Remote Module Notes

This is a collection of notes that will help you build a remote-control for your stereo or six-channel sound system. It is based around one of two chips, one that has microcode for stereo control and another that is coded for six channel sound. It can be built as a volume-only controller or it can be used as a five channel switcher. Boards are available or it can be built on a proto board. The basic circuit is very simple, as most logic is incorporated in microcode.

Usage instructions are provided below, as are several schematics. There is the main processor schematic, which shows connection between the processor and RDAC/digipot. Another shows basic switcher control, a transistor and relay that can be used for channel selection. One transistor/relay pair is provided for each signal line, and all are paralleled together.

A DPST or DPDT relay can be used to switch a stereo pair, or three DPST or DPDT relays can be paralleled to switch six channels simultaneously. Small signal relays can be driven with a single 2N2222 transistor without any problem. Each relay's normally open contacts are used, and the digipot input ties to all relays – Only the one switched on will provide continuity to the digipot, thereby providing channel selection.

The power supply can be a simple 5V supply, but this poses a problem if audio signals are presented. Audio is AC, so it swings positive and negative. The suggested supply is therefore +/-2.5V, and a schematic is provided for that. Note that decoupling capacitors are not shown on the power supply schematic (or any others, for that matter). It is common practice to install small capacitors across the power lines for each integrated circuit, placed physically close to the chip. Typical values are 0.01uF to 0.1uF. These filter VHF noise that can be developed on the wires from power supply to chip.

Lastly, a visual indicator schematic is provided. In fact, there are at least a couple ways to do this. Using an unused digipot output, the positive supply ties to the "A" line, the negative to the "B" line and the "W" signal then becomes an analog voltage that indicates the volume setting. This can be passed directly to an LED, which then indicates volume by intensity. It can be passed into an LM3916 to provide a 10-LED bar graph that shows volume. Or it can be sent to a panel meter, which indicates volume by numeric display.

More information including build photos, part numbers and other useful stuff can be found in the Group Build thread on *AudioRoundTable.com*:

http://AudioRoundTable.com/forum/index.php?t=msg&th=17476

Blue Stereo Remote Module

The *Blue* Stereo Remote Module reads IR codes sent from a universal remote (set to code 0380).

The user interface is designed for universal remotes with the up/down/left/right controls arranged in a circle. That way volume is up/down, and balance is left/right. It's an intuitive interface. The center button toggles locking the channels together, in case you don't want to set left/right channels separately. If they're already panned to one side or the other, then both channels are set to the average value, the "middle" level. When channels are locked, only up/down work. Toggle it to set that mode on or off.

The "power" button selects power on/off. Buttons one through five select the corresponding input channel. Pressing "input" or "select" will also select channels in a round-robin fashion, incrementing the channel each time it's pushed. The "mute" button sets volume to zero first time it's pressed, then back to normal volume the next time.

When the processor is powered up, the remote is monitored and digipots can be modified. But input selectors can't until "power" is pressed. This turns on the power pin (5V, 40mA max), which can be used to drive a relay and LED. Once power is on, the channel selection can be made as well. It is initially set to channel one, and the corresponding pin is set (again, 5V, 40mA). If another channel is selected, the channel one pin turns off, and the other selected channel pin turns on. When power is tuned off, all channel pins go off.

The digipot and channel selections are volatile, meaning the settings are lost if processor power is removed. However, it is assumed that power to the processor chip will always be applied (so it can listen to the remote for commands). Power to the preamp circuits can be switched by the power relay, but power to the processor should always be present.

When power is first applied to the processor, it sets the digipots to zero (lowest volume) and sets channel to one. However, until "power" is pressed, the channel select pins are off. Once power is pressed, the channel one pin turns on and channel selection can be changed, as described above.

Relays should not be connected directly to the processor, but instead powered using a 2N2222 or similar transistor. An LED can also be safely connected, but current should probably be limited to about 20mA. The maximum rating is 40mA per output pin. A schematic for a suggested drive circuit is attached.

Input pins are provided to sense front-panel buttons. That way the device can be controlled without the remote control. There are pins for power, up, down, left, right and (channel) select. These are all selected by connection to ground. There's an internal pullup resistor, so no other components are necessary - just an SPST pushbutton to ground.

Red Six-Channel Remote Module

The *Red* Six-Channel Remote Module reads IR codes sent from a universal remote (set to code 0380).

The user interface is designed for universal remotes with the up/down/left/right controls arranged in a circle. That way front/back balance is up/down, and left/right balance is left/right. It's an intuitive interface. Overall volume is set with the volume buttons and channel up/down are another front/back fader control. The center button toggles locking the channels together, in case you don't want to set left/right channels separately. If they're already panned to one side or the other, then both left/right channels are set to the average value, the "middle" level. When channels are locked, only up/down work. Toggle it to set that mode on or off.

The "power" button selects power on/off. Buttons one through five select the corresponding input channel. Pressing "input" or "select" will also select channels in a round-robin fashion, incrementing the channel each time it's pushed. The "mute" button sets volume to zero first time it's pressed, then back to normal volume the next time.

When the processor is powered up, the remote is monitored and digipots can be modified. But input selectors can't until "power" is pressed. This turns on the power pin (5V, 40mA max), which can be used to drive a relay and LED. Once power is on, the channel selection can be made as well. It is initially set to channel one, and the corresponding pin is set (again, 5V, 40mA). If another channel is selected, the channel one pin turns off, and the other selected channel pin turns on. When power is tuned off, all channel pins go off.

The digipot and channel selections are volatile, meaning the settings are lost if processor power is removed. However, it is assumed that power to the processor chip will always be applied (so it can listen to the remote for commands). Power to the preamp circuits can be switched by the power relay, but power to the processor should always be present.

When power is first applied to the processor, it sets the digipots to zero (lowest volume) and sets channel to one. However, until "power" is pressed, the channel select pins are off. Once power is pressed, the channel one pin turns on and channel selection can be changed, as described above.

Relays should not be connected directly to the processor, but instead powered using a 2N2222 or similar transistor. An LED can also be safely connected, but current should probably be limited to about 20mA. The maximum rating is 40mA per output pin. A schematic for a suggested drive circuit is attached.

Input pins are provided to sense front-panel buttons. That way the device can be controlled without the remote control. There are pins for power, up, down, left, right and (channel) select. These are all selected by connection to ground. There's an internal pullup resistor, so no other components are necessary - just an SPST pushbutton to ground.

Sheet 1 — Preamp Remote Control Logic

V+ V+ V+

R1
220

C1
1.0uF

V-

IR

TSOP4838

C2
0.1uF

V-

IC1 — AT2313

Pin	Signal		Pin	Signal
1	N/C		20	
2	SEL1_OUT		19	
3	SEL2_OUT		18	
4	BTN_SEL		17	N/C
5	BTN_PWR		16	
6	SEL3_OUT		15	BTN_RT
7	SEL4_OUT		14	BTN_LF
8	SEL5_OUT		13	BTN_DN
9	PWR_OUT		12	BTN_UP
10			11	

V-

IC2 — AD5206

Pin	Signal		Pin	Signal
R6A	1		24	R4B
R6W	2		23	R4W
R6B	3		22	R4A
	4		21	R2B
	5		20	R2W
	6		19	R2A
	7		18	R1A
	8		17	R1W
	9		16	R1B
R5B	10		15	R3A
R5W	11		14	R3W
R5A	12		13	R3B

V-

Note about power:

Split supply +/- 2.5v allows digipots to be run at 0V (from -2v to +2v)
or single +5v supply can be used, with 2.5v bias on digipots.

Voltage on all digipot lines must be greater than V- and less than V+.

All switch outputs are V- when off, V+ when on.

All switch inputs are momentary to V-.

Stereo Pot:	Six-channel Pot:
R1 - Left	R1 - Front Left
R2 - Left	R2 - Rear Left
R3 - Left	R3 - Center
R4 - Right	R4 - Front Right
R5 - Right	R5 - Rear Right
R6 - Right	R6 - Subwoofer

Sheet 2 — Suggested Output Circuit

Left Digipot → Left Audio Input

Right Digipot → Right Audio Input

V+

RELAY DPST

4 3
6 5
1
2

1N4001

Processor Output Pin

1K

2N2222

220

LED

V-   V-

Notes:

All input relays tied to digipot "A" side, "B" side to common
(usually ground) and "W" (wiper) side goes to amplifier input.

Only one relay is energised at a time, so only one input
is connected to the digipots.

Power relay is connected similarly, except switched lines
control power to the amplifier circuitry.

7805

LM317

+ 2.5V

+ 1000uF

470uF

1K

1K

100uF

0.5A Fuse

Input AC Power

12VAC CT Transformer

Bridge Rectifier

7905

LM337

- 2.5V

470uF

1K

1K

100uF

1000uF

Title	Suggested +/-2.5V Power Supply	
Size A	Document Number 20121031	Rev 1
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220

V -

1.0K

Signal Input

10K

10K

4.7K

V -

V +

SIGIN   REFOUT   7

6   RHI
4   RLO

9   MODE
8   REF ADJ

3   V+
2   V-

LED1   1
LED2   18
LED3   17
LED4   16
LED5   15
LED6   14
LED7   13
LED8   12
LED9   11
LED10   10

V +

V -

LM3916

V -

Note: This circuit provides visual indication of volume level
for a single channel. For stereo, two should be used.

Title	Volume Indicator	
Size A	Document Number 20121030	Rev 1
Date:	Wednesday, October 31, 2012 Sheet 1 of 1	