A

SERVICE MANUAL

PROJECT EIGHT
REFERENCE
PRE-AMP

A

The Sphinx Project Eight design

The Sphinx Project Eight was designed for the ever-increasing group of quality-conscious audiophiles.
We are very proud of the tradition connected with the SPHINX name, especially concerning audio quality perfection.
This service manual will help you to optimally service and repair the Sphinx Project Eight Reference Pre-Amp.

This Reference pre-amp uses the newest technologies and refined designs and is extremely simple to operate.
Features include ultra-linear extremely low-noise Class A audio circuits, built from the finest hand-selected parts.
The signal path is completely balanced from input to output, and left and right are totally separated.
Volume and balance controls are achieved by means of precision relays, as is the input selection.
All settings and controls can also be accessed from the supplied Sphinx *Remote Control*.

To obtain the maximum quality from this pre amp it is necessary for it to be properly aligned and to be used with top quality audio components, preferably other Sphinx components.

Please also refer to the User Manual of the Project Eight for information about functions not described in this manual.
It is important to familiarise yourself with the special functions, operation and possibilities of the Sphinx Project Eight.

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1. UNPACKING

Before leaving the factory every Project Eight is subjected to stringent and extensive technical and exterior quality inspection. This ensures the user many years of high quality audio from a perfect-looking product.
We recommend owners to ship the Project Eight in its original carton.

After unpacking the Project Eight we therefore recommend you carefully check it for any transport damage.
If you find any damage and the product has not been shipped in the original carton the ensuring repair costs will not be covered by the warranty.

2. SPHINX WARRANTY CARD

To be entitled to any warranty repairs the owner must have send the filled out warranty card to Sphinx or a distributor where it has been registered. Other regulations may apply in your specific country: when in doubt, please consult the proper authorities.

3. CONTACTING THE MANUFACTURER

In case of any problem not covered in this manual or if you have other questions you may contact the **Sphinx International Service Department** in The Netherlands (local time: GMT +1h) during office hours at the following numbers:

Telephone   (+31) 35 602 0302
Fax   (+31) 35 602 2806
E-mail   audionl@euronet.nl

It is always very helpful and efficient if you have all relevant information about the specific product and the problem ready.

4. TECHNICAL SPECIFICATIONS

Bandwidth	0 - 500,000 Hz (+0/-3 dB)
Phase response error	<1°
Gain	20 dB max.
THD+N (IHF-A)	<0.008% (2nd harm., < 100 kHz and 6 V into 600 ohm)
	<0.0015% (2nd harm., 10 – 20,000 Hz and 6 V into 600 ohm)
IMD	<0.0015%
S/N ratio (IHF-A)	>110 dB
Channel separation	>110 dB
Inputs	2x XLR balanced
	6x WBT cinch unbalanced
Level, nominal (for 1 V output)	0.16 V (-18 dBV)
Impedance	XLR: 10 kohm / cinch: 50 kohm
Sensitivity (programmable for each input)	adjustable between –9 dB and +9 dB
Outputs	2x XLR balanced
	1x WBT cinch unbalanced
	1x cinch Tape
level	10 V max. (20 dBV) (1 - 100,000 Hz, THD <0.001%)
impedance	<10 ohm
Volume control	Relay-controlled in steps of 0.2 dB
	Range 100 dB
channel imbalance	less than 0.2 dB
Sphinx Control	3x optical
	OUT-1: 1 second delayed
	OUT-2: normal
	OUT-3: programmable via Auto On
Remote control	full function
Mechanical decoupling of housings	Transrotor absorbing 'pucks'
Power supply	External, in completely separate housing
Supply capacitance	148,000 µF total
Power consumption	50 W
Dimensions (h x w x d)	68 x 482 x 328 mm (one housing only)
Weight	14 kg

This unit conforms to the EMC interference regulations issued by the EU and to the CE standards.
This unit complies with safety regulation VDE 0860 and therefore with international safety regulation IEC 65.
Technical specifications may be changed by SPHINX without prior notice if technical developments make this necessary.

5. GENERAL CHECKLIST

This checklist should be used for every pre-amp received.

To correctly perform the following procedures you may have to refer to the User Manual for more detailed information on specific functions.

Note: The pre-amp should be switched on at least 1 hour before performing the checklist procedures!

Serial number and software version

The serial number and software version should match those mentioned in the documentation as supplied with every Project Eight.

❑ Switch off the mains power.
❑ Press the Standby button.
❑ Switch the mains on again while holding the Standby button depressed.
❑ The display will now show the serial number or software version.

Input functions

All inputs should be checked for the correct:
❑ Name
❑ Boost/Attenuation setting
❑ Polarity

Channel imbalance

For every position ('step') of the volume control the imbalance between Left and Right should never exceed +/- 0.1 dB.

Remote Control

Each Remote Control is manually programmed during manufacturing.
Therefore it is important to check whether all functions work correctly as mentioned in the User Manual.
See also Chapter 6.
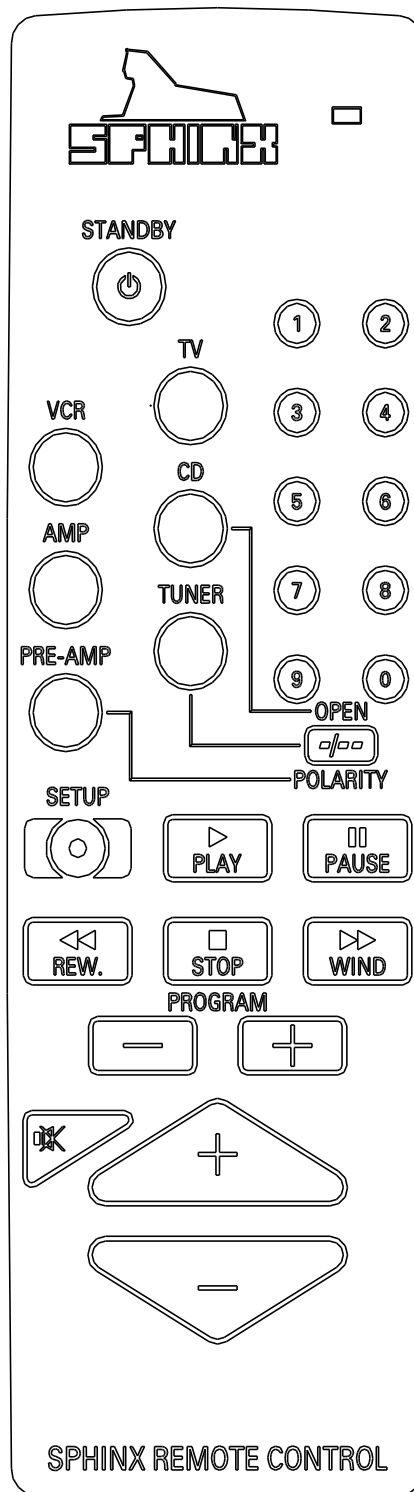
6. SPHINX REMOTE CONTROL

This single Sphinx Remote Control lets you control all functions: not only of the Project Eight, but of all other Sphinx equipment.
Moreover: you may also use it to control other types of equipment (e.g. TV and VCR) thanks to the 'learn' mode!
Only the following buttons and indications on the Remote apply to the Project Eight:

Buttons and LED indication

1. **LED:** As soon as you press a button this LED will blink *green*: the Remote is functioning. When blinking *green/red*: batteries running low. When blinking *red*: change batteries (see Batteries).

2. **STANDBY:** Use this button to switch the Project Eight to stand-by.

3. **PRE-AMP**: To select the pre-amp. All buttons pressed hereafter will control only the pre-amp functions.

4. **1 - 8**: To select inputs input 1 to 8 (*Note: 9 and 0 have no function*).

5. **POLARITY**: To change the polarity of the selected input from **+** to **–** (as indicated in the display).

6. **SET-UP**: To activate the SET-UP mode, pressing this button has the same effect as pressing the PRESETS button on the front panel.

7. **PROGRAM - / +**: After activating the SET-UP mode you can change the parameters with these two buttons: they have the same effect as the INPUT control on the front panel.

8. ◁ : Pressing this button mutes the outputs (temporarily) and you will not hear any sound. The display shows "MUTE". Another press on this button unmutes the outputs.

9. **+** button: Pressing this big triangular button has the same effect as rotating the VOLUME control on the front panel clockwise. You increase the volume. The VOL value in the display increases (to max. 99).

10. **—** button: Pressing this big triangular button has the same effect as rotating the VOLUME control on the front panel anti-clockwise. You decrease the volume. The VOL value in the display decreases (to min. OFF).

Operation

The Sphinx Remote is used with several different models and can therefore transmit different control codes, depending on which model has been selected with the select buttons (3.).
Important: Always press the PRE-AMP button before you send a command (even if you only have one Sphinx component).
Otherwise it is possible that, although the Remote will send a signal (LED blinks), nothing happens because the transmitted signal is not 'recognised' by the component.
Indoors the Remote may be used up to a distance of 7 meter, provided there is no strong sunlight in the room and if you aim the Remote at the component.
Always aim the Remote straight at the front panel of the component, the maximum offset angle is 30°.

Selecting without switching

Suppose, for instance, that you would like to select the Tuner to Radio 4 without interrupting CD playback.
In that case you momentarily depress (not longer than 0.5 sec) the 'TUNER' button and the '4' button.
The same procedure is used for the other system components (TV, VCR).
If you depress the select button for longer than 0.5 sec, the system will select a different signal source (in our example you will then hear the Tuner playback).

'Learning' the commands

This Sphinx Remote Control is not only pre-programmed for all Sphinx components, but you can also remotely control your TV and VCR.
The Remote Control is able to 'learn' the commands from each of the specific remote controls This will simplify the daily use of your audio/video system enormously.

The following paragraphs explain how you can 'teach' the Remote Control all those TV- and VCR-specific commands.

1. Place both the Sphinx Remote Control and the other remote (TV or VCR) flat on a table, facing each other with a spacing of no more than 2 cm.
   Note: *Please do not attempt this in direct sunlight or under strong lighting conditions.*

2. Simultaneously press the ⫣ and TV buttons on the Sphinx Remote.
   The orange LED at the top right-hand of the Remote will light.

3. Momentarily press the first button on the Sphinx Remote to be programmed.
   The orange LED blinks.

4. Then keep the appropriate button on the other remote depressed until the LED becomes *green*. After releasing the button the LED will blink orange and you may program the next button.

5. If the LED is red, repeat steps 3 and 4. If it still remains red please refer to "**Remote does not 'learn**".

6. Repeat steps 3 and 4 until all necessary buttons are programmed.
   Note: *Do not forget to program the STANDBY button!*
   Note: *Do not forget to program the TV button with the "TV-ON"-command!*

7. When you are finished press any two buttons on the Remote to return to Normal mode.
   The LED will now be turned off.

Repeat steps 1 to 7 to program the remote for the VCR (in step **2**. you should press the ⫣ and VCR buttons). When this is finished your Sphinx Remote Control is ready for use.
How to operate the Remote Control with the different Sphinx components is explained in the corresponding User Manual for each component.

Changing a command

This is done in exactly the same way as described in the preceding paragraph **'LEARNING' THE COMMANDS**, but you now only carry out the procedure for a certain command and a certain system component.

Erasing all commands of one component

You may want to erase the commands of one system component (for instance because you have bought a new TV).
Simultaneously depress the ⫣ , Stand-by and component select button (in our example 'TV'). This enables the Remote Control to re-'learn' the commands of the new unit (see also **'LEARNING' the commands**...).

WARNING!:
If you depress one of the other component select buttons (than TV or VCR) you will erase the commands for a Sphinx audio component! You should only do this if you do not have that specific Sphinx model, but one of another brand and want to program the commands of its remote control.

The LED during Normal mode

- Blinks *green*: Remote sends a command.
- Blinks *green/red*: batteries are low, you should change them within a few days.
- Blinks *red*: replace batteries immediately. Replace them within 30 minutes or else all information in memory will be erased!

The LED during 'Learn' mode

- Indicates *orange*: Remote is in 'Learn' mode.
- Blinks *orange*: Remote awaits the command to be 'learned' from the other remote control.
- Indicates *green*: the new command has been 'learned'.
- Indicates *red*: the new command has NOT been 'learned'.
- Blinks for 10 seconds *red*, *yellow* and *green*: memory full, you cannot program new commands.
  Note: *You can still change any commands already programmed*.

Batteries

The two batteries have a life span of approximately one year during normal use, but shorter when used more intensely.
Replacement batteries: 1.5 V, model *penlite* or *AAA* (one of these codes is indicated on the packaging and the batteries). You may also use rechargeable 1.5 V batteries.
Do not leave the battery compartment empty for more than 30 minutes or else all information in memory will be erased!
Note: *Position the new batteries exactly as shown in the illustration at the bottom of the battery compartment, otherwise the memory might be erased completely!*

Other things worth knowing...

The 'advanced user' will understand that you can program any function for any button! You are therefore able to custom configure the Remote Control and use it for several pieces of equipment. The memory holds a maximum of 120 commands.
Warning: *If you don't know exactly what you are doing, please consult your Sphinx dealer*!

Encountering problems...

Remote Control does not work	
Wrong component selected	Select the correct one
Wrong Remote mode ('Learn' instead of Normal)	Select correct mode
Wrong command programmed	Re-program with Learn mode
Distance to component exceeds 7 m	Use Remote at closer range
Angle between Remote and component exceeds ±30°	Decrease angle
Sensor window on front dirty	Clean window
Batteries empty or incorrectly placed	Use new batteries or replace the old ones correctly
Strong (sun)light in room	Shade off light source
Component is not switched on (!)	Switch it on
Memory erased	Re-program completely

Remote Control does not 'learn'	
Wrong Remote mode (Normal instead of 'Learn')	Select correct mode
Distance between two remotes exceeds 2 cm	Place them closer together
Signal to be learned is not infrared	'Learning' only possible with infrared systems
Sensor window on front dirty	Clean window
Batteries in remote(s) empty	Use new batteries
Strong (sun)light hits sensor window	Shade off light source

Component reacts differently than expected or not at all	
Wrong component selected	Select the correct one
Wrong command programmed	Re-program with Learn mode
Component or Remote does not function	Check component with its original remote
Batteries in remote empty	Use new batteries

7. MEASUREMENTS

To properly service the Project Eight you need some specific measurement equipment and use a specific set-up.

General set-up

For the correct measurement set-up and hook-up please refer to the drawing titled "Figure 3: Connection Diagram for testing the Project Eight" at page 14.

Necessary Equipment

❑ 2x **millivolt-meter** (Ri >1 MΩ)

❑ 2x non-inductive **load resistor** 8 Ω / 250 W

❑ 1x **harmonic distortion analyser**
   (internal distortion <0.0005%, measured without filters)

❑ 1x **2-channel oscilloscope**
   (minimum bandwidth >60 MHz)

❑ 1x **connection unit / switch box**
   (to connect resistors and amp outputs to distortion meter)
   Note: *See drawing 4. for construction details*.

❑ 2x **shorting connector**
   (for balanced pre-amp inputs)

❑ 2x **balanced cable set**
   (to connect distortion meter, pre-amp and power amp)

❑ 1x special **top cover plate** (preferably transparent) with holes for adjustment tools
   Note: *See drawing 5. for construction details*.

❑ A two channel DC-coupled **power amplifier**
   (e.g. Project Eighteen)

Audio signal distortion measurement

Before adjusting the Project Eight please first measure the total harmonic distortion at the audio output. The measured value is an indication of the current state of the Project Eight.

Set-up

For the correct measurement set-up please refer to figure 3 at page 14.

❑ Set the oscillator output level to 0.775 V (0 dBu).

❑ Adjust the pre-amp volume control so that output level equals input level (0 dBu).

❑ THD should now be 0.1% unweighted (or 0.013% IHF-A).

❑ Now set volume control to maximum (fully clockwise).

❑ Increase the oscillator output of the distortion analyser to set the pre-amp output just before clipping.

❑ THD should now be 0.12% unweighted (or 0.005% IHF-A).

8. OUTPUT DC-OFFSET ADJUSTMENT

Proper DC-offset adjustment is very important.

A simple trick will greatly increase the accuracy of this critical adjustment (see also the drawing titled "Connection Diagram for testing the Project Eight" at page 14).
By connecting a DC-coupled power amp to the Project Eight outputs and measuring the offset at the speaker outputs, the offset is boosted to around 30 times the original value!

Note: We strongly recommend that you use a power amp with a very low DC-offset, such as the Project Eighteen.
Note: The pre-amp and the power amp should be switched on at least 1 hour before performing this adjustment so they can reach optimum working temperatures.

Set-up
- ❑ Connect a distortion analyser input and a DC mV-meter to a pre-amp output (or to the power ampifier). The correct pre-amp output will be mentioned later.
- ❑ Connect the distortion analyser output to a pre-amp input, the correct input will be mentioned later.
- ❑ Switch off the oscillator of the analyser, this will short-circuit the pre-amp input.
- ❑ Remove the top cover of the Project Eight and replace it with the special cover plate (with adjustment holes, see figure 5 at page 16).

Adjustment
For the actual adjustment you may refer to Figure 20 (*Main PCB drawing*) at page 29 and Figure 7 (*Schematic overview of all relevant potentiometers*) at page 17.
In Figure 6 *(Schematic operational diagram of project Eight*) at page 16 you will find the placement of all amps:

Connect the (muted)distortion analyser output to an unbalanced input of the project eight and select the correct input at the front panel.
Connect the power amplifier (or, if no power amplifier is used, the distortion analyser and mV-meter) to the unbalanced output of the project eight.
The unbalanced signal will only be processed by disamp A1 & A3 (left channel) and disamp B1 & B3 (right channel). The remaining disamps have no effect on an unbalanced signal.
- ❑ Turn the volume of the project eight to 'off'. The offset currently visible on the mV-meter is the offset of disamp A3(left channel) and/or disamp B3(right channel).

- ❑ This offset can be adjusted by potentiometer P1 & P2 of disamp A3 for the left channel, and by potmeter P1 & P2 of disamp B3 for the right channel.

- ❑ Turn the volume of the project eight fully open. The offset currently visible on the mV-meter is the offset of disamp A1(left channel) and/or disamp B1(right channel)
- ❑ This offset can be adjusted by potentiometer P1 & P2 of disamp A1 for the left channel, and by potmeter P1 & P2 of disamp B1 for the right channel.

The distortion analyser output must now be connected to a balanced input of the project eight. The correct input must also be selected at the front panel.
The power amplifier (or, if no power amplifier is used, the distortion analyser and mV-meter) must now be connected to a balanced output of the project eight.
The total offset of all disamps is now visible on the mV-meter, but since the offset of disamp A1 & A3(left channel) and disamp B1 & B3(right channel) has already been adjusted, the offset visible is the offset of the remaining disamps(A2&A4 and B2&B4).

Notice: do not commence with the following procedures before the procedures mentioned above have been completed.

- ❑ Turn the volume of the project eight to 'off'. The offset currently visible on the mV-meter is the offset of disamp A4(left channel) and/or disamp B4(right channel).
- ❑ This offset can be adjusted by potentiometer P1 & P2 of disamp A4 for the left channel, and by potmeter P1 & P2 of disamp B4 for the right channel.

- ❑ Turn the volume of the project eight fully open. The offset currently visible on the mV-meter is the offset of disamp A2(left channel) and/or disamp B2(right channel)
- ❑ This offset can be adjusted by potentiometer P1 & P2 of disamp A2 for the left channel, and by potmeter P1 & P2 of disamp B2 for the right channel.

Repeat the offset adjustment proceduces a few times for a perfect adjustment. When this is done, the offset adjustments are completed

9. PROBLEMS AND SOLUTIONS

At the moment of writing the Project Eight has one known specific problem.
If in the future you encounter any problem(s) you may enter the info in this table. This table can then be used for future reference.
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Please also send (by fax or e-mail) the specific information to the **Sphinx International Service Department** (see page 3): this info can then be added to the general database to aid others.

Problem	Cause	Solution	Refer to page…
Volume control doesn't work properly	IC U15, U16, U17 or U18 may be defective.	Replace the defective one.	Page 24 Page 25

10. DIAGRAMS AND PARTS LISTS

The next pages contain the front and rear panel layout and a complete set of schematic drawings including the associated parts lists (if applicable).

Figure 1: Front panel
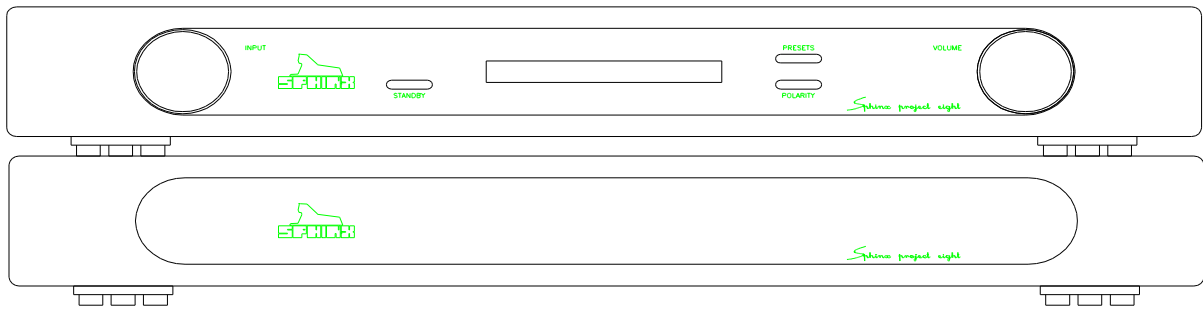
Figure 2: Rear panel
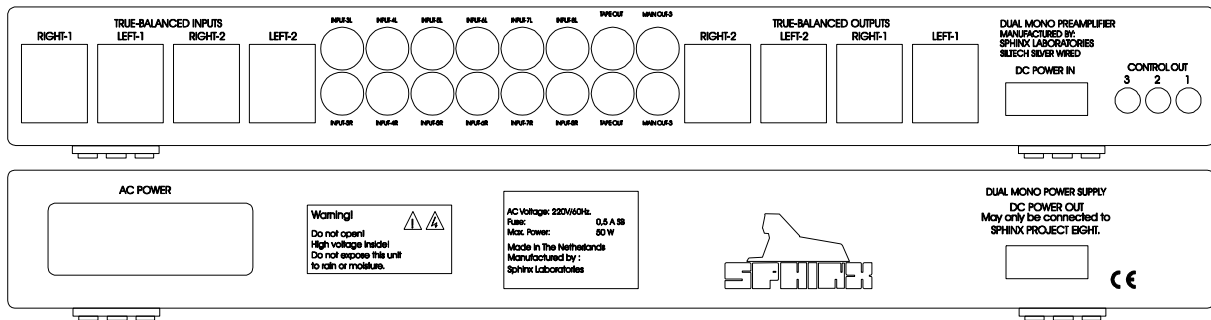
Index of diagrams and drawings

Figure 3: Connection Diagram for testing the Project Eight
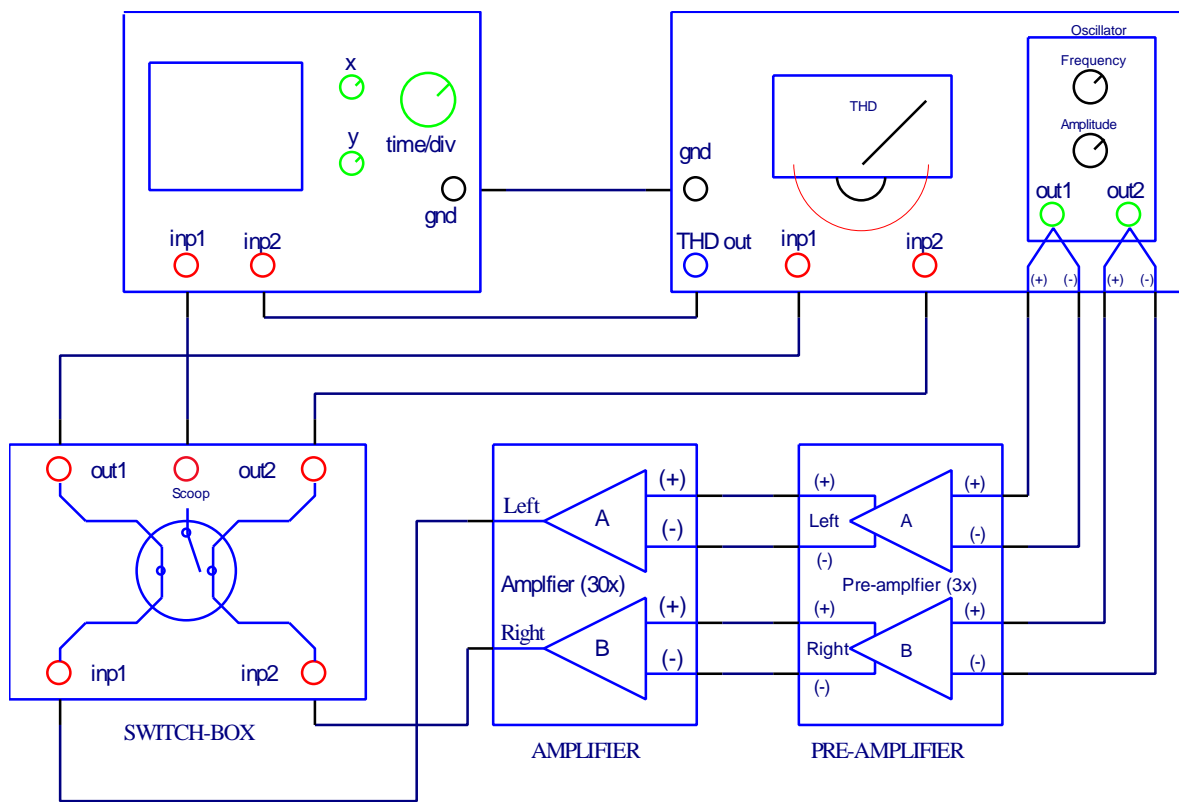
Figure 4: Display Board Schematic Layout
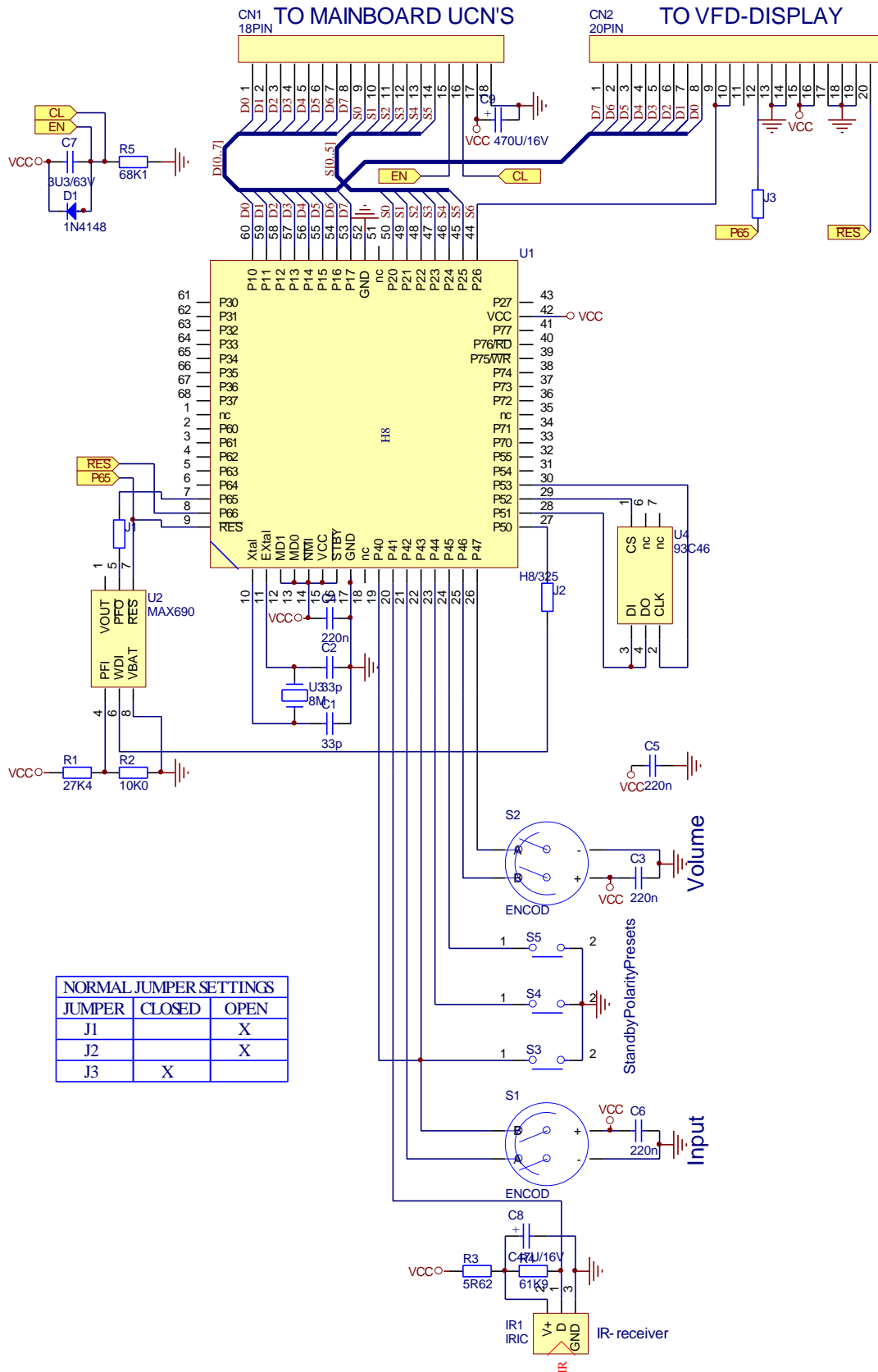
Figure 5: Construction Drawing for top cover plate

All sizes in millimeters

315

216

480

For holes use drill size of
approx. Ø 6 mm

Holes use same spacing as the
ones shown below

Front

Back

230

Top View

33   48   6   48   12   48   6   48   66   34
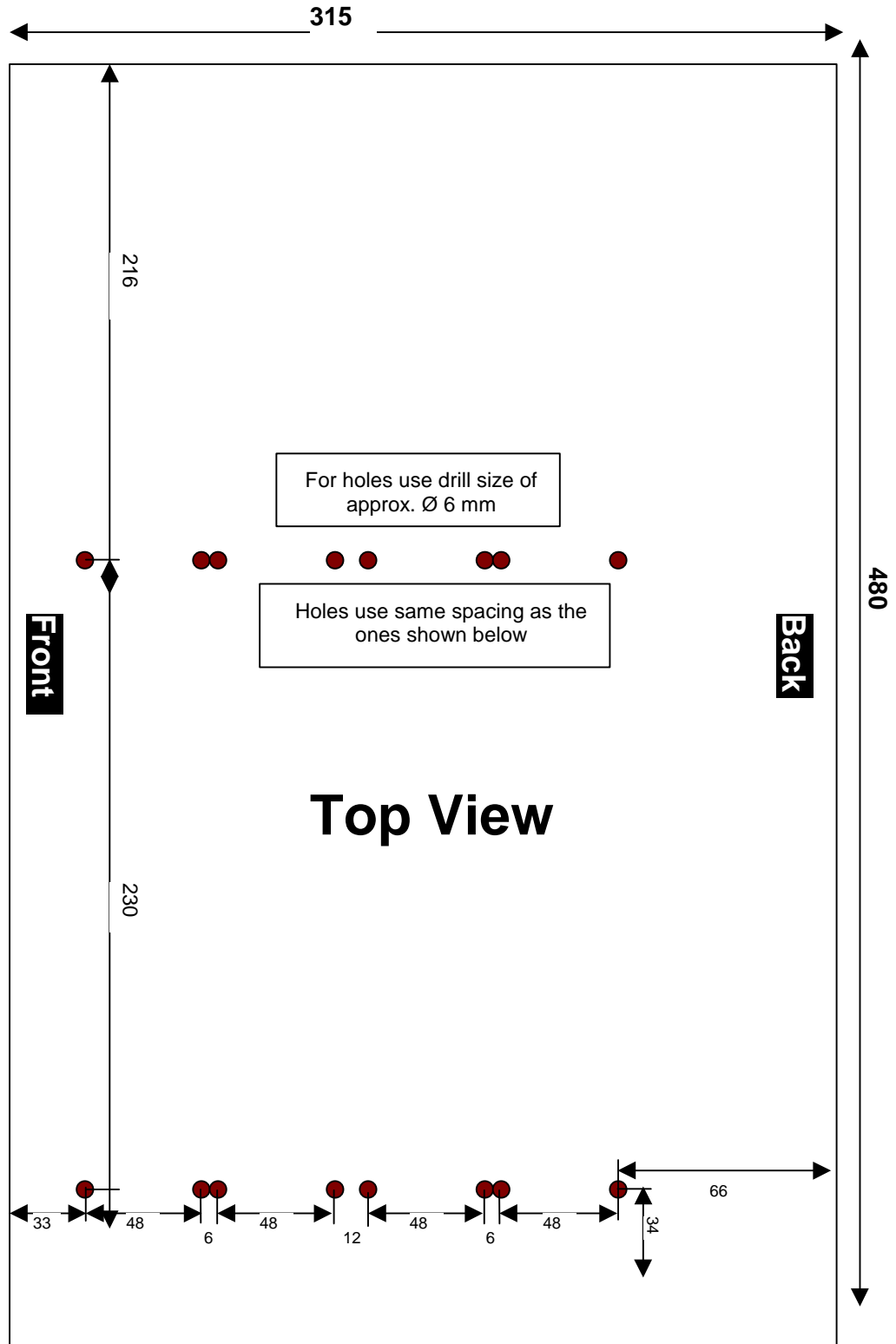
Figure 6: Schematic Operational Diagram Project Eight

project eight main board

disamp module 5 **A4**	disamp module 1 **A2**

left

disamp module 6 **A3**	disamp module 2 **A1**

top view

disamp module 7 **B4**	disamp module 3 **B2**

right

disamp module 8 **B3**	disamp module 4 **B1**

front
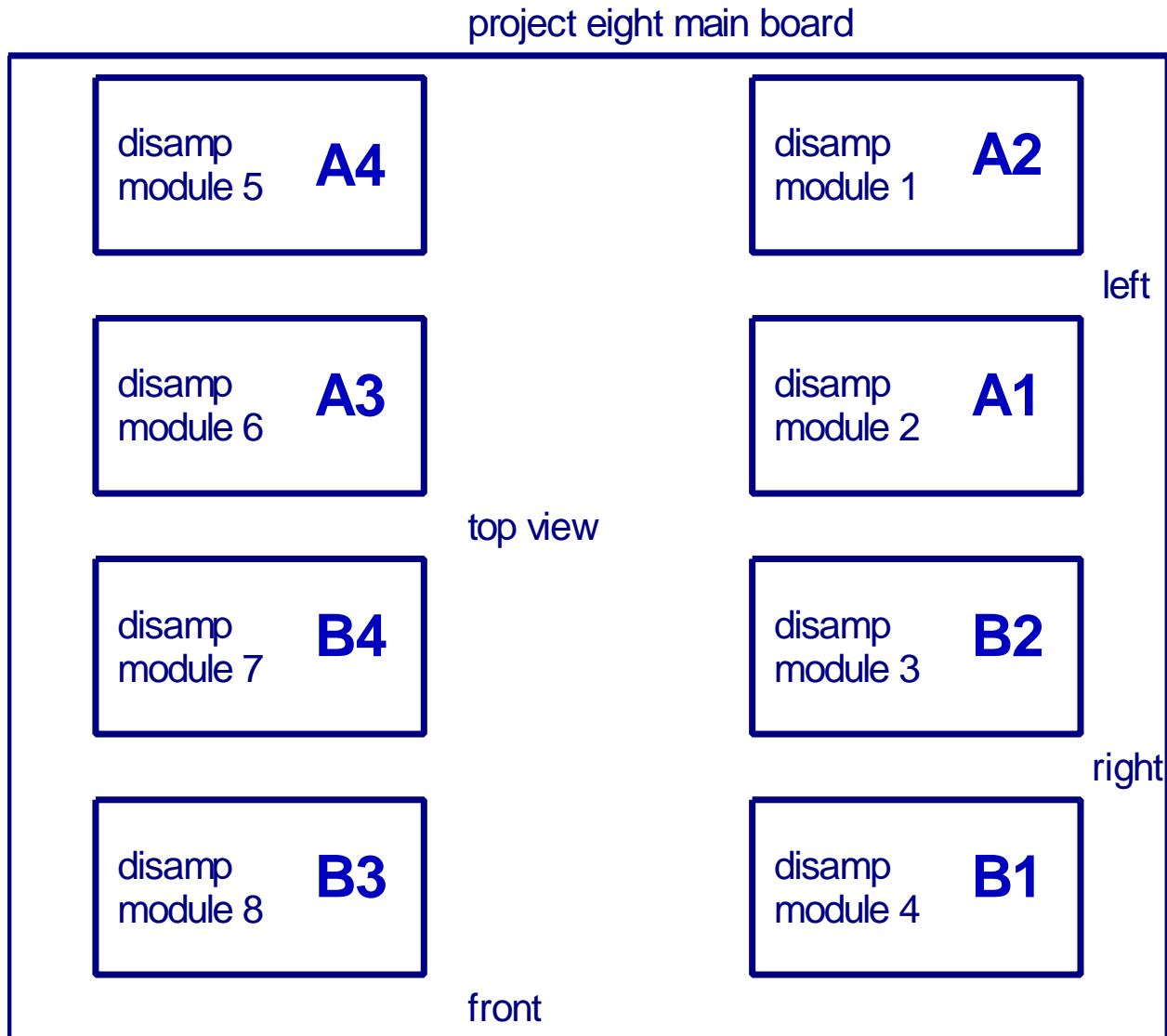
Figure 7: Schematic Overview of all relevant potentiometers
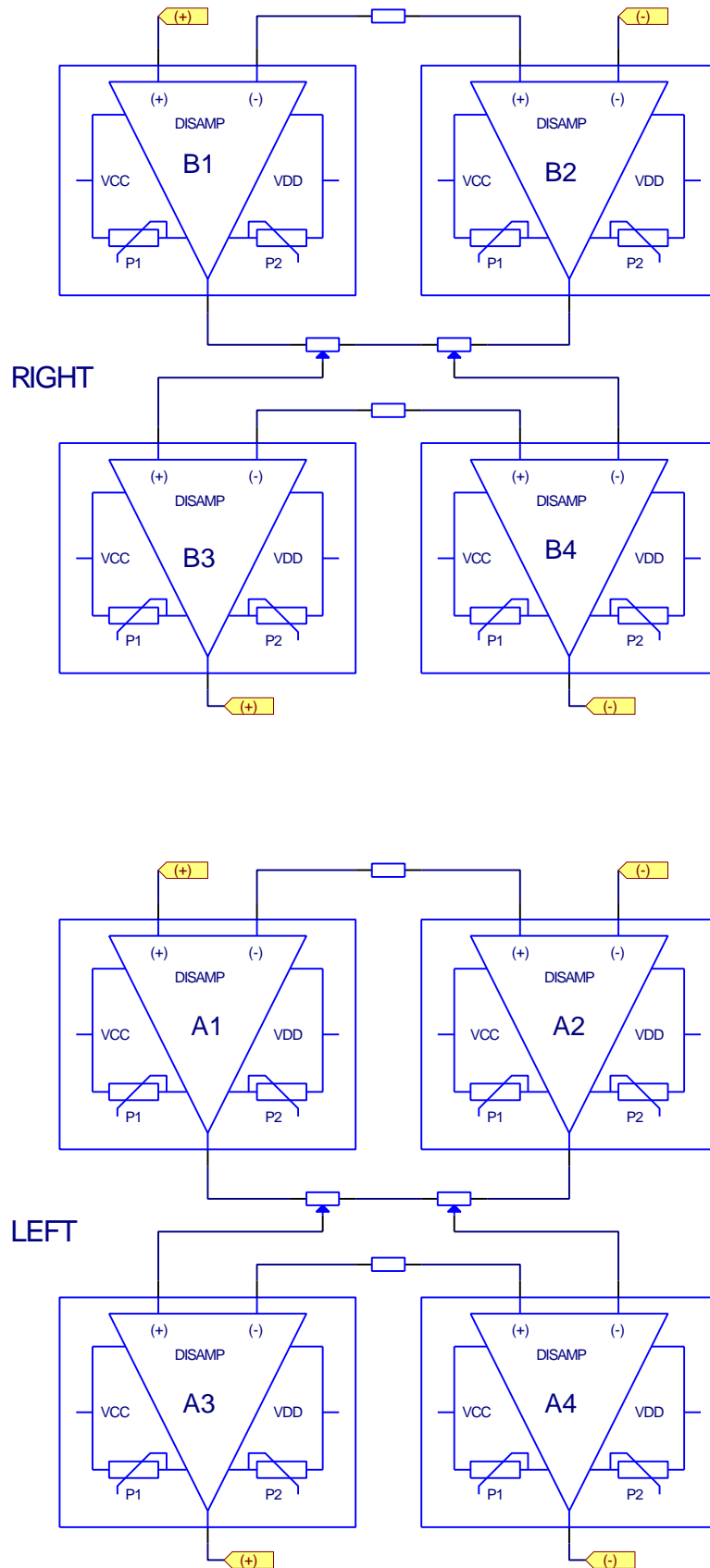
Figure 8: Disamp-96
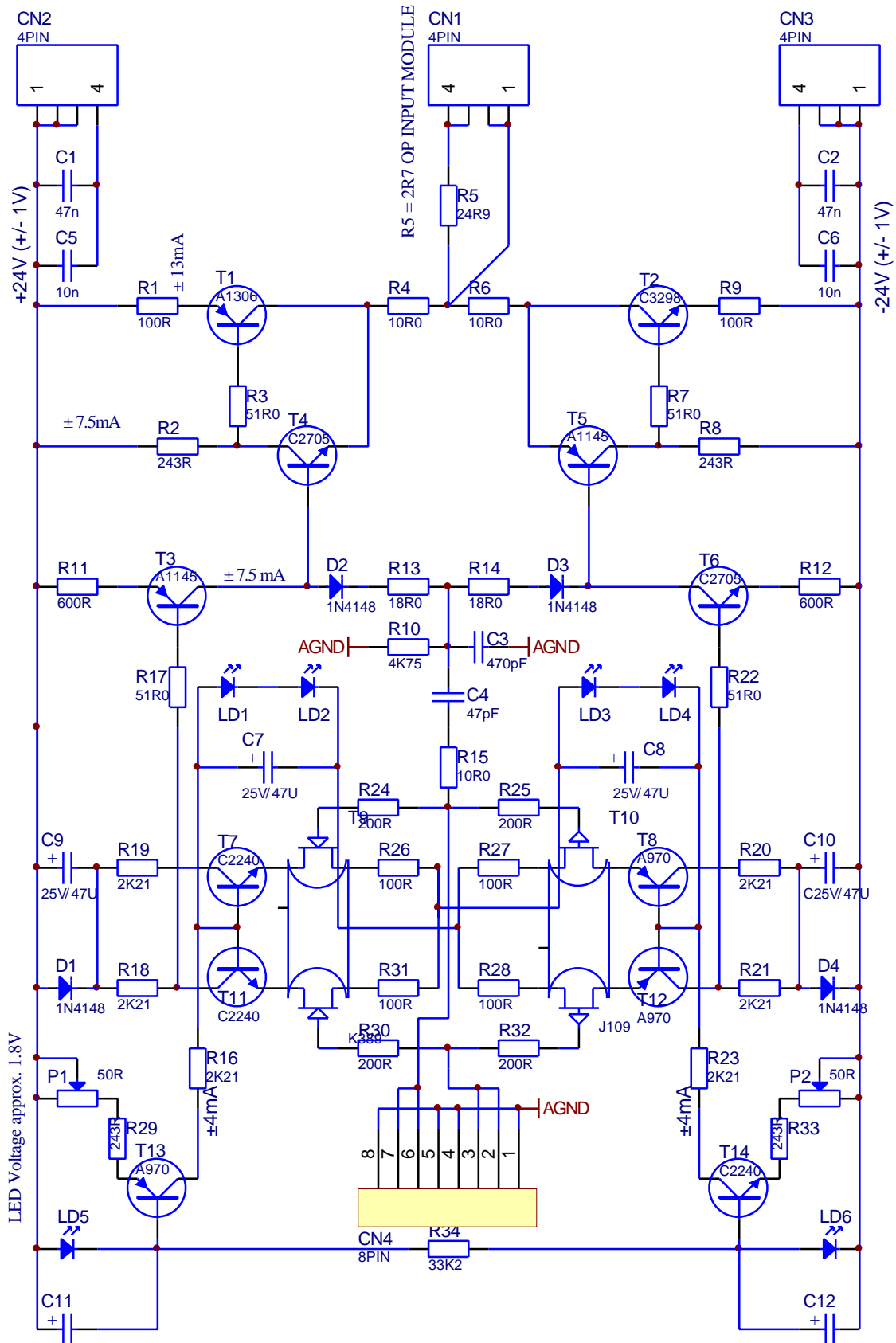
Figure 9: Functional Schematic
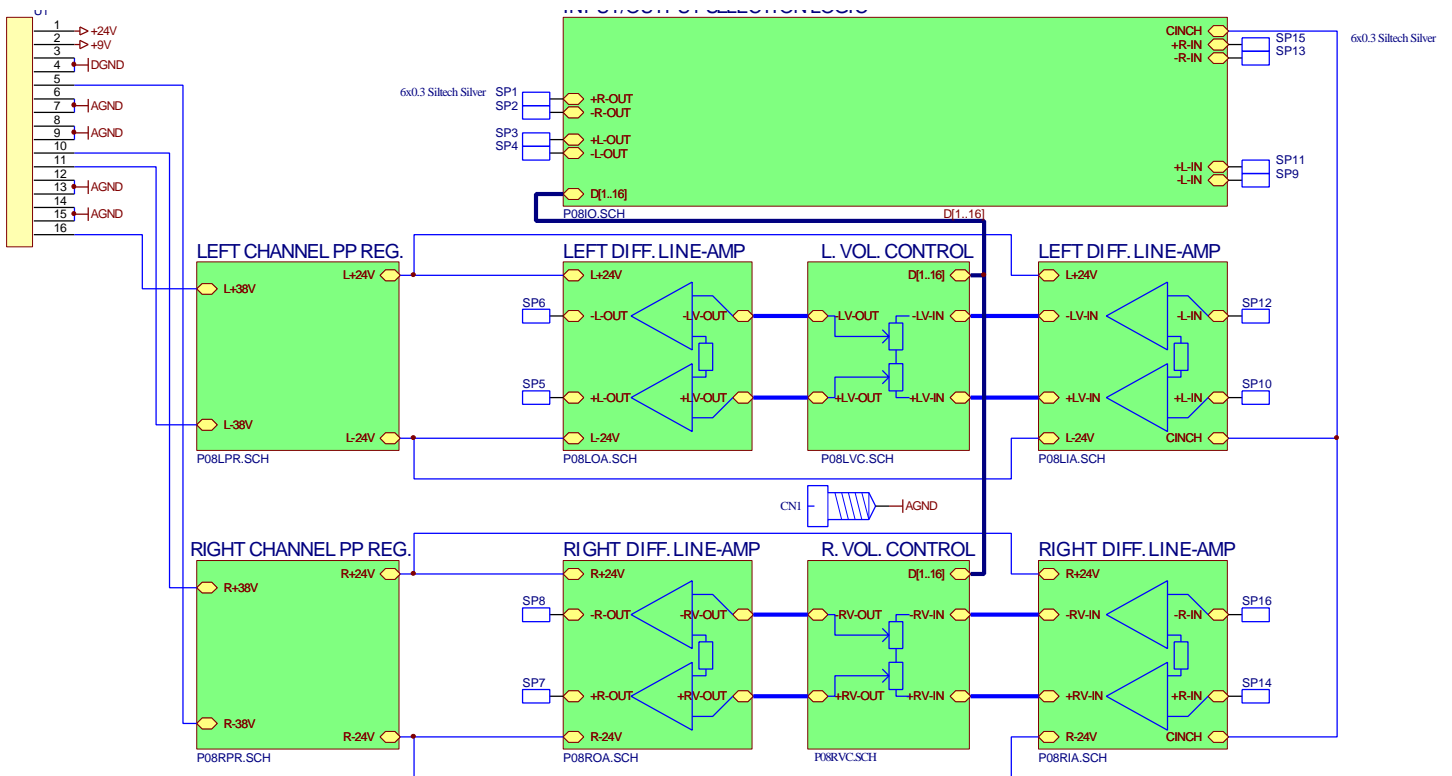
Project Eight Functional Schematic

Figure 10: Left Power Supply
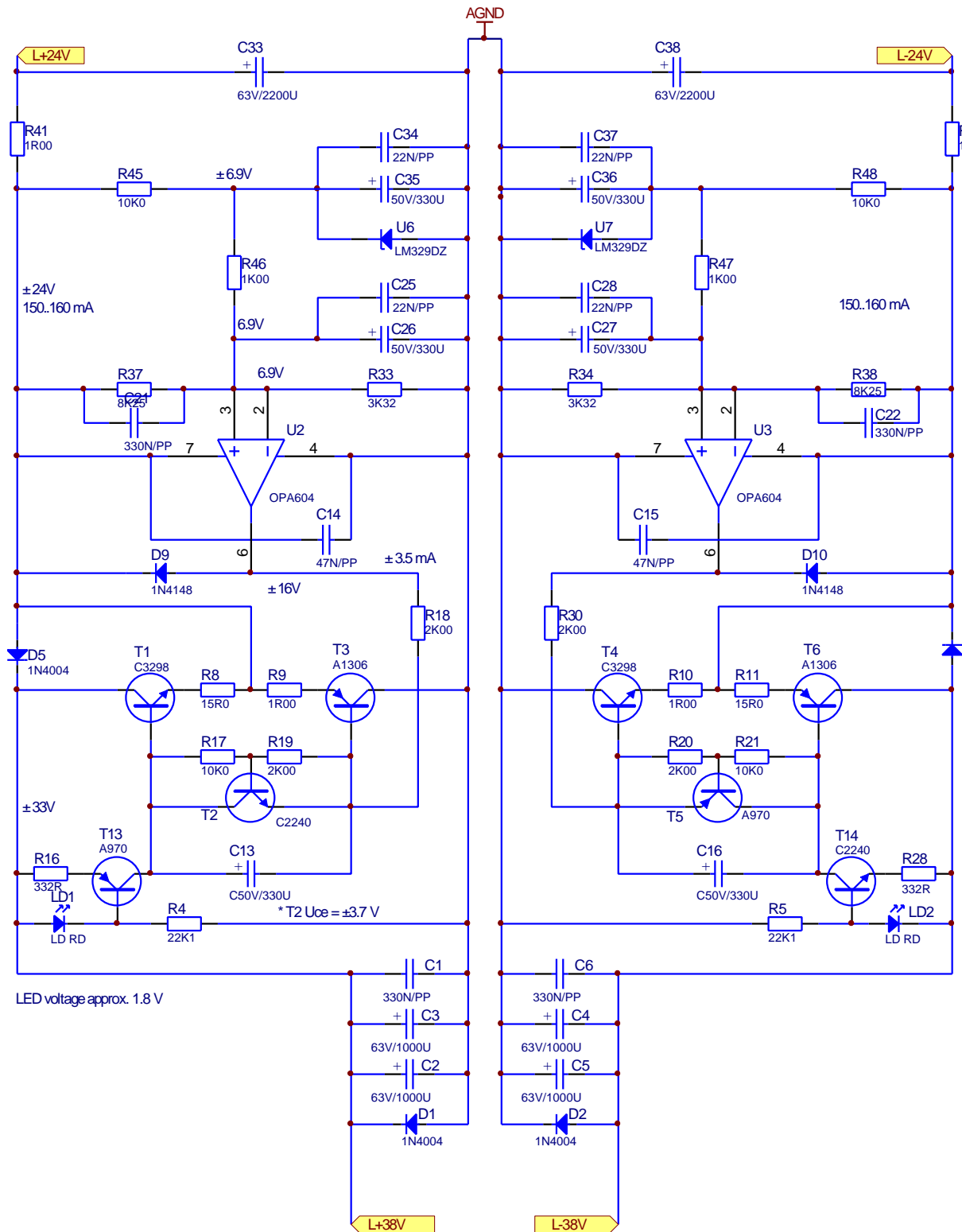
Figure 11: Right Power Supply
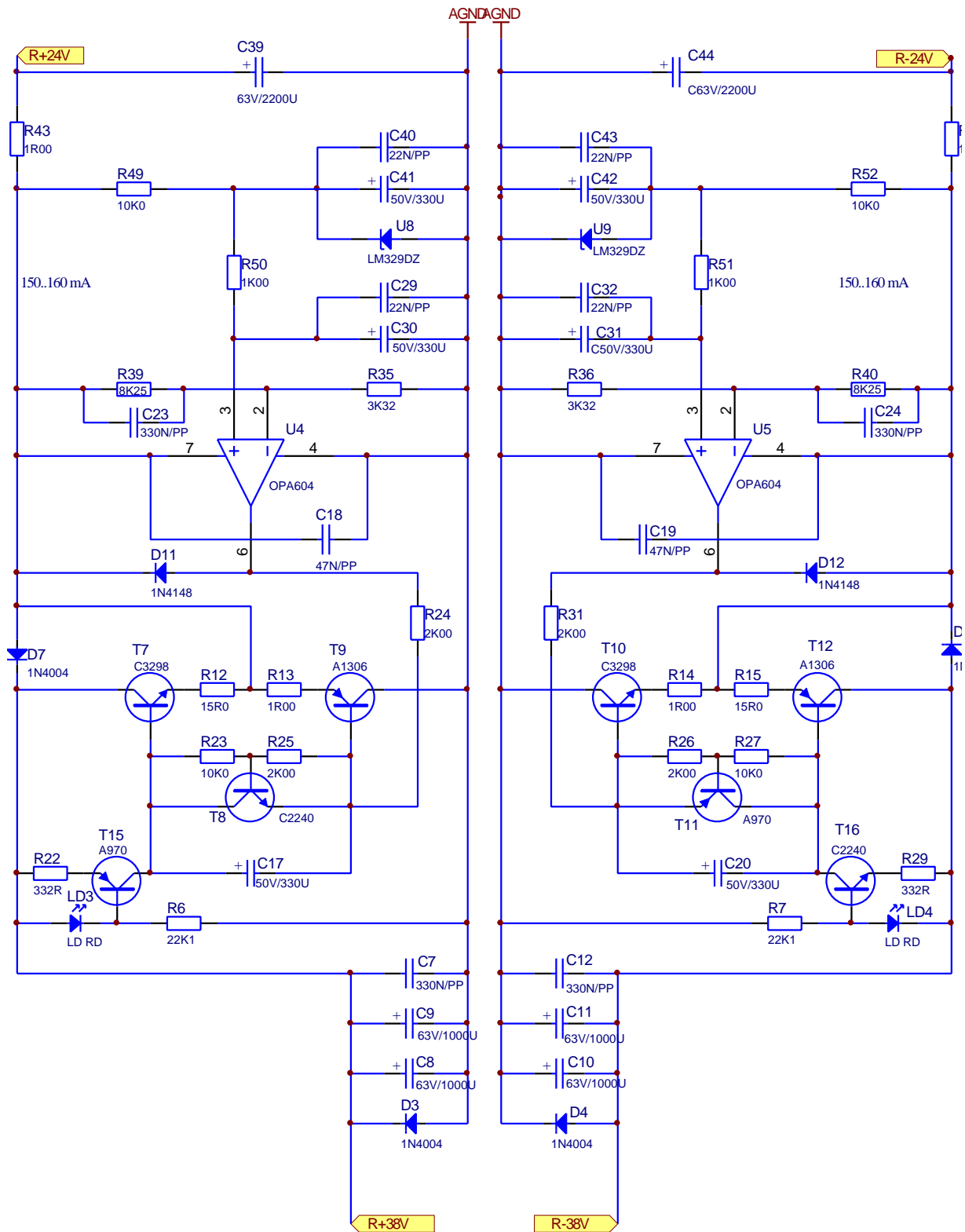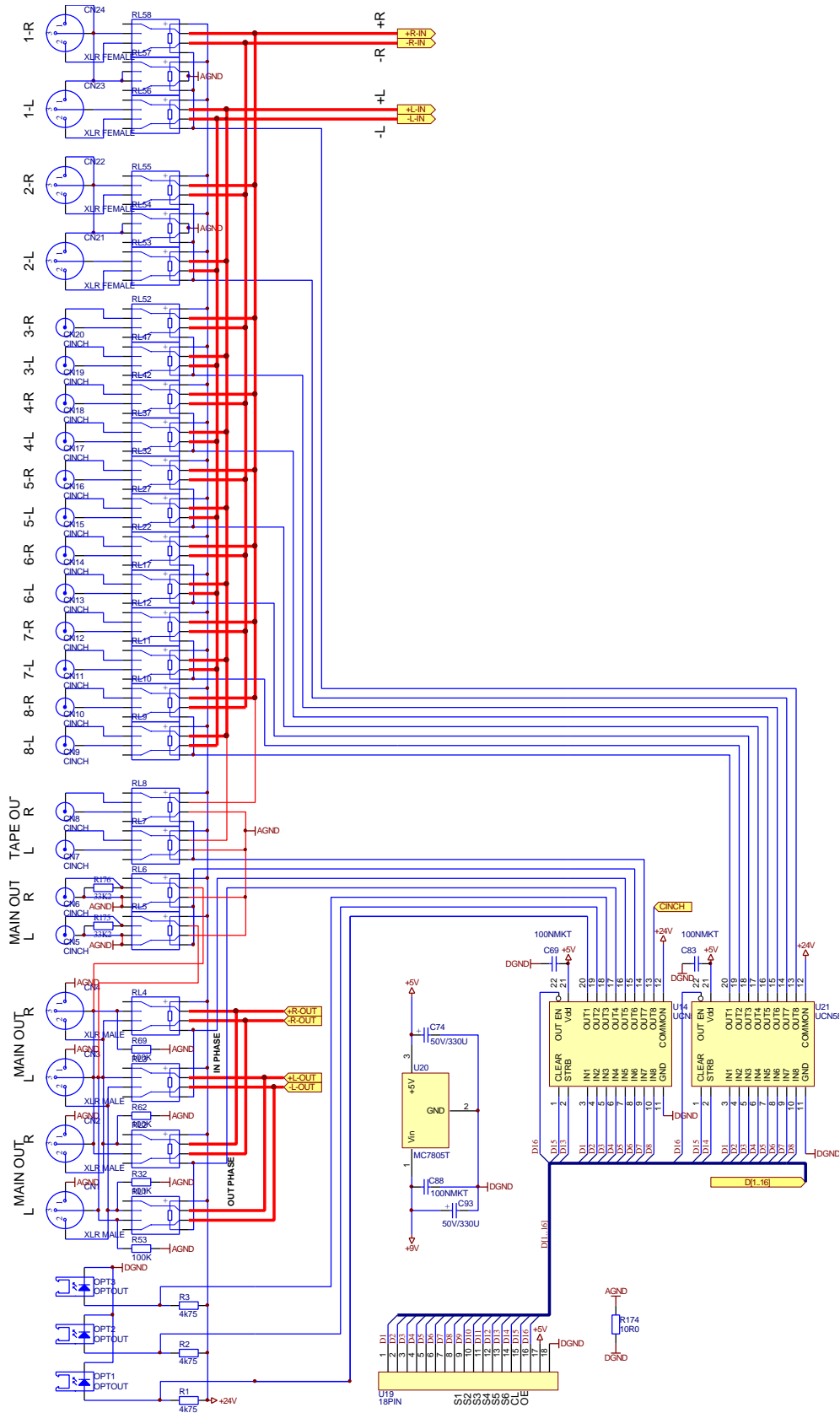
Figure 13: Left Volume Control
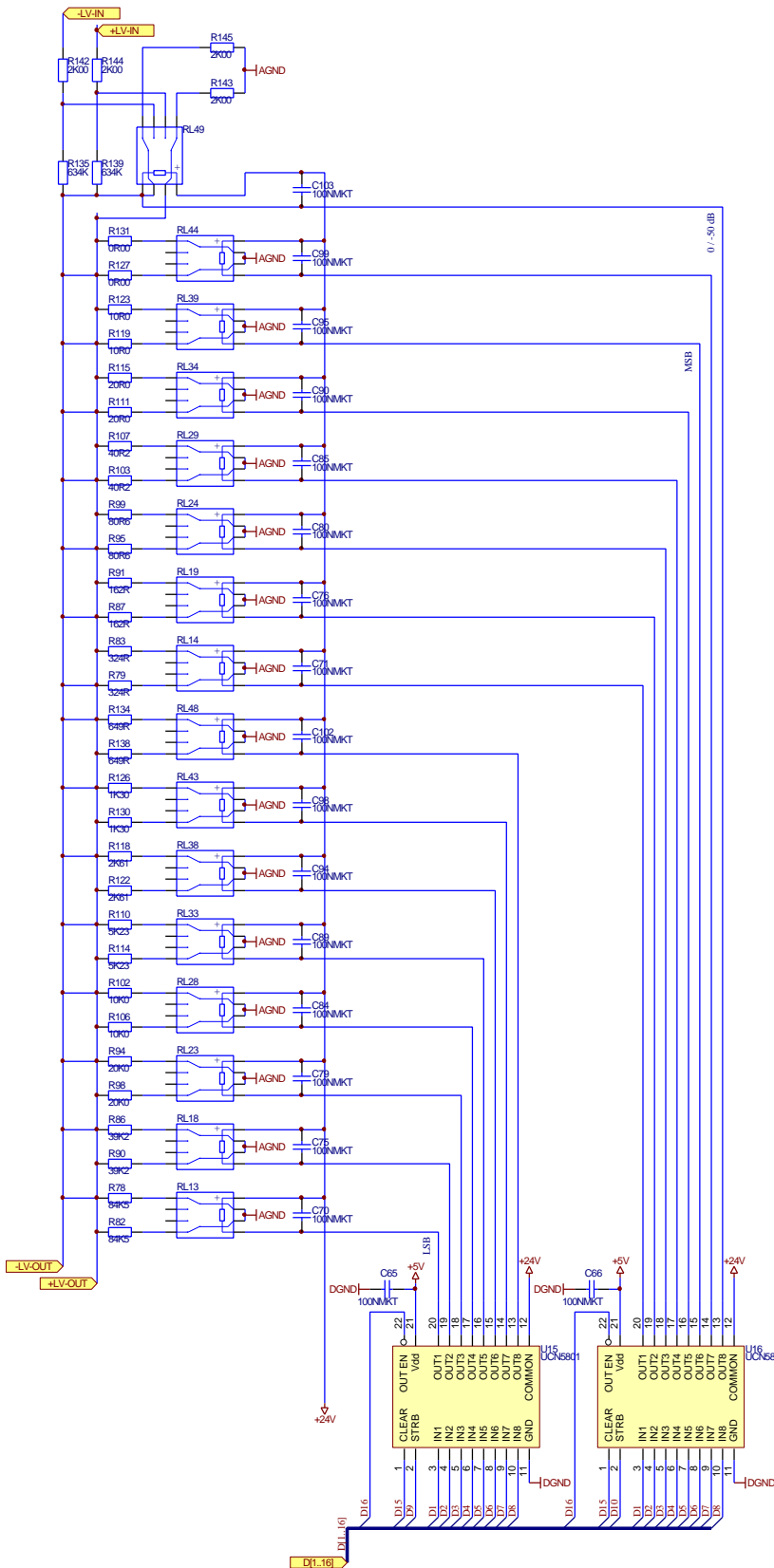
Figure 14: Right Volume Control
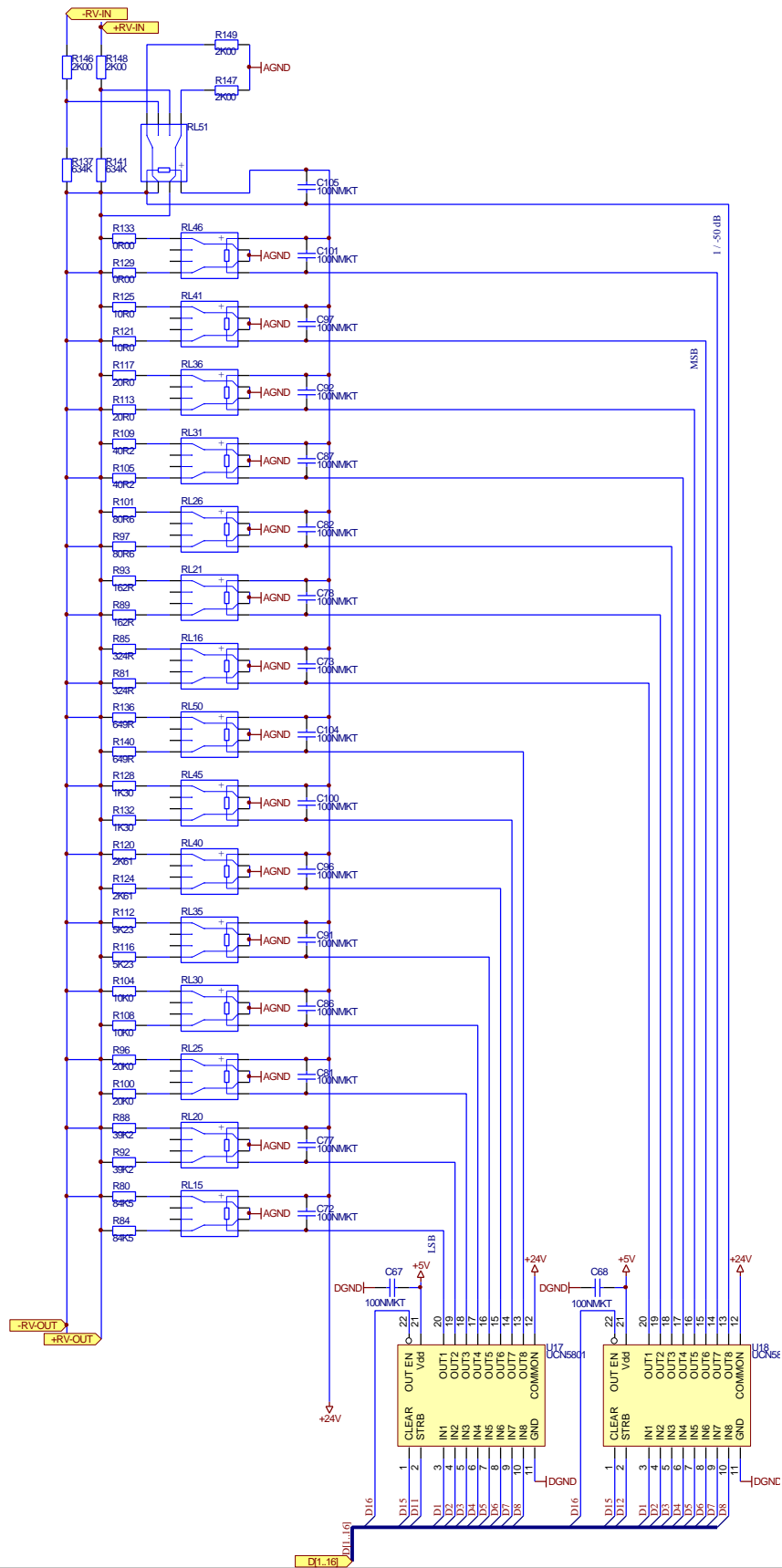
Figure 15: Left Output Amp
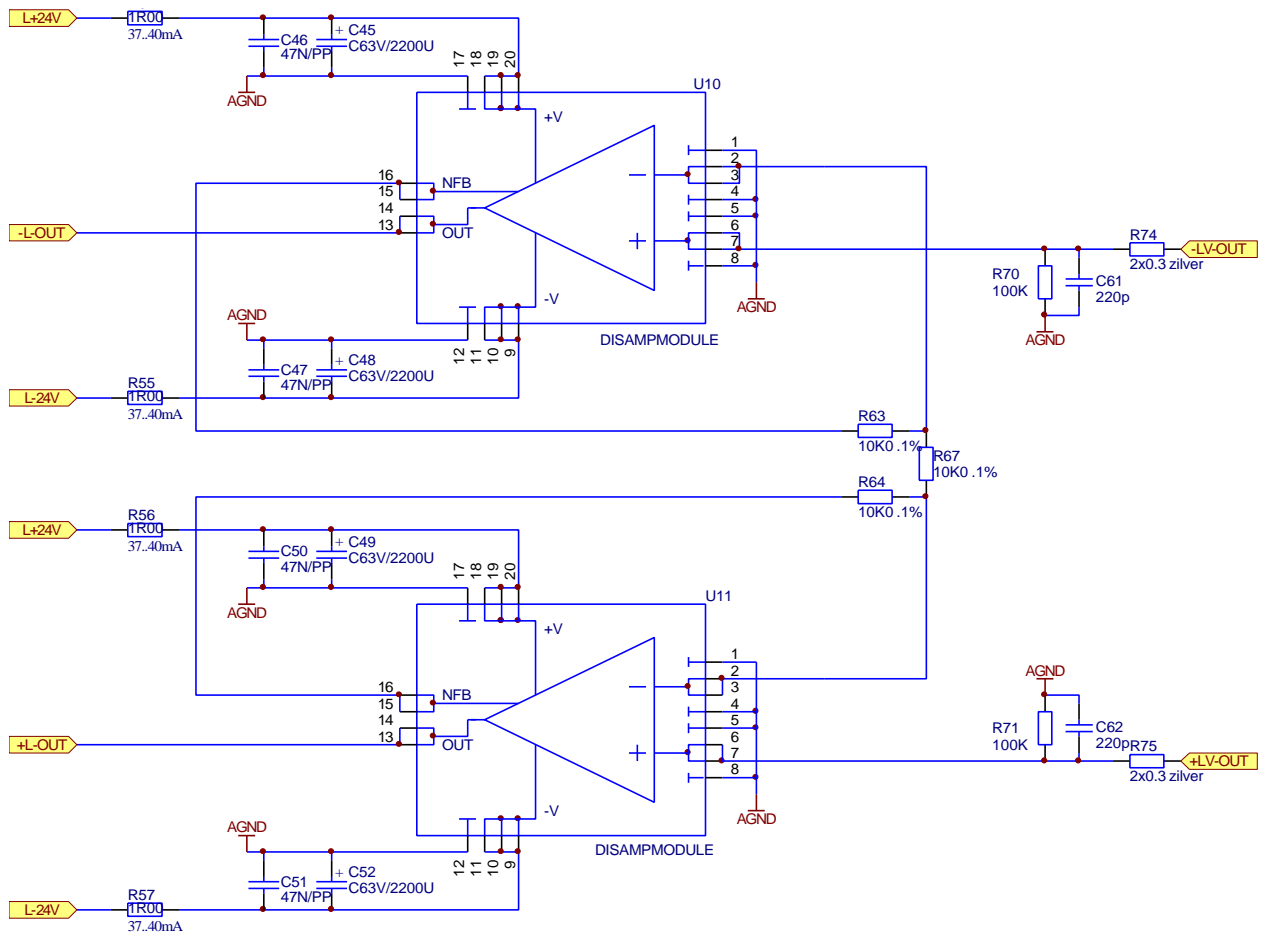
Figure 16: Right Output Amp
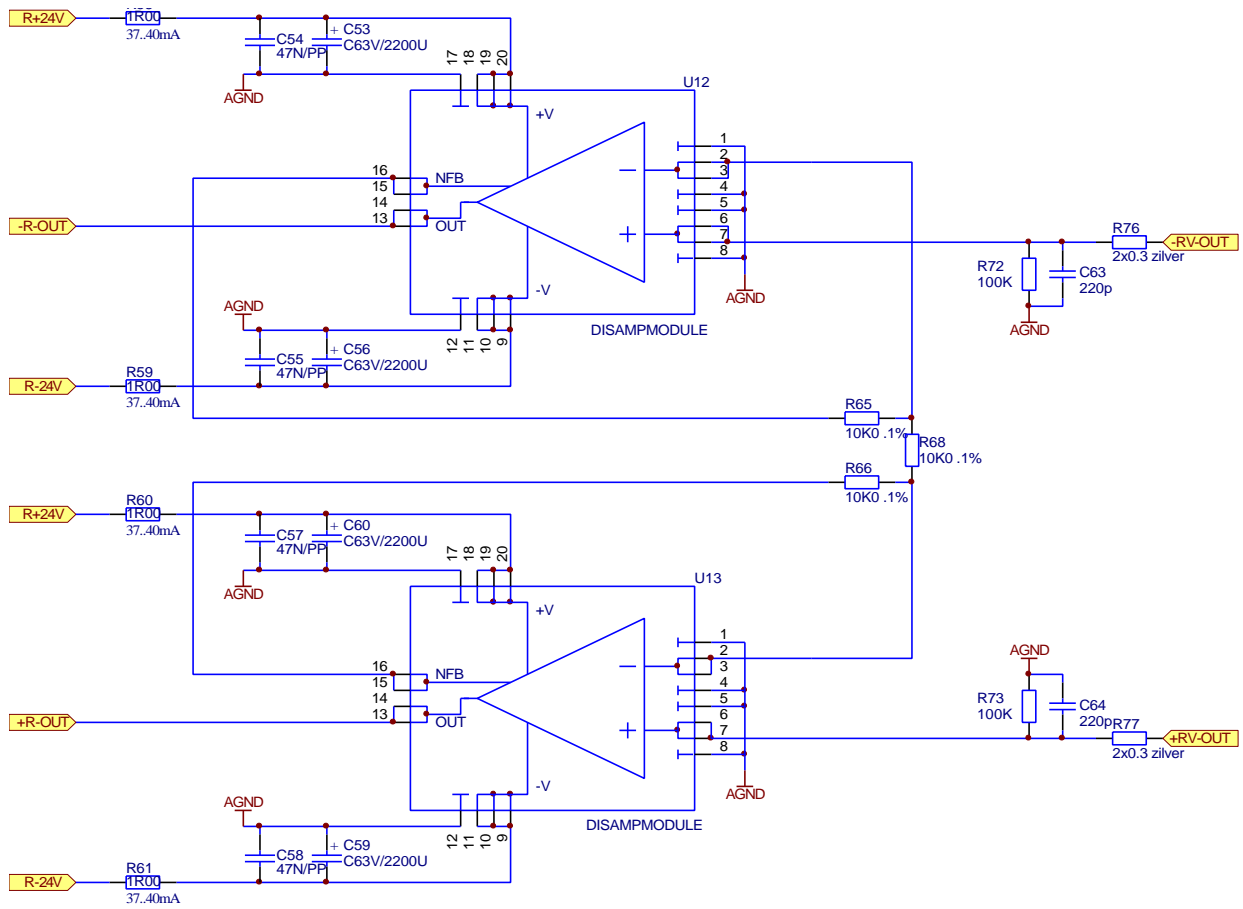
Figure 17: Left Input Amp
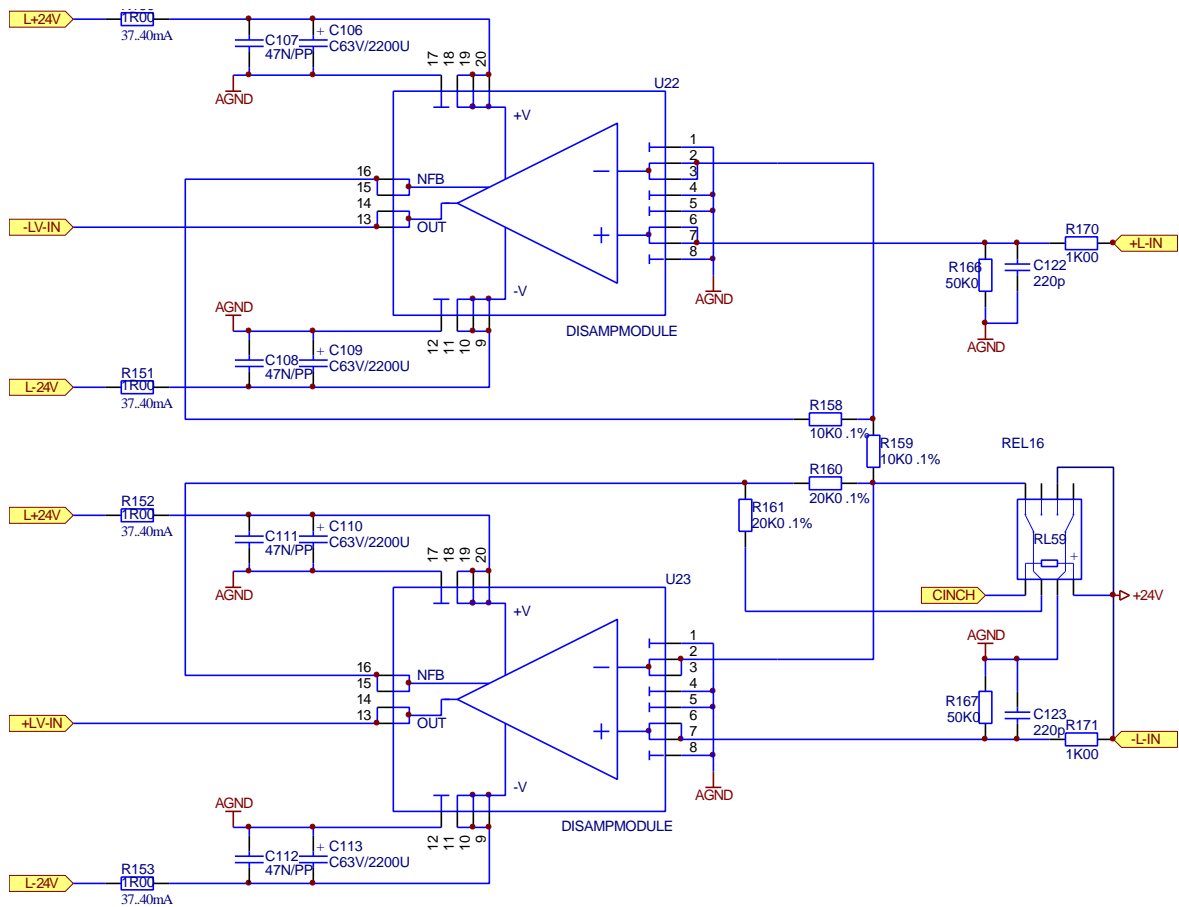
Figure 18: Right Input Amp
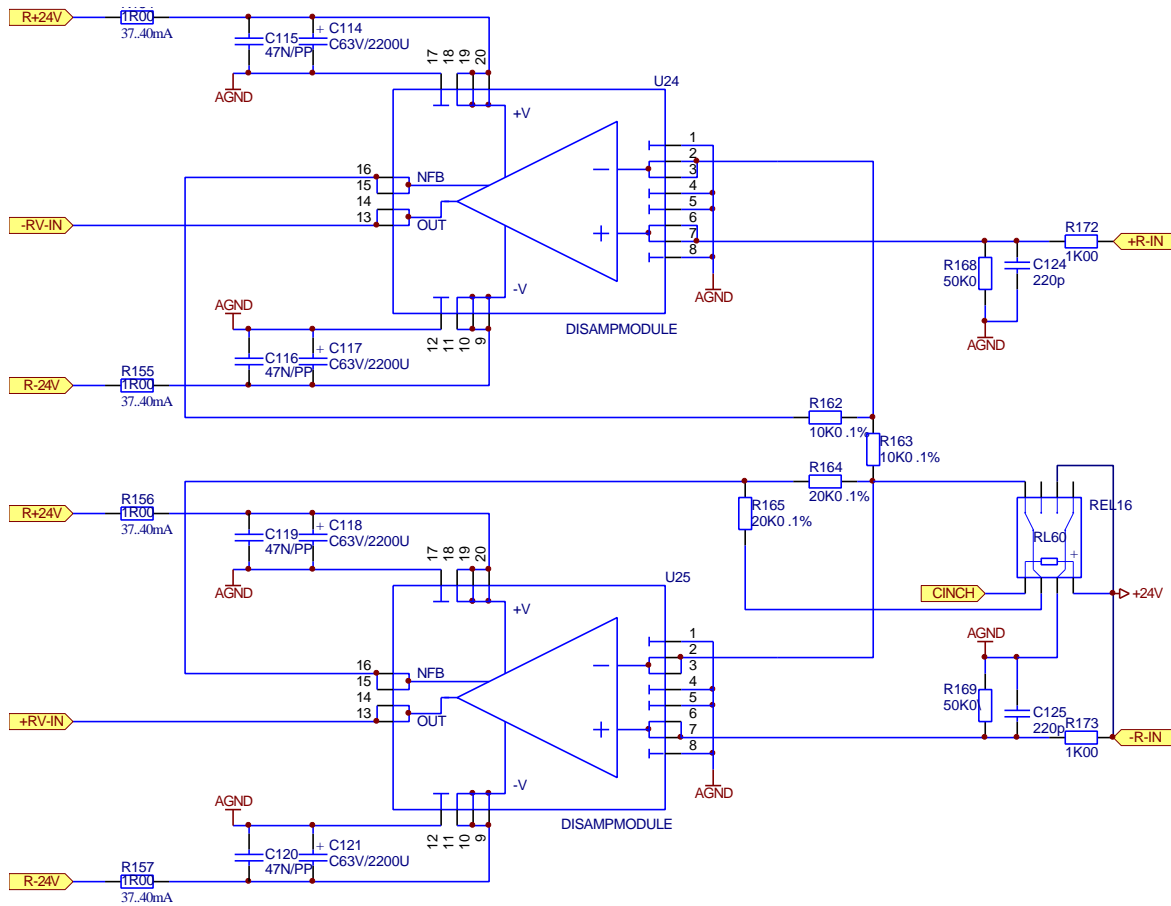
Figure 19: Power Supply Unit
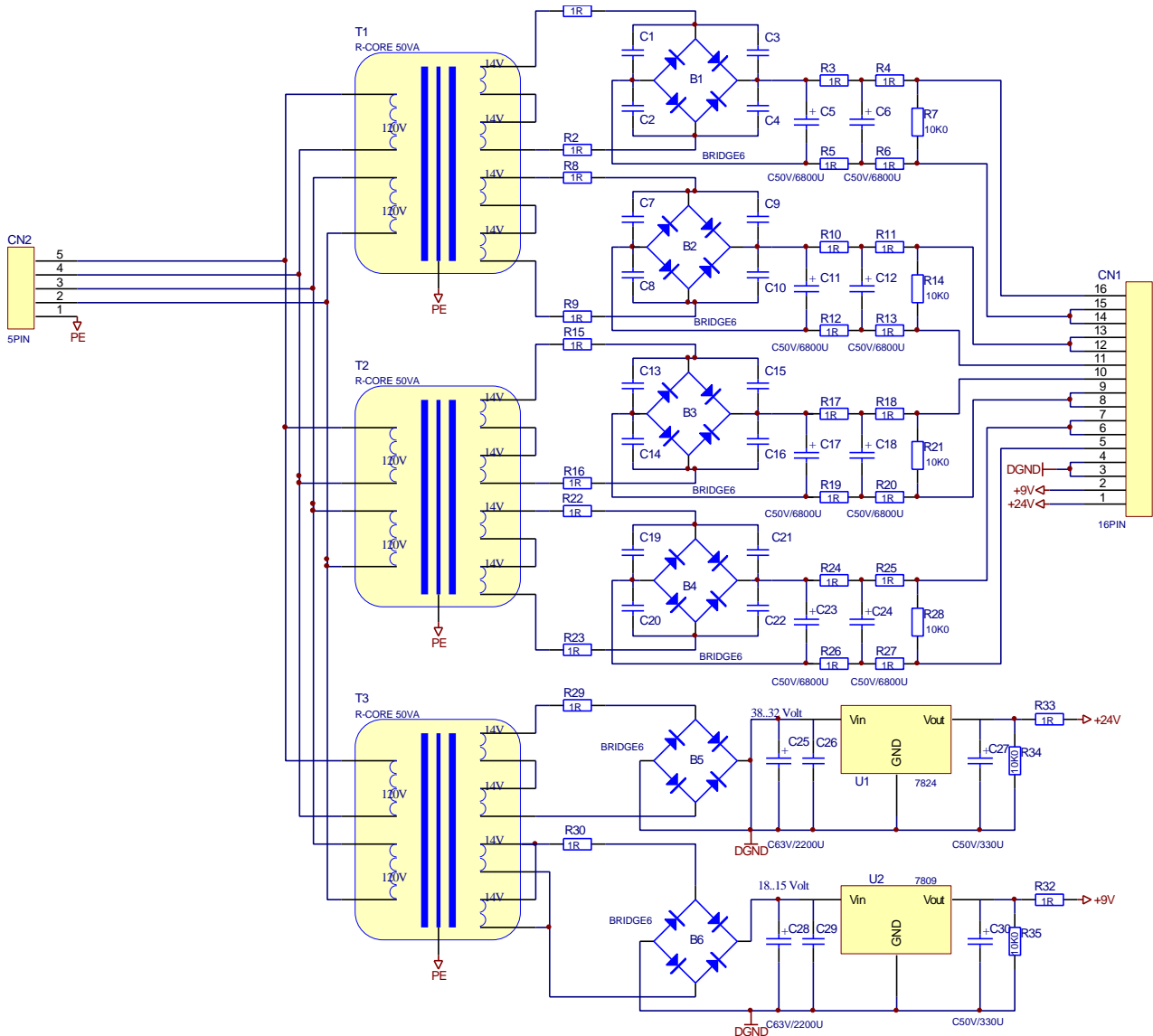
Figure 20: PCB drawings

Because there is a significant image-quality loss during the conversion of the drawings, The PCB-drawings are located in separate files.
These files are in PDF-format (Adobé Acrobat 3.0 Reader)

Project 8 mainboard (A3 format)
      "PJ-8A3mainboard.pdf"

Project 8 mainboard (A4 format)
      "PJ-8A4mainboard.pdf"

Project 8 Disamp Module (A4 format)
      "Pj-8disamp.pdf"

Project 8 Display Module (A4 format)
      "Pj-8display.pdf"

Project 8 Power Supply (A4 format)
      "Pj-8powersupply.pdf"

Parts List

Designator	Part Type	Description
B1	BRIDGE6	Bridge rectifier
B2	BRIDGE6	Bridge rectifier
B3	BRIDGE6	Bridge rectifier
B4	BRIDGE6	Bridge rectifier
B5	BRIDGE6	Bridge rectifier
B6	BRIDGE6	Bridge rectifier
C1	100NMKT	Capacitor
C1	330N/PP	Capacitor
C1	33p	Capacitor
C1	47n	Capacitor
C10	100NMKT	Capacitor
C10	C25V/47U	Capacitor
C10	C63V/1000U	Capacitor
C100	100NMKT	Capacitor
C101	100NMKT	Capacitor
C102	100NMKT	Capacitor
C103	100NMKT	Capacitor
C104	100NMKT	Capacitor
C105	100NMKT	Capacitor
C106	C63V/2200U	Capacitor
C107	47N/PP	Capacitor
C108	47N/PP	Capacitor
C109	C63V/2200U	Capacitor
C11	C25V/47U	Capacitor
C11	C50V/6800U	Capacitor
C11	C63V/1000U	Capacitor
C110	C63V/2200U	Capacitor
C111	47N/PP	Capacitor
C112	47N/PP	Capacitor
C113	C63V/2200U	Capacitor
C114	C63V/2200U	Capacitor
C115	47N/PP	Capacitor
C116	47N/PP	Capacitor
C117	C63V/2200U	Capacitor
C118	C63V/2200U	Capacitor
C119	47N/PP	Capacitor
C12	330N/PP	Capacitor
C12	C25V/47U	Capacitor
C12	C50V/6800U	Capacitor
C120	47N/PP	Capacitor
C121	C63V/2200U	Capacitor
C122	220p	Capacitor
C123	220p	Capacitor
C124	220p	Capacitor
C125	220p	Capacitor
C13	100NMKT	Capacitor
C13	C50V/330U	Capacitor
C14	100NMKT	Capacitor
C14	47N/PP	Capacitor
C15	100NMKT	Capacitor
C15	47N/PP	Capacitor
C16	100NMKT	Capacitor
C16	C50V/330U	Capacitor
C17	C50V/330U	Capacitor
C17	C50V/6800U	Capacitor
C18	47N/PP	Capacitor
C18	C50V/6800U	Capacitor
C19	100NMKT	Capacitor
C19	47N/PP	Capacitor
C2	100NMKT	Capacitor
C2	33p	Capacitor
C2	47n	Capacitor

Designator	Part Type	Description
C2	C63V/1000U	Capacitor
C20	100NMKT	Capacitor
C20	C50V/330U	Capacitor
C21	100NMKT	Capacitor
C21	330N/PP	Capacitor
C22	100NMKT	Capacitor
C22	330N/PP	Capacitor
C23	330N/PP	Capacitor
C23	C50V/6800U	Capacitor
C24	330N/PP	Capacitor
C24	C50V/6800U	Capacitor
C25	22N/PP	Capacitor
C25	C63V/2200U	Capacitor
C26	100NMKT	Capacitor
C26	C50V/330U	Capacitor
C27	C50V/330U	Capacitor
C27	C50V/330U	Capacitor
C28	22N/PP	Capacitor
C28	C63V/2200U	Capacitor
C29	100NMKT	Capacitor
C29	22N/PP	Capacitor
C3	100NMKT	Capacitor
C3	220n	Capacitor
C3	470pF	Capacitor
C3	C63V/1000U	Capacitor
C30	C50V/330U	Capacitor
C30	C50V/330U	Capacitor
C31	C50V/330U	Capacitor
C32	22N/PP	Capacitor
C33	C63V/2200U	Capacitor
C34	22N/PP	Capacitor
C35	C50V/330U	Capacitor
C36	C50V/330U	Capacitor
C37	22N/PP	Capacitor
C38	C63V/2200U	Capacitor
C39	C63V/2200U	Capacitor
C4	100NMKT	Capacitor
C4	220n	Capacitor
C4	47pF	Capacitor
C4	C63V/1000U	Capacitor
C40	22N/PP	Capacitor
C41	C50V/330U	Capacitor
C42	C50V/330U	Capacitor
C43	22N/PP	Capacitor
C44	C63V/2200U	Capacitor
C45	C63V/2200U	Capacitor
C46	47N/PP	Capacitor
C47	47N/PP	Capacitor
C48	C63V/2200U	Capacitor
C49	C63V/2200U	Capacitor
C5	10n	Capacitor
C5	220n	Capacitor
C5	C50V/6800U	Capacitor
C5	C63V/1000U	Capacitor
C50	47N/PP	Capacitor
C51	47N/PP	Capacitor
C52	C63V/2200U	Capacitor
C53	C63V/2200U	Capacitor
C54	47N/PP	Capacitor
C55	47N/PP	Capacitor
C56	C63V/2200U	Capacitor
C57	47N/PP	Capacitor
C58	47N/PP	Capacitor
C59	C63V/2200U	Capacitor
C6	10n	Capacitor
C6	220n	Capacitor
C6	330N/PP	Capacitor
C6	C50V/6800U	Capacitor
C60	C63V/2200U	Capacitor

Designator	Part Type	Description
C61	220p	Capacitor
C62	220p	Capacitor
C63	220p	Capacitor
C64	220p	Capacitor
C65	100NMKT	Capacitor
C66	100NMKT	Capacitor
C67	100NMKT	Capacitor
C68	100NMKT	Capacitor
C69	100NMKT	Capacitor
C7	100NMKT	Capacitor
C7	330N/PP	Capacitor
C7	3U3/63V	Capacitor
C7	C25V/47U	Capacitor
C70	100NMKT	Capacitor
C71	100NMKT	Capacitor
C72	100NMKT	Capacitor
C73	100NMKT	Capacitor
C74	C50V/330U	Capacitor
C75	100NMKT	Capacitor
C76	100NMKT	Capacitor
C77	100NMKT	Capacitor
C78	100NMKT	Capacitor
C79	100NMKT	Capacitor
C8	100NMKT	Capacitor
C8	C25V/47U	Capacitor
C8	C47U/16V	Capacitor
C8	C63V/1000U	Capacitor
C80	100NMKT	Capacitor
C81	100NMKT	Capacitor
C82	100NMKT	Capacitor
C83	100NMKT	Capacitor
C84	100NMKT	Capacitor
C85	100NMKT	Capacitor
C86	100NMKT	Capacitor
C87	100NMKT	Capacitor
C88	100NMKT	Capacitor
C89	100NMKT	Capacitor
C9	100NMKT	Capacitor
C9	470U/16V	Capacitor
C9	C25V/47U	Capacitor
C9	C63V/1000U	Capacitor
C90	100NMKT	Capacitor
C91	100NMKT	Capacitor
C92	100NMKT	Capacitor
C93	C50V/330U	Capacitor
C94	100NMKT	Capacitor
C95	100NMKT	Capacitor
C96	100NMKT	Capacitor
C97	100NMKT	Capacitor
C98	100NMKT	Capacitor
C99	100NMKT	Capacitor
CN1	16PIN	Connector
CN1	18PIN	Connector
CN1	4PIN	Connector
CN1	KAST_GND	Connector
CN1	XLR MALE	Connector
CN10	CINCH	Connector
CN11	CINCH	Connector
CN12	CINCH	Connector
CN13	CINCH	Connector
CN14	CINCH	Connector
CN15	CINCH	Connector
CN16	CINCH	Connector
CN17	CINCH	Connector
CN18	CINCH	Connector
CN19	CINCH	Connector
CN2	20PIN	Connector

Designator	Part Type	Description
CN2	4PIN	Connector
CN2	5PIN	Connector
CN2	XLR MALE	Connector
CN20	CINCH	Connector
CN21	XLR FEMALE	Connector
CN22	XLR FEMALE	Connector
CN23	XLR FEMALE	Connector
CN24	XLR FEMALE	Connector
CN3	4PIN	Connector
CN3	XLR MALE	Connector
CN4	8PIN	Connector
CN4	XLR MALE	Connector
CN5	CINCH	Connector
CN6	CINCH	Connector
CN7	CINCH	Connector
CN8	CINCH	Connector
CN9	CINCH	Connector
D1	1N4004	Diode
D1	1N4148	Diode
D1	1N4148	Diode
D10	1N4148	Diode
D11	1N4148	Diode
D12	1N4148	Diode
D2	1N4004	Diode
D2	1N4148	Diode
D3	1N4004	Diode
D3	1N4148	Diode
D4	1N4004	Diode
D4	1N4148	Diode
D5	1N4004	Diode
D6	1N4004	Diode
D7	1N4004	Diode
D8	1N4004	Diode
D9	1N4148	Diode
IR1	IRIC	Infrared receiver
J1	Jumper R	Jumper
J2	Jumper R	Jumper
J3	Jumper R	Jumper
LD1	LD RD	LED
LD1	LD RD	LED
LD2	LD RD	LED
LD2	LD RD	LED
LD3	LD RD	LED
LD3	LD RD	LED
LD4	LD RD	LED
LD4	LD RD	LED
LD5	LD RD	LED
LD6	LD RD	LED
OPT1	OPTOUT	optical output
OPT2	OPTOUT	optical output
OPT3	OPTOUT	optical output
P1	50R	Var. Resistor
P2	50R	Var. Resistor
R1	100R	Resistor
R1	1R	Resistor

Designator	Part Type	Description
R1	27K4	Resistor
R1	4k75	Resistor
R10	1R	Resistor
R10	1R00	Resistor
R10	4K75	Resistor
R100	20K0	Resistor
R101	80R6	Resistor
R102	10K0	Resistor
R103	40R2	Resistor
R104	10K0	Resistor
R105	40R2	Resistor
R106	10K0	Resistor
R107	40R2	Resistor
R108	10K0	Resistor
R109	40R2	Resistor
R11	15R0	Resistor
R11	1R	Resistor
R11	600R	Resistor
R110	5K23	Resistor
R111	20R0	Resistor
R112	5K23	Resistor
R113	20R0	Resistor
R114	5K23	Resistor
R115	20R0	Resistor
R116	5K23	Resistor
R117	20R0	Resistor
R118	2K61	Resistor
R119	10R0	Resistor
R12	15R0	Resistor
R12	1R	Resistor
R12	600R	Resistor
R120	2K61	Resistor
R121	10R0	Resistor
R122	2K61	Resistor
R123	10R0	Resistor
R124	2K61	Resistor
R125	10R0	Resistor
R126	1K30	Resistor
R127	0R00	Resistor
R128	1K30	Resistor
R129	0R00	Resistor
R13	18R0	Resistor
R13	1R	Resistor
R13	1R00	Resistor
R130	1K30	Resistor
R131	0R00	Resistor
R132	1K30	Resistor
R133	0R00	Resistor
R134	649R	Resistor
R135	634K	Resistor
R136	649R	Resistor
R137	634K	Resistor
R138	649R	Resistor
R139	634K	Resistor
R14	10K0	Resistor
R14	18R0	Resistor
R14	1R00	Resistor
R140	649R	Resistor
R141	634K	Resistor
R142	2K00	Resistor
R143	2K00	Resistor
R144	2K00	Resistor
R145	2K00	Resistor
R146	2K00	Resistor
R147	2K00	Resistor
R148	2K00	Resistor
R149	2K00	Resistor
R15	10R0	Resistor
R15	15R0	Resistor

Designator	Part Type	Description
R15	1R	Resistor
R150	1R00	Resistor
R151	1R00	Resistor
R152	1R00	Resistor
R153	1R00	Resistor
R154	1R00	Resistor
R155	1R00	Resistor
R156	1R00	Resistor
R157	1R00	Resistor
R158	10K0 .1%	Resistor
R159	10K0 .1%	Resistor
R16	1R	Resistor
R16	2K21	Resistor
R16	332R	Resistor
R160	20K0 .1%	Resistor
R161	20K0 .1%	Resistor
R162	10K0 .1%	Resistor
R163	10K0 .1%	Resistor
R164	20K0 .1%	Resistor
R165	20K0 .1%	Resistor
R166	50K0	Resistor
R167	50K0	Resistor
R168	50K0	Resistor
R169	50K0	Resistor
R17	10K0	Resistor
R17	1R	Resistor
R17	51R0	Resistor
R170	1K00	Resistor
R171	1K00	Resistor
R172	1K00	Resistor
R173	1K00	Resistor
R174	10R0	Resistor
R175	33K2	Resistor
R176	33K2	Resistor
R18	1R	Resistor
R18	2K00	Resistor
R18	2K21	Resistor
R19	1R	Resistor
R19	2K00	Resistor
R19	2K21	Resistor
R2	10K0	Resistor
R2	1R	Resistor
R2	243R	Resistor
R2	4k75	Resistor
R20	1R	Resistor
R20	2K00	Resistor
R20	2K21	Resistor
R21	10K0	Resistor
R21	10K0	Resistor
R21	2K21	Resistor
R22	1R	Resistor
R22	332R	Resistor
R22	51R0	Resistor
R23	10K0	Resistor
R23	1R	Resistor
R23	2K21	Resistor
R24	1R	Resistor
R24	200R	Resistor
R24	2K00	Resistor
R25	1R	Resistor
R25	200R	Resistor
R25	2K00	Resistor
R26	100R	Resistor
R26	1R	Resistor
R26	2K00	Resistor
R27	100R	Resistor
R27	10K0	Resistor
R27	1R	Resistor
R28	100R	Resistor

Designator	Part Type	Description
R28	10K0	Resistor
R28	332R	Resistor
R29	1R	Resistor
R29	243R	Resistor
R29	332R	Resistor
R3	1R	Resistor
R3	4k75	Resistor
R3	51R0	Resistor
R3	5R62	Resistor
R30	1R	Resistor
R30	200R	Resistor
R30	2K00	Resistor
R31	100R	Resistor
R31	2K00	Resistor
R32	100K	Resistor
R32	1R	Resistor
R32	200R	Resistor
R33	1R	Resistor
R33	243R	Resistor
R33	3K32	Resistor
R34	10K0	Resistor
R34	33K2	Resistor
R34	3K32	Resistor
R35	10K0	Resistor
R35	3K32	Resistor
R36	3K32	Resistor
R37	8K25	Resistor
R38	8K25	Resistor
R39	8K25	Resistor
R4	10R0	Resistor
R4	1R	Resistor
R4	22K1	Resistor
R4	61K9	Resistor
R40	8K25	Resistor
R41	1R00	Resistor
R42	1R00	Resistor
R43	1R00	Resistor
R44	1R00	Resistor
R45	10K0	Resistor
R46	1K00	Resistor
R47	1K00	Resistor
R48	10K0	Resistor
R49	10K0	Resistor
R5	1R	Resistor
R5	22K1	Resistor
R5	24R9	Resistor
R5	68K1	Resistor
R50	1K00	Resistor
R51	1K00	Resistor
R52	10K0	Resistor
R53	100K	Resistor
R54	1R00	Resistor
R55	1R00	Resistor
R56	1R00	Resistor
R57	1R00	Resistor
R58	1R00	Resistor
R59	1R00	Resistor
R6	10R0	Resistor
R6	1R	Resistor
R6	22K1	Resistor
R60	1R00	Resistor
R61	1R00	Resistor
R62	100K	Resistor
R63	10K0 .1%	Resistor
R64	10K0 .1%	Resistor
R65	10K0 .1%	Resistor
R66	10K0 .1%	Resistor
R67	10K0 .1%	Resistor
R68	10K0 .1%	Resistor

Designator	Part Type	Description
R69	100K	Resistor
R7	10K0	Resistor
R7	22K1	Resistor
R7	51R0	Resistor
R70	100K	Resistor
R71	100K	Resistor
R72	100K	Resistor
R73	100K	Resistor
R74	2x0.3 silver	Resistor
R75	2x0.3 zilver	Resistor
R76	2x0.3 zilver	Resistor
R77	2x0.3 zilver	Resistor
R78	84K5	Resistor
R79	324R	Resistor
R8	15R0	Resistor
R8	1R	Resistor
R8	243R	Resistor
R80	84K5	Resistor
R81	324R	Resistor
R82	84K5	Resistor
R83	324R	Resistor
R84	84K5	Resistor
R85	324R	Resistor
R86	39K2	Resistor
R87	162R	Resistor
R88	39K2	Resistor
R89	162R	Resistor
R9	100R	Resistor
R9	1R	Resistor
R9	1R00	Resistor
R90	39K2	Resistor
R91	162R	Resistor
R92	39K2	Resistor
R93	162R	Resistor
R94	20K0	Resistor
R95	80R6	Resistor
R96	20K0	Resistor
R97	80R6	Resistor
R98	20K0	Resistor
R99	80R6	Resistor
RL1	REL16	Relay 24V
RL10	REL16	Relay 24V
RL11	REL16	Relay 24V
RL12	REL16	Relay 24V
RL13	REL16	Relay 24V
RL14	REL16	Relay 24V
RL15	REL16	Relay 24V
RL16	REL16	Relay 24V
RL17	REL16	Relay 24V
RL18	REL16	Relay 24V
RL19	REL16	Relay 24V
RL2	REL16	Relay 24V
RL20	REL16	Relay 24V
RL21	REL16	Relay 24V
RL22	REL16	Relay 24V
RL23	REL16	Relay 24V
RL24	REL16	Relay 24V
RL25	REL16	Relay 24V
RL26	REL16	Relay 24V
RL27	REL16	Relay 24V
RL28	REL16	Relay 24V
RL29	REL16	Relay 24V
RL3	REL16	Relay 24V
RL30	REL16	Relay 24V
RL31	REL16	Relay 24V
RL32	REL16	Relay 24V

Designator	Part Type	Description
RL33	REL16	Relay 24V
RL34	REL16	Relay 24V
RL35	REL16	Relay 24V
RL36	REL16	Relay 24V
RL37	REL16	Relay 24V
RL38	REL16	Relay 24V
RL39	REL16	Relay 24V
RL4	REL16	Relay 24V
RL40	REL16	Relay 24V
RL41	REL16	Relay 24V
RL42	REL16	Relay 24V
RL43	REL16	Relay 24V
RL44	REL16	Relay 24V
RL45	REL16	Relay 24V
RL46	REL16	Relay 24V
RL47	REL16	Relay 24V
RL48	REL16	Relay 24V
RL49	REL16	Relay 24V
RL5	REL16	Relay 24V
RL50	REL16	Relay 24V
RL51	REL16	Relay 24V
RL52	REL16	Relay 24V
RL53	REL16	Relay 24V
RL54	REL16	Relay 24V
RL55	REL16	Relay 24V
RL56	REL16	Relay 24V
RL57	REL16	Relay 24V
RL58	REL16	Relay 24V
RL59	REL16	Relay 24V
RL6	REL16	Relay 24V
RL60	REL16	Relay 24V
RL7	REL16	Relay 24V
RL8	REL16	Relay 24V
RL9	REL16	Relay 24V
S1	ENCOD	Encoder
S2	ENCOD	Encoder
S3	DRUK-TOETS	Switch
S4	DRUK-TOETS	Switch
S5	DRUK-TOETS	Switch
SP1	SILPAD	Soldering pad
SP10	SILPAD	Soldering pad
SP11	SILPAD	Soldering pad
SP12	SILPAD	Soldering pad
SP13	SILPAD	Soldering pad
SP14	SILPAD	Soldering pad
SP15	SILPAD	Soldering pad
SP16	SILPAD	Soldering pad
SP2	SILPAD	Soldering pad
SP3	SILPAD	Soldering pad
SP4	SILPAD	Soldering pad
SP5	SILPAD	Soldering pad
SP6	SILPAD	Soldering pad
SP7	SILPAD	Soldering pad
SP8	SILPAD	Soldering pad
SP9	SILPAD	Soldering pad
T1	R-CORE 50VA	Transformer
T2	R-CORE 50VA	Transformer
T3	R-CORE 50VA	Transformer
T1	A1306	Transistor
T1	C3298	Transistor

Designator	Part Type	Description
T2	C2240	Transistor
T2	C3298	Transistor
T3	A1145	Transistor
T3	A1306	Transistor
T4	C2705	Transistor
T4	C3298	Transistor
T5	A1145	Transistor
T5	A970	Transistor
T6	A1306	Transistor
T6	C2705	Transistor
T7	C2240	Transistor
T7	C3298	Transistor
T8	A970	Transistor
T8	C2240	Transistor
T9	A1306	Transistor
T9	K389	Transistor
T10	C3298	Transistor
T10	J109	Transistor
T11	A970	Transistor
T11	C2240	Transistor
T12	A1306	Transistor
T12	A970	Transistor
T13	A970	Transistor
T13	A970	Transistor
T14	C2240	Transistor
T14	C2240	Transistor
T15	A970	Transistor
T16	C2240	Transistor
U1	7824	Stab. IC
U2	7809	Stab. IC
U20	MC7805T	Stab. IC
U1	16PIN	Connector
U1	H8/325	Microprocessor
U10	DISAMPMODULE	DISCRETE OPAMP MODULE
U11	DISAMPMODULE	DISCRETE OPAMP MODULE
U12	DISAMPMODULE	DISCRETE OPAMP MODULE
U13	DISAMPMODULE	DISCRETE OPAMP MODULE
U14	UCN5801	Driver IC
U15	UCN5801	Driver IC
U16	UCN5801	Driver IC
U17	UCN5801	Driver IC
U18	UCN5801	Driver IC
U21	UCN5801	Driver IC
U19	18PIN	Connector
U2	MAX690	Reset IC
U2	OP604	Opamp
U3	OP604	Opamp
U4	OP604	Opamp
U5	OP604	Opamp
U22	DISAMPMODULE	DISCRETE OPAMP MODULE
U23	DISAMPMODULE	DISCRETE OPAMP MODULE
U24	DISAMPMODULE	DISCRETE OPAMP MODULE
U25	DISAMPMODULE	DISCRETE OPAMP MODULE
U3	8M	X-TAL
U4	93C46	EEPROM
U6	LM329DZ	ZENER Diode

Designator	Part Type	Description
U7	LM329DZ	ZENER Diode
U8	LM329DZ	ZENER Diode
U9	LM329DZ	ZENER Diode

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