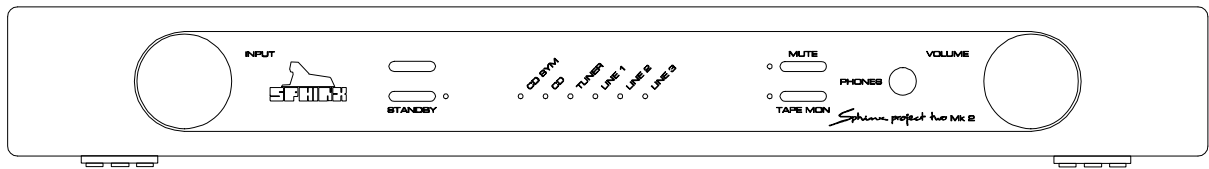


SERVICE MANUAL

PROJECT TWO Mk2

PRE-AMP



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The Sphinx Project Two Mk2 design principles

The Sphinx Project Two Mk2 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 Two Mk2 Pre-Amp.

This pre-amp is extremely simple to operate and uses the newest technologies and refined designs. Designs that have successfully been used in the award winning Project Eight.

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.

The power supply is of a unique design (fully Class-A!) and consists of three completely separate and independent sections: one for the digital control plus one each for the left and right channel.

The ALPS volume control is motor-controlled.

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 Two Mk2 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 Two Mk2.

1. UNPACKING

Before leaving the factory every Project Two Mk2 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 Two Mk2 in its original carton.

After unpacking the Project Two Mk2 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

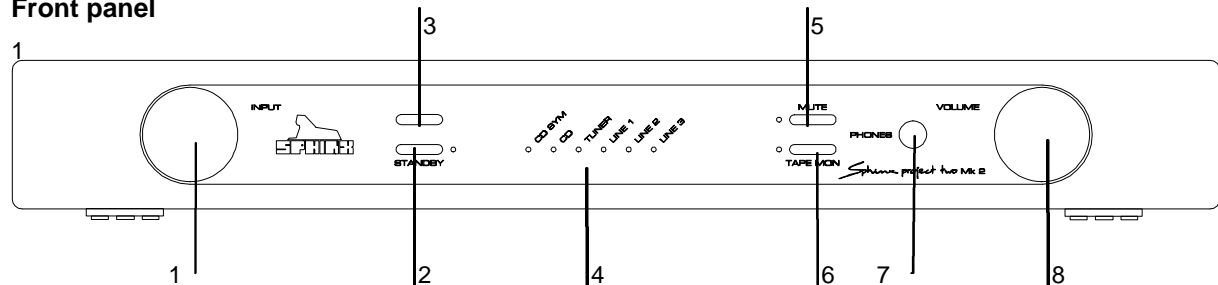
In case of any problem not covered in this manual or if you have other questions you may contact the **Sphinx International Service Department** in The Netherlands (local time: GMT +1h) during office hours at the following numbers:

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.

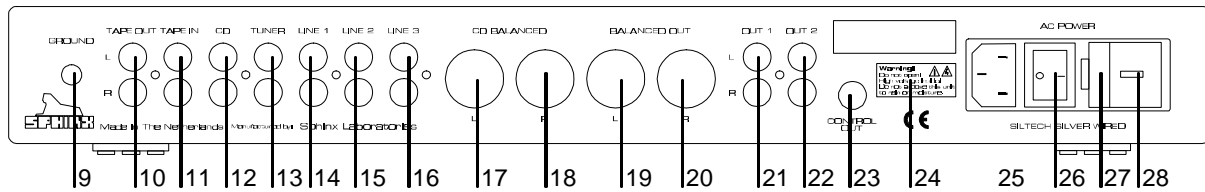
4. THE PRE-AMP AT A GLANCE

Front panel



1. **INPUT:** With this rotary knob you may select one of the six inputs. Turn clockwise for an input to the right of the active one, anti-clockwise for an input to the left.
2. **STANDBY:** To switch the component on and off:
 on LED is green
 off LED is red
3. **Receptor window** for the IR signals from the Remote Control.
4. **Input selection LED's:** The input selected with knob (1.) is indicated by one of these LED's:
 CD SYM balanced CD input
 CD unbalanced CD input
 TUNER unbalanced Tuner input
 LINE 1 unbalanced line input 1
 LINE 2 unbalanced line input 2
 LINE 3 unbalanced line input 3.
5. **MUTE:** Press this button to temporarily mute the sound. The red LED will light.
6. **TAPE MON:** To select the TAPE IN input. The red LED will light.
7. **PHONES:** To connect dynamic stereo headphones.
8. **VOLUME:** This rotary knob adjusts the volume level.

Rear panel



9. **GROUND:** You may directly connect the signal grounds of other equipment to the signal ground of the Project Two Mk2.
10. **TAPE OUT:** Connect this output to the input of the recorder.
11. **TAPE IN:** Connect this input to the output of the recorder.
12. **CD:** To connect the cinch signal cable from the CD player.
13. **TUNER:** To connect the cinch signal cable from the tuner.
14. **LINE 1:** To connect the cinch signal cable from the signal source for LINE 1.
15. **LINE 2:** To connect the cinch signal cable from the signal source for LINE 2.
16. **LINE 3:** To connect the cinch signal cable from the signal source for LINE 3.
17. **CD BALANCED L:** To connect the XLR signal cable (balanced cable) from the left output of the CD player.
18. **CD BALANCED R:** To connect the XLR signal cable (balanced cable) from the right output of the CD player.
19. **BALANCED OUT L:** To connect the XLR signal cable (balanced cable) from the left input of the power amp.
20. **BALANCED OUT R:** To connect the XLR signal cable (balanced cable) from the right input of the power amp.
21. **OUT 1 L+R:** Connect this output with a cinch signal cable to the input of your power amp.
22. **OUT 2 L+R:** To connect the XLR signal cable (balanced cable) from the right input of the extra power amp or surround processor.
23. **Control Out:** To connect the optical cable going to another Sphinx component.
24. **Warning!** This shows important information about the safety regulations for the Project Two Mk2.
25. **AC Power:** Connect the mains cable to a mains power outlet (230 - 240 VAC).
26. **O / I:** This is the mains power switch.
27. **Fuse holder:** Contains a fuse (500 mA slow).
28. **Selector for power supply voltage** (120/240 V), (115/230 V).

5. OPERATION

Connect the mains cable to a mains outlet. Once you have finished connecting all components, you can power on the Project Two Mk2 with the mains switch **O / I** (26.).

The volume control will then automatically turn counter-clockwise and, for a while, the STANDBY LED will blink red/green, after which it will remain red.

The pre-amp is now in standby mode.

Power on

You switch the amp on with the STANDBY button. That way, all circuits will remain at optimum operating temperatures and the audio quality will be 100% immediately after switching on. Additionally it significantly increases the life span of the component.

The pre-amp will select the CD SYM input after which it un-mutes the output.

Selecting an input

You select the input with the large rotary knob INPUT:

clockwise to the right of the selected one,
anti-clockwise to the left of the selected one.
Upon reaching LINE 3 or CD SYM you cannot 'roll over' to CD SYM or LINE 3 respectively.

As long as you move the knob, only the LED's will change: the current selected input remains active. The new input only becomes active after you have selected it and released the INPUT knob. You will hear a 'click'. This is caused by the precision relays for the inputs: the 'old' one is released while the new one is energised.

Adjusting the volume level

The large VOLUME control to the right adjusts the volume level from OFF to maximum (fully clockwise). The level change is immediate.

Memory mode

The Project Two Mk2 has a MEMORY mode: it automatically selects the last input that was active before you switched the component off with the stand-by button.

Power off




You switch the Project Two Mk2 off (to stand-by) with the STANDBY button (2.).



6. SPHINX REMOTE CONTROL

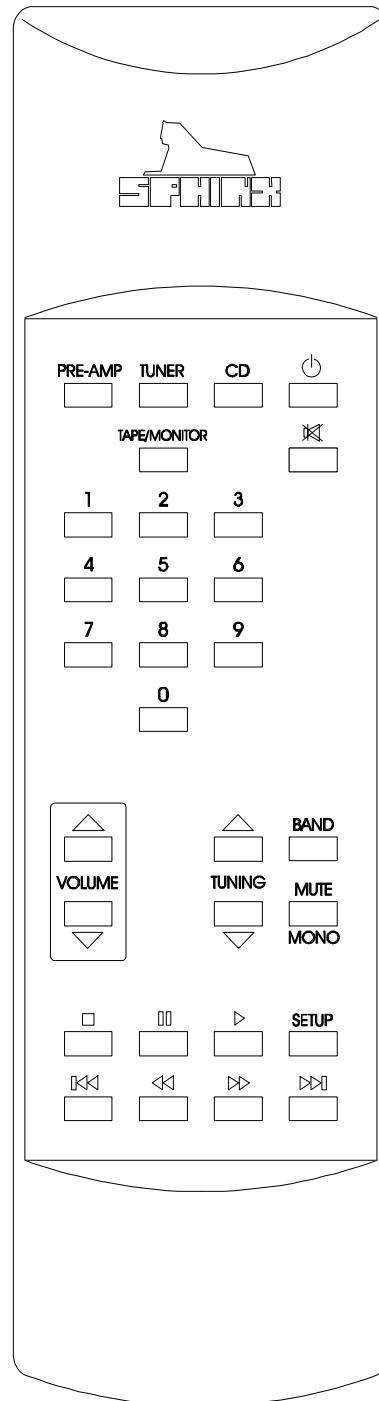
This single Sphinx Remote Control lets you control all functions: not only of the Project Two Mk2, but also of all other Sphinx equipment.

Only the following buttons and indications on the Remote apply to the Project Two Mk2 (the others will not function):

Buttons and LED indication

1. **PRE-AMP:** To select the pre-amp.
All buttons pressed hereafter will control only the pre-amp functions.
Note: TUNER and CD have no function.
2. **STANDBY:** Use this button to switch the Project Two Mk2 to stand-by.
3.  : Pressing this button mutes the outputs (temporarily) and you will not hear any sound. The red LED will be illuminated. Another press on this button un-mutes the outputs.
4. **TAPE/MONITOR:** Use this button to select the Tape IN input. Pressing this button has the same effect as pressing the TAPE button on the front panel.
Note: The LED of the selected input (see 4.) will remain illuminated.
5. **1 - 6:** To select inputs CD SYM to LINE 3
(Note: 7, 8, 9 and 0 do not function):
 - 1 CD SYM balanced CD input
 - 2 CD unbalanced CD input
 - 3 TUNER unbalanced Tuner
 - 4 LINE 1 unbalanced line input 1
 - 5 LINE 2 unbalanced line input 2
 - 6 LINE 3 unbalanced line input 3
6.  -button: Pressing this big triangular button has the same effect as rotating the VOLUME control on the front panel clockwise. You increase the volume and the volume control will turn clockwise.
7.  -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 and the volume control will turn counter-clockwise.

Note: The  - and  -button by default control volume of the Project Two Mk2 only, even if you have selected Tuner or CD.



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 sends 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. 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).

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, penlight or AAA (one of these codes is indicated on the packaging and the batteries). You may also use rechargeable 1.5 V batteries.

Note: Position the new batteries exactly as shown in the illustration at the bottom of the battery compartment, otherwise the remote control does not function!

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

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

7. TECHNICAL SPECIFICATIONS

Bandwidth	0 - 500,000 Hz (+0/-3 dB)
Phase response error	<0.5°
Gain	18 dB max.
THD+N (IHF-A)	<0.0015% (2nd harm., 10 - 20,000 Hz)
IMD	<0.003%
S/N ratio (IHF-A)	>100dB
Channel separation	>100 dB
Inputs	1x XLR balanced 5x cinch unbalanced (gold-plated)
level, nominal (for 1 V output)	0.13 V (-18 dBV)
impedance	XLR: 10 kohm / cinch: 50 kohm
Outputs	1x XLR balanced 2x cinch unbalanced (gold-plated) 1x cinch Tape (gold-plated)
level	9.2 V max. (19.3 dBV) (1 - 100,000 Hz, THD <0.002%)
impedance	<10 ohm
Volume control	ALPS motorised
channel imbalance	less than 2 dB
Sphinx Control	1x optical
Remote control	full function
Mechanical decoupling of housing	Transrotor absorbing 'pucks'
Power supply	external, completely stabilised
Supply capacitance	35,200 µF total
Power consumption	15 W stand-by 17,5 W 'on'
Dimensions (h x w x d)	68 x 482 x 328 mm
Weight	11 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.

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8. ADJUSTMENT PROCEDURES

The Project Two Mk2 only has two parameters that might need adjustment:

- **Bias:** to set the bias current and bias voltage of the amplifier.
- **Offset:** to set the DC-offset voltage of the output.

These adjustments might be necessary when the amplifier has been used for a period of time (and settings have changed due to ageing) or when a part of the Project Two Mk2 have been replaced.

After opening the Project Two Mk2 (by removing the 6 screws in the bottom), the following sections will be visible:

- The Mains Transformer.
- The Main Print Board with inputs, outputs, the dual power supply and both amps.
- The Display Print Board.

Bias and Offset

Both adjustment procedures use the same controls: potmeters P1 & P2 (Left Channel) and potmeters P3 & P4 (Right Channel).

At first both Bias parameters should be set (re. the bias current and bias voltage of output transistors). The positive and negative bias are adjusted separately.

This may result in an output DC-offset voltage which has to be adjusted afterwards.

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 Two Mk2" at page 13).

By connecting a DC-coupled power amp to the Project Two Mk 2 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.

Initial Set-up

- Connect a low distortion signal generator (<0.002% internal distortion) to an input of the pre-amp.
- Connect the distortion analyser input, the DC mV-meter and the oscilloscope to an output of the pre-amp.

Bias / Offset Adjustment

- Short-circuit the input.
- Measure the voltage across resistor R102 (Left) and R110 (Right). Both should read 9 V (+/- 500 mV).
Adjust the value with potmeter P1 (Left) and potmeter P3 (Right), **see file Pj2Adjust.PDF**. This will set the bias for one side of the differential amp.
The Offset is not important.
- Measure the voltage across resistor R117 (Right) and R109 (Left). Both should read 9 V (+/- 500 mV).
Adjust the value with potmeter P4 (Right) and potmeter P2 (Left), **see file Pj2Adjust.PDF**. This will set the bias for the other side of the differential amp.

The Offset should now also be correct (<1 mV). Although due to small variances in components it may be higher so you have to re-adjust it.

- Turn the volume control to MAX.
The mV-meter should show an Offset of less than 1 mV. If this is not the case please re-adjust the value with potmeters P1 and P2 (Left) and/or P3 and P4 (Right).
- Select a 1V / 1 kHz signal at the function generator.
- Check the output for the correct THD (<0.005%) and clip-level (>10 V).
- If all values are correct this will indicate the Project Two Mk2 is properly adjusted and the procedure is now completed.

9. PROBLEMS AND SOLUTIONS

At the moment of writing the Project Two Mk2 has two known specific problems. 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.

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.

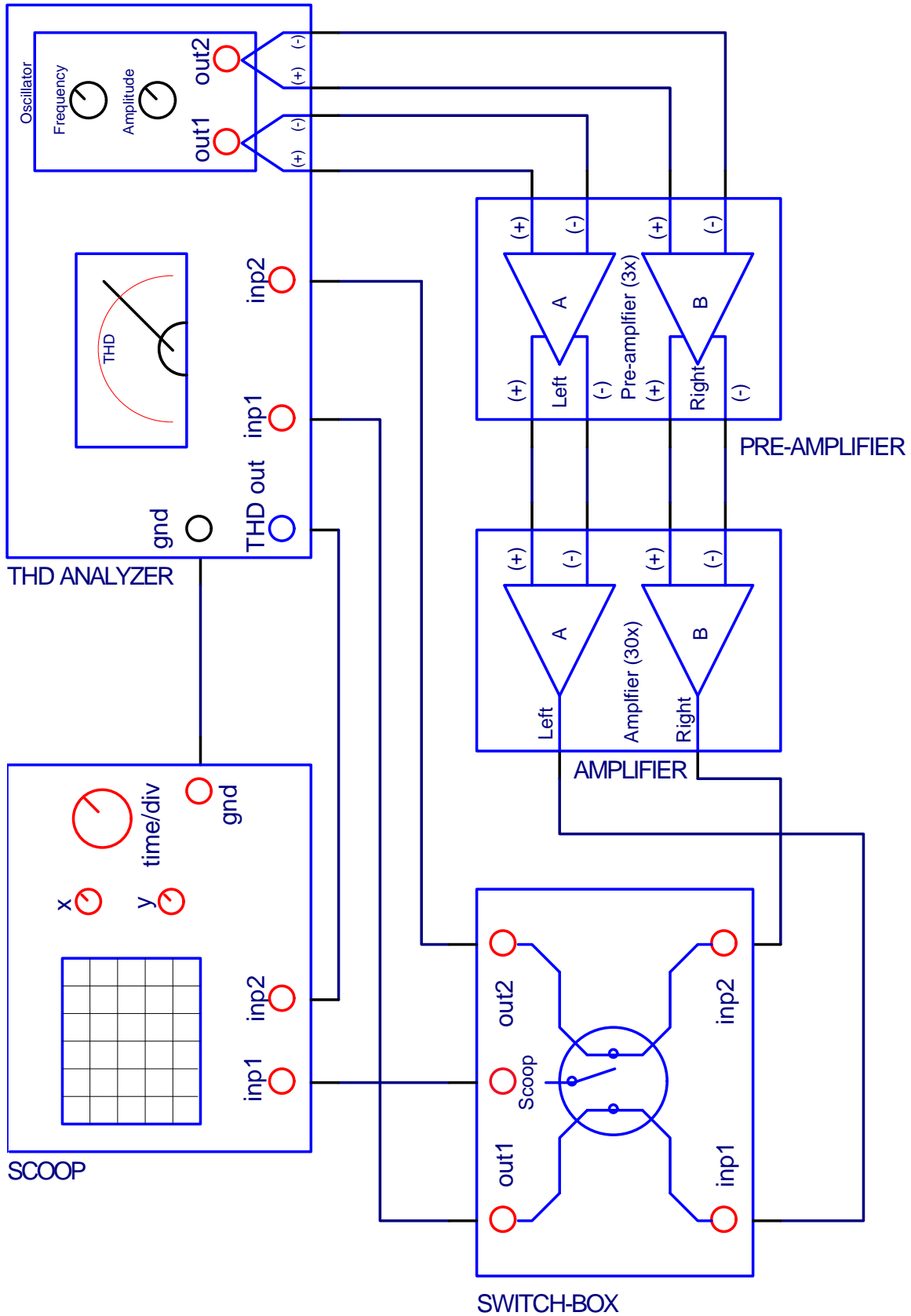
Problem	Cause	Solution	Refer to page/file
Volume potmeter has not enough gain range	Overall Gain of pre-amp is too high	Change R76 (left channel) and R85 (right channel) from 3k33 to 1k8.	Pj2Adjust.PDF
Oscillation problem at balanced output	Not enough frequency compensation across U2 and U3	Install a ceramic condenser (56 pF / 50 V) between pin 2 and pin 6 of U2 and U3	Pj2Adjust.PDF

10. DIAGRAMS AND PARTS LISTS

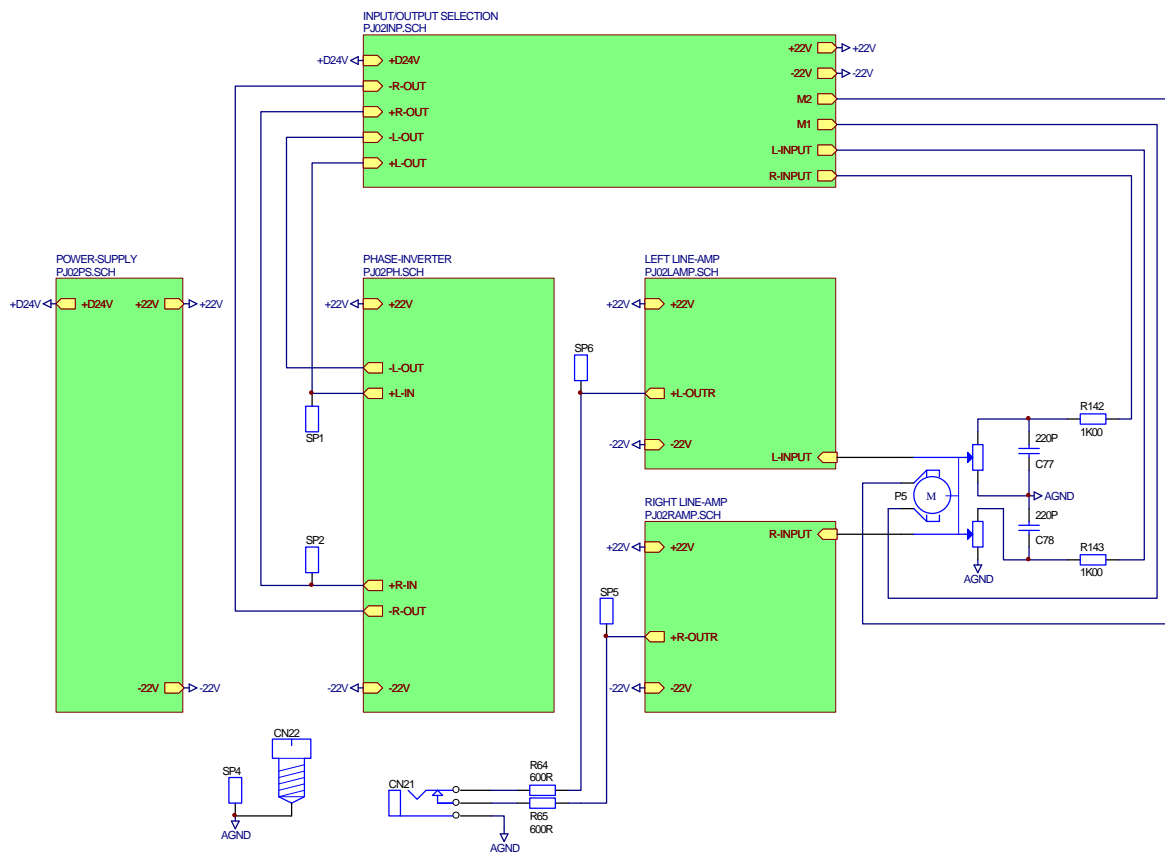
The next pages contain a complete set of schematic drawings including the associated parts lists (if applicable).

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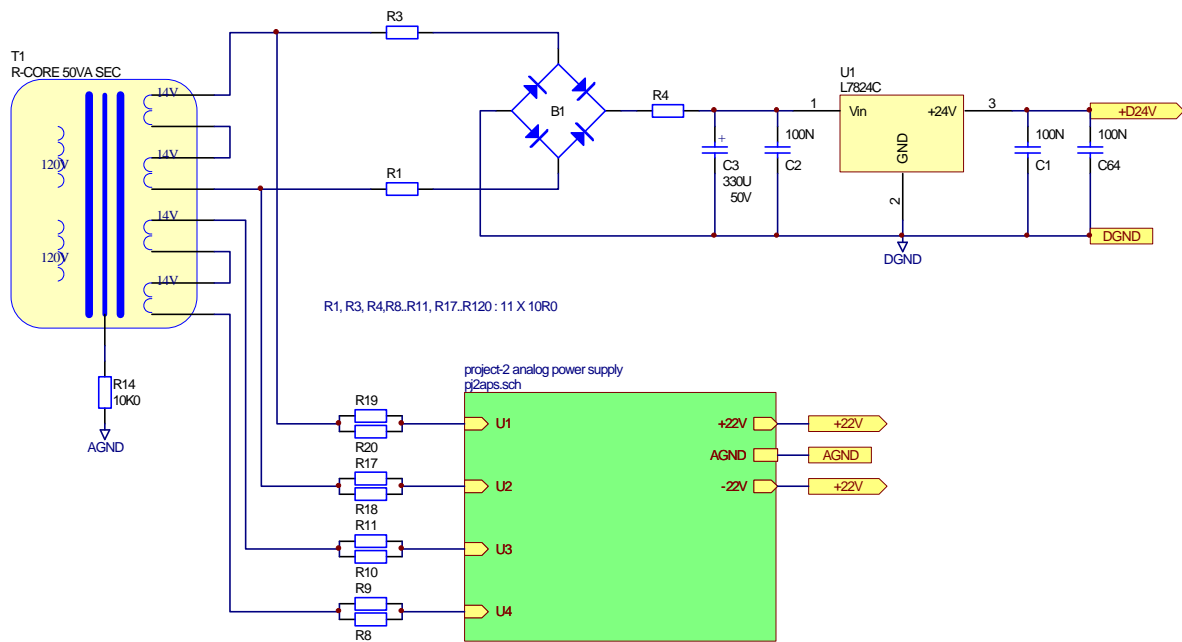
Connection Diagram for testing the Project 2 Mk2



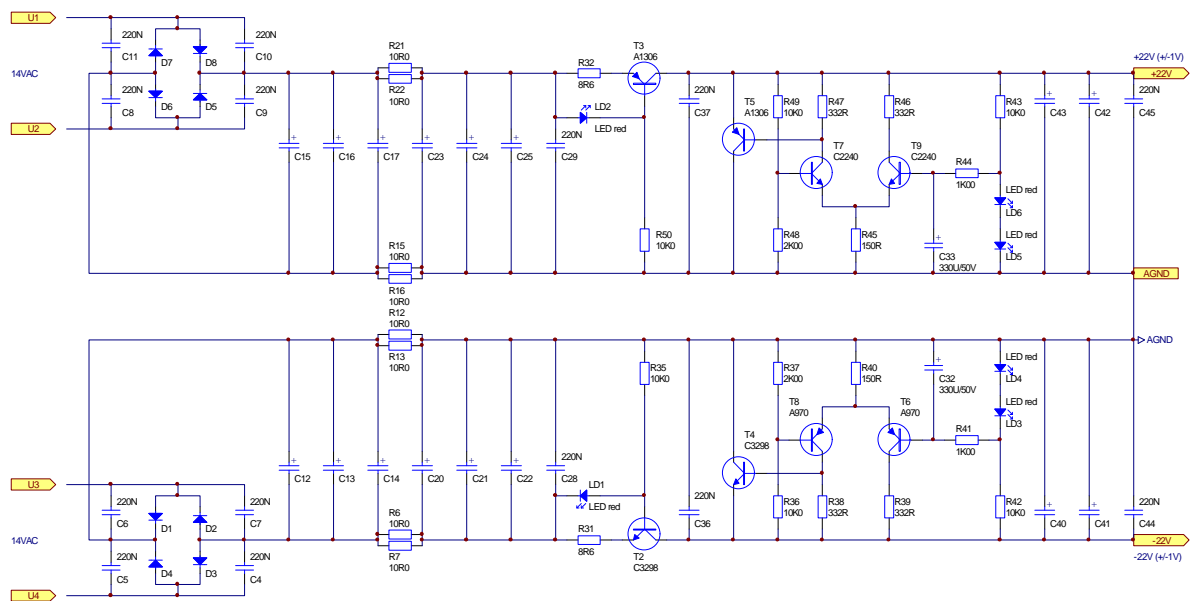
Schematic overview of Project 2 mainboard



Project 2 power supply overview

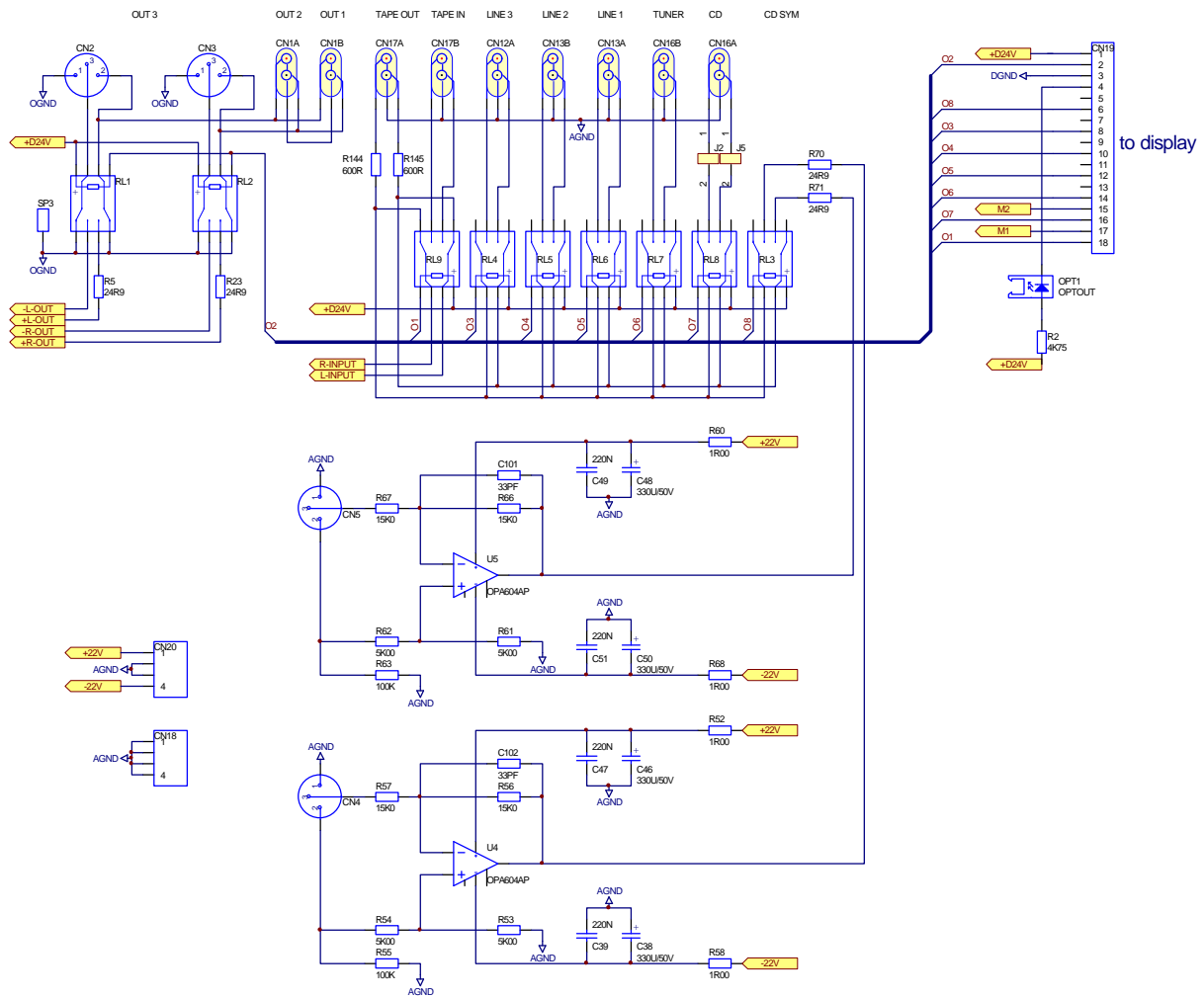


Project 2 power supply

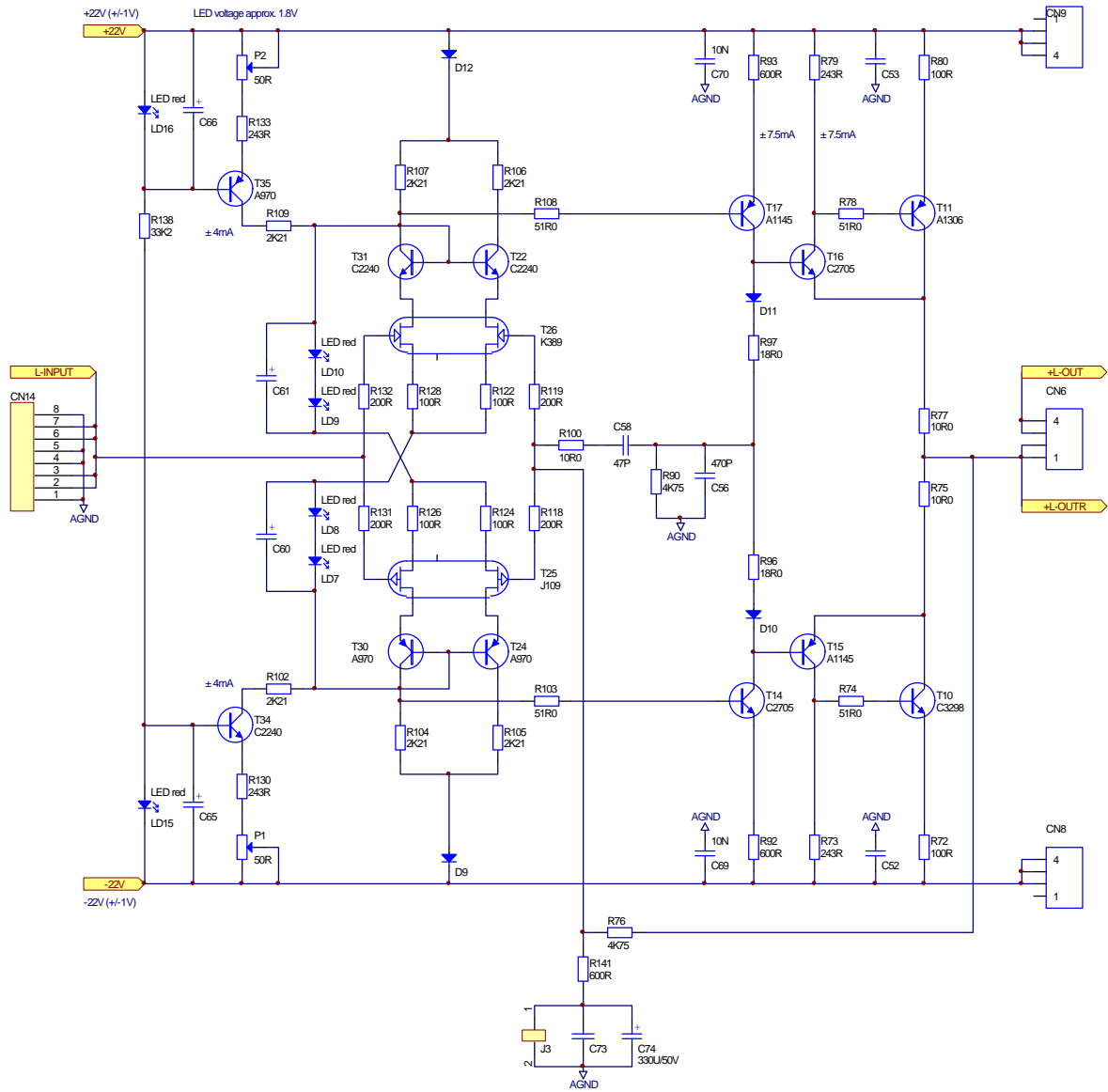


D1, D8 : 6 X 1N4001
 C12, C17
 C20, C25 : 16 X 2200µF63V
 C40, C43

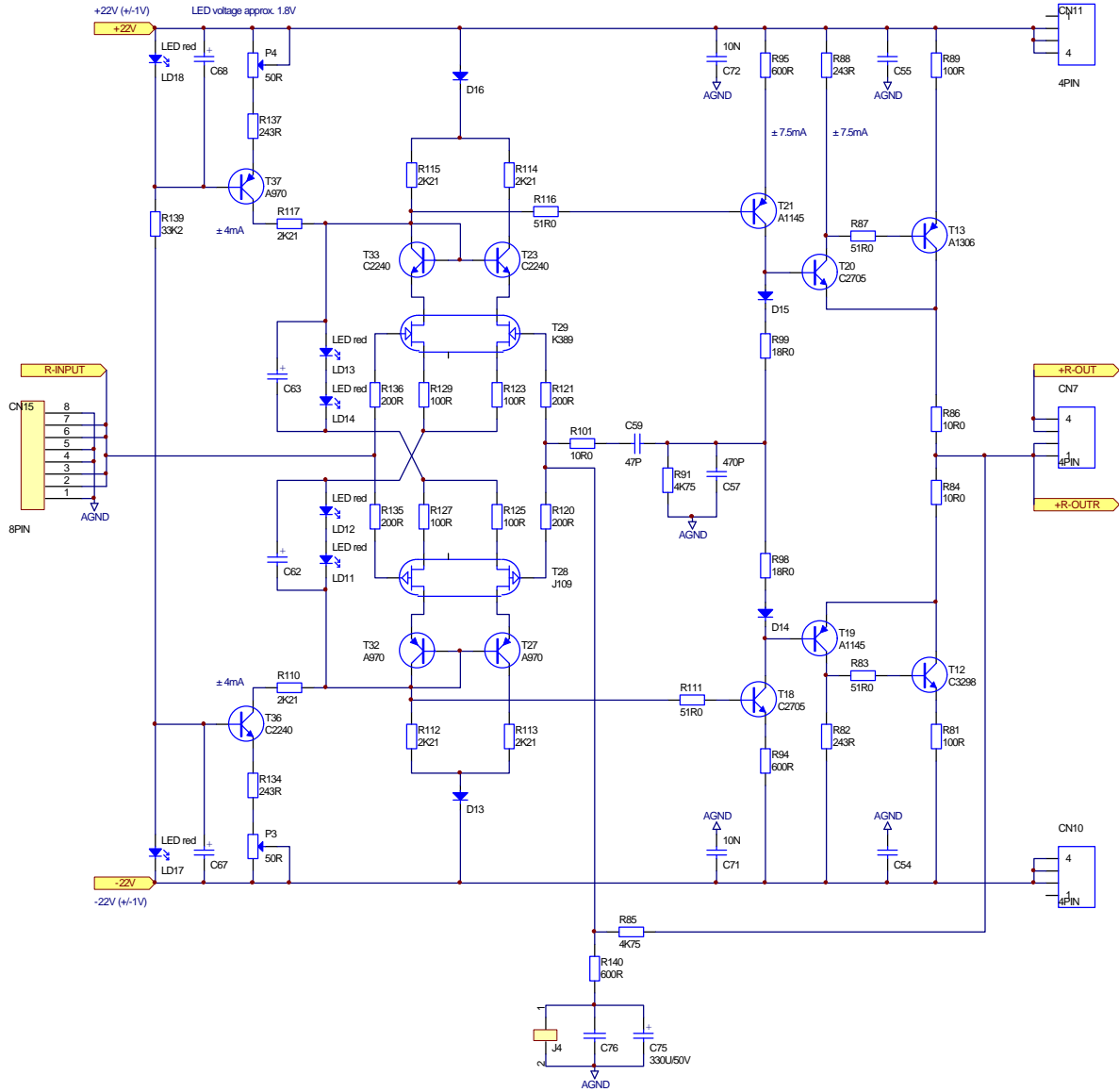
Project 2 input selection



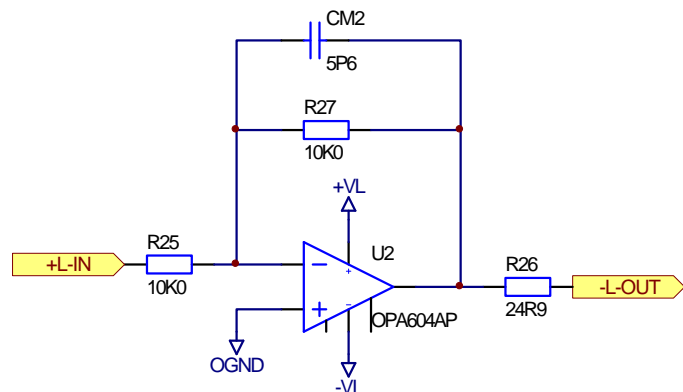
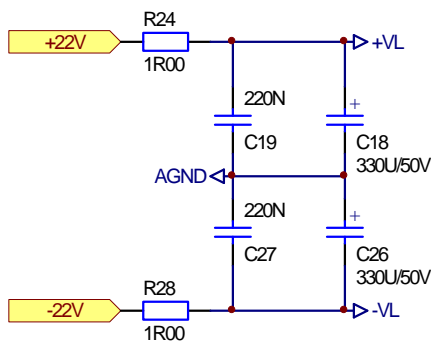
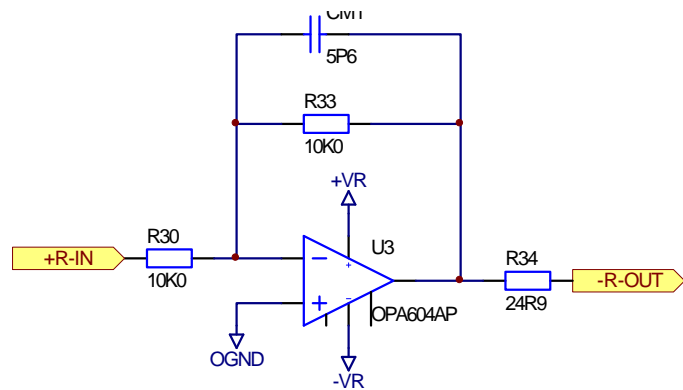
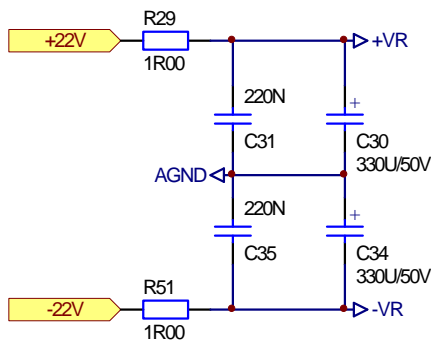
Project 2 left pre-amp



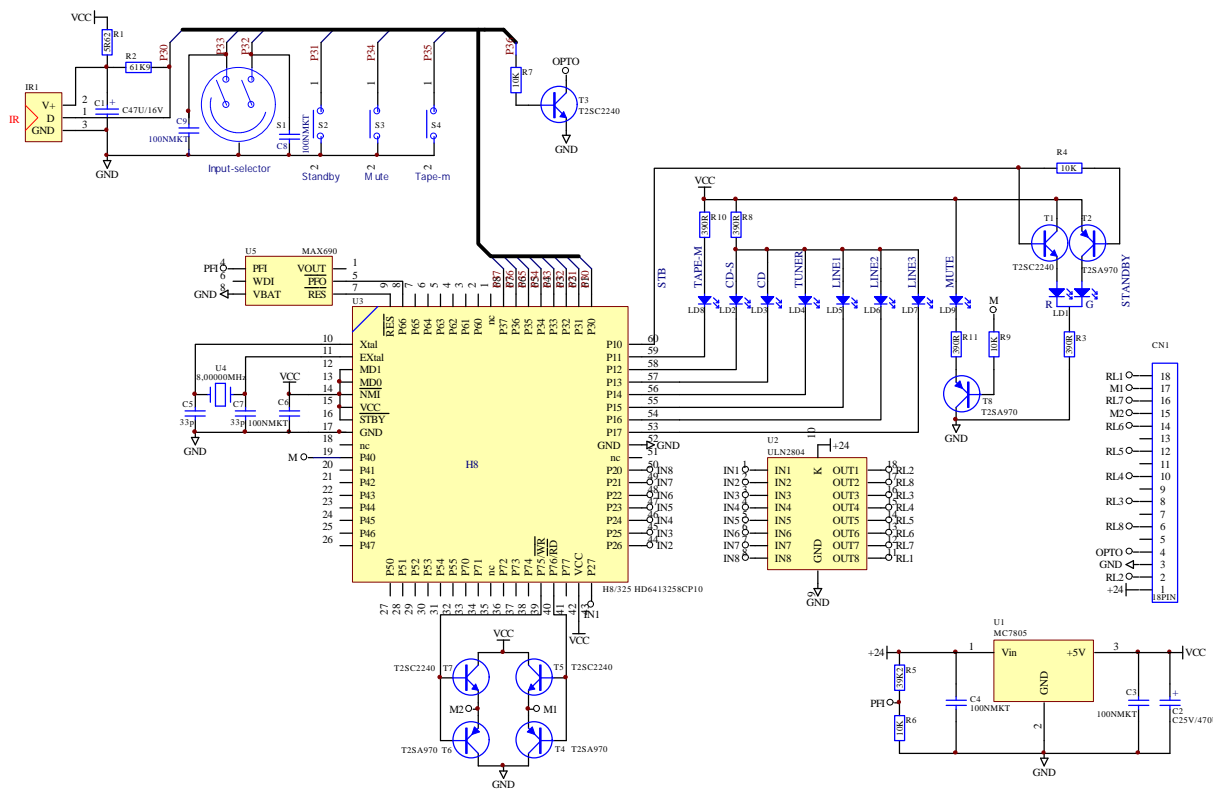
Project 2 right pre-amp



Project 2 phase inverter



Project 2 display



PCB 026018-AS-S15W

1

PCB drawings of Project 2 Mk2

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 (Adobe Acrobat 3.0 Reader).

- Pj2Main.PDF for Mainboard
- Pj2Display.PDF for Displayboard
- Pj2Adjust.PDF for adjustment procedures

Partlist pre-amp

Designator	Part Type	Description
B1	W02M	Bridge rectifier
C1	100nF	MKT capacitor
C10	220nF	MKT capacitor
C101	33pF	Ceramic capacitor
C102	33pF	Ceramic capacitor
C11	220nF	MKT capacitor
C12	2200uF/63V	Electrolytic capacitor
C13	2200uF/63V	Electrolytic capacitor
C14	2200uF/63V	Electrolytic capacitor
C15	2200uF/63V	Electrolytic capacitor
C16	2200uF/63V	Electrolytic capacitor
C17	2200uF/63V	Electrolytic capacitor
C18	330uF/50V	Electrolytic capacitor
C19	220nF	MKT capacitor
C2	100nF	MKT capacitor
C20	2200uF/63V	Electrolytic capacitor
C21	2200uF/63V	Electrolytic capacitor
C22	2200uF/63V	Electrolytic capacitor
C23	2200uF/63V	Electrolytic capacitor
C24	2200uF/63V	Electrolytic capacitor
C25	2200uF/63V	Electrolytic capacitor
C26	330uF/50V	Electrolytic capacitor
C27	220nF	MKT capacitor
C28	220nF	MKT capacitor
C29	220nF	MKT capacitor
C3	330uF/50V	Electrolytic capacitor
C30	330uF/50V	Electrolytic capacitor
C31	220nF	MKT capacitor
C32	330uF/50V	Electrolytic capacitor
C33	330uF/50V	Electrolytic capacitor
C34	330uF/50V	Electrolytic capacitor
C35	220nF	MKT capacitor
C36	220nF	MKT capacitor
C37	220nF	MKT capacitor
C38	330uF/50V	Electrolytic capacitor
C39	220nF	MKT capacitor
C4	220nF	MKT capacitor
C40	2200uF/63V	Electrolytic capacitor
C41	2200uF/63V	Electrolytic capacitor
C42	2200uF/63V	Electrolytic capacitor
C43	2200uF/63V	Electrolytic capacitor
C44	220nF	MKT capacitor
C45	220nF	MKT capacitor
C46	330uF/50V	Electrolytic capacitor
C47	220nF	MKT capacitor
C48	330uF/50V	Electrolytic capacitor
C49	220nF	MKT capacitor

Designator	Part Type	Description
C5	220nF	MKT capacitor
C50	330uF/50V	Electrolytic capacitor
C51	220nF	MKT capacitor
C52	220nF	MKT capacitor
C53	220nF	MKT capacitor
C54	220nF	MKT capacitor
C55	220nF	MKT capacitor
C56	470pF	Styroflex capacitor
C57	470pF	Styroflex capacitor
C58	47pF	Styroflex capacitor
C59	47pF	Styroflex capacitor
C6	220nF	MKT capacitor
C60	47uF/25V	Electrolytic capacitor
C61	47uF/25V	Electrolytic capacitor
C62	47uF/25V	Electrolytic capacitor
C63	47uF/25V	Electrolytic capacitor
C64	100nF	MKT capacitor
C65	47uF/25V	Electrolytic capacitor
C66	47uF/25V	Electrolytic capacitor
C67	47uF/25V	Electrolytic capacitor
C68	47uF/25V	Electrolytic capacitor
C69	10nF	MKT capacitor
C7	220nF	MKT capacitor
C70	10nF	MKT capacitor
C71	10nF	MKT capacitor
C72	10nF	MKT capacitor
C73	220nF	MKT capacitor
C74	330uF/50V	Electrolytic capacitor
C75	330uF/50V	Electrolytic capacitor
C76	220nF	MKT capacitor
C77	220pF	Styroflex capacitor
C78	220pF	Styroflex capacitor
C8	220nF	MKT capacitor
C9	220nF	MKT capacitor
CM1	56pF	Ceramic capacitor
CM2	56pF	Ceramic capacitor
CN1	CINCH4P	Cinch plug
CN10	4PIN	4 pins header
CN11	4PIN	4 pins header
CN12	CINCH2P	Cinch plug
CN13	CINCH4P	Cinch plug
CN14	8PIN	8 pins header
CN15	8PIN	8 pins header
CN16	CINCH4P	Cinch plug
CN17	CINCH4P	Cinch plug
CN18	4PIN	4 pins header
CN19	18PIN	4 pins header
CN2	XLR-M	XLR connector male
CN20	4PIN	4 pins header

Designator	Part Type	Description
CN21	PHONEJACK	Phone jack
CN22	KAST_GND	Ground connection with case
CN3	XLR-Male	XLR connector male
CN4	XLR-Female	XLR connector female
CN5	XLR-Female+B51	XLR connector female
CN6	4PIN	4 pins header
CN7	4PIN	4 pins header
CN8	4PIN	4 pins header
CN9	4PIN	4 pins header
D1	1N4001	Diode
D10	1N4148	Diode
D11	1N4148	Diode
D12	1N4148	Diode
D13	1N4148	Diode
D14	1N4148	Diode
D15	1N4148	Diode
D16	1N4148	Diode
D2	1N4001	Diode
D3	1N4001	Diode
D4	1N4001	Diode
D5	1N4001	Diode
D6	1N4001	Diode
D7	1N4001	Diode
D8	1N4001	Diode
D9	1N4148	Diode
J2	Jumper	Jumper
J5	Jumper	Jumper
LD1	LED red	LED red
LD10	LED red	LED red
LD11	LED red	LED red
LD12	LED red	LED red
LD13	LED red	LED red
LD14	LED red	LED red
LD15	LED red	LED red
LD16	LED red	LED red
LD17	LED red	LED red
LD18	LED red	LED red
LD2	LED red	LED red
LD3	LED red	LED red
LD4	LED red	LED red
LD5	LED red	LED red
LD6	LED red	LED red
LD7	LED red	LED red
LD8	LED red	LED red
LD9	LED red	LED red
OPT1	173298-2	Optical output

Designator	Part Type	Description
P1	50R	Adjustable pot.
P2	50R	Adjustable pot.
P3	50R	Adjustable pot.
P4	50R	Adjustable pot.
P5	ALPS POT M	Stereo motor pot.
R1	10R0	Resistor MRS25
R10	10R0	Resistor MRS25
R100	10R0	Resistor MRS25
R101	10R0	Resistor MRS25
R102	2K21	Resistor MRS25
R103	51R0	Resistor MRS25
R104	2K21	Resistor MRS25
R105	2K21	Resistor MRS25
R106	2K21	Resistor MRS25
R107	2K21	Resistor MRS25
R108	51R0	Resistor MRS25
R109	2K21	Resistor MRS25
R11	10R0	Resistor MRS25
R110	2K21	Resistor MRS25
R111	51R0	Resistor MRS25
R112	2K21	Resistor MRS25
R113	2K21	Resistor MRS25
R114	2K21	Resistor MRS25
R115	2K21	Resistor MRS25
R116	51R0	Resistor MRS25
R117	2K21	Resistor MRS25
R118	200R	Resistor MRS25
R119	200R	Resistor MRS25
R12	10R0	Resistor MRS25
R120	200R	Resistor MRS25
R121	200R	Resistor MRS25
R122	100R	Resistor MRS25
R123	100R	Resistor MRS25
R124	100R	Resistor MRS25
R125	100R	Resistor MRS25
R126	100R	Resistor MRS25
R127	100R	Resistor MRS25
R128	100R	Resistor MRS25
R129	100R	Resistor MRS25
R13	10R0	Resistor MRS25
R130	243R	Resistor MRS25
R131	200R	Resistor MRS25
R132	200R	Resistor MRS25
R133	243R	Resistor MRS25
R134	243R	Resistor MRS25
R135	200R	Resistor MRS25
R136	200R	Resistor MRS25
R137	243R	Resistor MRS25
R138	33K2	Resistor MRS25

Designator	Part Type	Description
R139	33K2	Resistor MRS25
R14	10K0	Resistor MRS25
R140	600R	Resistor MRS25
R141	600R	Resistor MRS25
R142	1K00	Resistor MRS25
R143	1K00	Resistor MRS25
R144	600R	Resistor MRS25
R145	600R	Resistor MRS25
R15	10R0	Resistor MRS25
R16	10R0	Resistor MRS25
R17	10R0	Resistor MRS25
R18	10R0	Resistor MRS25
R19	10R0	Resistor MRS25
R2	4K75	Resistor MRS25
R20	10R0	Resistor MRS25
R21	10R0	Resistor MRS25
R22	10R0	Resistor MRS25
R23	24R9	Resistor MRS25
R24	1R00	Resistor MRS25
R25	10K0	Resistor MRS25
R26	24R9	Resistor MRS25
R27	10K0	Resistor MRS25
R28	1R00	Resistor MRS25
R29	1R00	Resistor MRS25
R3	10R0	Resistor MRS25
R30	10K0	Resistor MRS25
R31	8R6	Resistor MRS25
R32	8R6	Resistor MRS25
R33	10K0	Resistor MRS25
R34	24R9	Resistor MRS25
R35	10K0	Resistor MRS25
R36	10K0	Resistor MRS25
R37	2K00	Resistor MRS25
R38	332R	Resistor MRS25
R39	332R	Resistor MRS25
R4	10R0	Resistor MRS25
R40	150R	Resistor MRS25
R41	1K00	Resistor MRS25
R42	10K0	Resistor MRS25
R43	10K0	Resistor MRS25
R44	1K00	Resistor MRS25
R45	150R	Resistor MRS25
R46	332R	Resistor MRS25
R47	332R	Resistor MRS25
R48	2K00	Resistor MRS25
R49	10K0	Resistor MRS25
R5	24R9	Resistor MRS25
R50	10K0	Resistor MRS25
R51	1R00	Resistor MRS25
R52	1R00	Resistor MRS25

Designator	Part Type	Description
R53	5K00	Resistor MRS25
R54	5K00	Resistor MRS25
R55	100K	Resistor MRS25
R56	15K0	Resistor MRS25
R57	15K0	Resistor MRS25
R58	1R00	Resistor MRS25
R6	10R0	Resistor MRS25
R60	1R00	Resistor MRS25
R61	5K00	Resistor MRS25
R62	5K00	Resistor MRS25
R63	100K	Resistor MRS25
R64	600R	Resistor MRS25
R65	600R	Resistor MRS25
R66	15K0	Resistor MRS25
R67	15K0	Resistor MRS25
R68	1R00	Resistor MRS25
R7	10R0	Resistor MRS25
R70	24R9	Resistor MRS25
R71	24R9	Resistor MRS25
R72	100R	Resistor MRS25
R73	243R	Resistor MRS25
R74	51R0	Resistor MRS25
R75	10R0	Resistor MRS25
R76	4K75	Resistor MRS25
R77	10R0	Resistor MRS25
R78	51R0	Resistor MRS25
R79	243R	Resistor MRS25
R8	10R0	Resistor MRS25
R80	100R	Resistor MRS25
R81	100R	Resistor MRS25
R82	243R	Resistor MRS25
R83	51R0	Resistor MRS25
R84	10R0	Resistor MRS25
R85	4K75	Resistor MRS25
R86	10R0	Resistor MRS25
R87	51R0	Resistor MRS25
R88	243R	Resistor MRS25
R89	100R	Resistor MRS25
R9	10R0	Resistor MRS25
R90	4K75	Resistor MRS25
R91	4K75	Resistor MRS25
R92	600R	Resistor MRS25
R93	600R	Resistor MRS25
R94	600R	Resistor MRS25
R95	600R	Resistor MRS25
R96	18R0	Resistor MRS25
R97	18R0	Resistor MRS25
R98	18R0	Resistor MRS25
R99	18R0	Resistor MRS25

Designator	Part Type	Description
RL1	Alcatel 24V MT2	DIL relay
RL2	Alcatel 24V MT2	DIL relay
RL3	Alcatel 24V MT2	DIL relay
RL4	Alcatel 24V MT2	DIL relay
RL5	Alcatel 24V MT2	DIL relay
RL6	Alcatel 24V MT2	DIL relay
RL7	Alcatel 24V MT2	DIL relay
RL8	Alcatel 24V MT2	DIL relay
RL9	Alcatel 24V MT2	DIL relay
SP1	SILPAD	Soldering pad
SP2	SILPAD	Soldering pad
SP3	SILPAD	Soldering pad
SP4	SILPAD	Soldering pad
SP5	SILPAD	Soldering pad
SP6	SILPAD	Soldering pad
T1	R-CORE 50VA SEC	Transformer
T10	2SC3298	Transistor
T11	2SA1306	Transistor
T12	2SC3298	Transistor
T13	2SA1306	Transistor
T14	2SC2240	Transistor
T15	2SA1145	Transistor
T16	2SC2705	Transistor
T17	2SA1145	Transistor
T18	2SC2240	Transistor
T19	2SA1145	Transistor
T2	2SC3298	Transistor
T20	2SC2705	Transistor
T21	2SA1145	Transistor
T22	2SC2240	Transistor
T23	2SC2240	Transistor
T24	2SA970	Transistor
T25	2SJ109	Dual P-JFET
T26	2SK389	Dual N-JFET
T27	2SA970	Transistor
T28	2SJ109	Dual P-JFET
T29	2SK389	Dual N-JFET
T3	2SA1306	Transistor
T30	2SA970	Transistor
T31	2SC2240	Transistor
T32	2SA970	Transistor
T33	2SC2240	Transistor
T34	2SC2240	Transistor
T35	2SA970	Transistor
T36	2SC2240	Transistor
T37	2SA970	Transistor
T4	2SC3298	Transistor

Designator	Part Type	Description
T5	2SA1306	Transistor
T6	2SA970	Transistor
T7	2SC2240	Transistor
T8	2SA970	Transistor
T9	2SC2240	Transistor
U1	L7824C	Voltage regulator
U2	OPA604AP	IC
U3	OPA604AP	IC
U4	OPA604AP	IC
U5	OPA604AP	IC

Partlist display

Designator	Part Type	Description
C1	47uF/16V	Electrolytic capacitor
C2	470uF/25V	Electrolytic capacitor
C3	100nF	MKT capacitor
C4	100nF	MKT capacitor
C5	33pF	Ceramic capacitor
C6	100nF	MKT capacitor
C7	33pF	Ceramic capacitor
C8	100nF	MKT capacitor
C9	100nF	MKT capacitor
CN1	18PIN	18 pins header
IR1	SHARP GP1U5	Infrared receiver
LD1	LD2C	LED
LD2	TLL46221C	LED red
LD3	TLL46221C	LED red
LD4	TLL46221C	LED red
LD5	TLL46221C	LED red
LD6	TLL46221C	LED red
LD7	TLL46221C	LED red
LD8	TLL46221C	LED red
LD9	TLL46221C	LED red
R1	5R62	Resistor MRS25
R10	390R	Resistor MRS25
R11	390R	Resistor MRS25
R2	61K9	Resistor MRS25
R3	390R	Resistor MRS25
R4	10K	Resistor MRS25
R5	39K2	Resistor MRS25
R6	10K	Resistor MRS25
R7	10K	Resistor MRS25
R8	390R	Resistor MRS25
R9	10K	Resistor MRS25
S1	ENCOJ-B24-AE0006	Switch
S2	ITW 60 1000	Switch
S3	ITW 60 1000	Switch
S4	ITW 60 1000	Switch
T1	2SC2240	Transistor
T2	2SA970	Transistor
T3	2SC2240	Transistor
T4	2SA970	Transistor
T5	2SC2240	Transistor
T6	2SA970	Transistor
T7	2SC2240	Transistor

Designator	Part Type	Description
T8	2SA970	Transistor
U1	MC7805	IC
U2	ULN2804	IC
U3	H8/325 HD6413258CP10	IC
U4	8,00000MHz	X-TAL
U5	MAX690	IC

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