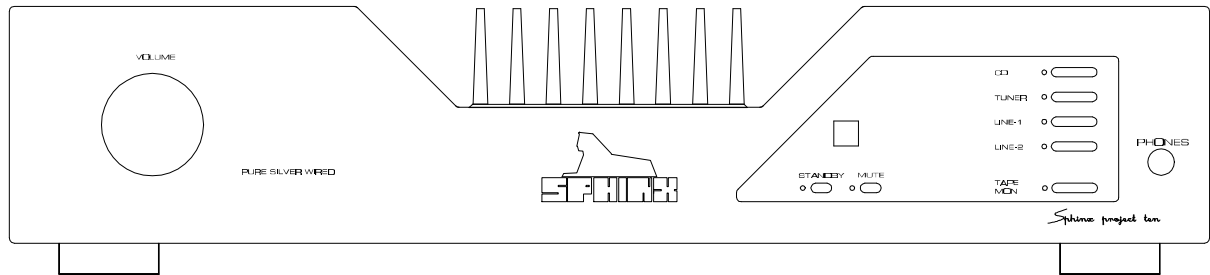


SERVICE MANUAL

PROJECT TEN

INTEGRATED STEREO AMPLIFIER



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The Sphinx Project Ten design

The Sphinx Project Ten 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 Ten Integrated Stereo Amplifier

This integrated high-end stereo amplifier is of exceptional quality. With exception of the balanced input section, it is of discrete design throughout (no IC's are used). The pre-amp section is built around Dual FET's and the amplifier is DC-coupled from input to output.

The two mono power amps (each channel is totally independent) use special power transistors with a power bandwidth of over 20 MHz, a very fast slew rate and an unsurpassed phase linearity over the power bandwidth. The amplifiers are therefore very stable and can effortlessly drive every type and format of loudspeaker (even the most complex ones such as electrostatic and magnetostatic...) at maximum quality.

All internal audio cabling is Siltech pure silver and the amp outputs are sent to the loudspeaker connectors via heavy duty, completely sealed gold-plated relays.

To obtain the maximum quality from this integrated 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 Ten 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 Ten.**

1. UNPACKING

Before leaving the factory every Project Ten 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 Ten in its original carton.

After unpacking the Project Ten 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.

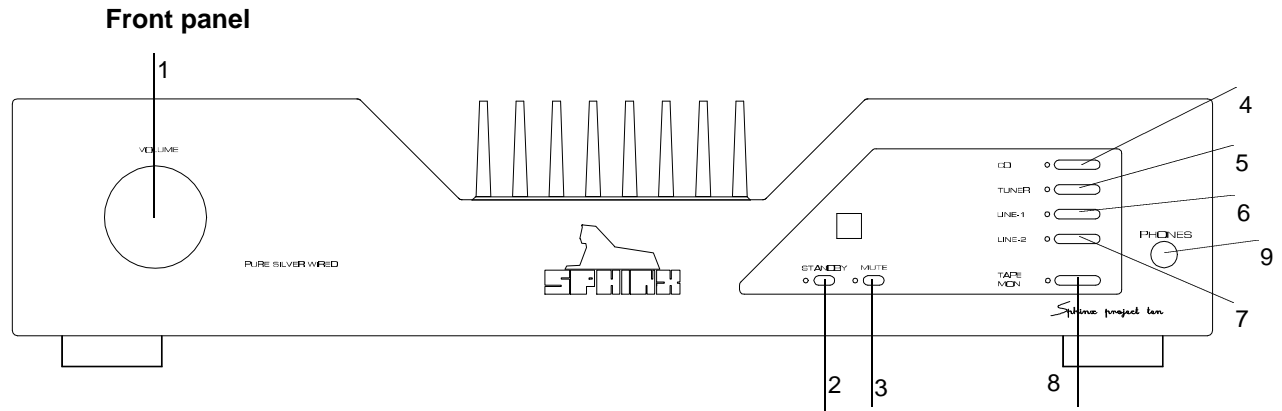
3. CONTACTING THE MANUFACTURER

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 AMP AT A GLANCE



1. **VOLUME:** With this motor-controlled knob you may adjust the volume of the loudspeakers. The volume can be controlled manually or via the optional Remote Control.

2. **STANDBY:** To switch the component on and off. When the component is 'off' (standby) this is indicated by the red LED. When the component is active the LED will be green.

3. **MUTE:** Press this button to temporarily mute the sound. The red LED will light.

4. **CD:** To select the CD input.

5. **TUNER:** To select the TUNER input.

6. **LINE 1:** To select the LINE 1 input.

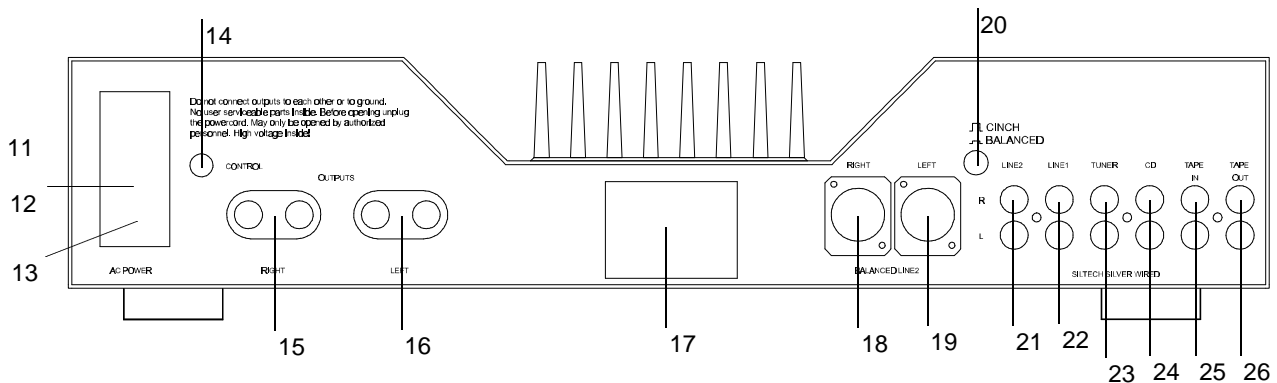
7. **LINE 2:** To select the LINE 2 input (cinch or balanced).

8. **TAPE MON:** To select the TAPE IN input.

As soon as you have pressed one of the buttons 5. to 9. the corresponding red LED next to it will light.

9. **PHONES:** To connect dynamic stereo headphones.

Rear panel



11. **ON/OFF:** This is the mains power switch.
12. **Fuse holder:** Contains a fuse (3.15 A slow).
13. **AC Power:** Connect the mains cable to a mains power outlet (230 - 240 VAC).
14. **CONTROL OUT:** To connect the optical cable going to another Sphinx component.
15. **RIGHT OUTPUT:** To connect the cable from the right loudspeaker:
red +
white -
16. **LEFT OUTPUT:** To connect the cable from the left loudspeaker:
red +
white -
17. **Manufacturer's label:** This shows important data for the component, such as serial number and mains power voltage.
18. **BALANCED LINE 2 RIGHT:** To connect the XLR signal cable (balanced cable) from the right output of the signal source for Input 2.
19. **BALANCED LINE 2 LEFT:** To connect the XLR signal cable (balanced cable) from the left output of the signal source for Input 2.
20. **CINCH/BALANCED:** This switch is to select the input connector for LINE 2:
out LINE 2 (cinch)
in BALANCED LINE 2
21. **LINE 2:** To connect the cinch signal cable from the signal source for LINE 2.
22. **LINE 1:** To connect the cinch signal cable from the signal source for LINE 1.
23. **TUNER:** To connect the cinch signal cable from the tuner.
24. **CD:** To connect the cinch signal cable from the CD player.
25. **TAPE IN:** Connect this input to the output of the recorder.
26. **TAPE OUT:** Connect this output to the Input of the recorder..

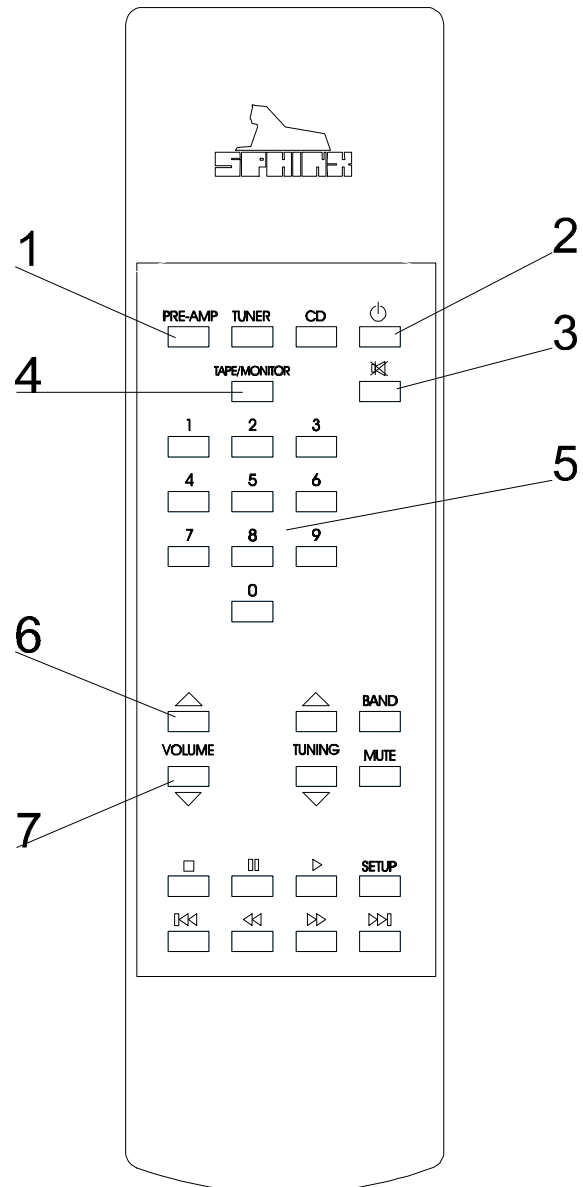
5. SPHINX REMOTE CONTROL

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

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

Buttons and LED indication

1. **PRE-AMP:** To select the amp. All buttons pressed hereafter will only control the amp functions. The buttons TUNER and CD will have no effect on the amp.
2. **STANDBY:** Use this red button to switch the Project Ten to stand-by.
3. **⏏** : Pressing this green 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 5.) will remain illuminated.
5. **1 - 4:** To select inputs CD to Line 2 .
1 CD
2 Tuner
3 Line1
4 Line 2
6. **⬆** button: Pressing this button has the same effect as clockwise rotating the VOLUME control on the front panel. You will increase the volume.
7. **⬇** button: Pressing this button has the same effect as anti-clockwise rotating the VOLUME control on the front panel. You will decrease the volume.



Operation

The Sphinx Remote is used for several different models and can therefore transmit different control codes, depending on which model has been selected with the select buttons (1.).

Important: Always press the PRE-AMP button before you send a command (even if you only have one Sphinx component).

If not 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 the 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

How to operate the Remote Control with the different Sphinx components will be explained in the corresponding User Manual of each component.

Batteries

The four batteries have a life span of approx. one year during normal use, but shorter when used more intensely.

Replacement batteries: 1.5 V, model *penlight* or AAA . 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 will not function!

Encountering problems...

Remote Control does not work	
Wrong component selected	Select the correct one
Distance to component exceeds 7 m	Use remote at closer range
Angle between Remote and component exceeds $\pm 30^\circ$	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
Component is not switched on (!)	Switch it on

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 it's original remote
Batteries of remote empty	Use new batteries

6. TECHNICAL SPECIFICATIONS

Bandwidth	0 - 60,000 Hz (+0/-3 dB with RF input filter)
Phase response error	<15° (from 0 - 20,000 Hz)
Gain	21 dB max.
Minimum Power Output (1 - 20,000 Hz)	>2x 80 W into 8 Ω (19.0 dBW), THD <0.01% >2x 120 W into 4 Ω (20.8 dBW), THD <0.02% >2x 160 W into 2 Ω (22.0 dBW), THD <0.02%
Output voltage / current, max.	34 V / 20 A
THD+N (IHF-A)	<0.01% (80 W into 8 Ω)
IMD	<0.03%
S/N ratio (IHF-A)	>106 dB
Channel separation	>80 dB (1 - 20,000 Hz)
Slew rate	>25 V/μs
Damping factor	>200 (1 - 20,000 Hz)
Inputs	
XLR, balanced	1x Line 2
cinch, unbalanced	1x Line 2, 1x Line 1, 1x CD, 1x Tuner, 1x Tape
level, nominal	0.15 V (-16.5 dBV) for 60 W into 8 Ω
impedance	20 kΩ (3 kΩ balanced)
Outputs	
cinch	1x Tape
level	10 V max. (20 dBV) (1 - 20,000 Hz, THD <0.01%)
headphones	1x 6.3 mm stereo jack, adjustable level
clamp	1x loudspeaker L, 1x loudspeaker R
Supply capacitance	54,400 μF per channel
Power consumption	480 W max. (57.5 W standby)
Dimensions (h x w x d)	110 x 482 x 330 mm
Weight	12 kg

This unit conforms to the EMC interference regulations from the EU and to the CE standards.
This unit complies with safety regulation VDE 0860 and thus with international safety regulation IEC 65.

Technical specifications can be changed by SPHINX without prior notice if technical developments make this necessary.

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7. GENERAL CHECKLIST

Before you test or service the Project Ten please check the following items. They will give information about the current status of the amplifier.

Protection modes

The Project Ten has one protection mode.

Short Circuit

If the Left or Right output is shorted, fuse Z1 or Z2 will blow respectively.

Standby mode

The Project Ten will switch to Standby Mode if the:

- Standby button on the front panel or
- Standby button on the Remote is pressed.

In this Mode the following will happen:

- The output relay is switched off.
- The Control Output will be activated (red light).
- The bias current for the Left and Right amplifiers is reduced to 0 mA thus greatly decreasing the operating temperature.

Necessary Equipment

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

For the correct measurement set-up and hook-up please refer to the drawing titled "Connection Connection diagram..." at pages 14 and 15.

- ❑ 2x **millivolt-meter** ($R_i > 1 \text{ M}\Omega$)
- ❑ 2x non-inductive **load resistor** $8 \Omega / 100 \text{ Watt}$
- ❑ 1x **harmonic distortion analyser** (internal distortion $< 0.0005\%$, measured without filters)
- ❑ 1x **2-channel oscilloscope** (minimum bandwidth $> 60 \text{ MHz}$)
- ❑ 1x **connection unit / switch box** (to connect scope, resistors and amp outputs to distortion analyser)
- ❑ 2x **shorting connector** (for balanced pre-amp inputs)
- ❑ 2x **balanced cable set** (to connect distortion analyser to Project Ten)

8. ADJUSTMENT PROCEDURES

The Project Ten is an integrated amplifier, meaning the pre-amp and power amp sections are combined into one cabinet.

The Project Ten only has two parameters for each channel (so four in total) that might need adjustment:

- **Bias:** to set the bias current and bias voltage of the amplifier for normal use.
- **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 Ten have been replaced.

Attention:

When re-adjusting any setting please ensure that there is no loudspeaker connected to the output! Otherwise the loudspeaker may be seriously damaged.

Attention:

The amplifier is able to generate high output voltages of over + or -40 V.
Please be very careful during the adjustments!

The Project Ten is a two channel amplifier. After removing the top cover plate you will see the Left and Right Channels clearly marked.

The power transistors are mounted underneath the heatsinks.

Bias

With this procedure you set the proper bias level for the power transistors. This ensures their Class A operation at low power levels.

Connect the amplifier according to the drawing "Connection Diagram Bias Adjustment" (page 14). The input of the amplifier must be shorted (by way of the MUTE function of the oscillator).

- Switch the amplifier ON and wait until it has reached the proper working temperature (this takes an hour).
- Set the millivolt-meter to the DC-range.
- Place the two measuring clips of the meter across one of the emitter resistors
Left: R267, R271, R273, R277
Right: R467, R471, R473, R477
(refer to schematic in Pj10main.PDF).
These resistors are positioned to the left of the power supply condensers.
- The level for each should be 40 mV DC (± 2 mV).
If not: adjust potmeter P202 (Left) or potmeter P402 (Right) until the level is 40 mV.
- Switch the oscillator on and set it to 1 kHz and a level of 0 dBu.
- Check the distortion with a THD analyser: it should be conform the specified values (0.01% IHF-A @ 1 – 20 kHz @ 80 W into 8 ohm).
- If this is correct the procedure is finished.
- You may now switch off the amplifier or continue with another adjustment procedure.

Offset

The Offset adjustment procedure minimises the DC offset value of the amplifier output. This DC offset is important when capacitive loads are used, such as electrostatic loudspeakers. These loudspeakers often use a very low-impedance step-up transformer. The amplifier 'sees' this load as a short for the DC voltage.

Connect the amplifier according to the drawing "Connection Diagram Offset Adjustment" (page 15).

The input of the amplifier must be shorted (by way of the MUTE function of the oscillator)..

Attention:

Do not connect speakers on the Project 10 when adjusting the offset.

Please be careful during the adjustments!

- Switch the amplifier ON and wait until it has reached the proper working temperature (this takes an hour).
- Set the millivolt-meter to the DC-range.
- Place the measurement clips of the meter over the output terminal.
- The level should not exceed +5 or -5 mV DC. If not: adjust potmeter P201 (Left) or P401 (Right) until the level is within this range.
- Switch the oscillator on and set it to 1 kHz and a level of 0 dBu.
- Check the distortion with a THD analyser: it should conform the specified values (0.01% IHF-A @ 1 - 20 kHz).
- If this is correct the procedure is finished.
- You may now switch off the amplifier or continue with another adjustment procedure.

9. PROBLEMS AND SOLUTIONS

At the moment of writing the Project Ten has no 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.

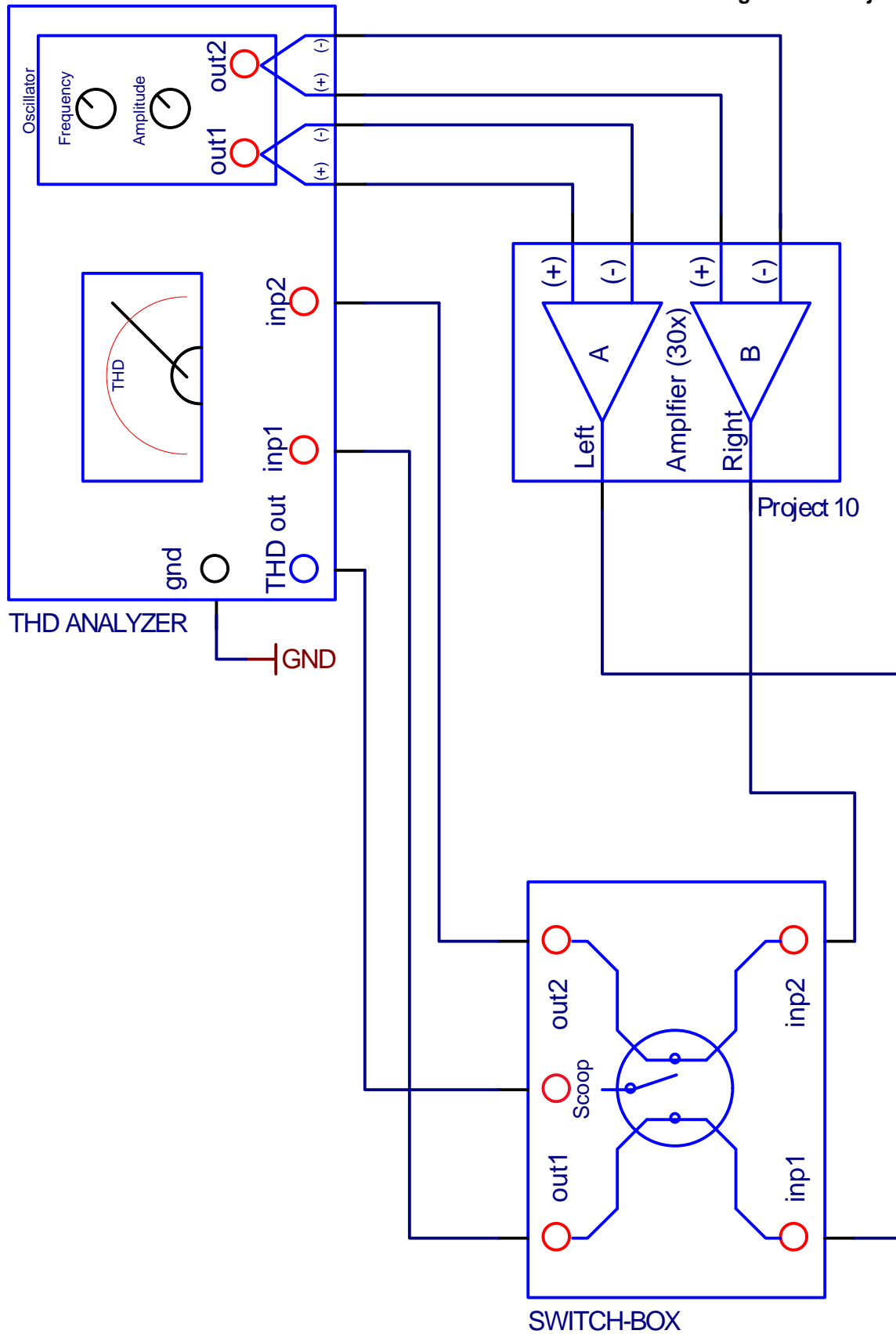
Problem	Cause	Solution	Refer to page...
Amplifier doesn't work	Fuses are blowed (short circuit output)	Replace fuses type 3.15A SB	Page 18

10. DIAGRAMS AND PARTS LISTS

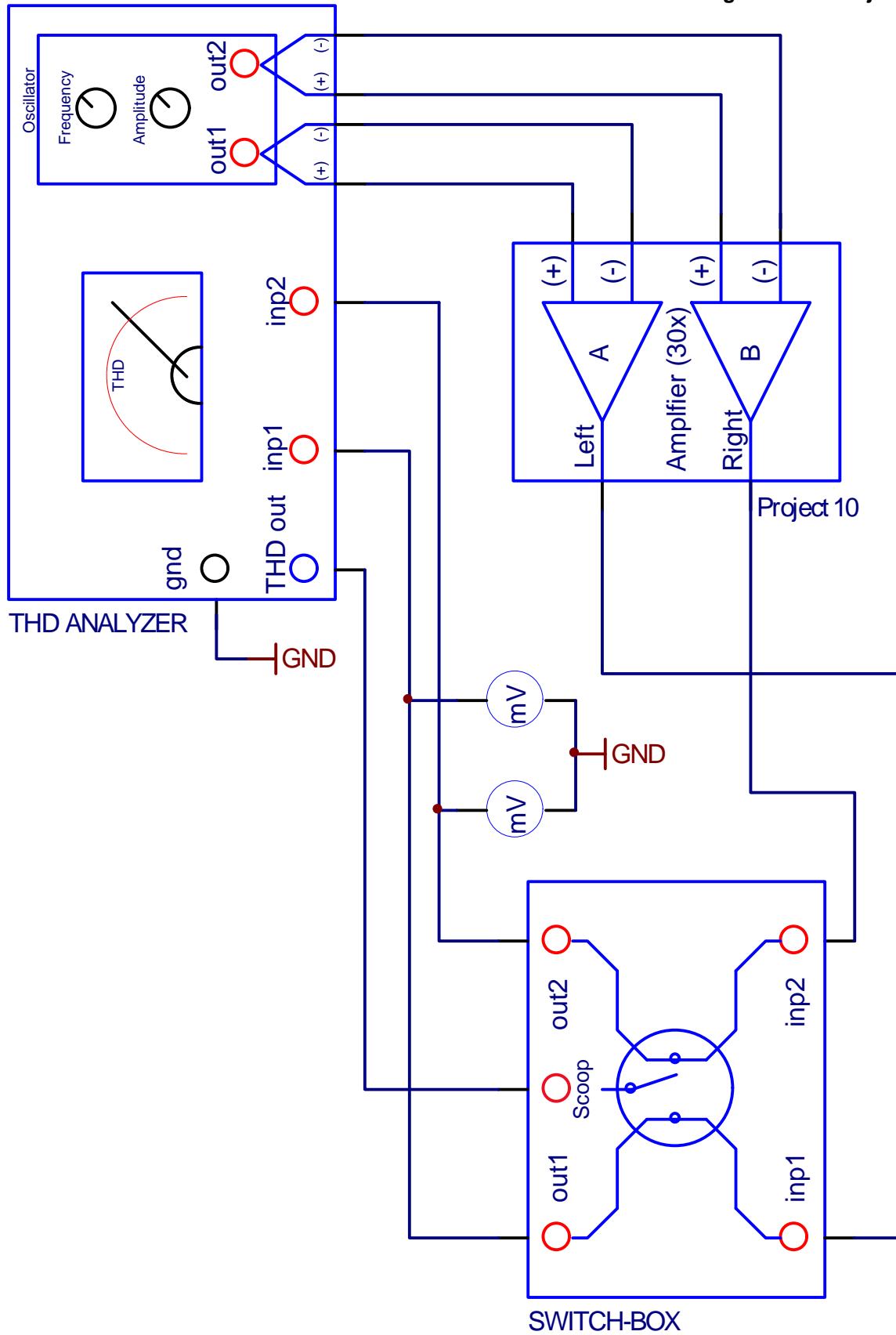
The next pages contain the front and rear panel lay-out and a complete set of schematic drawings including the associated parts lists (if applicable).

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Connection diagram offset adjustment	15
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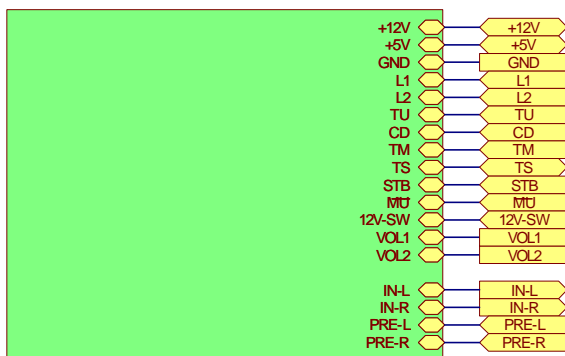
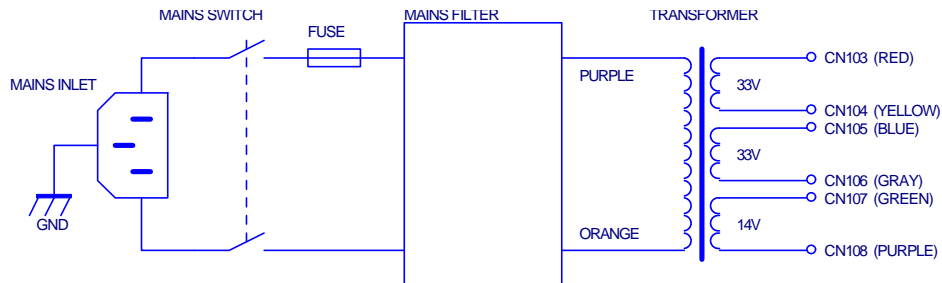
Connection diagram bias adjustment



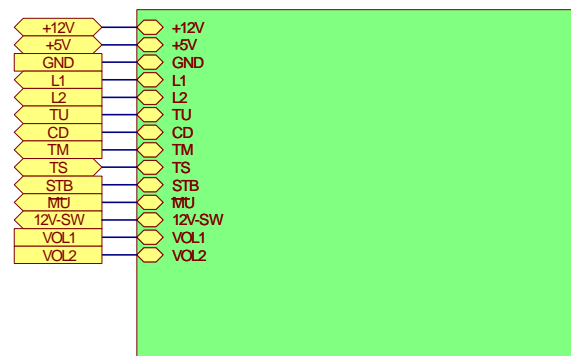
Connection diagram offset adjustment



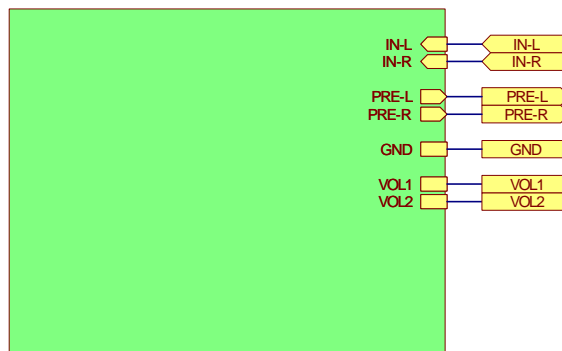
Connections main board and display board of Project 10



PJ10 main board

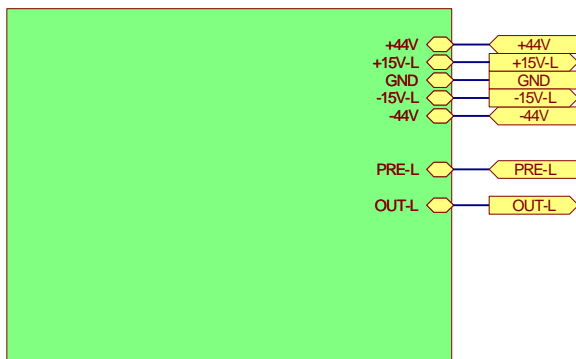


PJ10 control board

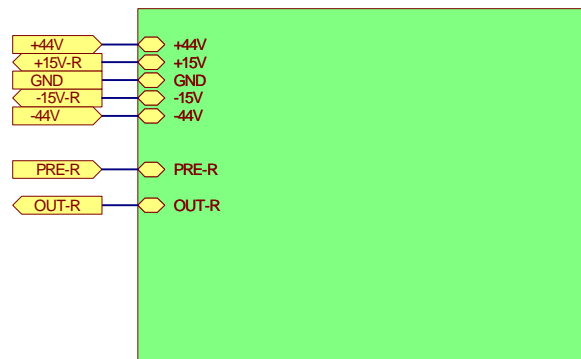


PJ10 volume board

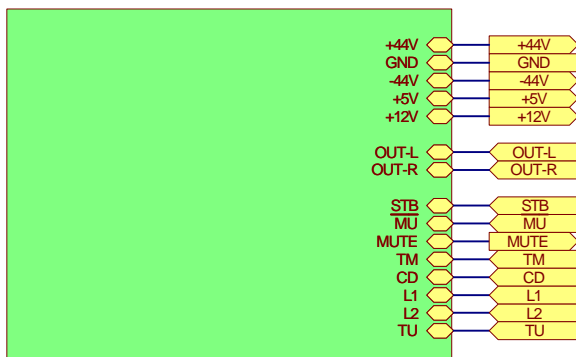
General overview Project 10



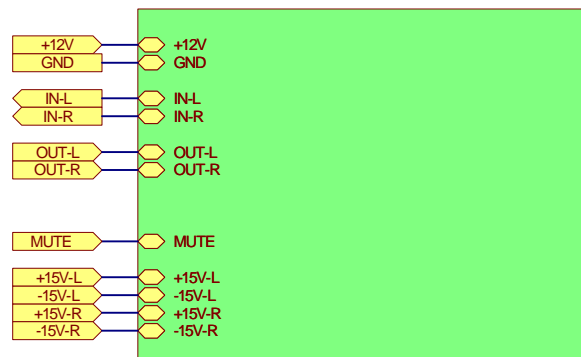
PJ10 left channel



PJ10 right channel

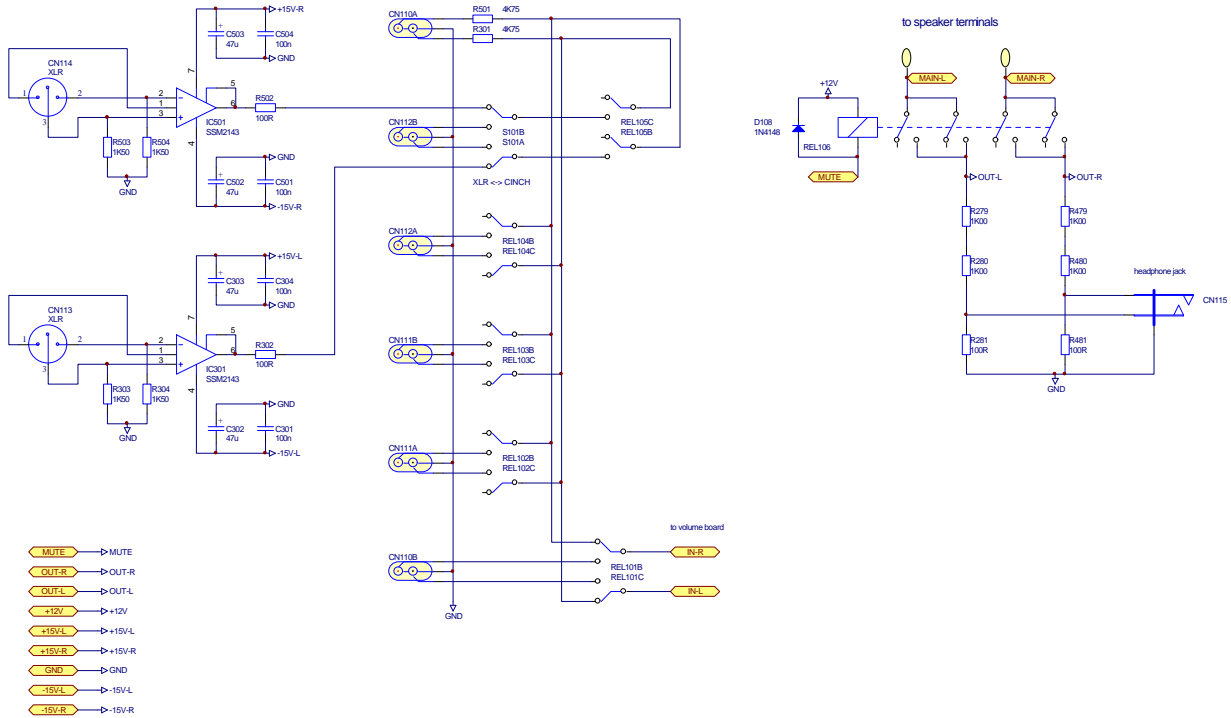
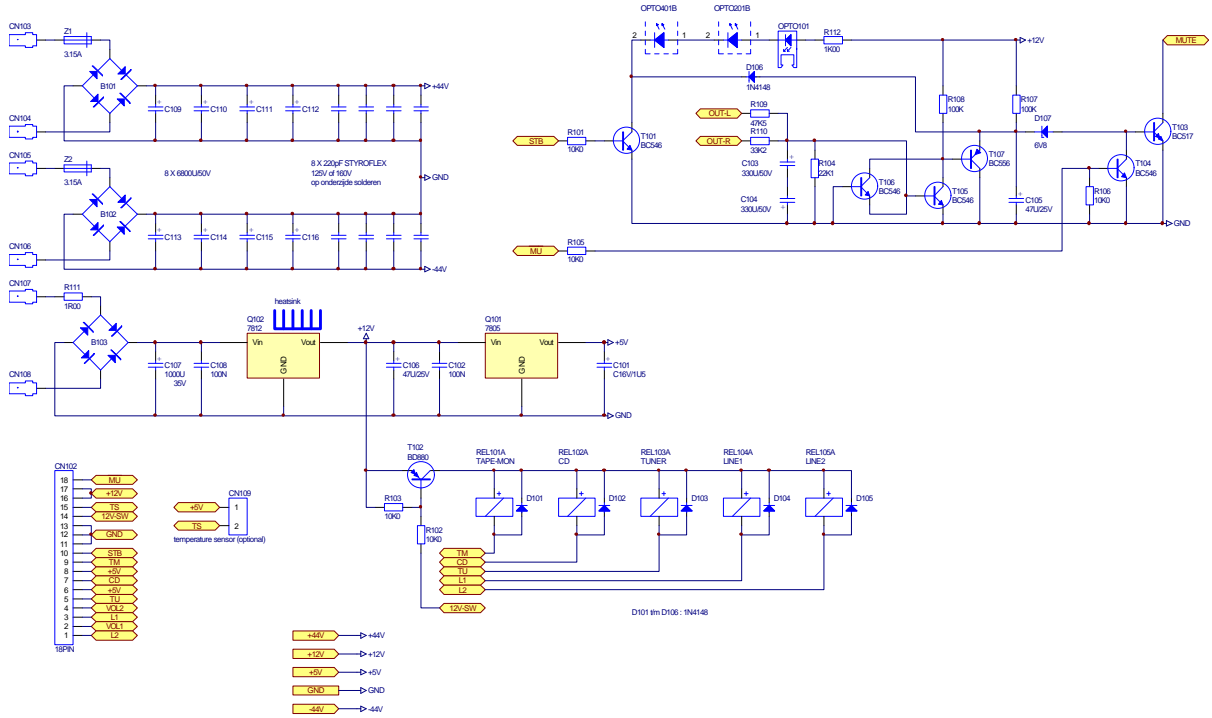


PJ10 power supply



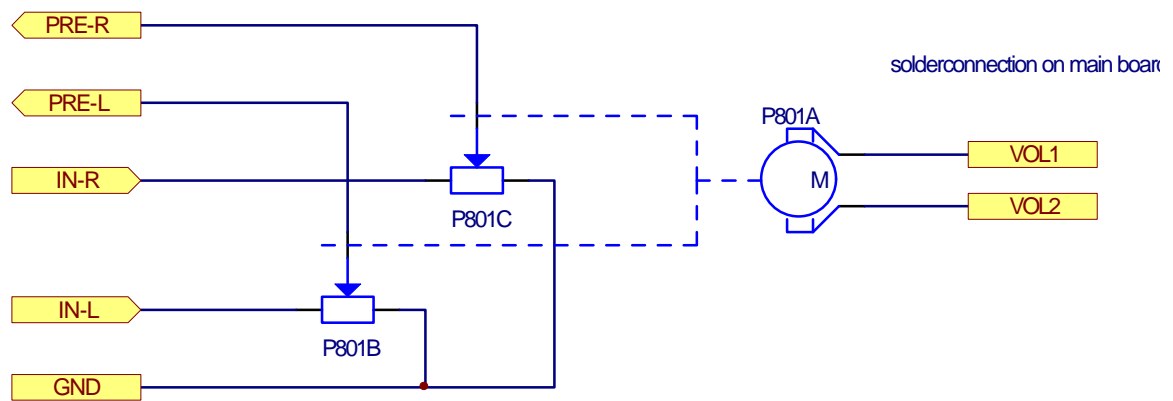
PJ10 input/output

Project 10 power supply and input selection

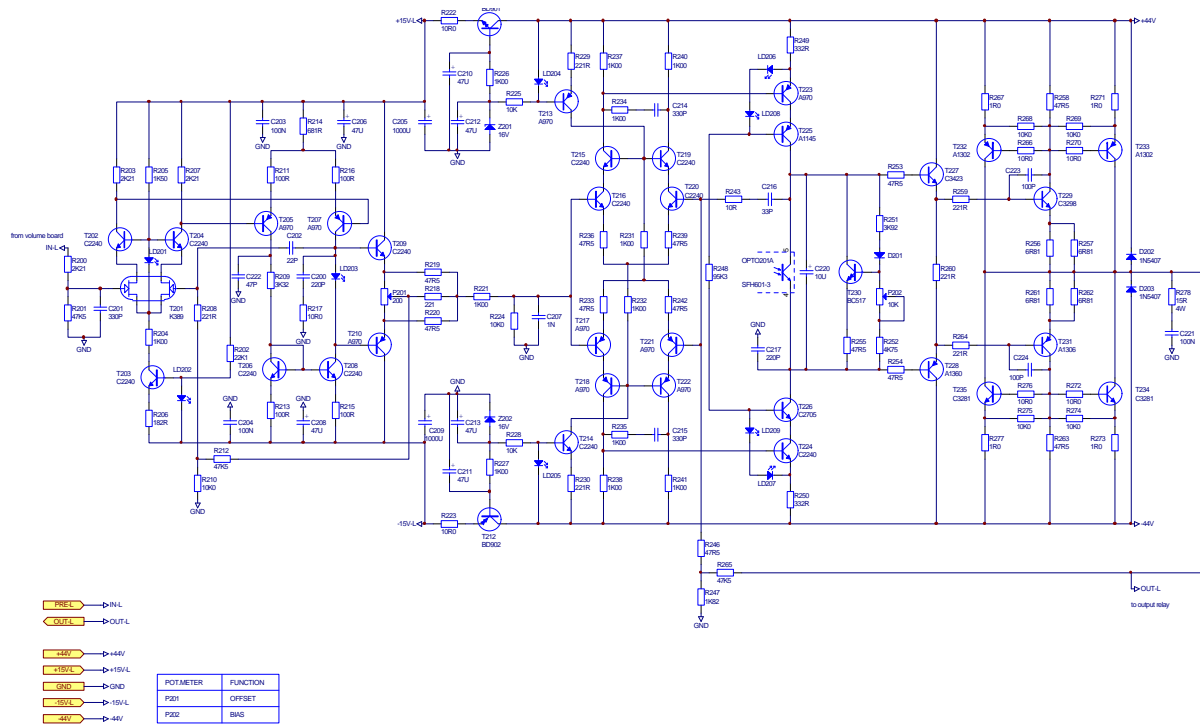


Project 10 volume board

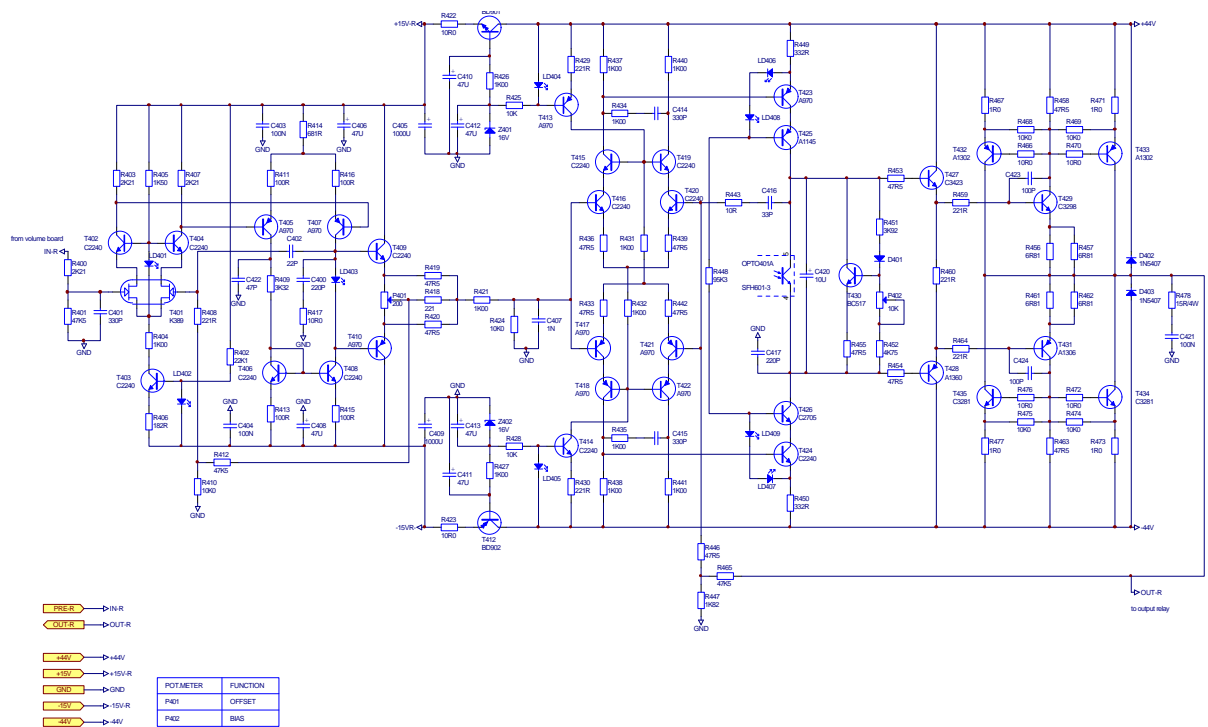
solderconnection on volume board



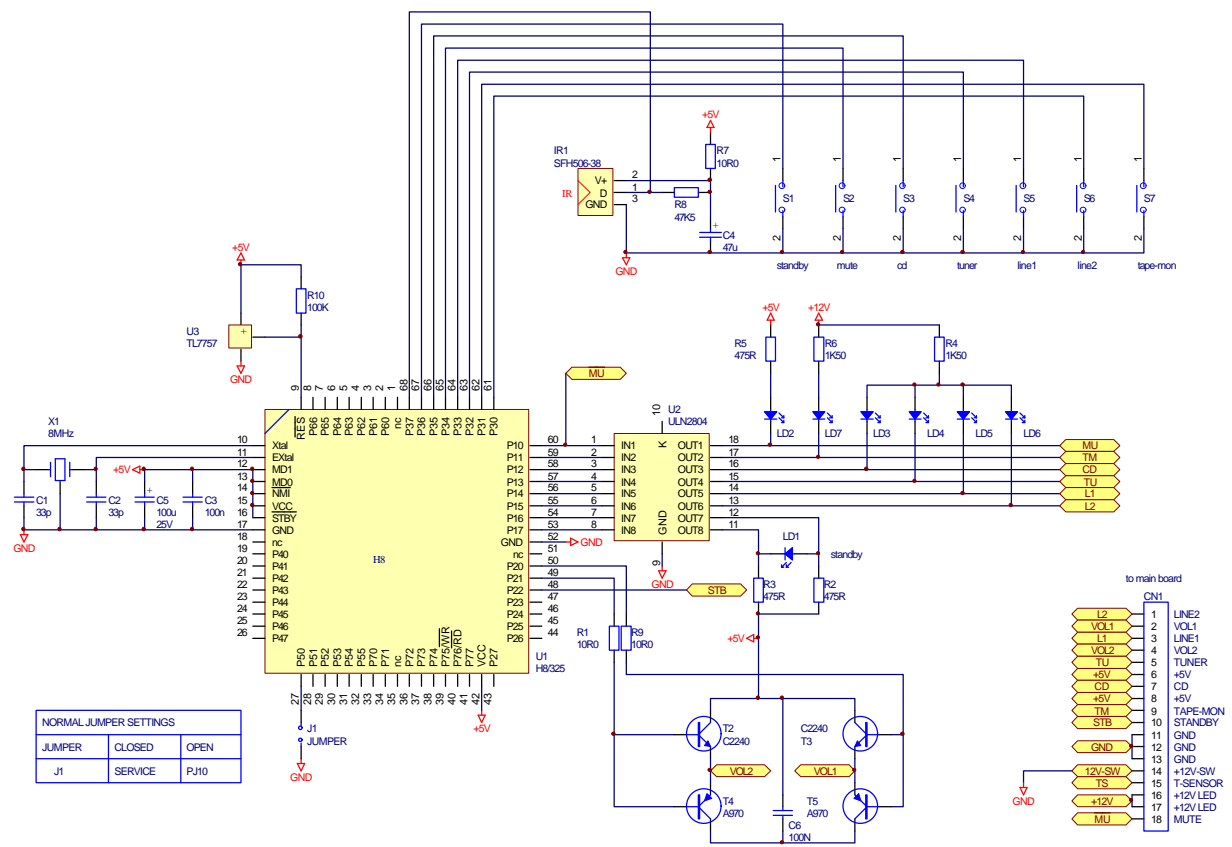
Project 10 amplifier left



Project 10 amplifier right



Project 10 control



PCB drawings of Project 10

Because there is a significant image-quality loss during the conversion of the drawings, the PCB-drawing is located in a separate file.

This file is in PDF-format (Adobé Acrobat 3.0 Reader).

- Pj10main.PDF for Mainboard
- Pj10disl.PDF for Display

Parts list

Designator	Part Type	Description
B101	BR102	Bridge rectifier
B102	BR102	Bridge rectifier
B103	WO2M	Bridge rectifier
C1	33pF	Ceramic capacitor
C101	1.5uF/16V	Electrolytic capacitor
C102	100nF	MKT capacitor
C103	330uF/50V	Electrolytic capacitor
C104	330uF/50V	Electrolytic capacitor
C105	47uF/25V	Electrolytic capacitor
C106	47uF/25V	Electrolytic capacitor
C107	1000uF	Electrolytic capacitor
C108	100nF	MKT capacitor
C109	6800uF/50V	Electrolytic capacitor
C110	6800uF/50V	Electrolytic capacitor
C111	6800uF/50V	Electrolytic capacitor
C112	6800uF/50V	Electrolytic capacitor
C113	6800uF/50V	Electrolytic capacitor
C114	6800uF/50V	Electrolytic capacitor
C115	6800uF/50V	Electrolytic capacitor
C116	6800uF/50V	Electrolytic capacitor
C2	33pF	Ceramic capacitor
C200	220pF	Styroflex capacitor
C201	330pF	Styroflex capacitor
C202	22pF	Ceramic capacitor
C203	100nF	MKT capacitor
C204	100nF	MKT capacitor
C205	1000uF	Electrolytic capacitor
C206	47uF/25V	Electrolytic capacitor
C207	1nF	MKT capacitor
C208	47uF/25V	Electrolytic capacitor
C209	1000uF	Electrolytic capacitor
C210	47uF/25V	Electrolytic capacitor
C211	47uF/25V	Electrolytic capacitor
C212	47uF/25V	Electrolytic capacitor
C213	47uF/25V	Electrolytic capacitor
C214	330pF	Styroflex capacitor
C215	330pF	Styroflex capacitor
C216	33pF	Styroflex capacitor
C217	220pF	Styroflex capacitor
C220	10uF	Electrolytic capacitor
C221	100nF	MKT capacitor
C222	47pF	Styroflex capacitor
C223	100pF	Styroflex capacitor
C224	100pF	Styroflex capacitor
C3	100nF	MKT capacitor
C301	100nF	MKT capacitor

Designator	Part Type	Description
C302	47uF/25V	Electrolytic capacitor
C303	47uF/25V	Electrolytic capacitor
C304	100nF	MKT capacitor
C4	47uF/16V	Electrolytic capacitor
C400	220pF	Styroflex capacitor
C401	330pF	Styroflex capacitor
C402	22pF	Ceramic capacitor
C403	100nF	MKT capacitor
C404	100nF	MKT capacitor
C405	1000uF	Electrolytic capacitor
C406	47uF	Electrolytic capacitor
C407	1nF	MKT capacitor
C408	47uF	Electrolytic capacitor
C409	1000uF	Electrolytic capacitor
C410	47uF	Electrolytic capacitor
C411	47uF	Electrolytic capacitor
C412	47uf	Electrolytic capacitor
C413	47uF	Electrolytic capacitor
C414	330pF	Styroflex capacitor
C415	330pF	Styroflex capacitor
C416	33pF	Styroflex capacitor
C417	220pF	Styroflex capacitor
C420	10uF	Electrolytic capacitor
C421	100nF	MKT capacitor
C422	47pF	Styroflex capacitor
C423	100pF	Styroflex capacitor
C424	100pF	Styroflex capacitor
C5	100uF/25V	Electrolytic capacitor
C501	100nF	MKT capacitor
C502	47uF	Electrolytic capacitor
C503	47uF	Electrolytic capacitor
C504	100nF	MKT capacitor
C6	100nF	MKT capacitor
CN1	18PIN	18 pin connector
CN102	18PIN	18 pin connector
CN103	FASTON	Flat-cable connector
CN104	FASTON	Flat-cable connector
CN105	FASTON	Flat-cable connector
CN106	FASTON	Flat-cable connector
CN107	FASTON	Flat-cable connector
CN108	FASTON	Flat-cable connector
CN110	CINCH2P	Cinch connector
CN111	CINCH2P	Cinch connector
CN112	CINCH2P	Cinch connector
CN113	NC3FPP	XLR connector
CN114	NC3FPP	XLR connector
D101	1N4148	Diode
D102	1N4148	Diode

Designator	Part Type	Description
D103	1N4148	Diode
D104	1N4148	Diode
D105	1N4148	Diode
D106	1N4148	Diode
D107	6V8	Zener diode
D108	1N4148	Diode
D202	1N5407	Diode
D203	1N5407	Diode
D402	1N5407	Diode
D403	1N5407	Diode
IC301	SSM2143	IC
IC501	SSM2143	IC
IR1	SFH 506-38	Infrared receiver
J1	Jumper	Jumper
LD1	LED red	LED red
LD2	LED red	LED red
LD201	LED red	LED red
LD202	LED red	LED red
LD203	LED red	LED red
LD204	LED red	LED red
LD205	LED red	LED red
LD206	LED red	LED red
LD207	LED red	LED red
LD208	LED red	LED red
LD209	LED red	LED red
LD3	LED red	LED red
LD4	LED red	LED red
LD401	LED red	LED red
LD402	LED red	LED red
LD403	LED red	LED red
LD404	LED red	LED red
LD405	LED red	LED red
LD406	LED red	LED red
LD407	LED red	LED red
LD408	LED red	LED red
LD409	LED red	LED red
LD5	LED red	LED red
LD6	LED red	LED red
LD7	LED red	LED red
OPTO101	OPTOUT	Optical output
OPTO201	SFH601-3	Opto-coupler
OPTO401	SFH601-3	Opto-coupler
P201	200R	Trim pot.
P202	10K	Trim pot.

Designator	Part Type	Description
P401	200R	Trim pot.
P402	10K	Trim pot.
Q101	L7805CV	Voltage stabiliser
Q102	L7812CV	Voltage stabiliser
R1	10R0	Resistor MRS25
R10	100K	Resistor MRS25
R101	10K0	Resistor MRS25
R102	10K0	Resistor MRS25
R103	10K0	Resistor MRS25
R104	22K1	Resistor MRS25
R105	10K0	Resistor MRS25
R106	10K0	Resistor MRS25
R107	100K	Resistor MRS25
R108	100K	Resistor MRS25
R109	47K5	Resistor MRS25
R110	33K2	Resistor MRS25
R111	1R00	Resistor MRS25
R112	1K00	Resistor MRS25
R2	475R	Resistor MRS25
R200	2K21	Resistor MRS25
R201	47K5	Resistor MRS25
R202	22K1	Resistor MRS25
R203	2K21	Resistor MRS25
R204	1K00	Resistor MRS25
R205	1K50	Resistor MRS25
R206	182R	Resistor MRS25
R207	2K21	Resistor MRS25
R208	221R	Resistor MRS25
R209	3K32	Resistor MRS25
R210	10K0	Resistor MRS25
R211	100R	Resistor MRS25
R212	47K5	Resistor MRS25
R213	100R	Resistor MRS25
R214	681R	Resistor MRS25
R215	100R	Resistor MRS25
R216	100R	Resistor MRS25
R217	10R0	Resistor MRS25
R218	221R	Resistor MRS25
R219	47R5	Resistor MRS25
R220	47R5	Resistor MRS25
R221	1K00	Resistor MRS25
R222	10R0	Resistor MRS25
R223	10R0	Resistor MRS25
R224	10K0	Resistor MRS25
R225	10K	Resistor MRS25
R226	1K00	Resistor MRS25
R227	1K00	Resistor MRS25
R228	10K	Resistor MRS25
R229	221R	Resistor MRS25

Designator	Part Type	Description
R230	221R	Resistor MRS25
R231	1K00	Resistor MRS25
R232	1K00	Resistor MRS25
R233	47R5	Resistor MRS25
R234	1K00	Resistor MRS25
R235	1K00	Resistor MRS25
R236	47R5	Resistor MRS25
R237	1K00	Resistor MRS25
R238	1K00	Resistor MRS25
R239	47R5	Resistor MRS25
R240	1K00	Resistor MRS25
R241	1K00	Resistor MRS25
R242	47R5	Resistor MRS25
R243	10R	Resistor MRS25
R246	47R5	Resistor MRS25
R247	1K82	Resistor MRS25
R248	95K3	Resistor MRS25
R249	332R	Resistor MRS25
R250	332R	Resistor MRS25
R251	3K92	Resistor MRS25
R252	4K75	Resistor MRS25
R253	47R5	Resistor MRS25
R254	47R5	Resistor MRS25
R255	47R5	Resistor MRS25
R256	6R81	Resistor MRS25
R257	6R81	Resistor MRS25
R258	47R5	Resistor MRS25
R259	221R	Resistor MRS25
R260	221R	Resistor MRS25
R261	6R81	Resistor MRS25
R262	6R81	Resistor MRS25
R263	47R5	Resistor MRS25
R264	221R	Resistor MRS25
R265	47K5	Resistor MRS25
R266	10R0	Resistor MRS25
R267	1R0	Resistor MRS25
R268	10K0	Resistor MRS25
R269	10K0	Resistor MRS25
R270	10R0	Resistor MRS25
R271	1R0	Resistor MRS25
R272	10R0	Resistor MRS25
R273	1R0	Resistor MRS25
R274	10K0	Resistor MRS25
R275	10K0	Resistor MRS25
R276	10R0	Resistor MRS25
R277	1R0	Resistor MRS25
R278	15R	Resistor MRS25
R279	1K00	Resistor MRS25
R280	1K00	Resistor MRS25
R281	100R	Resistor MRS25

Designator	Part Type	Description
R3	475R	Resistor MRS25
R301	4K75	Resistor MRS25
R302	100R	Resistor MRS25
R303	1K50	Resistor MRS25
R304	1K50	Resistor MRS25
R4	1K50	Resistor MRS25
R400	2K21	Resistor MRS25
R401	47K5	Resistor MRS25
R402	22K1	Resistor MRS25
R403	2K21	Resistor MRS25
R404	1K00	Resistor MRS25
R405	1K50	Resistor MRS25
R406	182R	Resistor MRS25
R407	2K21	Resistor MRS25
R408	221R	Resistor MRS25
R409	3K32	Resistor MRS25
R410	10K0	Resistor MRS25
R411	100R	Resistor MRS25
R412	47K5	Resistor MRS25
R413	100R	Resistor MRS25
R414	681R	Resistor MRS25
R415	100R	Resistor MRS25
R416	100R	Resistor MRS25
R417	10R0	Resistor MRS25
R418	221R	Resistor MRS25
R419	47R5	Resistor MRS25
R420	47R5	Resistor MRS25
R421	1K00	Resistor MRS25
R422	10R0	Resistor MRS25
R423	10R0	Resistor MRS25
R424	10K0	Resistor MRS25
R425	10K	Resistor MRS25
R426	1K00	Resistor MRS25
R427	1K00	Resistor MRS25
R428	10K	Resistor MRS25
R429	221R	Resistor MRS25
R430	221R	Resistor MRS25
R431	1K00	Resistor MRS25
R432	1K00	Resistor MRS25
R433	47R5	Resistor MRS25
R434	1K00	Resistor MRS25
R435	1K00	Resistor MRS25
R436	47R5	Resistor MRS25
R437	1K00	Resistor MRS25
R438	1K00	Resistor MRS25
R439	47R5	Resistor MRS25
R440	1K00	Resistor MRS25
R441	1K00	Resistor MRS25
R442	47R5	Resistor MRS25
R443	10R	Resistor MRS25

Designator	Part Type	Description
R446	47R5	Resistor MRS25
R447	1K82	Resistor MRS25
R448	95K3	Resistor MRS25
R449	332R	Resistor MRS25
R450	332R	Resistor MRS25
R451	3K92	Resistor MRS25
R452	4K75	Resistor MRS25
R453	47R5	Resistor MRS25
R454	47R5	Resistor MRS25
R455	47R5	Resistor MRS25
R456	6R81	Resistor MRS25
R457	6R81	Resistor MRS25
R458	47R5	Resistor MRS25
R459	221R	Resistor MRS25
R460	221R	Resistor MRS25
R461	6R81	Resistor MRS25
R462	6R81	Resistor MRS25
R463	47R5	Resistor MRS25
R464	221R	Resistor MRS25
R465	47K5	Resistor MRS25
R466	10R0	Resistor MRS25
R467	1R0	Resistor MRS25
R468	10K0	Resistor MRS25
R469	10K0	Resistor MRS25
R470	10R0	Resistor MRS25
R471	1R0	Resistor MRS25
R472	10R0	Resistor MRS25
R473	1R0	Resistor MRS25
R474	10K0	Resistor MRS25
R475	10K0	Resistor MRS25
R476	10R0	Resistor MRS25
R477	1R0	Resistor MRS25
R478	15R/4W	Resistor MRS25
R479	1K00	Resistor MRS25
R480	1K00	Resistor MRS25
R481	100R	Resistor MRS25
R5	475R	Resistor MRS25
R501	4K75	Resistor MRS25
R502	100R	Resistor MRS25
R503	1K50	Resistor MRS25
R504	1K50	Resistor MRS25
R6	1K50	Resistor MRS25
R7	10R0	Resistor MRS25
R8	47K5	Resistor MRS25
R9	10R0	Resistor MRS25
REL101	Relay	Relay
REL102	Relay	Relay
REL103	Relay	Relay
REL104	Relay	Relay

Designator	Part Type	Description
REL105	Relay	Relay
S1	Switch	Switch
S2	Switch	Switch
S3	Switch	Switch
S4	Switch	Switch
S5	Switch	Switch
S6	Switch	Switch
S7	Switch	Switch
T101	BC546	Transistor
T102	BD880	Transistor
T103	BC517	Transistor
T104	BC546	Transistor
T105	BC546	Transistor
T106	BC546	Transistor
T107	BC556	Transistor
T2	T2SC2240	Transistor
T201	K389	DUAL N-JFET
T202	2SC2240	Transistor
T203	2SC2240	Transistor
T204	2SC2240	Transistor
T205	2SA970	Transistor
T206	2SC2240	Transistor
T207	2SA970	Transistor
T208	2SC2240	Transistor
T209	2SC2240	Transistor
T210	2SA970	Transistor
T211	BD901	Transistor
T212	BD902	Transistor
T213	2SA970	Transistor
T214	2SC2240	Transistor
T215	2SC2240	Transistor
T216	2SC2240	Transistor
T217	2SA970	Transistor
T218	2SA970	Transistor
T219	2SC2240	Transistor
T220	2SC2240	Transistor
T221	2SA970	Transistor
T222	2SA970	Transistor
T223	2SA970	Transistor
T224	2SC2240	Transistor
T225	2SA1145	Transistor
T226	2SC2705	Transistor
T227	2SC3423	Transistor
T228	2SA1360	Transistor
T229	2SC3298	Transistor
T230	BC517	Transistor
T231	2SA1306	Transistor
T232	2SA1302	Transistor

Designator	Part Type	Description
T233	2SA1302	Transistor
T234	2SC3281	Transistor
T235	2SC3281	Transistor
T3	T2SC2240	Transistor
T4	T2SA970	Transistor
T401	K389	DUAL N-JFET
T402	2SC2240	Transistor
T403	2SC2240	Transistor
T404	2SC2240	Transistor
T405	2SA970	Transistor
T406	2SC2240	Transistor
T407	2SA970	Transistor
T408	2SC2240	Transistor
T409	2SC2240	Transistor
T410	2SA970	Transistor
T411	BD901	Transistor
T412	BD902	Transistor
T413	2SA970	Transistor
T414	2SC2240	Transistor
T415	2SC2240	Transistor
T416	2SC2240	Transistor
T417	2SA970	Transistor
T418	2SA970	Transistor
T419	2SC2240	Transistor
T420	2SC2240	Transistor
T421	2SA970	Transistor
T422	2SA970	Transistor
T423	2SA970	Transistor
T424	2SC2240	Transistor
T425	2SA1145	Transistor
T426	2SC2705	Transistor
T427	2SC3423	Transistor
T428	2SA1360	Transistor
T429	2SC3298	Transistor
T430	BC517	Transistor
T431	2SA1306	Transistor
T432	2SA1302	Transistor
T433	2SA1302	Transistor
T434	2SC3281	Transistor
T435	2SC3281	Transistor
T5	T2SA970	Transistor
U1	H8/325	IC
U2	ULN2804	IC
U3	TL7757	IC
X1	8MHz	X-TAL
Z1	T3.15A	Fuse
Z2	T3.15A	Fuse

Designator	Part Type	Description
Z201	16V	Zener diode
Z202	16V	Zener diode
Z401	16V	Zener diode
Z402	16V	Zener diode

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