Tube-Town
HOT STUFF - COOL SOUNDS

Midi Switch

MIDI / Channel Switcher
Version 2019

Content

Introduction

The TT MIDI switcher is based on an ATMEGA 16 micro-controller and can be used as switching central for channel switching and / or additional functions in guitar and bass amplifiers.
The module does not necessarily have to be controlled via MIDI, but can also be operated only with foot switches or switches mounted on the front of the amplifier. If a different switching behavior than the standard configuration is needed, the use of external switches is necessary.

General overview / inputs and outputs

If the TT-Midi-Switcher is operated with analog footswitches and panel mounted switches, the following functions are available.

Footswitch inputs I1 - I4 are for channel switching. These are designed to work with the usual cable lengths when footswitches are used. They correspond to the outputs A1 to A4 and output Z0, which is intended as a mute. Only one output can be active at a time in this switching group, all other outputs are switched off automatically as soon as a new switching state is initiated. Example: If input I2 is activated, then output A2 is set to ON and outputs A1, A3 and A4 are immediately set to ZERO. In addition, output Z0 is set to ON before the actual switching. This can be used to achieve a mute function (e.g., with an optocoupler which switches the input signal to ground).
The inputs I5-I8 are for additional controls, e.g. panel mount switches on the front panel and are assigned to the outputs A5-A8. These inputs have no added circuit to handle longer cable lengths and are intended only for the use of control elements directly on the amp, so the cable lengths should be kept as short as possible (maximum 0.5 m). The purpose of these inputs is to control features like e.g. a "bright" or a "boost" feature. The inputs or the assigned outputs work independently of each other. Thus, each of the outputs A5 - A8 can be ON or OFF at the same time, or in any possible mixed combination.
The outputs A1-A8 are linked to a power driver ULN2803 (Darlington Transistor Arrays). With the ULN2803, a maximum load of 500 mA per output can be controlled. Another advantage is the internal wiring of the ULN2803, which makes it possible to control relays directly without the need for an additional protection circuitry. Please note: it is always switched to ground!

Input Z1 is designed as "store" to permanently assign the current switching states to a MIDI program.

The output Z2 is intended for a LED, which signals the successful storage by briefly flashing.

Power-supply

On the main pcb of the TT-Midi-Switcher are two power supplies available. The main power supply is essential for the operation of the module, from an input voltage of 6.3 - 9 VAC or VDC, it supplies the voltage of 5 VDC required for the module. The TT Midi Switcher is designed for use with 5V relays or optocouplers in the basic configuration.

Important: before using the TT-Midi-Switcher, the total power consumption of the switching elements must be determined and it must be ensured it does not exceed the maximum current of 1,5 A the used 7805 can deliver. For higher current and / or different voltages, the additional power supply must be used. It may also be necessary to passively cool the 7805 with a heat sink.

The second power supply on the main board, labeled "Extra Power Supply", can be used for voltages other than the supply voltage. As an example 12 V for the operation of 12 V relays or 9 V for phantom power of a MIDI device. It is not necessary to use relays for channel switching, the use of optocouplers or transistors is also possible, of course.

If the available supply voltages are too high it is also conceivable to connect them first to the additional power supply for lowering and then connect them to the main power supply. For example you could bring the voltage down from 15 V to 9 V and then feed it into the main power supply, which further reduces the voltage to 5V. With regard to cooling, the same requirements apply as with the main power supply.
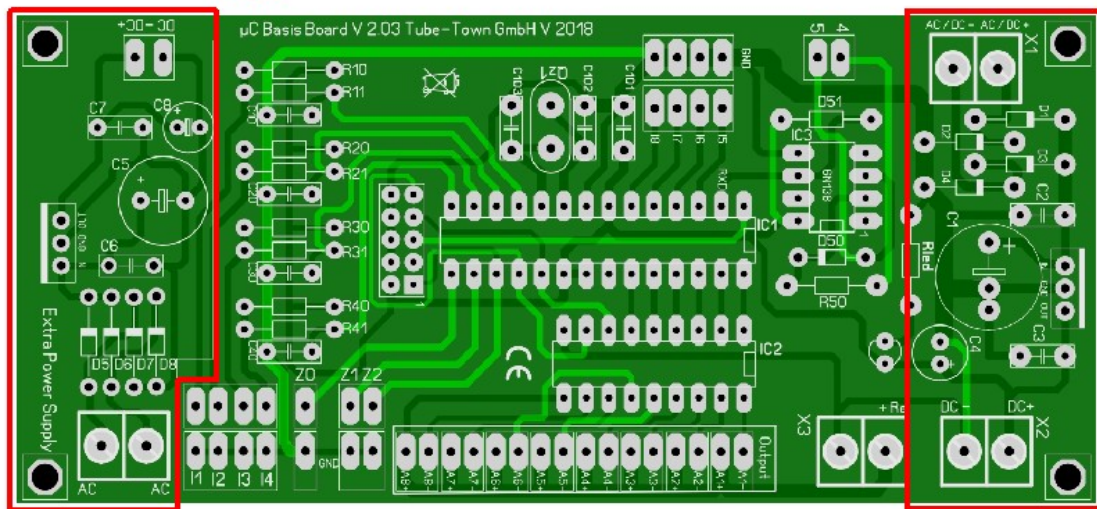
BOM

Part	Value
R10, R20, R30, R40, D51	1 kOhm
R11, R21, R31, R41	10 kOhm
R50, Rled	220 Ohm
LED	3mm, rot
C1	1000 µF / 25 V
C2	1000 pF / 500 V
C3	100n / 50V
C4	47 µF /35 V
C10, C20, C30, C40, C101	100n / 63 V
C102, C103	22 pF / 100 V
Oz1	7,372800 MHz
D1, D2, D3, D4, D50	1N4007
7805	LM7805
IC1	AVR Atmega 168-PU
IC2	ULN2803A
IC3	6N138

Switching via MIDI commands

The TT-MIDI switcher can also be switched via MIDI, of course. In the default setting, the module expects the commands on MIDI channel 1.

To switch outputs A1 to A4, program change messages must be sent to the MIDI module, followed by the program number. In the default configuration, PC 1 is assigned to output A1, PC2 to output 2 and so on. So if PC 3 is sent to the MIDI switcher, the output A3 is switched ON and the outputs A1, A2 and A4 are set to OFF (channel switching).

However, to address the outputs A5 to A8 directly, "Controller Change" commands must be used.

The controllers are assigned to the outputs as follows:

Controller 85 to A5
Controller 86 to A6
Controller 87 to A7
Controller 88 to A8

To turn on output A6, a CC command must be sent on MIDI channel 1 to the MIDI switcher, which addresses the controller 86 and includes a value greater than 64. Conversely, a value less than 64 switches the output off.

Besides the standard ON / OFF switching, the controllers 89, 90, 91 and 92 enable a "toggle" mode. The current switching state of the output is simply reversed: ON turns OFF and OFF turns ON. The value sent to the controller change has no influence and can be arbitrary.

Since firmware version 2.1, outputs A1 to A4 can also be switched via controller change commands. The output is switched ON with a value greater than 64. OFF switching is not provided.

The following overview shows all available commands, assignments and possible parameters

Program Change

PC 1 - switches A1 ON - A2 OFF - A3 OFF - A4 OFF
PC 2 - switches A1 OFF - A2 ON - A3 OFF - A4 OFF
PC 3 - switches A1 OFF - A2 OFF - A3 ON - A4 OFF

PC 4 - switches A1 OFF - A2 OFF - A3 OFF - A4 ON

Controller Change

The first number corresponds to the controller:

81 - switches output A1 if value > 64 to ON, if value < 64 to OFF
82 - switches output A2 if value > 64 to ON, if value < 64 to OFF
83 - switches output A3 if value > 64 to ON, if value < 64 to OFF
84 - switches output A4 if value > 64 to ON, if value < 64 to OFF
85 - switches output A5 if value > 64 to ON, if value < 64 to OFF
86 - switches output A6 if value > 64 to ON, if value < 64 to OFF
87 - switches output A7 if value > 64 to ON, if value < 64 to OFF
88 - switches output A8 if value > 64 to ON, if value < 64 to OFF
89 - switches output A5: Toggle, value arbitrary
90 - switches output A6: Toggle, value arbitrary
91 - switches output A7: Toggle, value arbitrary
92 - switches output A8: Toggle, value arbitrary

Special functions

Since firmware 2.2 the following controller change commands are also available by means of which further configurations and settings can be made on the MIDI module:

93 mute function
Switches output Z0 (Mute) with a value > 64 to ON, with a value < 64 to OFF

94 Mute toggle, ditto, but pure toggle, value is ignored

102 clear memory
with a value > 64 delete (Reinit, all settings are reset to default and the program memory is deleted)

103 Set the MIDI channel
Value corresponds to channel 1-16

104 Store Preset
assign current switching states to the program currently set

105 change mute time
Value corresponds to new mute time, default setting: 80 ms

106 Mute I5-I8 ON/OFF
Activate / deactivate mute function for inputs I5-I8

Programming your own switching states

Of course, own switching states can be assigned to individual programs and be activated directly by calling the respective program number (Program Change). Proceed as follows:

Set the desired program with the "Program Change" command. This must be done using external MIDI controllers, i.e. PC 4.

Then set the desired switching states, either with external footswitches and front panel controls or via the controller change commands listed above. Example: A2 to ON, A5 and A6 to ON, remaining outputs all OFF.

The configuration is finally saved by pressing the memory key, or alternatively by controller change 104.

Finished.

If you want to recall this switching state at a later time, simply send "Program Change 4" command to the MIDI switcher.

Hints

Up-to-date information, additions and additional software (MIDI SEND), as well as sample images of the build can be found on the project page. Here is also informations on the separately available µC for a looper version available.
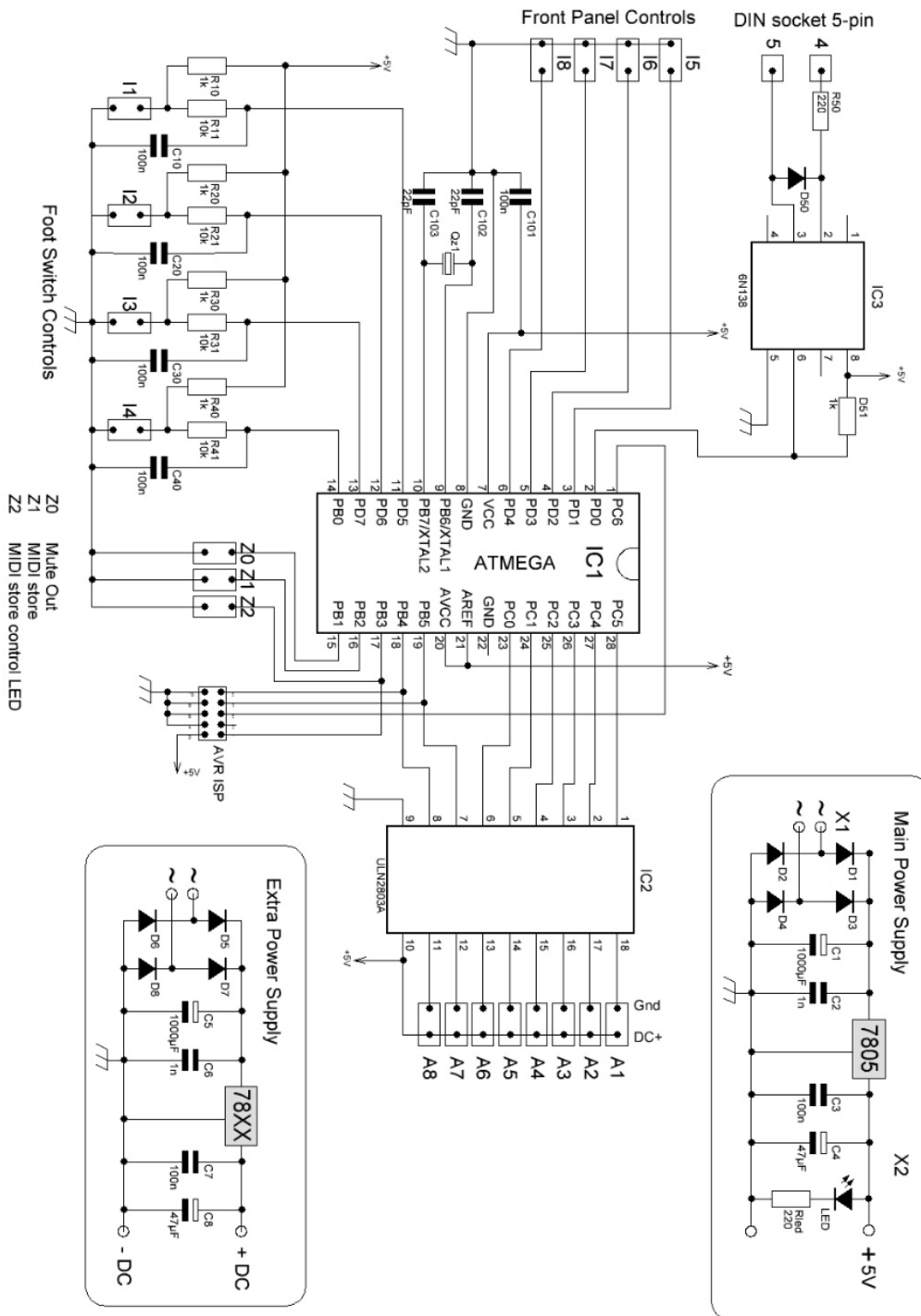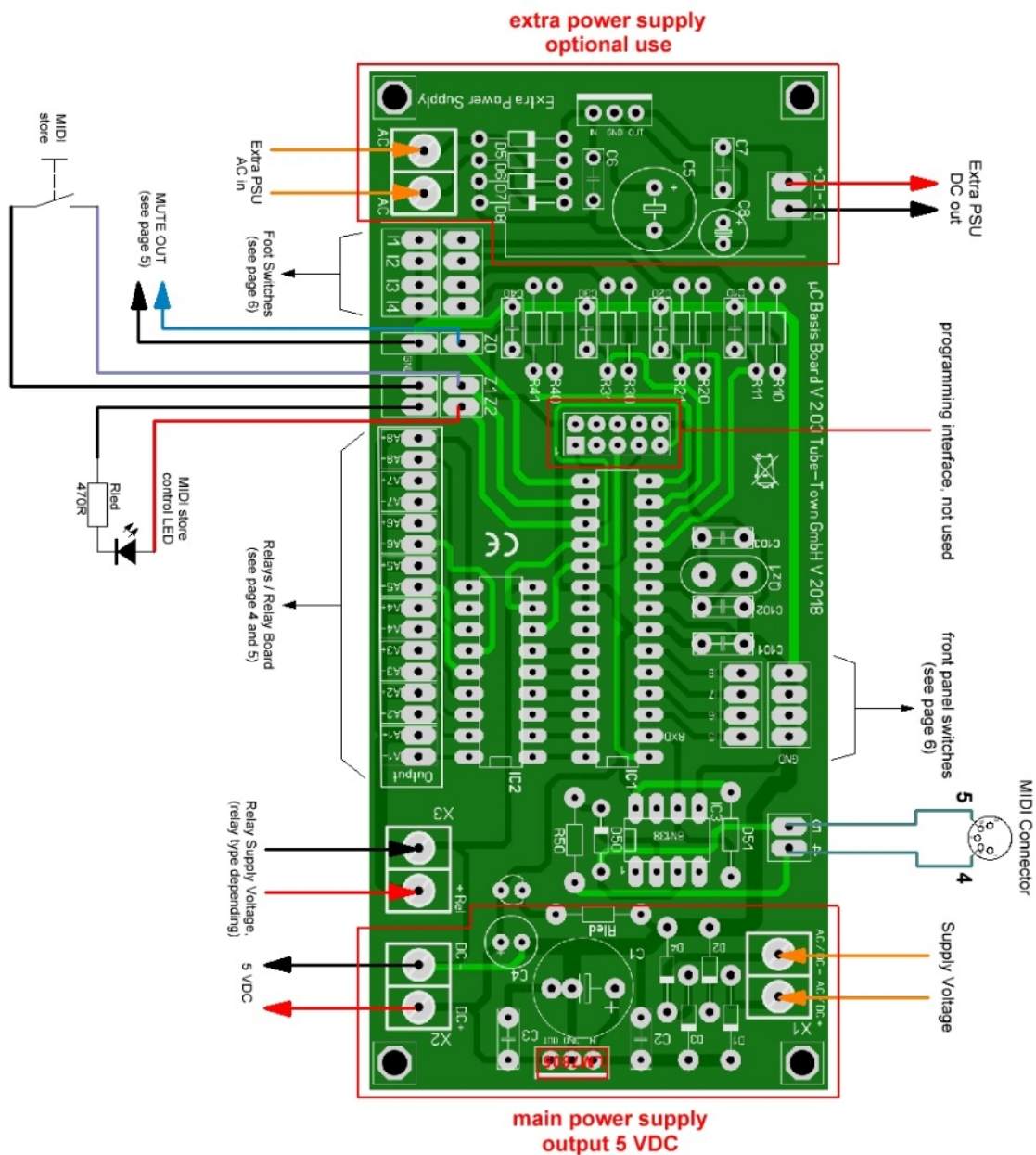
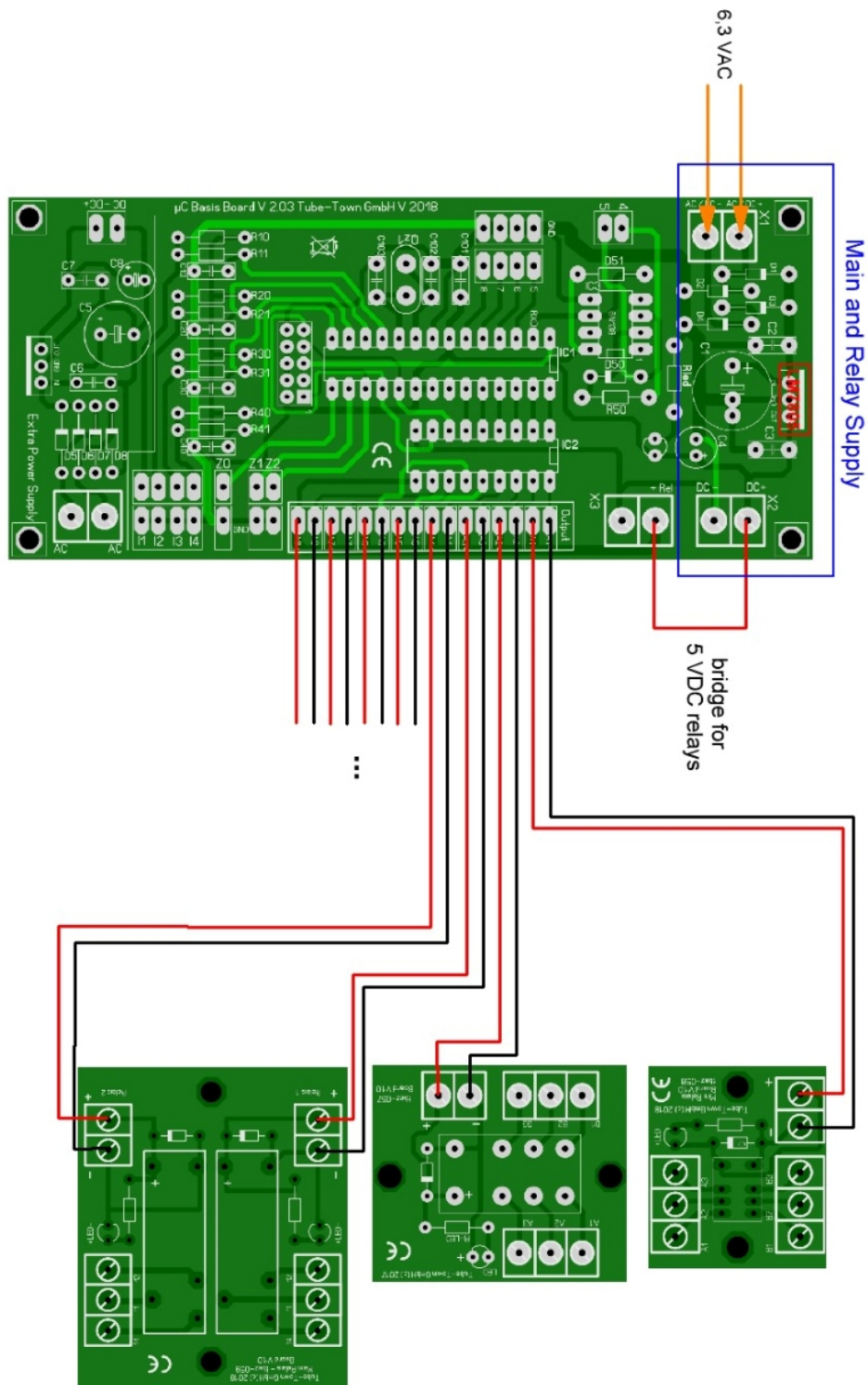The actual link to the project page can be found on the product page of the article kit-midisw.

Appendix 1 – schematic
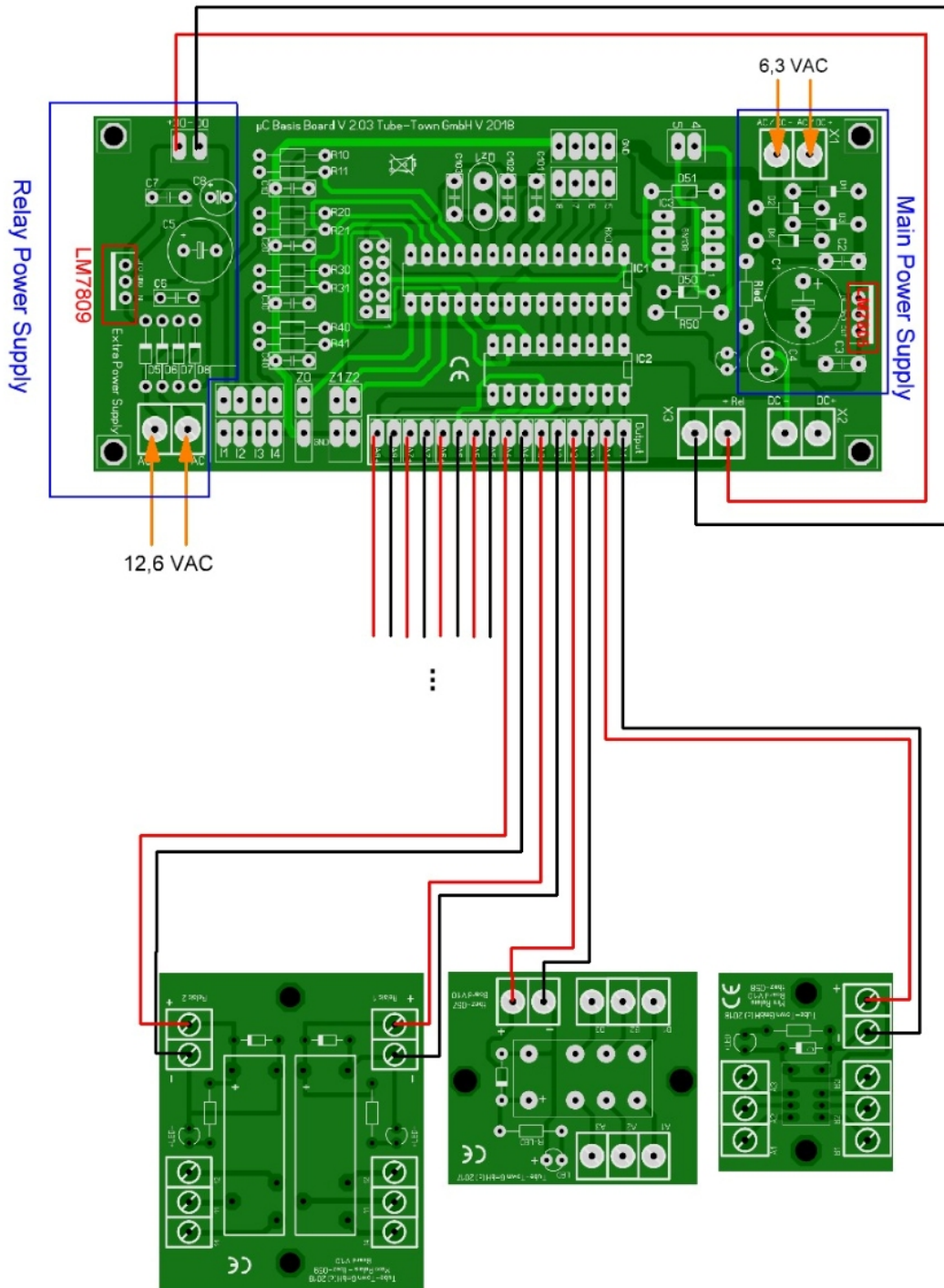
Appendix 2 – basic wiring

Appendix 3 – Example, switching with 5V relays

Appendix 4 – Example, switching with 9 V relays

Notes for relay switching

Generally all switching is done on the ground side, so the ULN2803 switches to ground. Not all inputs and outputs must be assigned or used. Unused inputs and outputs are simply left unconnected.

If voltages other than 5 V are required for relays, the needed voltage can be supplied by the "extra power supply" on the main pcb (components not included!). It is important that both the main voltage and the extra supply voltage have the same ground reference, so both grounds are referenced together. This is shown in appendix 4.

The relay boards shown on the pictures are not included, these can be selected as required. Possible boards to use are e.g. the following articles:

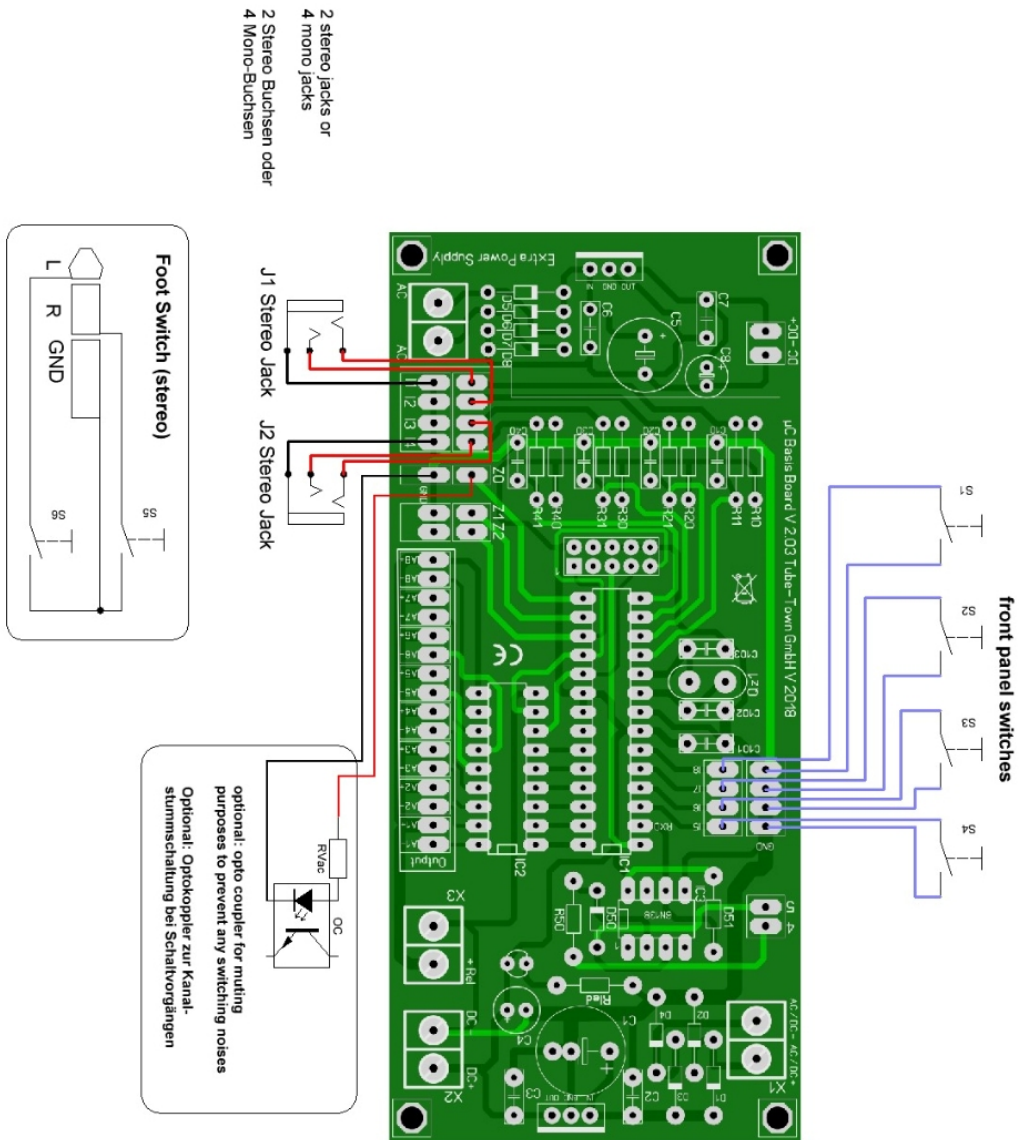tbez-010 (double relay PCB)
tbez-020 (single relay PCB)
tbez-057 (single relay PCB, PCB terminal blocks)
tbez-059 (double relay PCB MAXI, PCB terminal blocks)
tbez-058 (single relay PCB MINI, PCB terminal blocks)

Instead of relays, also optocouplers or transistors can be utilized for the switching tasks. This may require additional circuitry, such as dropping resistors for optocouplers as example.

Appendix 5 – Connection of external switches

2 stereo jacks or
4 mono jacks

2 Stereo Buchsen oder
4 Mono-Buchsen

Foot Switch (stereo)

J1 Stereo Jack

J2 Stereo Jack

front panel switches

S1

S2

S3

S4

optional: opto coupler for muting
purposes to prevent any switching
noises

Optional: Optokoppler zur Kanal-
stummschaltung bei Schaltvorgängen

ACHTUNG:
Alle Schalter müssen als TASTER
ausgeführt sein: AUS - (AN)

ATTENTION:
All switches must be momentary
types: OFF - (ON)