Remote Footswitch Bypass with Relays and CMOS - Conceptual Design
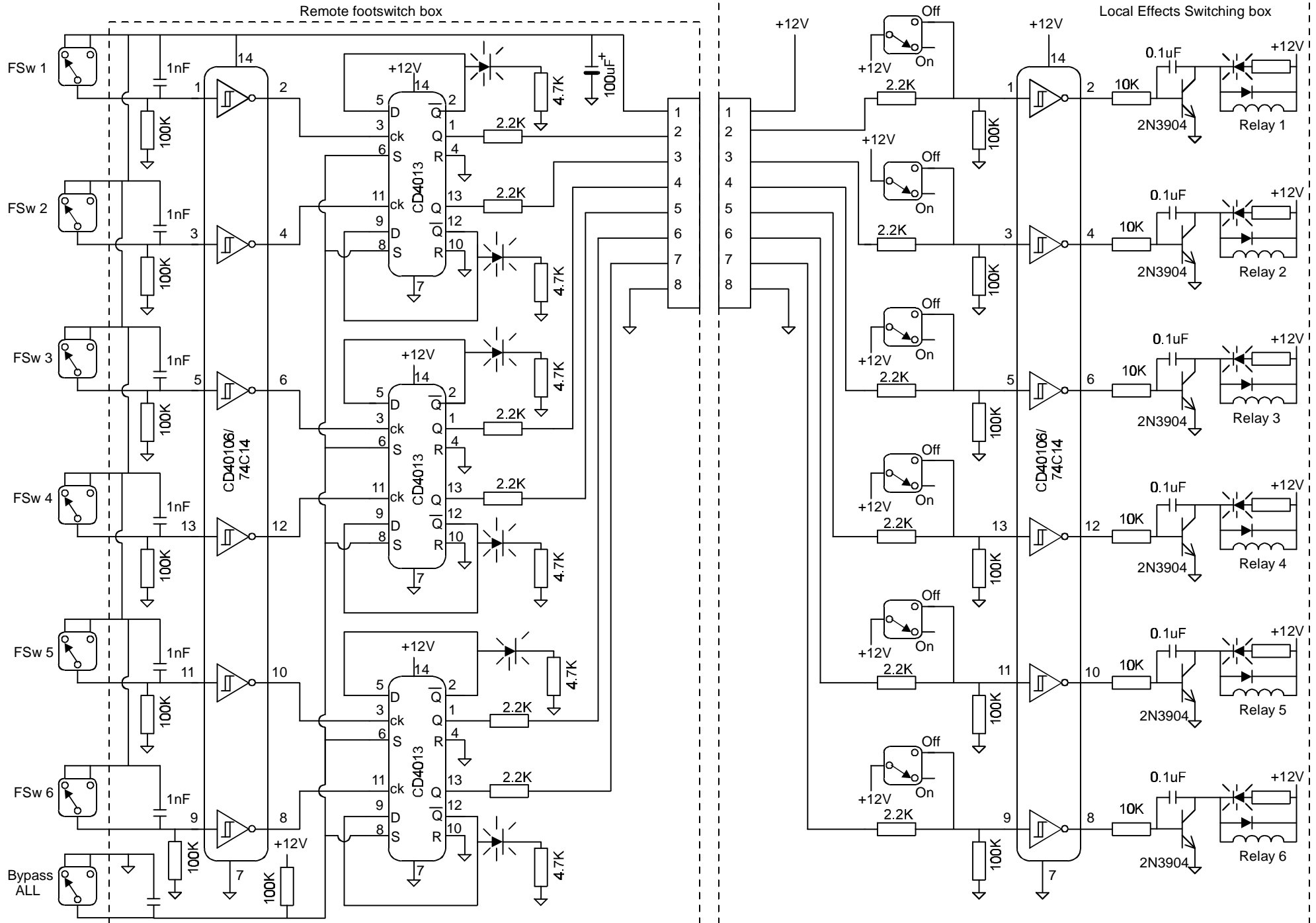
One Relay "Channel"

+V

Panel Switch
+V

On | Off

1/6
CD40106
or 74C14

4.7K

0.1uF

Soft on/off for relay, no
voltage transients to click

100K

10K

One Footswitch "Channel"

+V

SPDT
Alternate
Action

1/2
CD4013

1nF

100K

1/6
CD40106
or 74C14

D   R   Q

ck Q̄

S
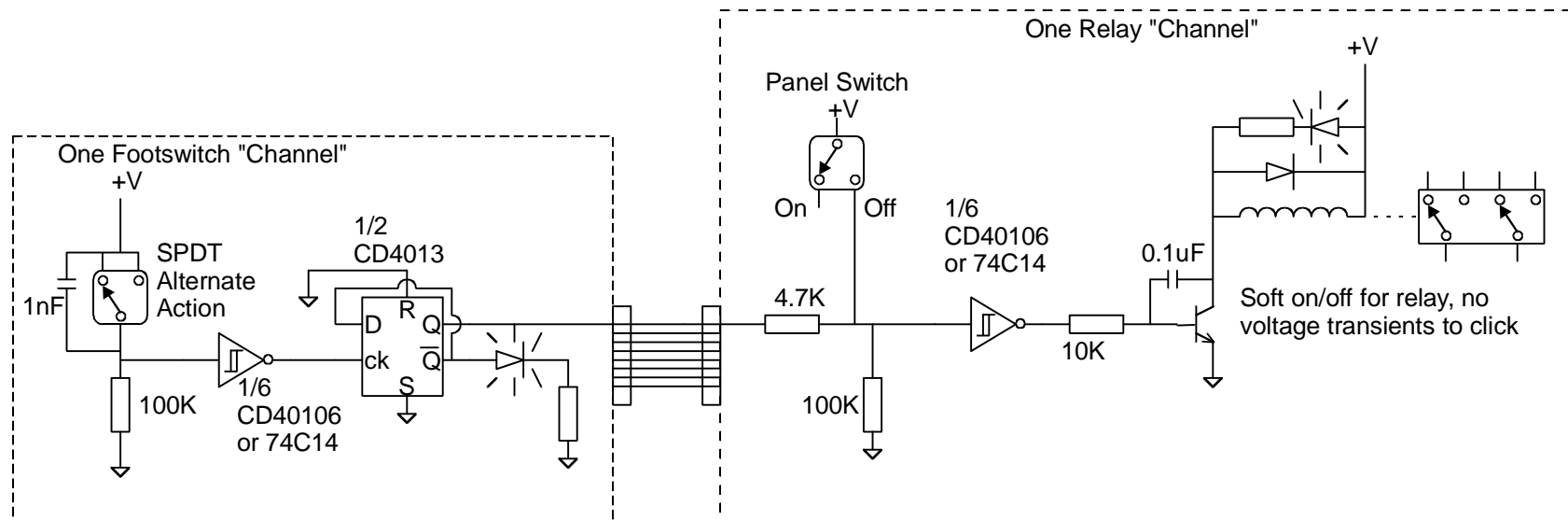
Footswitch operation:

1. Alternate action switch has slight open time when switching.
2. 1nF capacitor debounces the "make" when switched
3. 100K resistor pulls the input of Schmit trigger inverter to ground during
   open time.
4. Schmit trigger inverter senses and cleans up the open time into a
   clean positive going pulse into the clock of the flipflop. Combination of
   the debouncing capacitor and the Schmit trigger make one and only one
   clean clock pulse per switch actuation.
5. D-type flip flop configured as a toggle flip flop, changes state once with
   each clock pulse rising edge.
6. Low on "Q" output is "on" signal to panel.
7. Not Q output is high in "on" state, used to drive low-current LED. Note
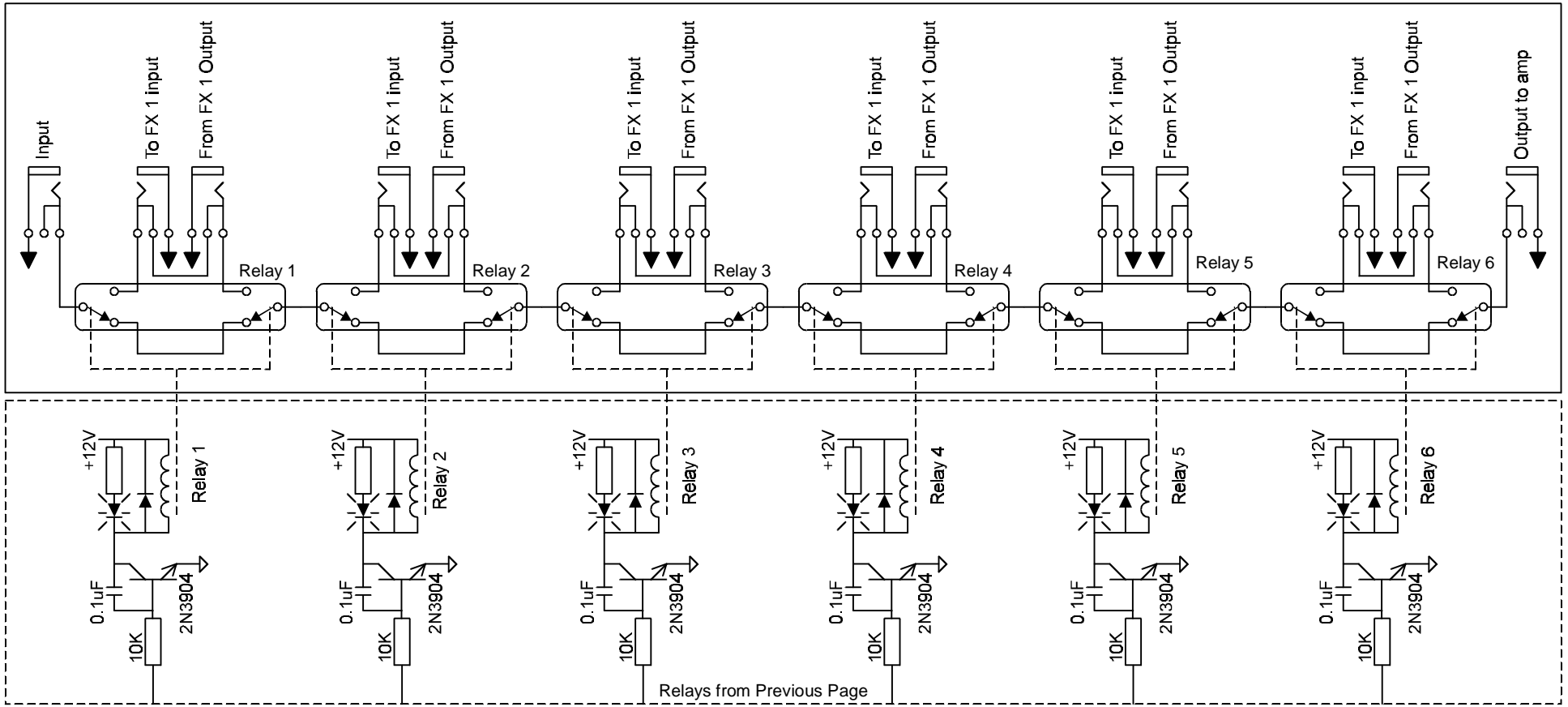   that LED must pull less than 2ma; otherwise a buffer is needed for LED.

Control Panel operation:

1. Relay coil held to +12V on one end, other end pulled low by driver transistor to turn relay ON.
2. LED/resistor to indicate relay state hooked up in parallel with relay coil.
3. Catch diode hooked up to snub inductive kickback of relay coil when relay turns off
4. Driver transistor turns on when a high is placed on the outside of its base resistor.
5. Collector-base capacitor slows the turn on/off times of the driver to prevent capacitive
   coupled clicks in the audio path.
6. CMOS inverter drives base high when its input is held low. CMOS input LOW = RELAY ON.
7. Panel switch can hold CMOS inverter input high (OFF) in spite of all other circuitry.
8. When panel switch is in "ON" position (*not* forcing the CMOS input high) then CMOS
   input is pulled low by 100K resistor if the cable is not plugged in.
9. If cable is plugged in and panel switch in "ON position" (*not* forcing the CMOS input high)
   then the remote footswitch logic can pull the CMOS input high or low through the 4.7K resistor.
10. The 4.7K resistor limits current pulled by the remote CMOS flipflop to 3ma if the panel switch
    is in the "off" position.

Remote Footswitch Bypass with Relays and CMOS - Implementation

Remote footswitch box

Local Effects Switching box

FSw 1
FSw 2
FSw 3
FSw 4
FSw 5
FSw 6
Bypass ALL

+12V

14

1nF
100K

CD40106/74C14

CD4013

+12V

2.2K
4.7K
100uF

Off
On
+12V
2.2K
100K

CD40106/74C14

10K
0.1uF
2N3904
Relay 1
Relay 2
Relay 3
Relay 4
Relay 5
Relay 6

Remote Footswitch Bypass with Relays and CMOS - Audio Path

Input

To FX 1 input | From FX 1 Output | To FX 1 input | From FX 1 Output | To FX 1 input | From FX 1 Output | To FX 1 input | From FX 1 Output | To FX 1 input | From FX 1 Output | To FX 1 input | From FX 1 Output

Output to amp

Relay 1 | Relay 2 | Relay 3 | Relay 4 | Relay 5 | Relay 6

+12V | Relay 1 | +12V | Relay 2 | +12V | Relay 3 | +12V | Relay 4 | +12V | Relay 5 | +12V | Relay 6

0.1uF | 2N3904 | 0.1uF | 2N3904 | 0.1uF | 2N3904 | 0.1uF | 2N3904 | 0.1uF | 2N3904 | 0.1uF | 2N3904

10K | 10K | 10K | 10K | 10K | 10K

Relays from Previous Page

Notes:
(1) Audio Ground (▼) is NOT the same as logic ground (⏚). They may be connected by
    a 1M resistor, a 100 ohm resistor, or left open depending on which gives the lowest hum..
(2) the "Bypass ALL switch from page 2 switches all the relays to off simultaneously.
(3) The jacks in each loop are "normalled" together, so the signal goes through them
    transparently if no jacks are plugged in, regardless of the relay state.
(4) for imbedded effects boards, eliminate jacks and just wire relays to effect board in and out
    terminals.

1N4002 or
equivalent

7812

+12V

470uF
25V

10uF
25V
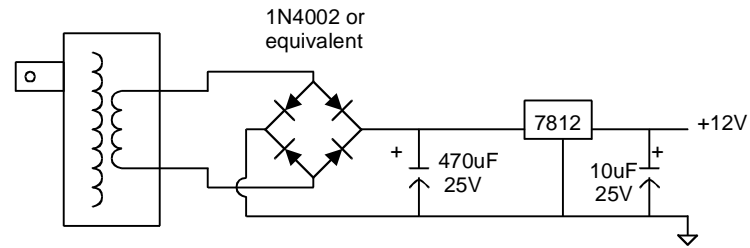
Wall Wart
12Vac to 16Vac
150ma minimum

Packaging It with Steel Studs

Top View, looking through the top of the stud

Input from
guitar

To FX 1
Input

From Fx1
Output

To FX 2
Input

From Fx2
Output

To FX 2
Input

From Fx2
Output

To FX 2
Input

From Fx2
Output

To FX 2
Input

From Fx2
Output

To FX 2
Input

From Fx2
Output

Output
To Amp

Cable Conn.
to panel unit

FX 1 LED

FX2 LED

FX31 LED

FX 4 LED

FX51 LED

FX 6 LED

FX 1
Switch

FX21
Switch

FX 3
Switch

FX41
Switch

FX 5
Switch

FX 6
Switch

Bypass All
Switch

2.25" to 2.5"

17" to 18"

Use a 2" by 6" nominal (1.825" by 5.825" actual) 20gauge to 18 gauge steel stud.