Complete Audio Chain Configuration - Ghetto Blaster

HiFiBerry AMP100 + PeppyMeter + CamillaDSP

Date: 2025-01-09
Status: ■ Complete Configuration Document

■ Audio Chain Overview

Complete Flow (PeppyMeter ON + CamillaDSP ON):

```
Music File
  ↓
MPD (Music Player Daemon)
  ↓
device "_audioout" (ALSA PCM)
  ↓
/etc/alsa/conf.d/_audioout.conf
  ↓ (routes to camilladsp when CamillaDSP is ON)
pcm.camilladsp (ALSA device)
  ↓
CamillaDSP Process (applies filters/EQ)
  ↓ (outputs to peppy when PeppyMeter is ON)
pcm.peppy (ALSA device)
  ↓
PeppyMeter Process (reads from /tmp/peppymeter FIFO, displays VU meters)
  ↓
/etc/alsa/conf.d/_peppyout.conf
  ↓
plughw:0,0 (HiFiBerry AMP100 - card 0, device 0)
  ↓
HiFiBerry AMP100 Hardware
  ↓
Speakers
```

Simplified Flow (PeppyMeter ON, CamillaDSP OFF):

```
MPD → _audioout → peppy → _peppyout → plughw:0,0 → AMP100
```

Simplified Flow (PeppyMeter OFF, CamillaDSP ON):

```
MPD → _audioout → camilladsp → plughw:0,0 → AMP100
```

Direct Flow (Both OFF):

```
MPD → _audioout → plughw:0,0 → AMP100
```

■ Configuration Files

1. Boot Configuration (`/boot/firmware/config.txt`)

```
# Pi 5 specific
[pi5]
dtoverlay=vc4-kms-v3d-pi5,noaudio
hdmi_enable_4kp60=0

# Common settings
[all]
max_framebuffers=2
display_auto_detect=1
disable_fw_kms_setup=1
arm_64bit=1
enable_uart=1

# Display settings
disable_overscan=1
hdmi_group=2
hdmi_mode=87
hdmi_cvt=400 1280 60 6 0 0 0
hdmi_force_mode=1

# Audio settings
dtparam=i2s=on
dtparam=audio=off
dtoverlay=hifiberry-amp100,automute
force_eeprom_read=0
```

Critical Settings:
• `dtoverlay=hifiberry-amp100,automute` - Enables AMP100 with auto-mute
• `dtparam=audio=off` - Disables onboard audio (prevents conflicts)
• `dtoverlay=vc4-kms-v3d-pi5,noaudio` - Disables HDMI audio

2. ALSA Configuration

`/etc/alsa/conf.d/_audioout.conf`

Purpose: Routes MPD output to correct destination

Configuration Logic (from `updAudioOutAndBtOutConfs()`):

```
Priority order:
1. If alsaequal != 'Off' → slave.pcm "alsaequal"
2. Else if camilladsp != 'off' → slave.pcm "camilladsp"
3. Else if crossfeed != 'Off' → slave.pcm "crossfeed"
4. Else if eqfa12p != 'Off' → slave.pcm "eqfa12p"
5. Else if invert_polarity != '0' → slave.pcm "invpolarity"
6. Else if peppy_display == '1' → slave.pcm "peppy"
7. Else if audioout == 'Bluetooth' → slave.pcm "btstream"
8. Else → slave.pcm "plughw:CARD,0" (direct to hardware)
```

Default Template:

```
pcm._audioout {
    type copy
    slave.pcm "plughw:0,0"
}
```

`/etc/alsa/conf.d/_peppyout.conf`

Purpose: Routes PeppyMeter output to hardware

Configuration Logic (from `updPeppyConfs()`):

```
If audioout == 'Bluetooth':
    slave.pcm "btstream"
Else:
    slave.pcm "plughw:CARD,0" (or hw:CARD,0 or iec958 device)
```

Default Template:

```
pcm._peppyout {
    type copy
    slave.pcm "plughw:0,0"
}
```

`/etc/alsa/conf.d/camilladsp.conf`

Purpose: ALSA wrapper for CamillaDSP

Configuration: Managed by CamillaDSP class
• Capture: stdin (pipe from MPD)
• Playback: Set by `setPlaybackDevice()`
• If PeppyMeter ON: `device: "peppy"`
• If Bluetooth: `device: "btstream"`
• Otherwise: `device: "plughw:CARD,0"`

3. MPD Configuration (`/var/lib/mpd/mpd.conf`)

Audio Output:

```
audio_output {
    type "alsa"
    name "ALSA Default"
    device "_audioout"
    mixer_type "hardware"  # or "software" or "null" (for CamillaDSP)
    mixer_control "PCM"    # or "Master" depending on device
    mixer_device "hw:0"
    mixer_index "0"
}
```

Critical Settings:
• `device "_audioout"` - Always uses ALSA `_audioout` device
• `mixer_type`:
• `"hardware"` - Uses AMP100 hardware volume control
• `"software"` - Uses MPD software volume
• `"null"` - No volume control (used when CamillaDSP is active)

4. CamillaDSP Configuration

Config File Location

• Active config: `/usr/share/camilladsp/working_config.yml`
• Configs directory: `/usr/share/camilladsp/configs/`
• Coefficients: `/usr/share/camilladsp/coeffs/`

Playback Device Logic (`setPlaybackDevice()`)

```
If peppy_display == '1':
    device: "peppy"  # Output to PeppyMeter
Else if audioout == 'Bluetooth':
    device: "btstream"
Else:
    device: "plughw:CARD,0"  # Direct to hardware
```

Capture Device

• Always: `type: "Stdin"` (reads from pipe)
• Format: Auto-detected from hardware capabilities

5. PeppyMeter Configuration (`/etc/peppymeter/config.txt`)

Critical Settings:

```
[current]
meter = blue                    # Always use blue meter skin
random.meter.interval = 0       # Disable random switching
meter.folder = 1280x400         # Display resolution folder
screen.width = 1280
screen.height = 400

[data.source]
```

```
type = pipe
pipe.name = /tmp/peppymeter     # FIFO pipe from MPD
```

Meter Skin: Always `blue` (set by `set-peppymeter-blue.sh`)

6. moOde Database Configuration

Critical Parameters:

```
-- Audio device
cfg_system.cardnum = 0                    -- AMP100 card number
cfg_system.i2sdevice = "HiFiBerry AMP100"
cfg_mpd.device = 0                        -- MPD device card number

-- PeppyMeter
cfg_system.peppy_display = 1              -- 1 = ON, 0 = OFF
cfg_system.peppy_display_type = "meter"   -- "meter" or "spectrum"

-- CamillaDSP
cfg_system.camilladsp = "bose_wave_filters.yml"  -- Config file name or "off"
cfg_system.cdsp_fix_playback = "Yes"     -- Enable playback device fix

-- Display
cfg_system.hdmi_scn_orient = "portrait"  -- Hardware orientation
cfg_system.local_display = 1              -- 1 = Local display ON
```

■ Configuration Logic (PHP Code)

Audio Output Routing (`updAudioOutAndBtOutConfs()`)

Priority Order:
1. **CamillaDSP** (highest priority if enabled)
2. **PeppyMeter** (if CamillaDSP OFF)
3. **Direct hardware** (if both OFF)

Code Logic:

```
if ($_SESSION['camilladsp'] != 'off') {
    $alsaDevice = 'camilladsp';  // Route to CamillaDSP
} else if ($_SESSION['peppy_display'] == '1') {
    $alsaDevice = 'peppy';       // Route to PeppyMeter
} else {
    $alsaDevice = 'plughw:' . $cardNum . ',0';  // Direct to hardware
}
```

CamillaDSP Playback Device (`setPlaybackDevice()`)

Code Logic:

```
if ($_SESSION['peppy_display'] == '1') {
    $alsaDevice = 'peppy';  // Output to PeppyMeter for display
} else {
    $alsaDevice = 'plughw:' . $cardNum . ',0';  // Direct to hardware
}
```

Result: When PeppyMeter is ON, CamillaDSP outputs to `peppy`, which then routes to `_peppyout` → hardware.

■ Perfect Configuration Checklist

Boot Configuration

• [x] `dtoverlay=hifiberry-amp100,automute` in config.txt
• [x] `dtparam=audio=off` in config.txt
• [x] `dtoverlay=vc4-kms-v3d-pi5,noaudio` in config.txt
• [x] `dtparam=i2s=on` in config.txt

moOde Database

• [x] `cardnum = 0` (AMP100 card number)
• [x] `i2sdevice = "HiFiBerry AMP100"`
• [x] `mpd.device = 0`
• [x] `peppy_display = 1` (if using PeppyMeter)
• [x] `peppy_display_type = "meter"`
• [x] `camilladsp = "bose_wave_filters.yml"` (or filter config name)
• [x] `cdsp_fix_playback = "Yes"`

ALSA Configuration

• [x] `_audioout.conf` routes to correct device:
• CamillaDSP ON → `camilladsp`
• PeppyMeter ON (CamillaDSP OFF) → `peppy`
• Both OFF → `plughw:0,0`
• [x] `_peppyout.conf` routes to `plughw:0,0`
• [x] `camilladsp.conf` configured correctly

PeppyMeter Configuration

• [x] `meter = blue` (always blue skin)
• [x] `random.meter.interval = 0` (no random switching)
• [x] `meter.folder = 1280x400` (correct resolution)
• [x] `pipe.name = /tmp/peppymeter` (FIFO pipe)

CamillaDSP Configuration

• [x] Config file exists in `/usr/share/camilladsp/configs/`
• [x] Playback device set correctly:
• PeppyMeter ON → `device: "peppy"`
• PeppyMeter OFF → `device: "plughw:0,0"`
• [x] Capture device: `type: "Stdin"`

MPD Configuration

• [x] `device "_audioout"` (always uses ALSA _audioout)
• [x] `mixer_type`:
• CamillaDSP ON → `"null"` (no volume control)
• CamillaDSP OFF → `"hardware"` or `"software"`

■■ Safety Checks & Validation

Audio Chain Validation Script

Location: `scripts/audio/validate-audio-chain.sh`

Checks:
1. AMP100 detection (`/proc/asound/cards`)
2. moOde database configuration
3. ALSA config files (`_audioout.conf`, `_peppyout.conf`)
4. MPD status and configuration
5. PeppyMeter status
6. CamillaDSP status
7. Volume/mute state

Audio Chain Fix Script

Location: `scripts/audio/fix-audio-chain.sh`

Fixes:
1. Detects AMP100 card number
2. Updates moOde database (`cardnum`, `i2sdevice`, `mpd.device`)
3. Fixes `_audioout.conf` to point to correct device
4. Fixes `_peppyout.conf` to point to AMP100
5. Unmutes and sets safe volume
6. Restarts MPD

PeppyMeter Blue Skin Script

Location: `scripts/wizard/set-peppymeter-blue.sh`

Fixes:
1. Sets `meter = blue` in `/etc/peppymeter/config.txt`
2. Disables random meter switching
3. Restarts PeppyMeter if running

■ Audio Chain Scenarios

Scenario 1: PeppyMeter ON + CamillaDSP ON

```
MPD → _audioout → camilladsp → peppy → _peppyout → plughw:0,0 → AMP100
```

Configuration:
• `_audioout.conf`: `slave.pcm "camilladsp"`
• CamillaDSP playback: `device: "peppy"`
• `_peppyout.conf`: `slave.pcm "plughw:0,0"`
• MPD mixer_type: `"null"` (CamillaDSP handles volume)

Scenario 2: PeppyMeter ON + CamillaDSP OFF

```
MPD → _audioout → peppy → _peppyout → plughw:0,0 → AMP100
```

Configuration:
• `_audioout.conf`: `slave.pcm "peppy"`
• `_peppyout.conf`: `slave.pcm "plughw:0,0"`
• MPD mixer_type: `"hardware"` or `"software"`

Scenario 3: PeppyMeter OFF + CamillaDSP ON

```
MPD → _audioout → camilladsp → plughw:0,0 → AMP100
```

Configuration:
• `_audioout.conf`: `slave.pcm "camilladsp"`
• CamillaDSP playback: `device: "plughw:0,0"`
• MPD mixer_type: `"null"`

Scenario 4: Both OFF (Direct)

```
MPD → _audioout → plughw:0,0 → AMP100
```

Configuration:
• `_audioout.conf`: `slave.pcm "plughw:0,0"`
• MPD mixer_type: `"hardware"` or `"software"`

■ Configuration Update Functions

`updAudioOutAndBtOutConfs($cardNum, $outputMode)`

Purpose: Updates `_audioout.conf` routing

Called from:
• `updMpdConf()` - When MPD config is updated
• `setAudioOut()` - When audio output changes
• `changeMPDMixer()` - When mixer type changes

`updPeppyConfs($cardNum, $outputMode)`

Purpose: Updates `_peppyout.conf` routing

Called from:
• `updMpdConf()` - When MPD config is updated
• `setAudioOut()` - When audio output changes

`setPlaybackDevice($cardNum, $outputMode)`

Purpose: Sets CamillaDSP playback device in YAML config

Called from:
• `updDspAndBtInConfs()` - When DSP configs are updated

■ Common Issues & Fixes

Issue: No Audio Output

Causes:
1. AMP100 not detected (check `/proc/asound/cards`)
2. Wrong card number in database
3. `_audioout.conf` points to wrong device
4. MPD not running
5. Volume muted or too low

Fix: Run `fix-audio-chain.sh`

Issue: PeppyMeter Shows No Activity

Causes:
1. PeppyMeter not running (`systemctl status peppymeter`)
2. FIFO pipe not created (`/tmp/peppymeter`)
3. MPD not outputting to `_audioout`
4. `_audioout.conf` not routing to `peppy`

Fix: Check PeppyMeter service and ALSA routing

Issue: CamillaDSP Filters Not Applied

Causes:
1. CamillaDSP not running (`systemctl status camilladsp`)
2. Config file not selected in moOde
3. Config file missing from `/usr/share/camilladsp/configs/`
4. Playback device misconfigured

Fix: Check CamillaDSP service and config file

Issue: Wrong Meter Skin

Causes:
1. `meter = blue` not set in `/etc/peppymeter/config.txt`
2. Random meter switching enabled

Fix: Run `set-peppymeter-blue.sh`

■ Verification Commands

Check Audio Chain

```
# 1. Check AMP100 detection
cat /proc/asound/cards

# 2. Check ALSA routing
cat /etc/alsa/conf.d/_audioout.conf
cat /etc/alsa/conf.d/_peppyout.conf

# 3. Check MPD config
grep "device\|mixer_type" /var/lib/mpd/mpd.conf

# 4. Check moOde database
sqlite3 /var/local/www/db/moode-sqlite3.db \
  "SELECT param, value FROM cfg_system WHERE param IN ('cardnum', 'i2sdevice', 'peppy_display', 'cam

# 5. Check PeppyMeter config
grep "meter\|random" /etc/peppymeter/config.txt

# 6. Check CamillaDSP config
cat /usr/share/camilladsp/working_config.yml | grep -A 5 "playback"

# 7. Check services
systemctl status mpd
systemctl status peppymeter
systemctl status camilladsp
```

Test Audio Output

```
# Direct hardware test
```

```
speaker-test -c 2 -t sine -f 1000 -D plughw:0,0

# Test via _audioout
speaker-test -c 2 -t sine -f 1000 -D _audioout
```

■ Deployment

Files to Deploy

Scripts:
• `scripts/audio/fix-audio-chain.sh` → `/usr/local/bin/`
• `scripts/audio/validate-audio-chain.sh` → `/usr/local/bin/`
• `scripts/wizard/set-peppymeter-blue.sh` → `/usr/local/bin/`

Services:
• `moode-source/lib/systemd/system/fix-audio-chain.service` → `/lib/systemd/system/`
• `moode-source/lib/systemd/system/set-peppymeter-blue.service` → `/lib/systemd/system/`

ALSA Configs:
• `moode-source/etc/alsa/conf.d/_audioout.conf` → `/etc/alsa/conf.d/`
• `moode-source/etc/alsa/conf.d/_peppyout.conf` → `/etc/alsa/conf.d/`

Deployment Method

Via INSTALL*FIXES*AFTER_FLASH.sh:
• All scripts and services automatically installed
• Configurations applied on boot

Manual Deployment:
• Copy scripts to `/usr/local/bin/`
• Copy services to `/lib/systemd/system/`
• Enable services: `systemctl enable fix-audio-chain.service`
• Run scripts manually or let services run on boot

■ Summary

Complete Audio Chain:
1. **MPD** outputs to `_audioout` ALSA device
2. **`_audioout.conf`** routes based on enabled features:
• CamillaDSP ON → `camilladsp`
• PeppyMeter ON → `peppy`
• Both OFF → `plughw:0,0`
3. **CamillaDSP** (if ON) processes audio, outputs to:
• PeppyMeter ON → `peppy`
• PeppyMeter OFF → `plughw:0,0`
4. **PeppyMeter** (if ON) displays VU meters, outputs to `_peppyout`
5. **`_peppyout.conf`** routes to `plughw:0,0`
6. **Hardware** `plughw:0,0` = HiFiBerry AMP100

Perfect Configuration:
• Boot: AMP100 overlay enabled, onboard audio disabled
• Database: Correct card number, device settings
• ALSA: Correct routing based on enabled features

• PeppyMeter: Blue skin, no random switching
• CamillaDSP: Correct playback device, filters configured
• MPD: Correct mixer type, device routing

Safety:
• Validation scripts check all components
• Fix scripts ensure correct configuration
• Services run on boot to maintain configuration
• Volume safety (unmute, set safe level)

This document contains the complete, precise audio chain configuration for Ghetto Blaster system.