21M.380 · Music and Technology
Recording Techniques & Audio Production

Mixing consoles

Session 14 · Wednesday, October 26, 2016

1 Preview recording sessions

- How to read a stage plan and routing table
- Main stereo mic + spot mics + ambience mics
- Review gain staging: How to set preamp gain

2 Student presentation (PA1)

- [redacted]

3 Early feedback

4 Introduction to mixing consoles

4.1 What are mixers for?

- Music is often consumed in stereo on 2 channels (L & R)
  - Public address (PA) systems typically designed in stereo
  - Home stereo systems: *nomen est omen*
  - Many physical media designed for stereo (e.g., CD)
- But you might want to record many more than just 2 instruments!
- And even a single instrument might require more than 2 mics (drumkit)!
- Problem: How to *mix* many input signals down to fewer output signals?
- That a mixer's primary function, but it also serves many others:
  - Central hub for all signals in a recording studio or live PA
  - Built-in mic preamps to amplify signals and provide phantom power
  - On-board EQs and (mostly on digital mixers) other effects
  - Splitting signals to multiple destinations (e.g., record and amplify)
- Mixers can be confusing, but always boils down to 2 simple questions:
  - What goes in where?
  - What comes out where?

4.2 Example models

- All mixers are different. All mixers are the same.
- We'll look at Mackie CR1604-VLZ in depth (popular small analog mixer)
- But goal is to enable you to find your way around *any* mixer model
- Principles we learn also apply to your DAW's built-in software mixer

4.3 Topology

Virtually all mixers feature 3 distinct sections:

- Patchbay (physical inputs; rear or top of console)
- Input channel strips (left side of console)
- Output section (right side of console)

5 Input channel strip

- Mackie CR1604-VLZ: 16 identical mono input channel strips
- Other mixers: (many) mono & (fewer) stereo input channels
- If you understand a single strip, you understand 80% of the mixer ☺

5.1 Physical inputs

- Mic input (XLR)
- Line input (TRS or TS): keyboards, guitars, CD players, tape returns, etc.[1]
- Mackie CR1604-VLZ: Mixes both inputs ☺, but using same trim ☹

[1] Note that the line input sockets on the Mackie CR1604-VLZ can very easily be confused with its channel *inserts*.

5.2 Preamps & phantom power

- Phantom power:
  - Mackie CR1604-VLZ: single switch for all 16 channels
  - Larger mixers: per-channel switches
- Trim:
  - Set gain of preamp to amplify mic and/or line input
  - Idea: Set trim once during soundcheck; use faders for actual mix
  - Goal: Set trim such that fader provides 'meaningful' signal (as loud as possible without resulting in overload or feedback)
  - Often done by eye (in the first instance), using signal meters
  - Mackie CR1604-VLZ: green -20 LED (signal) & red OL LED (overload)

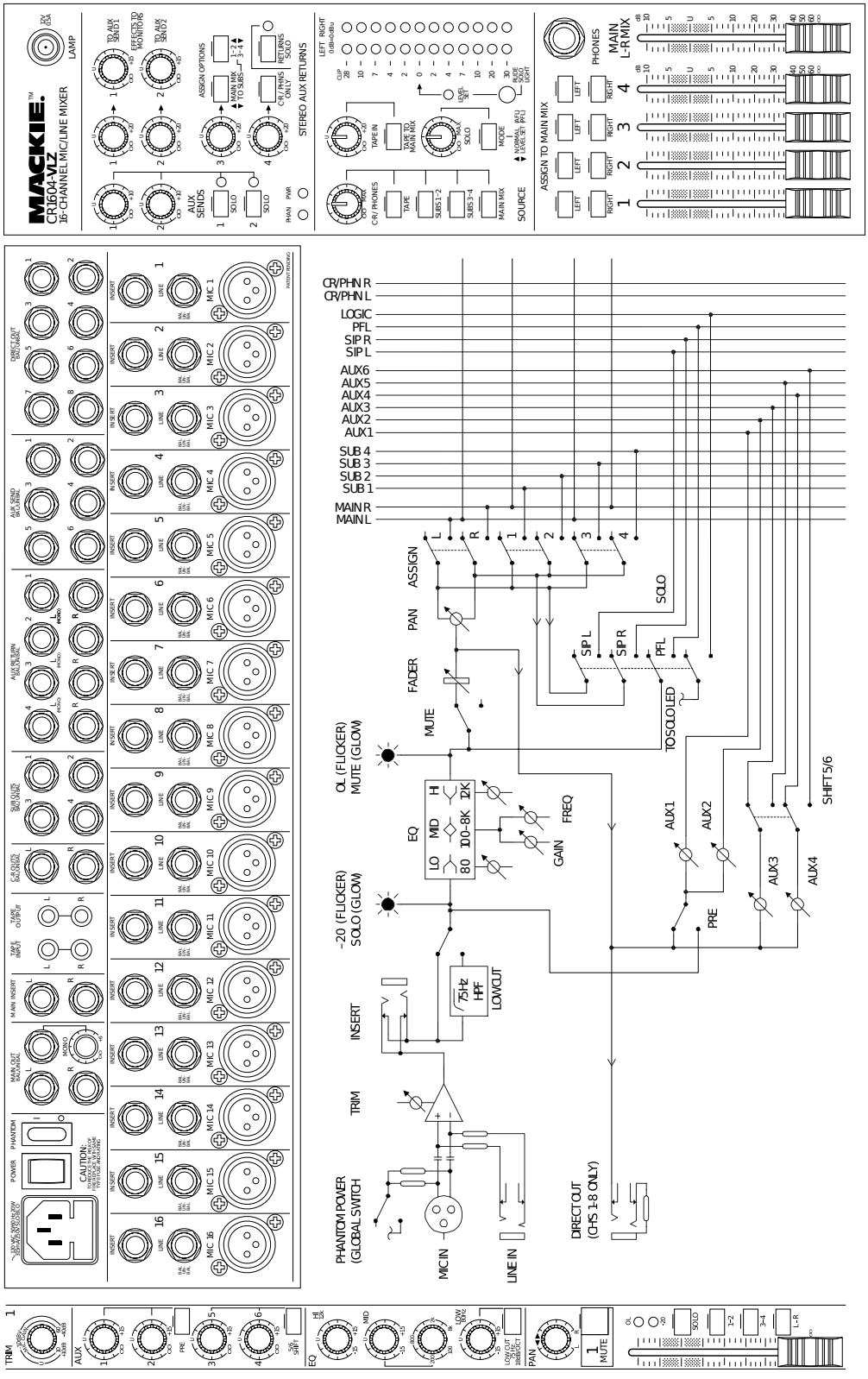

FIGURE 1. Mackie CR1604 VLZ mixer (© LOUD Technologies Inc. With edits. All rights reserved. This content is excluded from our Creative Commons license. For more information, see http://ocw.mit.edu/help/faq-fair-use/)

5.3 Inserts

- 2 different strategies for applying sound effects[2]
  - *Loop-in effects* (e.g., compressor, distortion, EQ): typically via *inserts*
  - *Mix-in effects* (e.g, reverb, chorus): typically via *auxiliaries* (see below)
- Unusual: An insert combines an output from the mixer (*insert send*) with an input to the mixer (*insert return*) in a single socket.
- Inserting a cable into that socket makes the (entire) signal leave the mixer and return through the same cable.
- Typical insert cable: Single TRS plug on mixer end splits into 2 TS plugs on effect end (Y cable). Balanced or unbalanced?

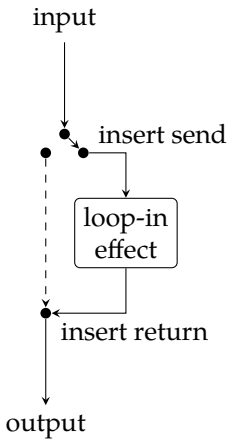

FIGURE 2. Loop-in effect (e.g., EQ, compressor, distortion), typically implemented as an *insert*

5.4 EQ section

Mackie CR1604-VLZ: Typical example of channel strip EQ

- Which kind of EQ? How many bands?
- Which parameters can be adjusted?

5.5 Mute button

- Takes signal out of the mix
- Mackie CR1604-VLZ:
  - Re-uses red LED that also indicates signal overload (OL)
  - Exercise: Will mute also affect aux sends?

5.6 Fader

- Mackie CR1604-VLZ: 60 mm ☹
- Larger mixers: 100 mm ☺
- Digital mixers might feature motorized faders (parameter automation)

5.7 Direct outputs

- Direct out(put) ≈ 'insert without return'
- Purpose: Split (single) input signal; send to 2 destinations at once
- Mackie CR1604-VLZ: Direct outs on input channels 1–8 (*post-fader*)
  - Signal level of direct outs cannot be adjusted (but digital HW & SW mixers often more flexible)
  - Nice hack: *Half-plugged inserts* can be used as *pre-fader* direct outs ☺

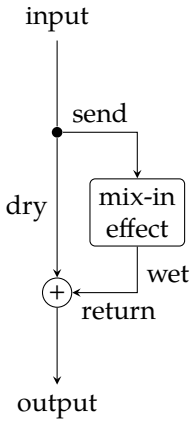

FIGURE 3. Mix-in effect (e.g., reverb, chorus, flanger), typically implemented as an *auxiliary*

[2] Izhaki (2011a) refers to loop-in effects as *processors* and to mix-in effects as *effects*.

- Typical application: Multitrack studio recording[3]
  - Send individual input signals 1–8 to DAW via direct outs
  - Feed DAW outputs back into mixer on input channels 9–16
  - Mix inputs 9–16 to main L/R (*post-tape monitoring*; control room)

[3] Note that this requires an audio interface with more than 2 input channels!

5.8 Auxiliaries

- Another way to get signals out of (and back into) the mixer
- Mackie CR1604-VLZ:
  - 6 mono aux sends (4 post-fader; 2 switchable pre/post)
  - 4 stereo aux returns

5.8.1 Pre-fader aux(iliari)es

- Signal leaves mixer *before* the fader (so fader does not affect it)
- Useful to create additional mix that is independent from main mix
- Typical application: *Monitor mix* for the musicians (no return required)

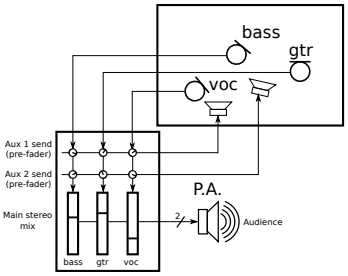

FIGURE 4. Using pre-fader auxiliaries for providing independent mixes on on-stage monitor loudspeakers

5.8.2 Post-fader aux(iliari)es

- Signal leaves mixer *after* the fader (so fader does affect it)
- Typical application: *Mix-in effects* (with return)
- Effect output returned via regular input channel(s) or special *aux return*
- Even if aux send is mono, aux return might be stereo (e.g., reverb)

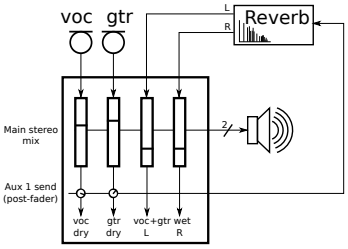

FIGURE 5. Using a post-fader auxiliary for a mix-in effect

5.9 Panpot or balance control

- Remember: Panpot for mono inputs, balance control for stereo inputs
- Mackie CR1604-VLZ: Only mono inputs (hence only panpots)
- Panpot law might be switchable on digital (but rarely analog) mixers

5.10 Solo function

Mode	Meaning	Output bus used	Application
PFL	Pre-fader listening	Solo (mono)	Live mixing
AFL	After-fader listening	Solo (mono)	
SIP	Solo-in-place	Main mix (stereo)	Mixdown

TABLE 1. Solo modes (cf., Thompson 2005, p. 76)

- Soloing a channel is not necessarily equivalent to muting all others!
  - Channel strip EQ might or might not affect solo bus

  - Fader position might or might not affect solo bus
- Different *solo modes* (cf., table 1)
- Mackie CR1604-VLZ:
  - Any solo button activates RUDE SOLO LIGHT in output section
  - Helpful to prevent confusion (what am I listening to?!)
  - Exercise: Is EQ audible in soloed signal?
  - Exercise: Which solo modes are offered?

5.11 Routing inputs to outputs

- Fader position determines *level* at which input is sent to output bus(es)
- Buttons determine whether input is routed to output(s) *at all* (on/off)
- Routing buttons on Mackie CR1604-VLZ (next to input faders):
  - Main stereo mix (L–R)
  - Sub groups (1–2 & 3–4): additional outputs (panpot applies)

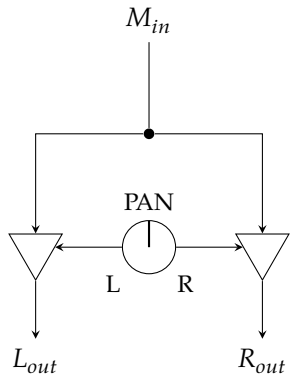

FIGURE 6. Panpot (mono input)

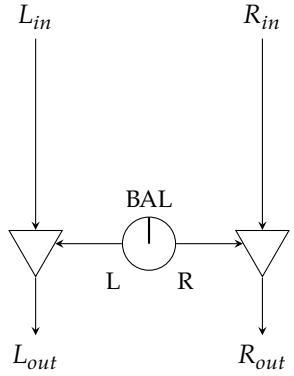

FIGURE 7. Balance control (stereo input)

6 Output section

- Less standardized across different models than input channel strips
- Output faders (main stereo mix L–R; sub groups 1–4)
- Aux return controls
- PFL/AFL switch
- Talkback (communication between control room and recording space)

6.1 Signal meters

Mackie CR1604-VLZ:

- Single 12-LED stereo level meter (not particularly luxurious)
- Serves multiple purposes (e.g., main stereo mix vs. solo bus)

6.2 Main inserts

- Feature on Mackie CR1604-VLZ (and many other analog mixers)
- Allows to insert a loop-in effect into main stereo mix
- Typical application: master compressor

6.3 Control-room monitoring

- Control-room and headphone mix controls (assignable source(s))

6.4 Tape return

- Unbalanced RCA connection
  - Send main L/R mix to stereo tape machine (tape send)
  - Feed output of tape machine back into mixer (tape return)
- Tape return for *post-tape monitoring*

7 Preview ED4 assignment

- Create *stems* for the individual instruments in a multitrack recording.
- Choose one of three productions you'd like to work with

References & further reading

Izhaki, Roey (2011a). *Mixing Audio. Concepts, Practices and Tools*. 2nd ed. Focal Press. 600 pp. ISBN: 978-0240522227. MIT LIBRARY: 002302617. Hardcopy and electronic resource. On course reserve at the Lewis Music Library. Accompanying sound examples: http://www.taylorandfrancis.com/cw/izhaki-9780240522227/p/resources/.

— (2011b). "Mixing consoles." In: *Mixing Audio. Concepts, Practices and Tools*. 2nd ed. Focal Press. Chap. 9, pp. 99–138. ISBN: 978-0240522227. MIT LIBRARY: 002302617. URL: http://libproxy.mit.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=454037&site=ehost-live&ebv=EB&ppid=pp_99 (visited on 11/22/2014). Requires MIT library login (max. 1 reader at a time).

— (2011c). "Software mixers." In: *Mixing Audio. Concepts, Practices and Tools*. 2nd ed. Focal Press. Chap. 10, pp. 139–73. ISBN: 978-0240522227. MIT LIBRARY: 002302617. URL: http://libproxy.mit.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=454037&site=ehost-live&ebv=EB&ppid=pp_139 (visited on 11/22/2014). Requires MIT library login (max. 1 reader at a time).

Lidbetter, Paul (1994). "Digital Mixing." In: *Sound Recording Practice*. Ed. by John Borwick. Oxford University Press. Chap. 8, pp. 176–203.

Rumsey, Francis and Tim McCormick (2009). "Mixers." In: *Sound and Recording. An Introduction*. 6th ed. Focal Press. Chap. 5, pp. 107–65. MIT LIBRARY: 002147704.

Swettenham, Richard (1994). "Mixing Consoles: Analogue." In: *Sound Recording Practice*. Ed. by John Borwick. Oxford University Press. Chap. 7, pp. 143–75.

Thompson, Daniel M. (2005). *Understanding audio. Getting the most out of your project or professional recording studio*. Berklee Press.

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