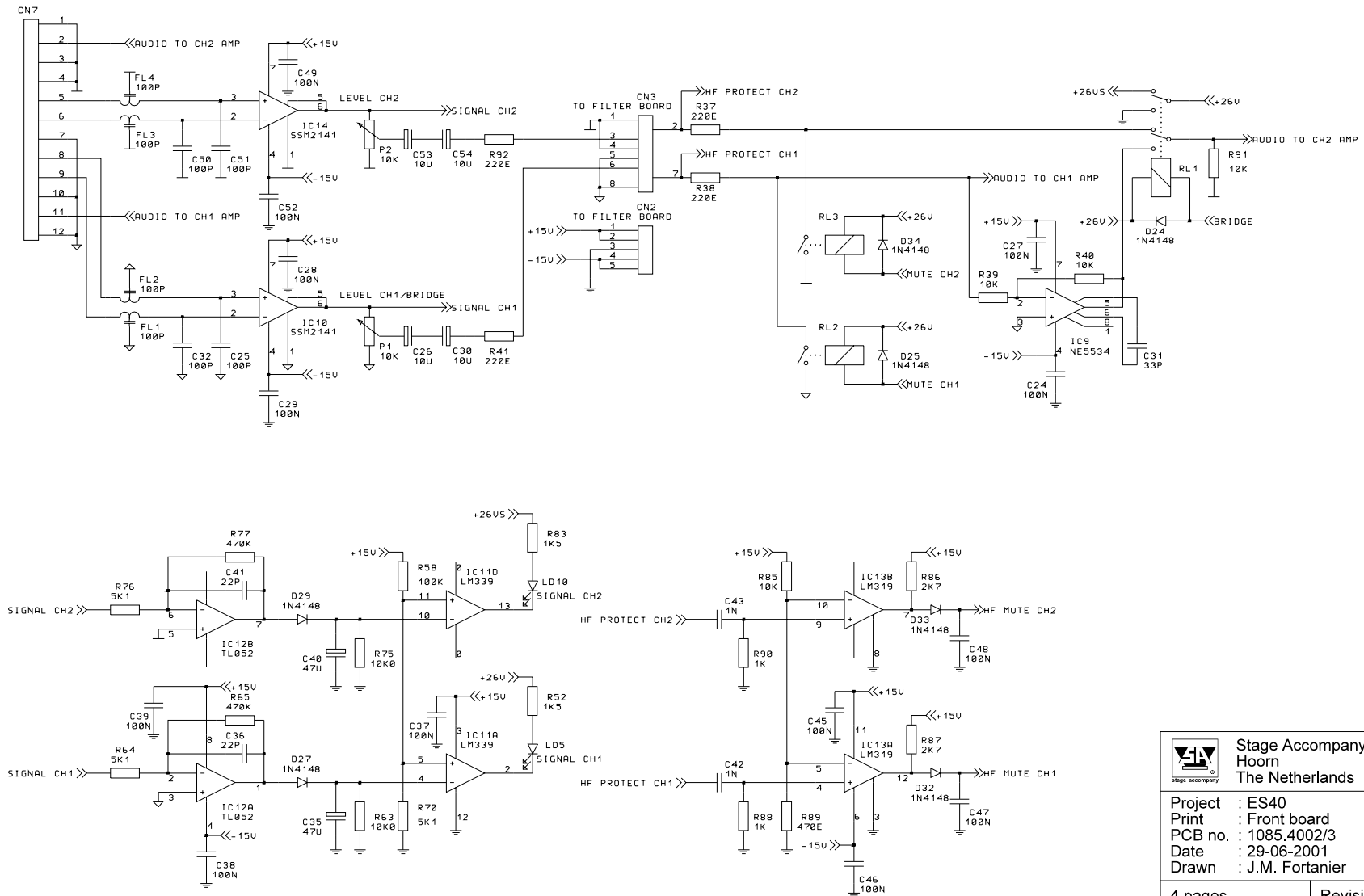
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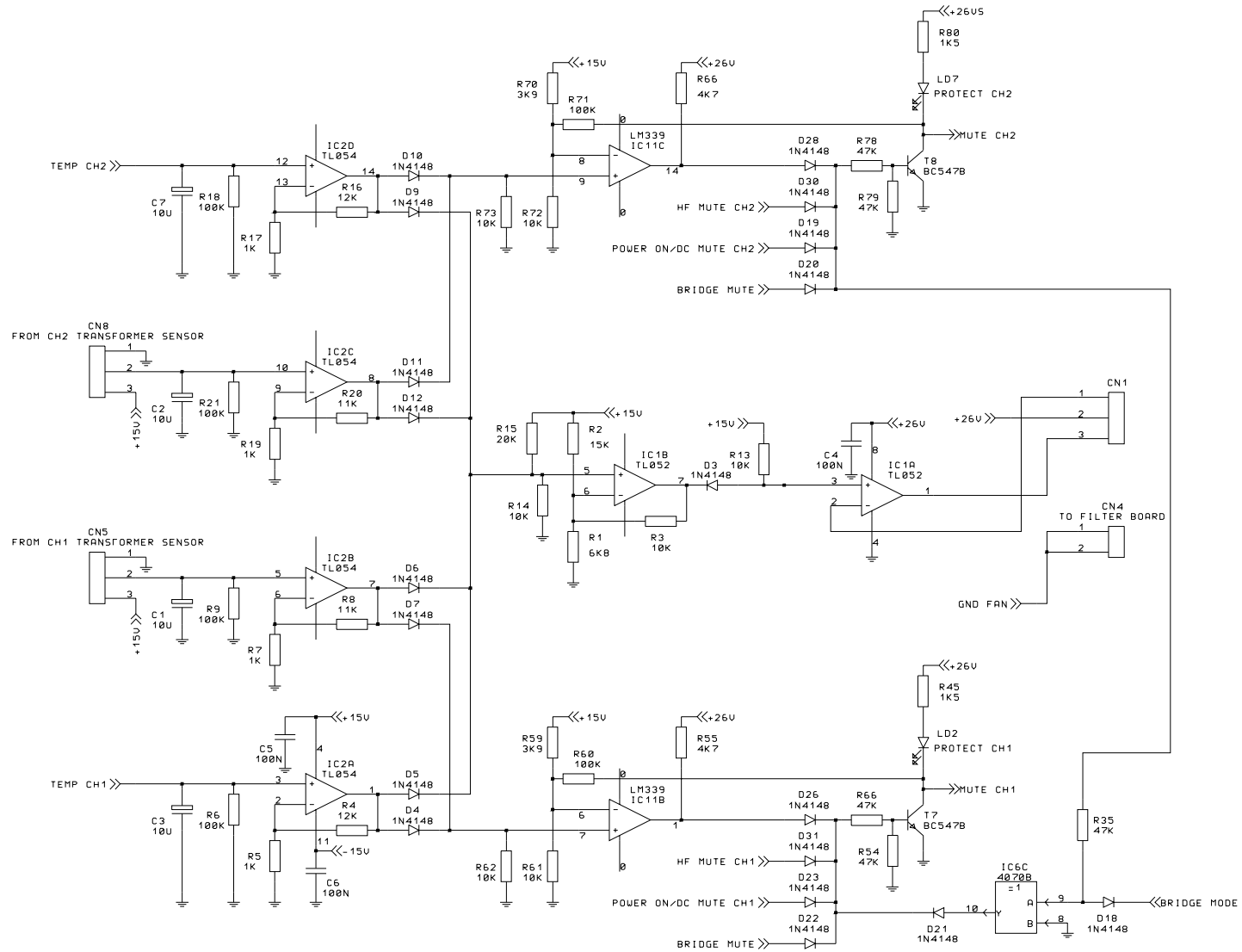



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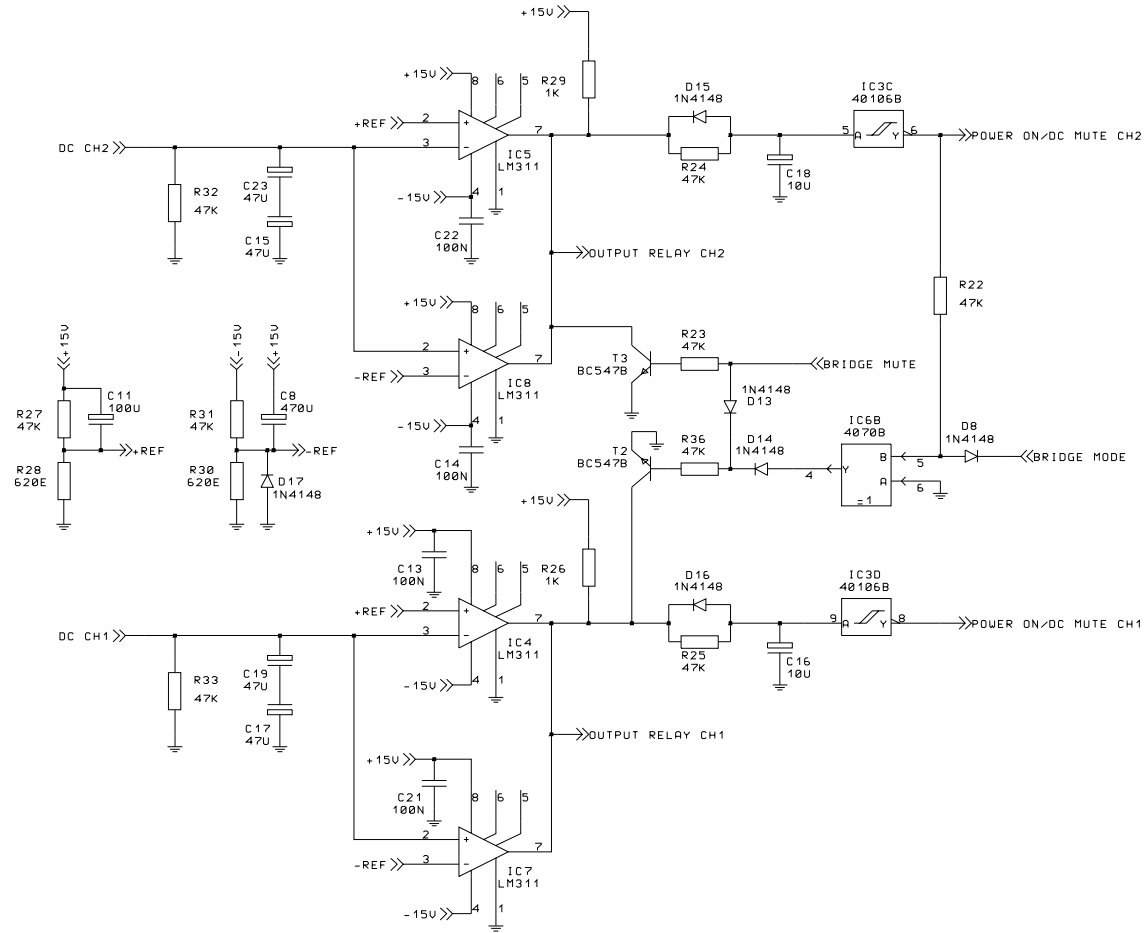
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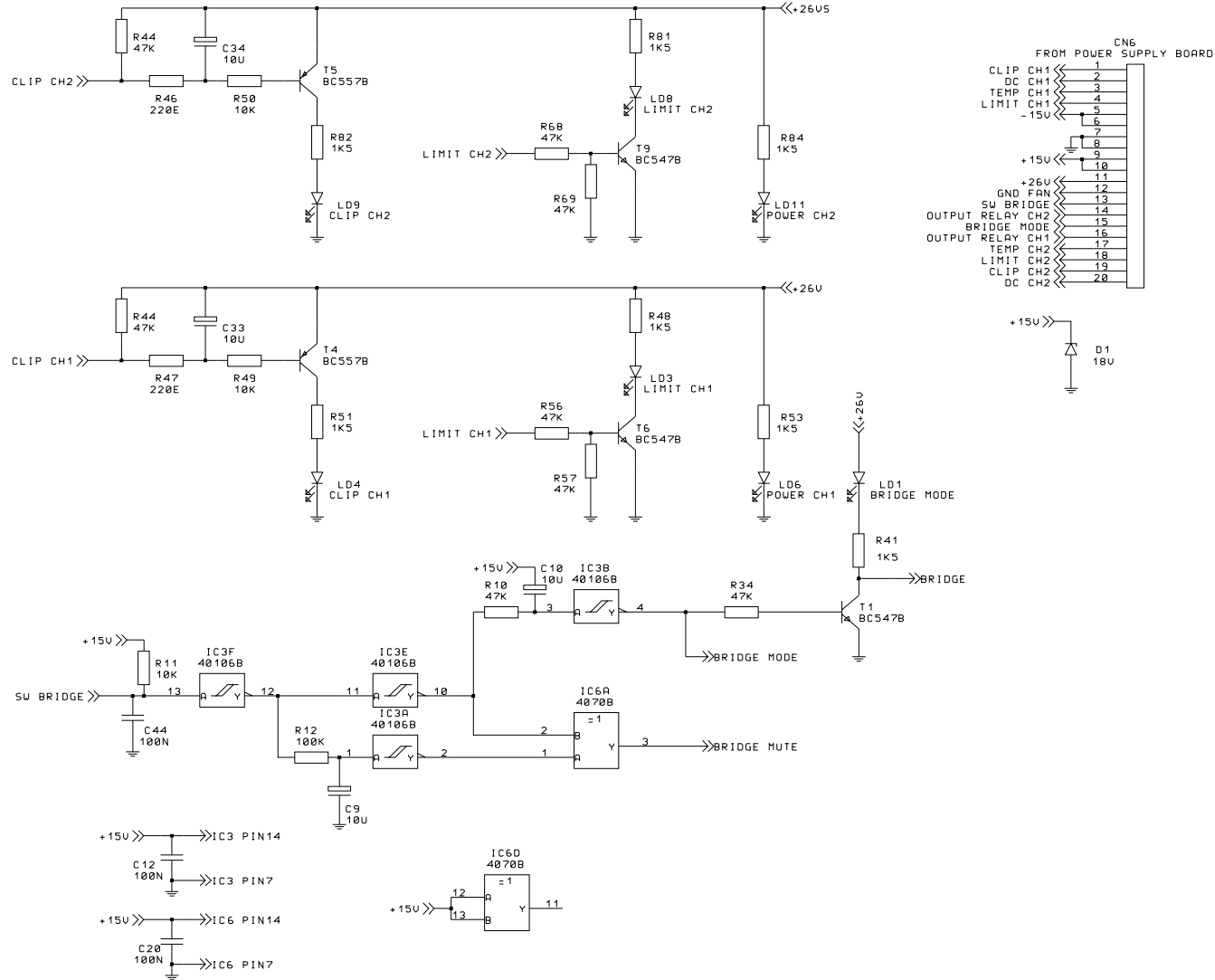
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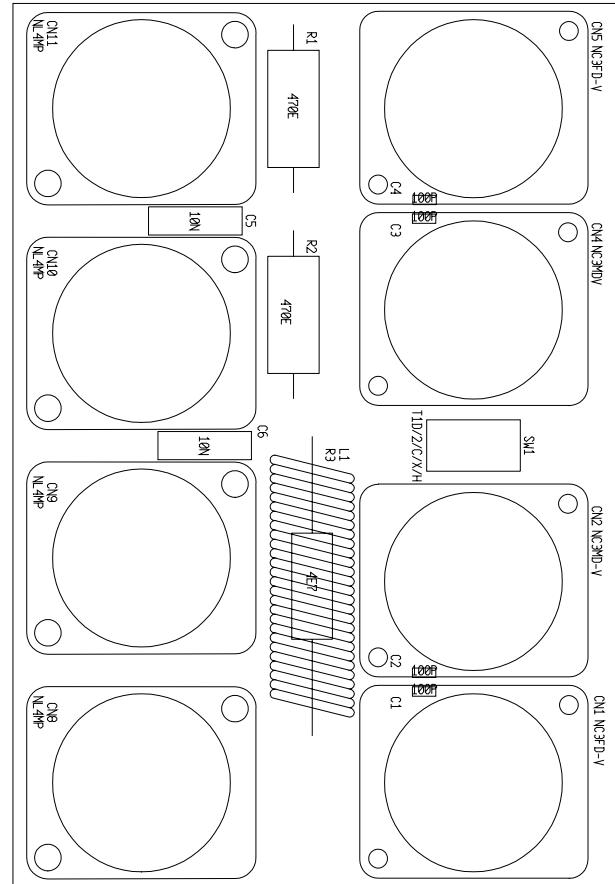
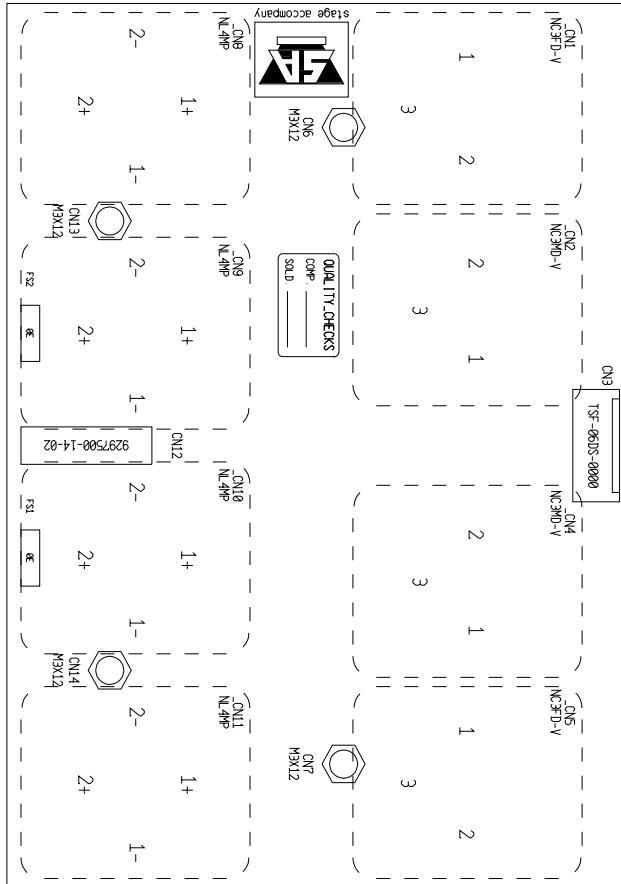
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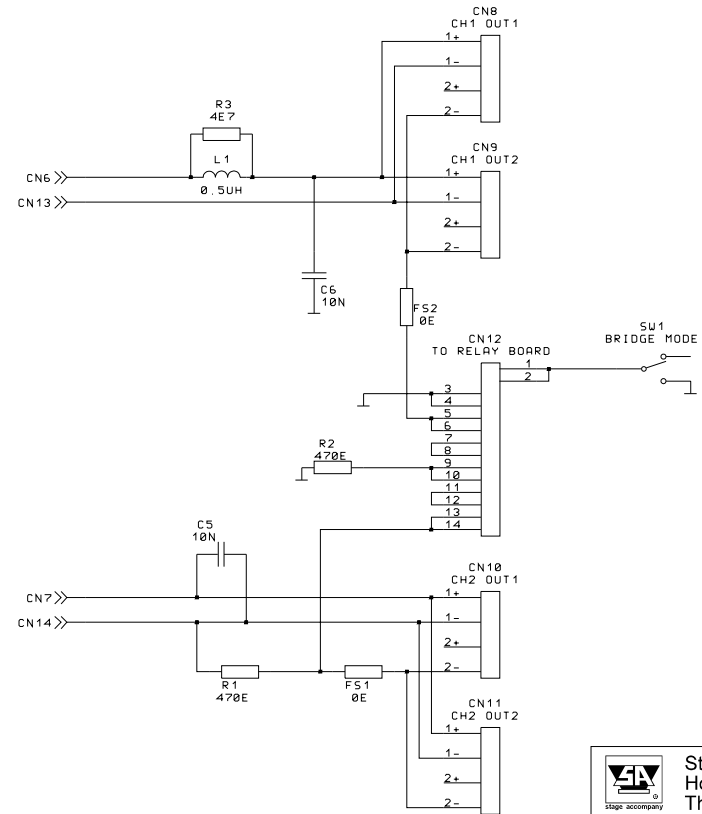
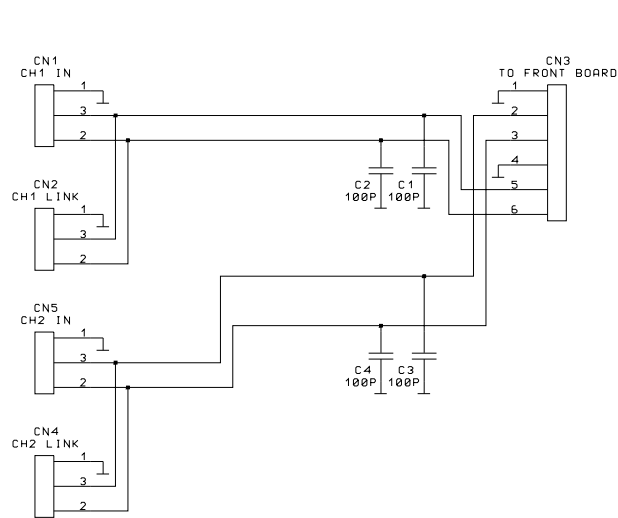
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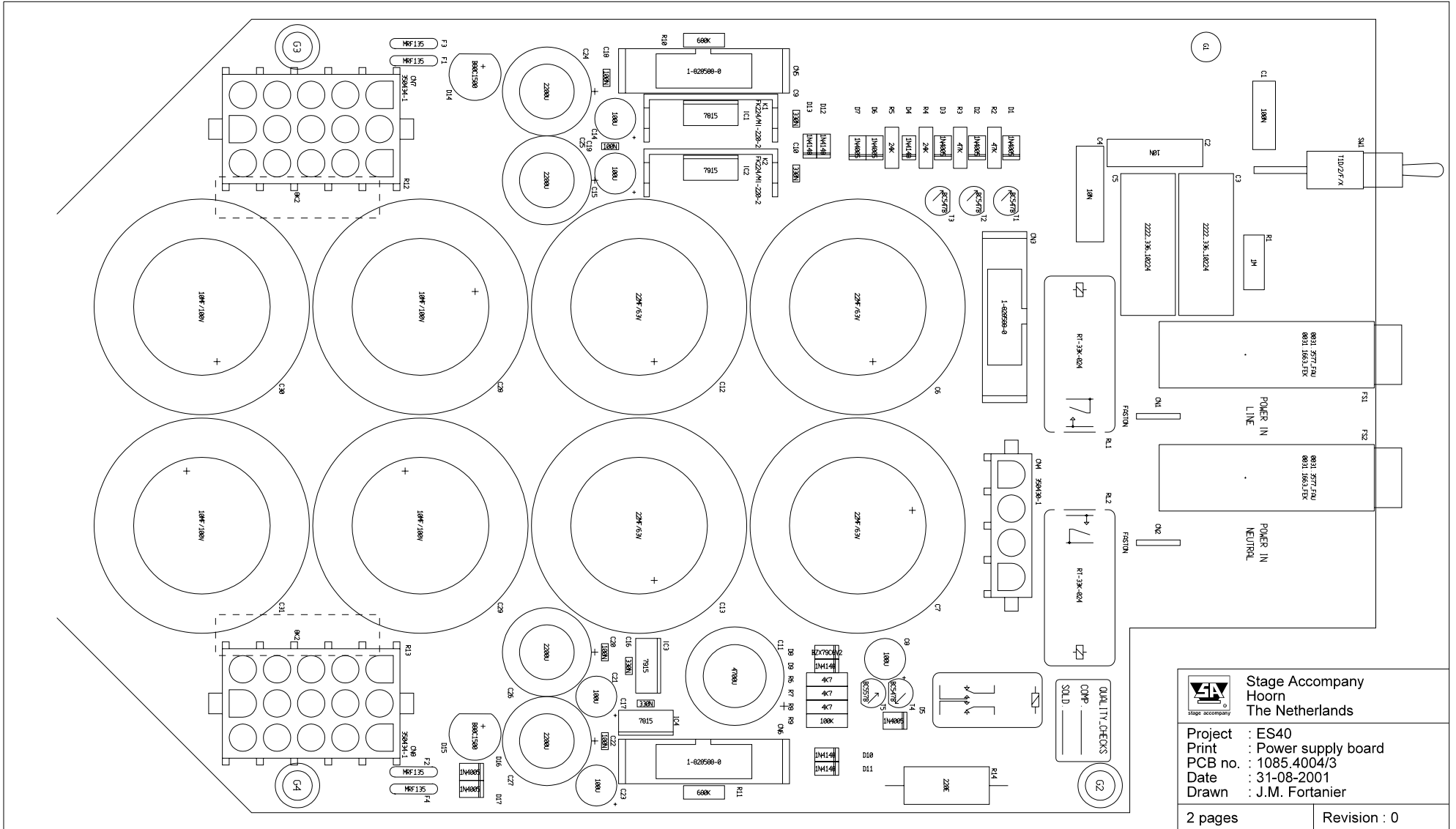
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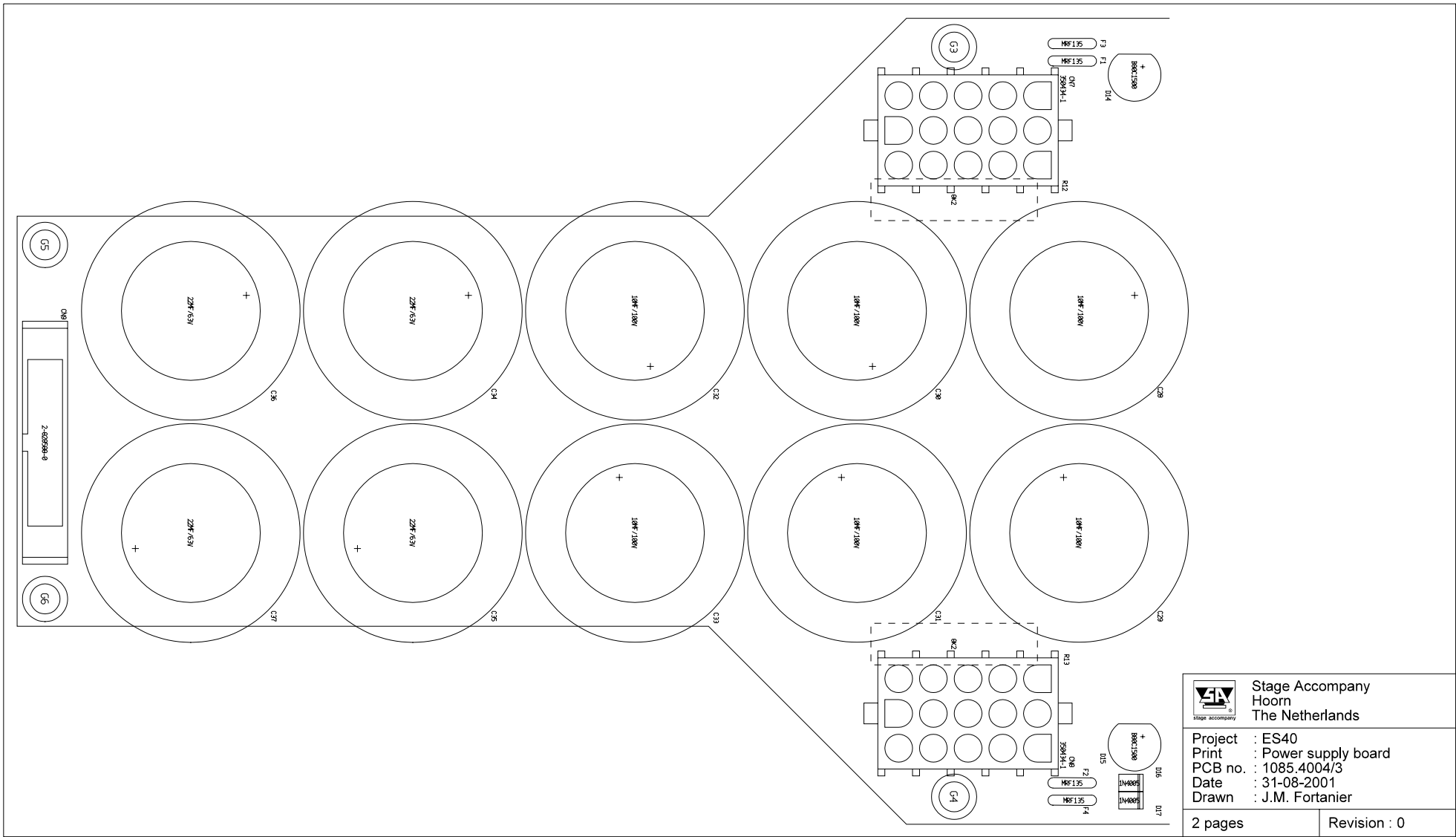
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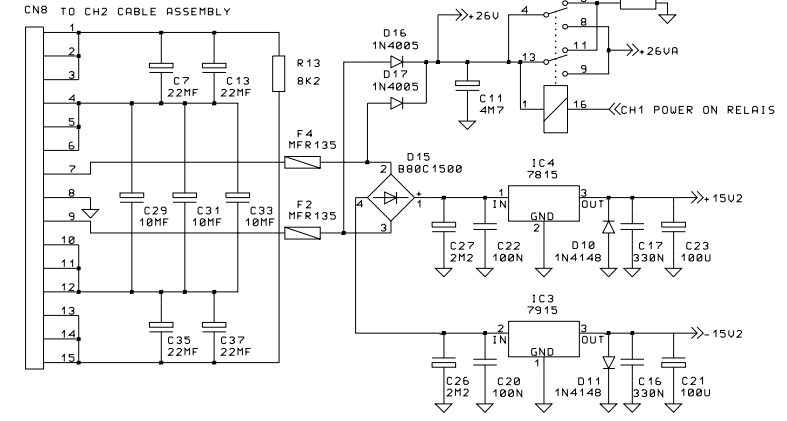
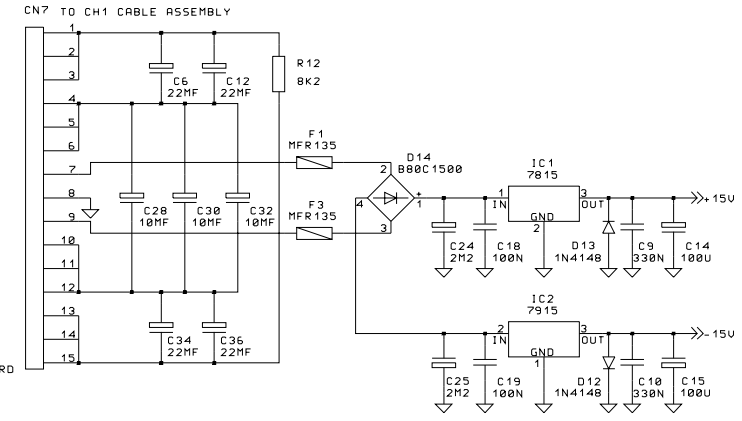
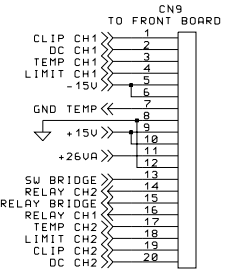
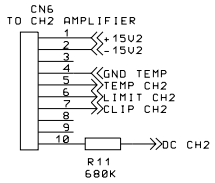
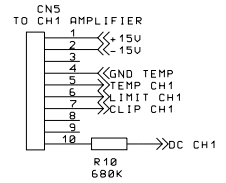
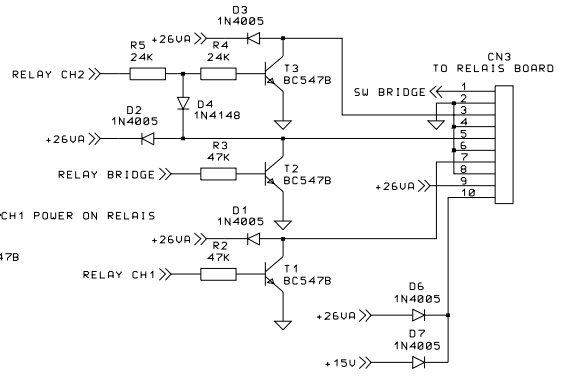
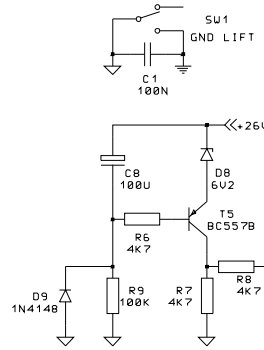
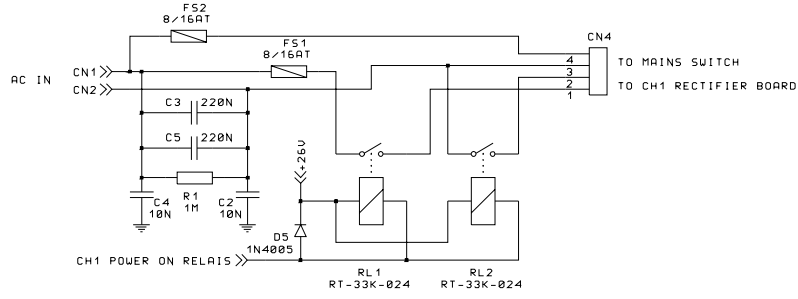
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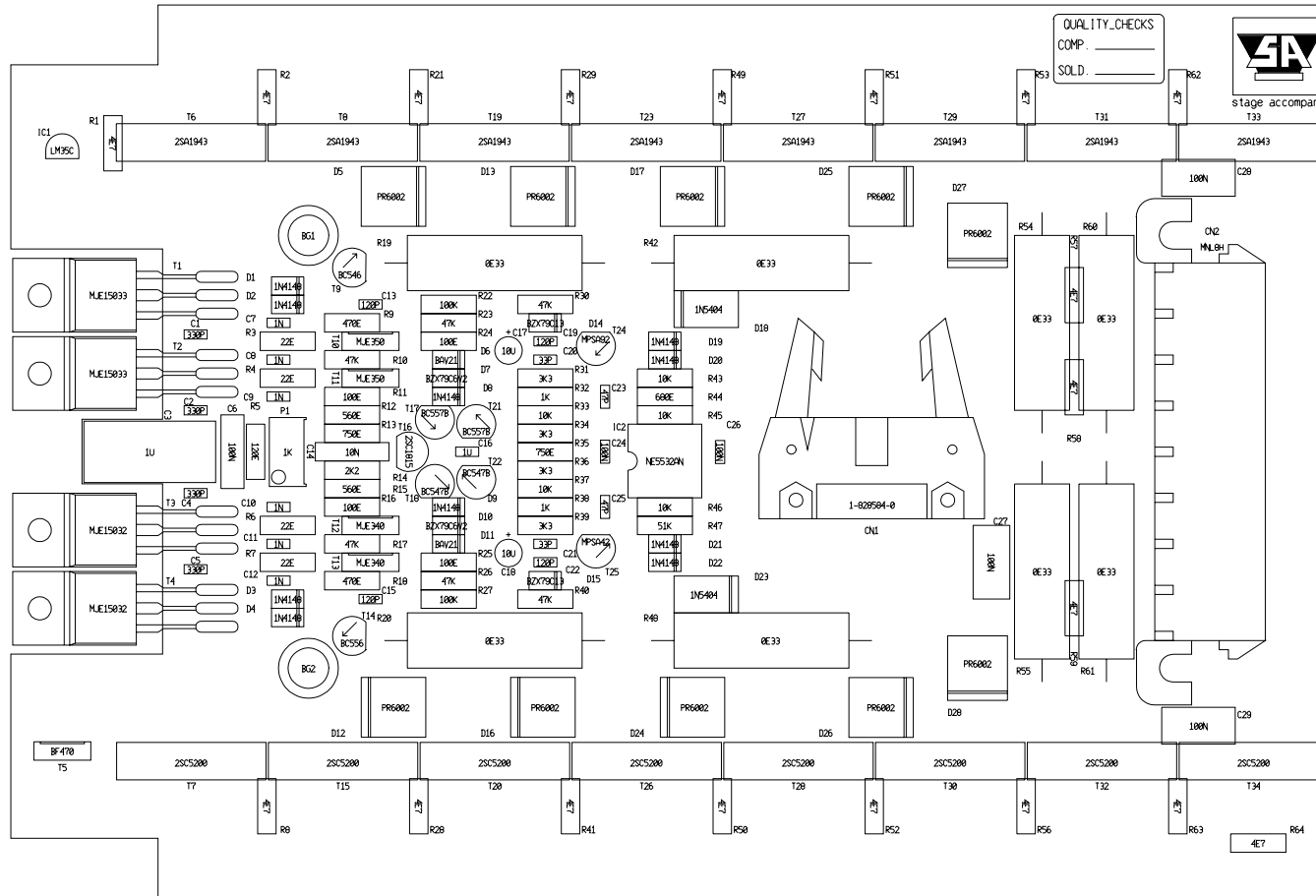
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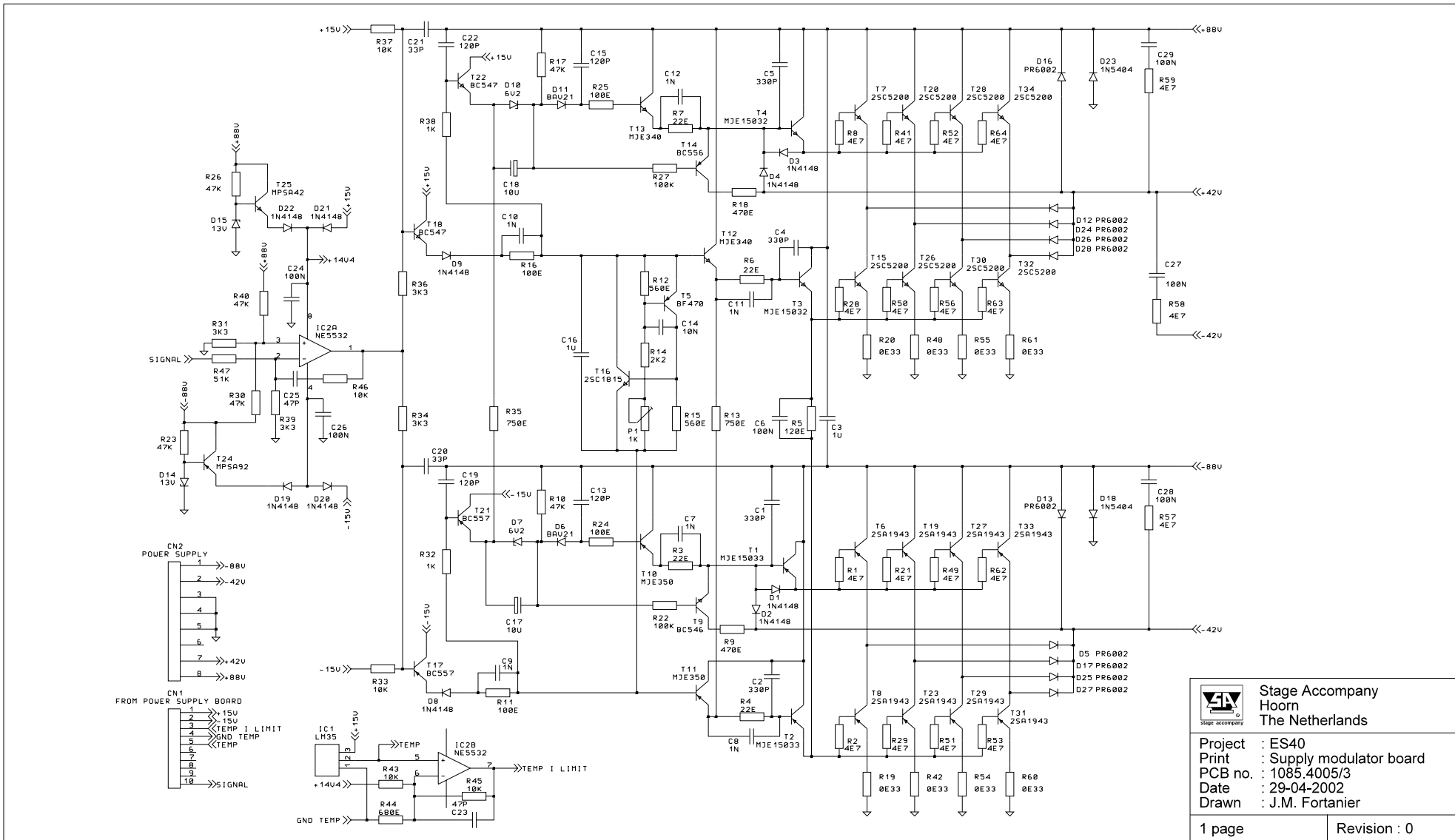
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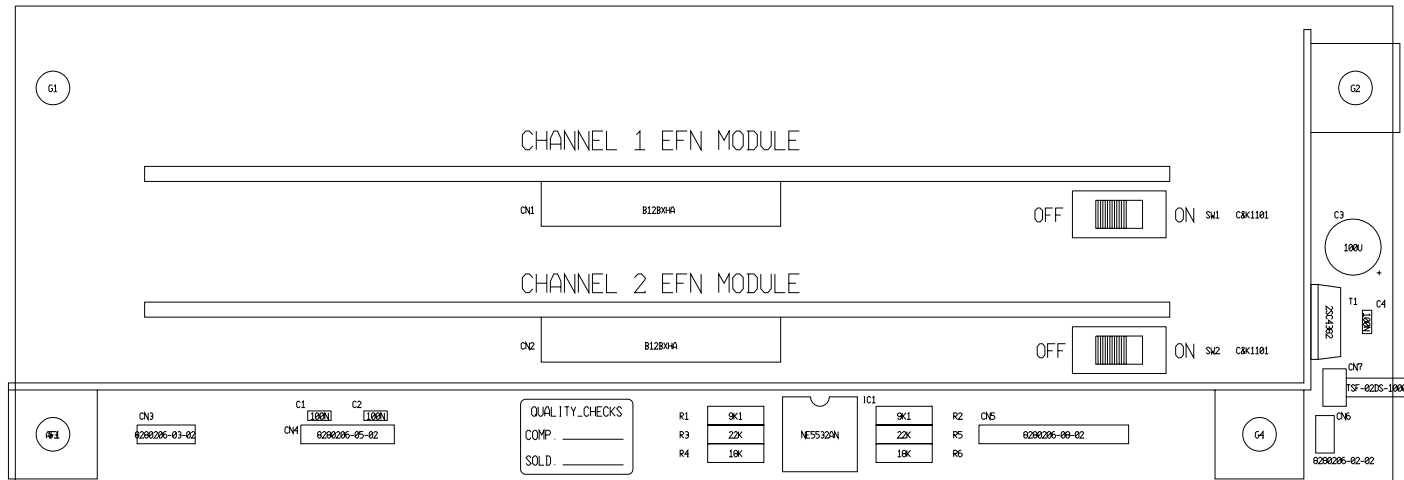
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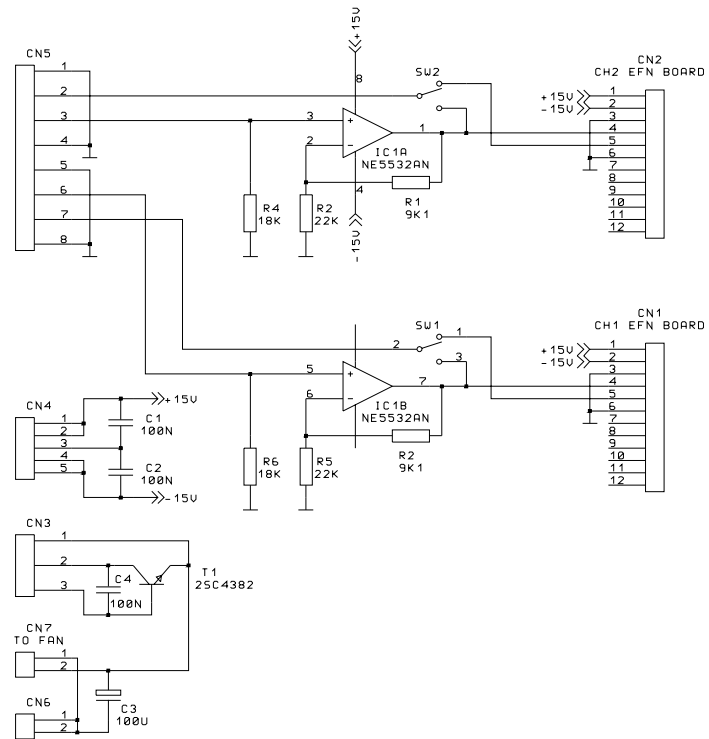
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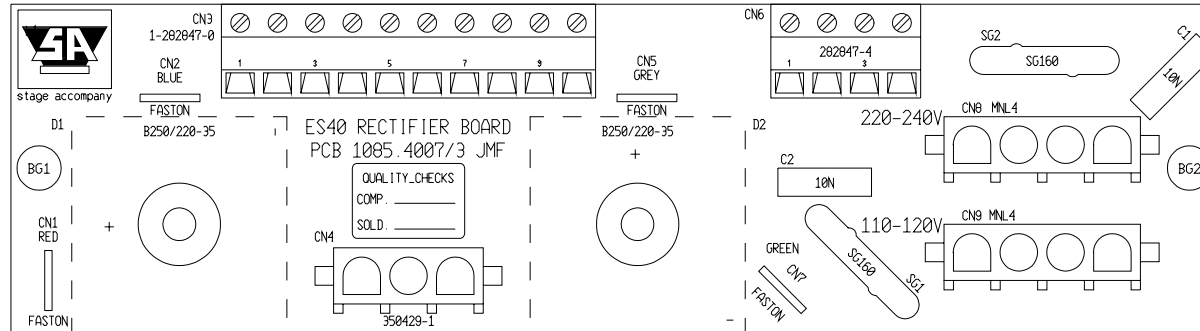
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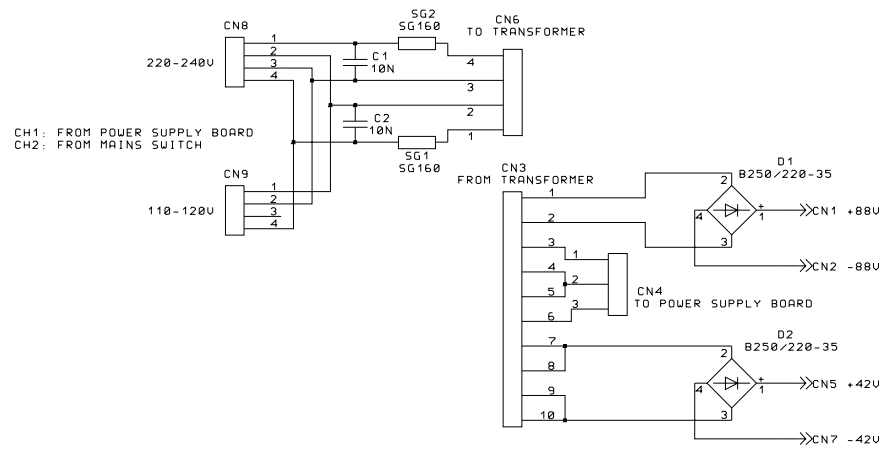
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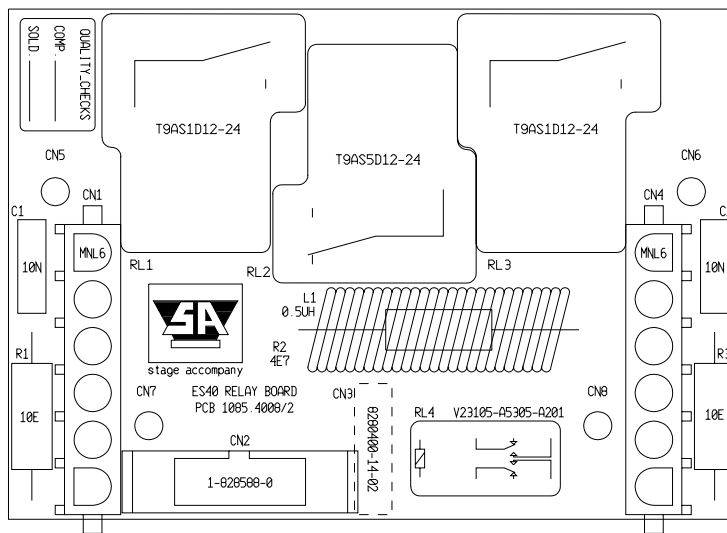
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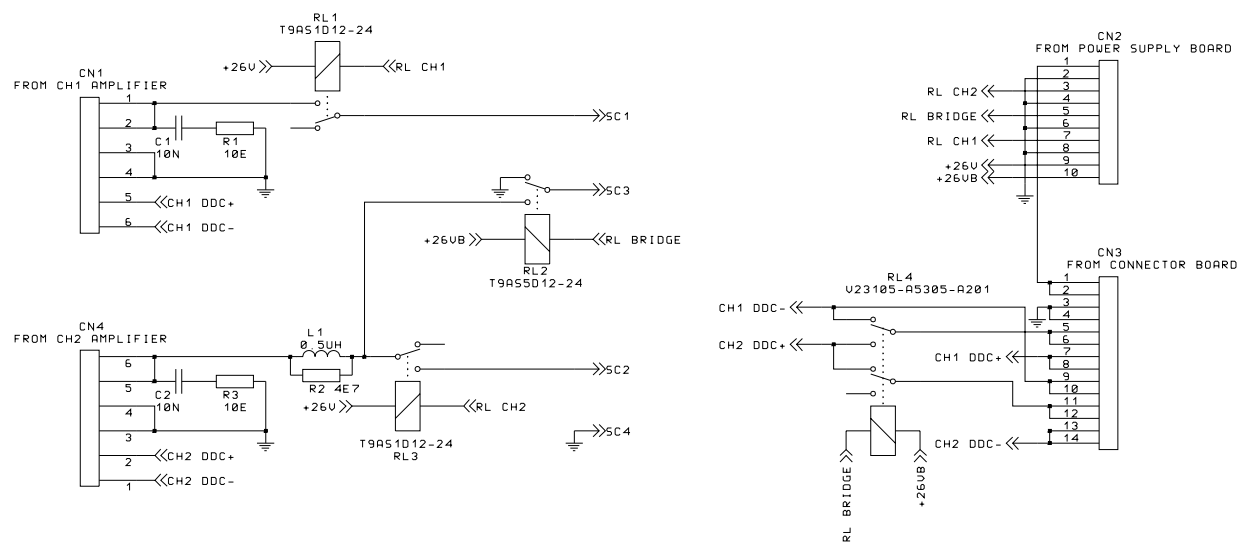
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	Project : ES40 Print : Rectifier board PCB no. : 1085.4007/3 Date : 31-08-2001 Drawn : J.M. Fortanier
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	Project : ES40 Print : Relay board PCB no. : 1085.4008/2 Date : 25-08-2000 Drawn : J.M. Fortanier
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	Stage Accompany Hoorn The Netherlands
	Project : ES40 Print : Relay board PCB no. : 1085.4008/2 Date : 25-08-2000 Drawn : J.M. Fortanier
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