LISY

LInux for SYstem 1 & 80

Software Version 4.09

user manual

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Important remark

By using LISY1 or LISY80 it is possible to damage your pinball machine. As this is a private project with NO commercial interest the author accept no liability for any damage that may arise by using LISY1 or LISY80!

1. Introduction

LISY uses a Raspberry PI Zero which is integrated in a self-designed PCB, used software basis is Raspbian und PINMAME.

With LISY1 you can control ALL Gottlieb System1 pinball machines by replacing the original MPU.

With LISY80 you can control ALL Gottlieb System80 pinball machines by replacing the original MPU.

- I sell the PCB with programmed PICs at my cost price. I'm not looking to earn money with LISY, it is a 100% hobby project. This makes the solution cheap, depending on where you buy your components it is possible to create your Gottlieb replacement MPU for less than 60 €.
    - Die modified pinmame code is under GNU License, you can download it for free.
    - List of (standard) components is documented.
- As the solution is using pinmame gameplay is 100% compared to the original game
- Optional you can use 'Freeplay' or 'Ballsave'.
- There is a Web interface integrated ('LISYcontrol'). This means, by connecting to LISY it is possible to control each lamp and each solenoid via Web browser. Status of switches are shown on one page, and switch descriptions can be edited in a 'csv' table. Connection to LISY can be done by integrating LISY to your local LAN/WLAN or by letting start LISY a WLAN hotspot where you can connect to.

What do you need?

- Basic soldering skills (only one of the integrated circuits are in SMD size)
- Possibility to read/write micro SD cards
- Wireless LAN oder LAN if you want to use LISYcontrol
- A Gottlieb pinball Machine System 1, System 80, 80A or 80B Series.

Note: Because of copyright reasons the image does not contain any Gottlieb code/roms. You can find these roms (‚pinamme‘ rom sets) at different places on the internet. Use of the rom sets is not allowed if you do not own the original proms.

2. Quickstart

1. Put the latest image of LISY from my website tom the SD card (details see next section)
2. Get the ‚pinmame‘ rom set for your Gottlieb pinball and save it onto the SD card. The ‚boot‘ partition of the sd card is readable within windows. For System1 games (LISY1) save the .zip archive to “/lisy1/roms”, for System games (LISY80) save it in the “/lisy80/roms” folder. See appendix A for the correct name of the .zip file. (Column ‚Mame Name‘)
3. Set all dips of switch S1 to OFF
4. Configure switch S2 according to your pinball (Appendix A or Appendix B)
5. Replace your original Gottlieb MPU with LISY1 or LISY80
6. Switch the Game ON
7. Enjoy

3. Put the LISY Image to the SD card

On my website you will find the latest version of LISY as an (zipped) image file. After unpacking the image can put on a 4GB SD card. As SD cards do differ in size it is possible that you got an error saying that there is not enough space on the SD card to put the image on. In this case you can try another 4GB SD card or use a 8GB SD card.

The image is based on Raspbian Jessie.

Etcher is typically the easiest option for most users to write images to SD cards, so it is a good place to start. If you're looking for an alternative on Windows, you can use Win32DiskImager.

Etcher

- Download the Windows installer from etcher.io
- Run Etcher and select the unzipped LISY image file
- Select the SD card drive
- Finally, click **Burn** to write the LISY image to the SD card
- You'll see a progress bar. Once complete, the utility will automatically unmount the SD card so it's safe to remove it from your computer.

Win32DiskImager

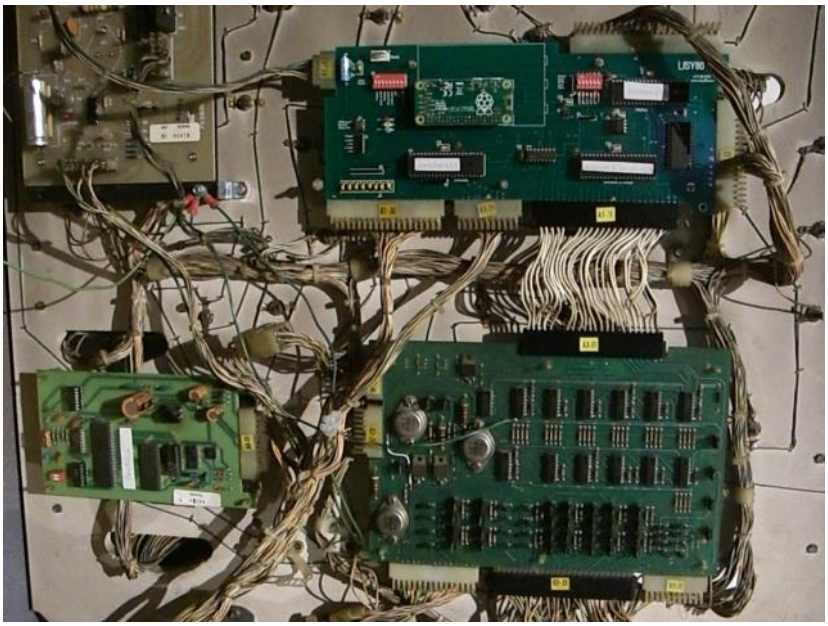
- Insert the SD card into your SD card reader. You can use the SD card slot if you have one, or an SD adapter in a USB port. Note the drive letter assigned to the SD card. You can see the drive letter in the left hand column of Windows Explorer, for example **E:**
- Download the Win32DiskImager utility from the Sourceforge Project page as an installer file, and run it to install the software.
- Run the `Win32DiskImager` utility from your desktop or menu.
- Select the LISY image file you extracted earlier.
- In the device box, select the drive letter of the SD card. Be careful to select the correct drive: if you choose the wrong drive you could destroy the data on your computer's hard disk! If you are using an SD card slot in your computer, and can't see the drive in the Win32DiskImager window, try using an external SD adapter.
- Click 'Write' and wait for the write to complete.
- Exit the imager and eject the SD card.

4. Installation

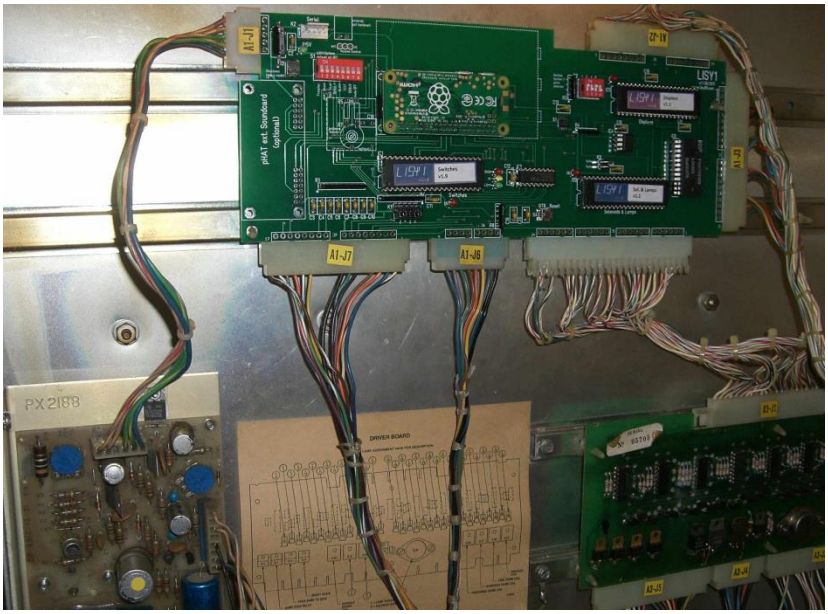
LISY1 and LISY80 boards have the same ,edge connectors and same mounting holes as the original Gottlieb MPUs, so replacing of the board can be done in seconds.

4.1. Replacing the original MPU

See below a Gottlieb System80 game where the original MPU is already swapped with a LISY80 board as an example. LISY1 and LISY80 boards have roughly only half the size of the original MPU and as you see the only small change in positioning of the edge connectors is with ‘J2’.



LISY80 in a Gottlieb System80 Pinball Machine ,Panthera‘



LISY1 in a Gottlieb System1 Pinball Machine ‘Charlies Angels’

In addition, with LISY1 you can replace the edge connectors with more modern ones.

5. Dip Switch Settings

Depending your needs and on your pinball machine, different settings can be done on the board. There are two main Switches, S1 and S2. S1 is for settings 'options' to the game, where with 'S2' you select which game you want to emulate.

5.1. DIP Switch S1: options

Default setting is all ‚OFF', with this the game will react like the original game, typical settings are:

Switch S1								Mode
S1	S2	S3	S4	S5	S6	S7	S8	
off	off	off	off	off	off	off	off	**start lisy (default)**
on	off	off	off	off	off	off	off	**start lisy (freeplay)**
off	off	off	off	off	off	on	off	**start lisy with debug**
on	off	off	off	off	off	on	off	**start lisy with debug (freeplay)**
off	on	off	off	off	off	off	off	**start lisy (internal sound)**
off	on	off	off	off	on	off	off	**start lisy (pinmame sound)**
on	on	off	off	off	off	off	off	**start lisy (internal sound & freeplay)**
on	on	off	off	off	on	off	off	**start lisy (pinmame sound & freeplay)**
off	off	off	off	off	on	off	on	**Start LISYcontrol**
off	off	off	on	off	off	off	on	**MPF Master Mode**
off	off	off	on	off	on	off	on	**MPF Slave Mode (serial)**
off	on	off	on	off	on	off	on	**MPF Slave Mode (network)**
off	off	off	off	off	off	off	on	**nothing to start**

5.1.1. S1-Dip1 -> Freeplay

With dip 1 to ‚ON' the game is configured for ‚Freeplay', meaning by pressing the ‚Replay-Button' longer than 2 seconds, LISY will 'emulate a coin drop' to the left coin chute, giving you the credits configured to your game.

5.1.2. S1-Dip2 -> Sound Emulation

The LISY onboard soundcard is activated (optional)

5.1.3. S1-Dip3 -> Ballsave

Not implemented yet.

5.1.4. S1-Dip4 -> MPF & 7digit option

With Dip8 set to 'off' this activates the 7digit option, see chapter 'Option 7digtit' for details.

With Dip8 set to 'on' this activate MPF (Server or Slave mode), see chapter MPF for details.

5.1.5. S1-Dip5 -> SLAM

With this dip to ON, the Gottlieb SLAM switch will be ignored

5.1.6. S1-Dip6 -> TEST

With dip6 to ‚ON' after boot ‚LISY80control' will be started instead of pinmame. See chapter 7 for details. (Note: you can start ‚LISY_control' after the game started by pressing the Gottlieb ‚test' button for more than 2 seconds).

5.1.7. S1-Dip7 -> DEBUG

With dip 7 to ‚ON' LISY will start in debug mode. Messages will be shown via the standard serial interface (/tty/AMA0) which is mapped to the system console and as well to a debug text file on the SD Card. For LISY1 this is ‚/lisy1/lisy1_debug.txt' and for LISY80 ‚/lisy80/lisy80_debug.txt'.

Note: In debug mode the system runs in read/write mode (in ‚normal mode' LISY runs in read-only mode). As the operating system is a standard Linux System switching off power without shutting down the system can damage your system files. Because of this in debug mode it is recommend to do a ‚graceful shutdown' of the system vi ‚S3' before switching of Power. After pressing S3 wait a minute or so and watch LED activities on the PI, after 20 seconds with no activity it is save to switch off Power, take of the SD card out and read debug messages on an external host.

Debugging options can be selected with 'jumpers' on K1. You can combine as many debug outputs as you want, but have to be aware that the more debugging you do the more will the system slow down and debug files can get huge. Doing debugging with no jumpers at all will give 'basic debugging messages which is a good option to start with.

K1-Jumper 1-2:	detailed debugging messages for displays
K1-Jumper 3-4:	detailed debugging messages for switches
K1-Jumper 5-6:	detailed debugging messages for lampes (Q1..Q52)
K1-Jumper 7-8:	detailed debugging messages for solenoids (Solenoid 1..9)
K1-Jumper 9-10:	detailed debugging messages for sound (without S16 (Q10))

5.1.8. S1-Dip8 -> Autostart On

With dip8 to ‚ON' there is no autostart of LISY (pinmame). Usually you choose this if you want to log in into the system (e.g. via ssh) to do maintenance or to start the mpf (missionpinballframework) option.

5.2. DIP Switch S2, Gottlieb Game

With Switch S2 you can select the Gottlieb Game which you want to emulate**. Take a look at Appendix A or Appendix B for valid selections.** With LISY80 all selections lower than 40 will be interpreted as a System80/80A which has impact on the way LISY drives the displays.

5.3. Options via K3(jumper)

K3 jumper above of ‘Solenoids & Lamps’ PIC

5.3.1. Fadecandy

By selecting Jumper on the upper side LISY will try to connect to the ‘fadecandy’ Hardware. See section Fadecandy for details

5.3.2. WiFi/WLAN Hotspot

By selecting Jumper on the lower side LISY will start an internal wireless LAN hotspot instead of trying to connect to your local wireless infrastructure. See section ‘wireless config’ for details.

5.4. S3, graceful shutdown

With S3 the system will do an immediate ‘shutdown’. This is only important (and advisable!) in debugging mode, as with debugging mode the Linux OS is running in read/write. Switching of the power with doing a shutdown beforehand may damage your file system on the SD card.

In normal mode, the system in running in ‘read/only’ mode, so you can safely switch off power at any time.

6. Displays during boot

Immediately after switching on the pinball LISY will show basic information on the displays of the pinball machine, while in the background the Rapberry PI is booting. If dip8 of Switch ‚S1‘ is set to ‚OFF‘ and the via ‚S2‘ configured pinmame rom set is found on the SD card; 20-30 seconds later pinmame will take control of the pinball, showing the usual display messages of a Gottlieb pinball machine. At this time your pinball is ready to run.

Lisy does try to auto detect the underlying type of HW (LISY1/LISY80/LISY35 and its different HW releases) in a very early state. If auto detection fails the pinball will stay in 'Phase 1' and LED D2 & D3 (red & yellow) will start blinking. Most likely the error reason is the SMD chip X1, check your soldering!

6.1. Gottlieb System1 (LISY1)

Phase 1 (boot Raspberry PI)

Display 0: 'LISY1', Display 1: GAMExx (xx is the internal number of appendix A)

Display 2: 'WAIT' Display 3: ‚For PI‘

Phase 2 (start LISY1)

Display 0: 'Pinmame Name‘ Display 1: GTB X (X is 'Gottlieb‘ System1 'char')

Display 2: 'boot' Display 3: Software Version of LISY

LED D3 (yellow) 'PI' went to ON

Phase 3 (LISY80)

The selected game is emulated, LED D4 (green) 'LISY1' went to ON

6.2. Gottlieb System80 & 80A (LISY80)

Phase 1 (boot Raspberry PI)

Display 0: 'LISY80', or. 'LISY80A' Display 1: GAMExx (xx is the internal number of appendix B)

Display 2: 'WAIT' Display 3: ‚For PI‘

Phase 2 (start LISY80)

Display 0: 'Pinmame Name‘ Display 1: GTBxxx (xxx is the 'Gottlieb‘ number)

Display 2: 'boot' Display 3: Software Version of LISY

LED D3 (yellow) 'PI' went to ON

Phase 3 (LISY80)

The selected game is emulated, LED D4 (green) 'LISY80' went to ON

6.3. Gottlieb 80B

Phase 1 (boot Raspberry PI)

Line 1: ‘LISY80B’ ,GAME NO xx‘ (xx is the internal number of appendix B)

Line 2: ,WAIT FOR PI‘

Phase 2 (start LISY80)

Line 1: ,NAME‘ ‘Pinmame Name‘

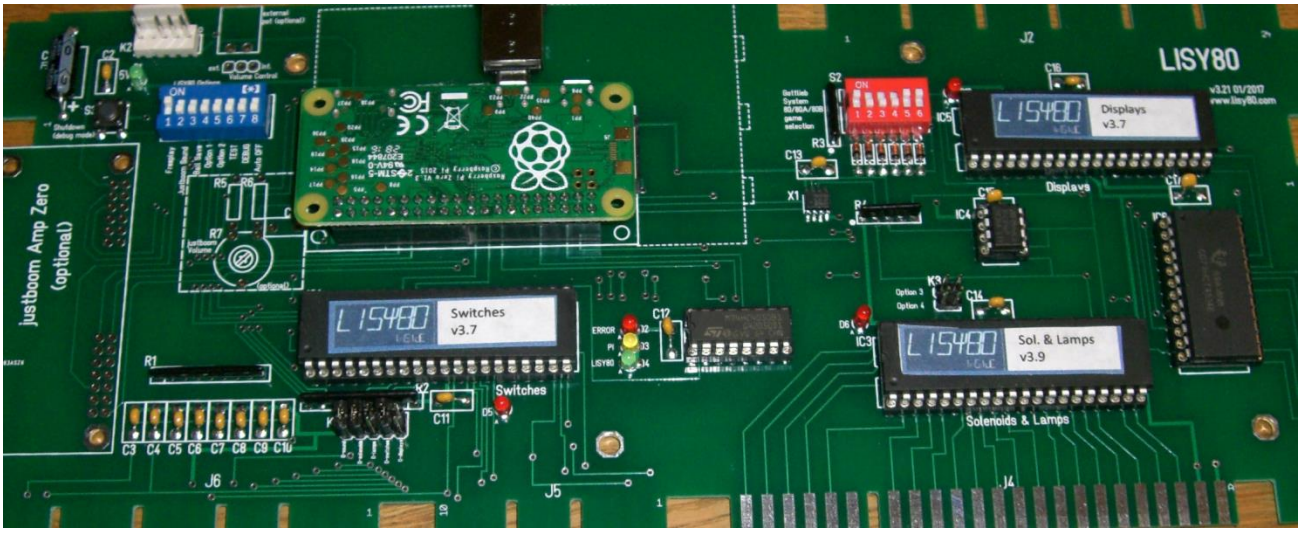
Line 2: ,BOOT LISY80 V , Software Version LISY80’

LED D3 (yellow) ‘PI’ went to ON

Phase 3 (LISY80)

The selected game is emulated, LED D4 (green) ‘LISY80’ went to ON

7. LEDs



D1 – Green – with D1 ON, you have 5Volt

D2 – Red ‚Error‘ – In case there was an internal error

D3 – Yellow ‚PI‘ – On at the time the PI is ‚up and running‘

D4 – Green ‚LISY1/LISY80‘ – On in case LISYS1/Lisy80 is ‚up and running

D5 – Red – does indicate activities on the switches

D6 – Red – does indicate activities on the solenoid and/or lamps

D13 – Red – does indicate activities on the displays

8. Performance

LISY does use ‚pinmame‘ in order to emulate a Gottlieb pinball machine. In order to be able to ‘fine adjust’ or even to ‘tune up’ your specific game, with LISY you adjust the speed the emulation is running.

For LISY80 take a look at the file ‚/lisy80/cfg/lisy80games.csv‘ column ‚throttle‘. The default value is 1000. Lowering the value will speed up the game and increasing the value will result in a slower gameplay. The file is in ‘CSV-format’ and can be edited within windows.

For LISY1 take look at the file ‚/lisy1/cfg/lisy1games.csv‘; default value here is 3000.

9. Webserver ‚LISYcontrol‘

With LISYcontrol (LISY1control/LISY80control) you have full control over the hardware of your Gottlieb pinball machine. Once started you can access it with any Web browser within your network. For this your raspberry PI needs a valid IP-address.

See section ‘9 Image’ and section 11 ‘wireless config’ for more details how to get LISY connected to your local network.

9.1. Start

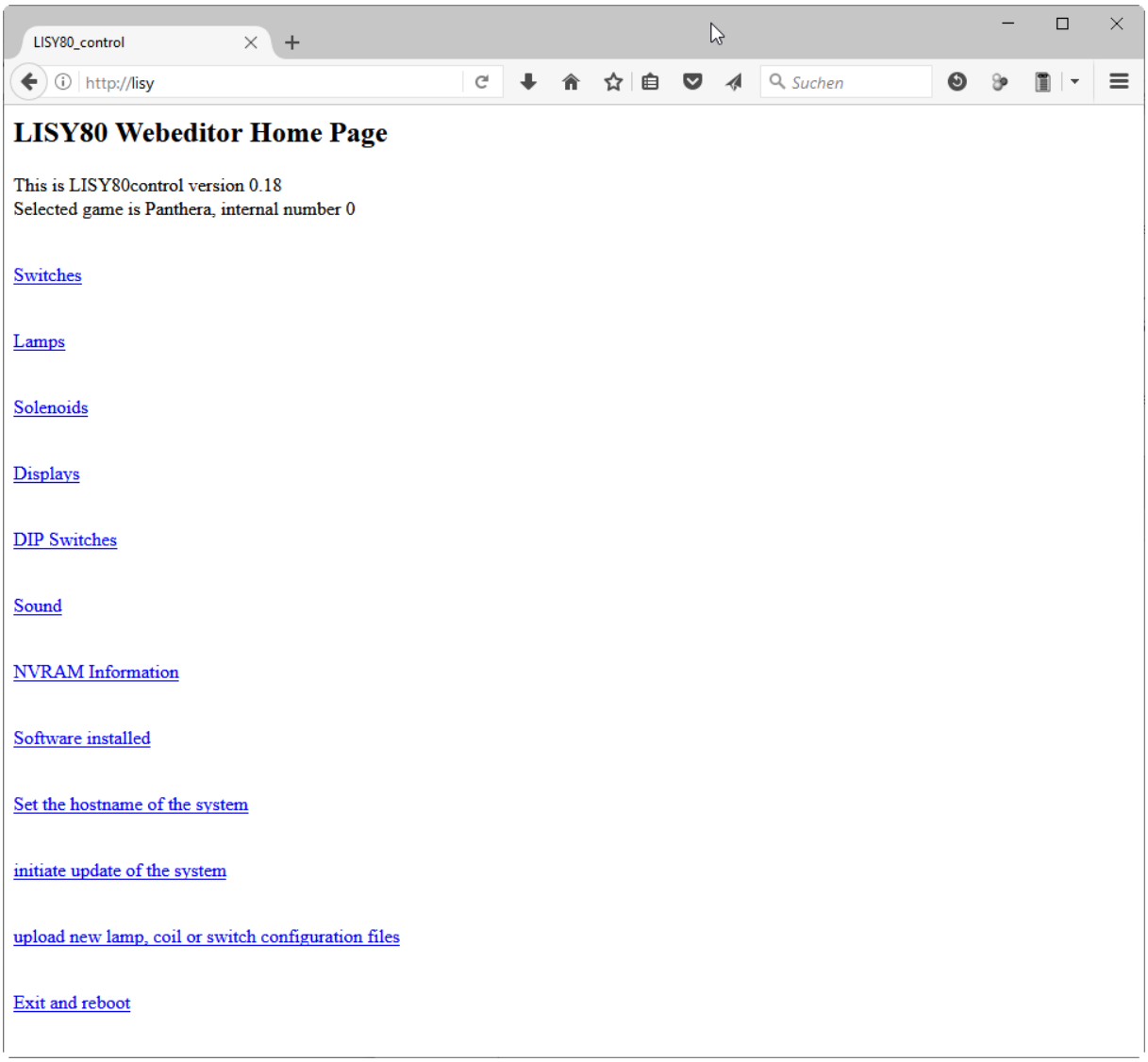
There are two possibilities to start LISYcontrol.

With S1,dip 6 (TEST) to ON at boot time LISYcontrol will be started instead of pinmame.

In a running game, push the Gottlieb Test button (located in the front door of the pinball) for more than 3 seconds. LISY will shutdown the pinmame emulation and start LISYcontrol instead.

9.2. How to access

‚LISYcontrol‘ will detect if the system has an valid IP-Address and show the IP via the connected displays. In your web browser just type in this IP-address and it should come up with a screen similar to the one below. (here the default hostname ‘lisy’ is mapped to the IP Address)



9.3. Switches

You will see an overview of all switches, together with the current state, of your pinball machine. The screen will do a 'refresh' any second or so. Closed switches are marked red, open switches are marked green.

The descriptions are configurable via the file '<NNN>_lisy1_switches.csv' (folder /lisy1/control/switch_descriptions) for a system1 machine; respective '<NNN>_lisy80_switches.csv'(folder /lisy80/control/switch_descriptions) for a system80 machine. With NNN as the internal number of your Gottlieb game, with leading zeros if it's shorter than three digits, according to appendix A for Lisy1 and appendix B for Lisy80.

In case the system does not find a description file with the current Gottlieb game number, it will take the file default_lisy1_switches.csv'; respective default_lisy80_switches.csv' for a system80 game.

LISY80_control

lisy/lisy80_switches.php

Back to LISY80 Homepage

Selected game is Panthera, internal number 0

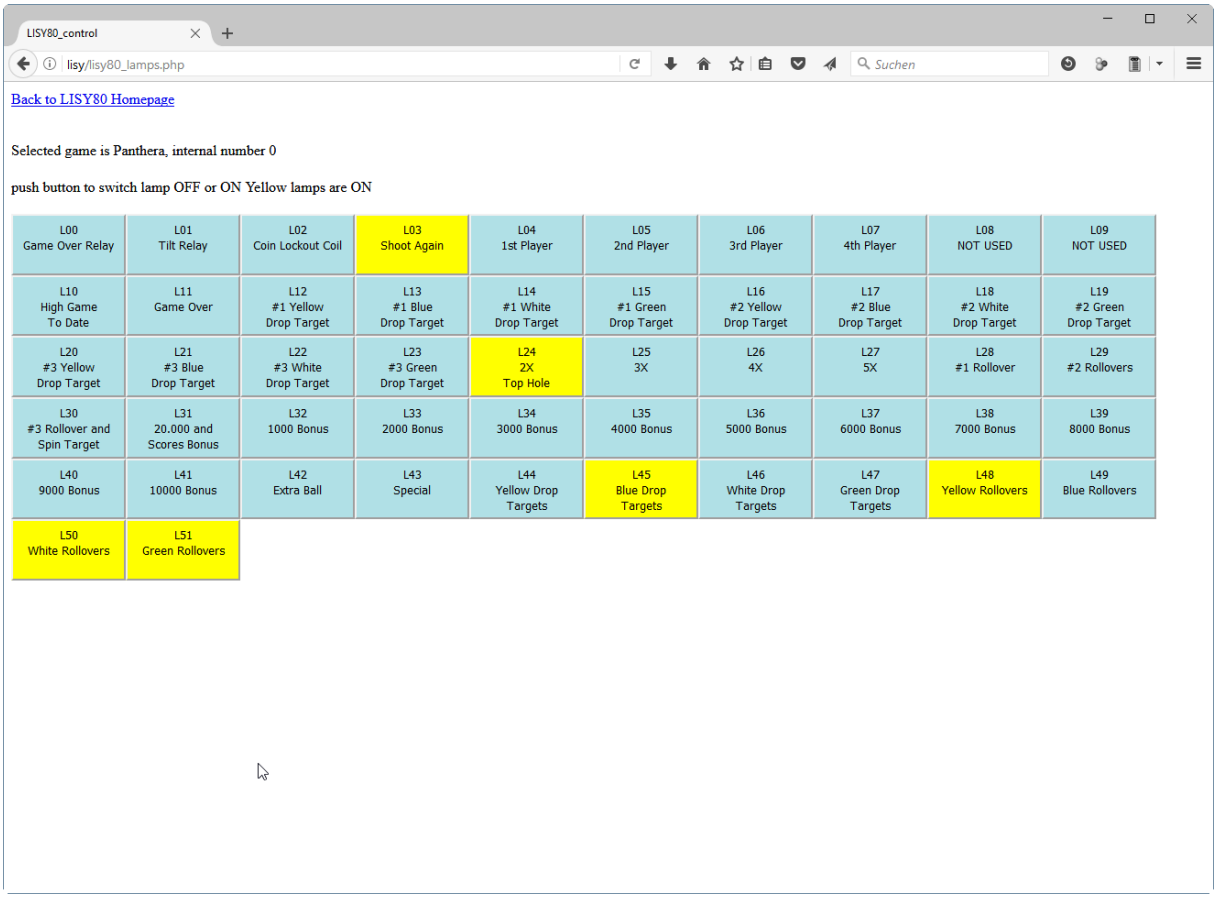
Switch 00 #1 Yellow Drop Target	Switch 01 #2 Yellow Drop Target	Switch 02 #3 Yellow Drop Target	Switch 03 Yellow Rollovers	Switch 04 Bull's Eye Target	Switch 05 #1 Rollover	Switch 06 NOT USED	Switch 07 Test Switch
Switch 10 #1 Blue Drop Target	Switch 11 #2 Blue Drop Target	Switch 12 #3 Blue Drop Target	Switch 13 Blue Rollovers	Switch 14 Rollover Buttons	Switch 15 #2 Rollovers	Switch 16 NOT USED	Switch 17 Left Coin Switch
Switch 20 #1 White Drop Target	Switch 21 #2 White Drop Target	Switch 22 #3 White Drop Target	Switch 23 White Rollovers	Switch 24 Pop Bumpers	Switch 25 #3 Rollover and Spin Target	Switch 26 NOT USED	Switch 27 Right Coin Switch
Switch 30 #1 Green Drop Target	Switch 31 #2 Green Drop Target	Switch 32 #3 Green Drop Target	Switch 33 Green Rollovers	Switch 34 10 Point Contacts	Switch 35 Hole	Switch 36 NOT USED	Switch 37 Center Coin Switch
Switch 40 NOT USED	Switch 41 NOT USED	Switch 42 NOT USED	Switch 43 NOT USED	Switch 44 NOT USED	Switch 45 NOT USED	Switch 46 NOT USED	Switch 47 Replay Button
Switch 50 NOT USED	Switch 51 NOT USED	Switch 52 NOT USED	Switch 53 NOT USED	Switch 54 NOT USED	Switch 55 NOT USED	Switch 56 NOT USED	Switch 57 Tilt Switch
Switch 60 NOT USED	Switch 61 NOT USED	Switch 62 NOT USED	Switch 63 NOT USED	Switch 64 NOT USED	Switch 65 NOT USED	Switch 66 NOT USED	Switch 67 Outhole
Switch 70 NOT USED	Switch 71 NOT USED	Switch 72 NOT USED	Switch 73 NOT USED	Switch 74 NOT USED	Switch 75 NOT USED	Switch 76 NOT USED	Switch 77 NOT USED

9.4. Lamps

You will see an overview of all lamps, together with the current state, of your pinball machine. By pushing the button you can switch ON or OFF the specific lamp. A lamp in state lamp will change the color to yellow.

The descriptions are configurable via the file '<NNN>_lisy1_lamps.csv' (folder /lisy1/control/lamp_descriptions) for a system1 machine; respective '<NNN>_lisy80_lamps.csv'(folder /lisy80/control/lamp_descriptions) for a system80 machine. With NNN as the internal number of your Gottlieb game, with leading zeros if it's shorter than three digits, according to appendix A for Lisy1 or appendix B for Lisy80.

In case the system does not find a description file with the current Gottlieb game number, it will take the file default_lisy1_lamps.csv'; respective default_lisy80_lamps.csv' for a system80 game.

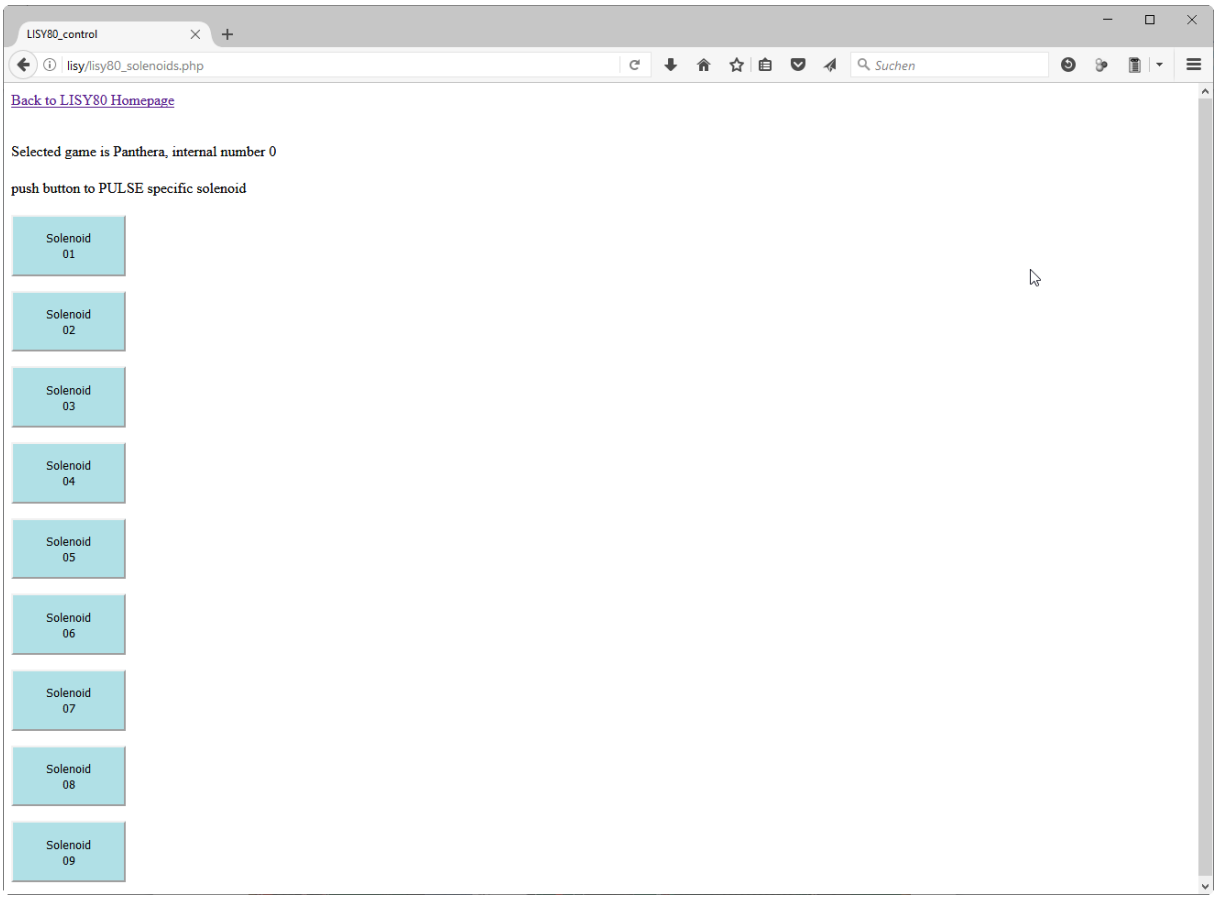


9.5. Solenoids

You will see an overview of all solenoids of your pinball machine. By pushing the button you can ‘pulse’ the specific solenoid.

The descriptions are configurable via the file ‘<NNN>_lisy1_coils.csv‘ (folder /lisy1/control/coil_descriptions) for a system1 machine; respective ‘<NNN>_lisy80_ coils.csv‘(folder /lisy80/control/coil_descriptions) for a system80 machine. With NNN as the internal number of your Gottlieb game, with leading zeros if it’s shorter than three digits, according to appendix A for Lisy1 or appendix B for Lisy80.

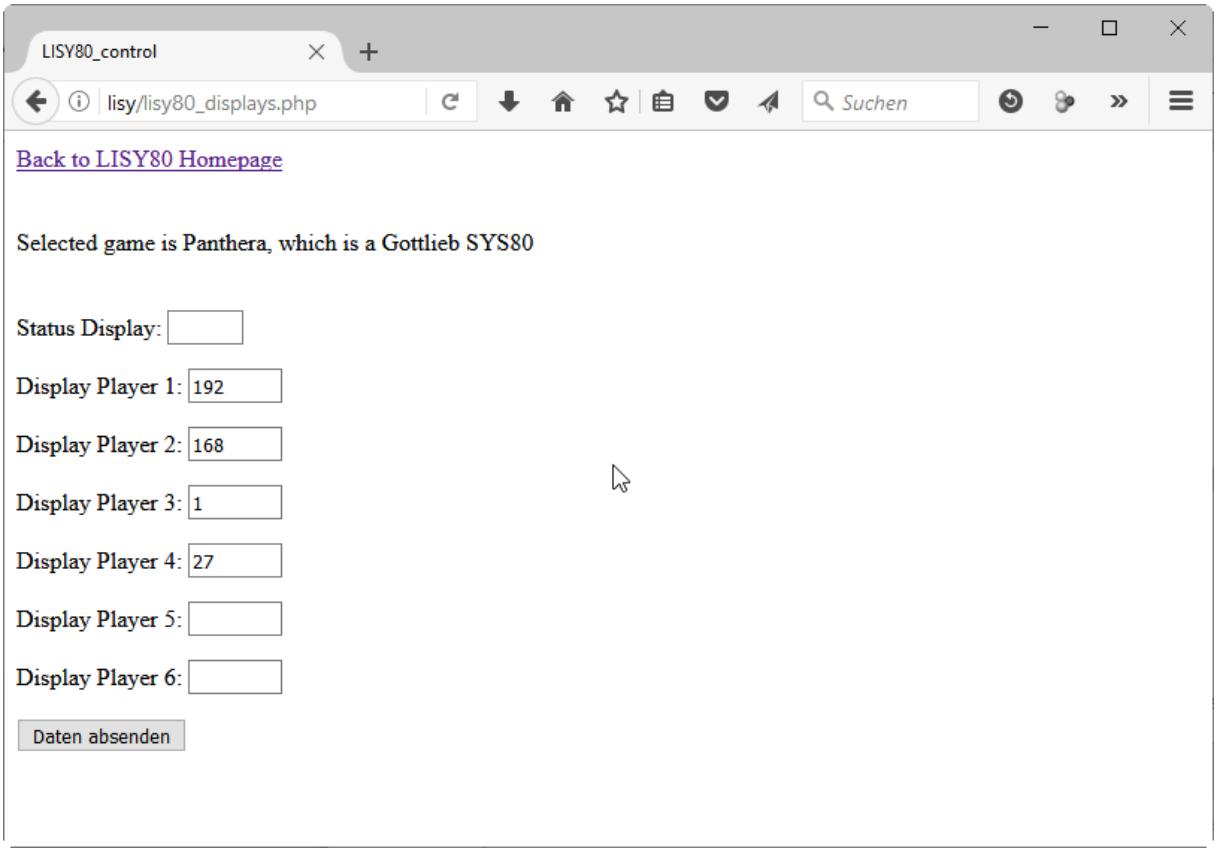
In case the system does not find a description file with the current Gottlieb game number, it will take the file default_lisy1_ coils.csv‘; respective default_lisy80_ coils.csv‘ for a system80 game.



9.6. Displays

Test your displays. Type in the text in the field for the display you want to set and push the button.

Note that in the example screenshot below, the displays are still showing the current IP address of the system, which is: 192.168.1.27



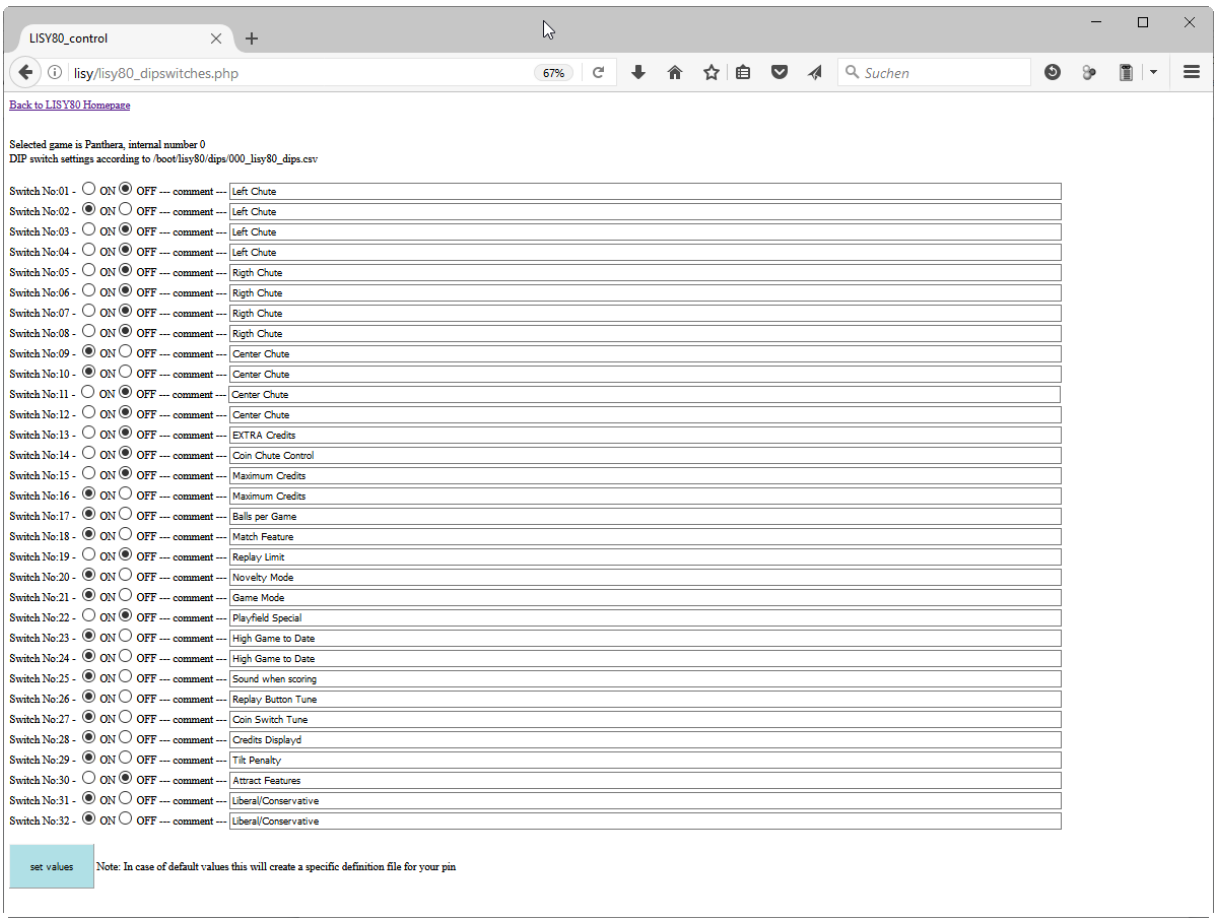
9.7. Dip switches

As LISY does not have the ‘hardware’ Gottlieb ‘dip switches’ on board, the dip switch configuration comes also as a ‘csv-file’ and will be read at boot time of the pinmame emulation.

The descriptions are configurable via the file ‘<NNN>_lisy1_dips.csv‘ (folder /lisy1/dips) for a system1 machine; respective ‘<NNN>_lisy80_dips.csv‘(folder /lisy80/dips) for a system80 machine. With NNN as the internal number of your Gottlieb game, with leading zeros if it’s shorter than three digits, according to appendix A for Lisy1 or appendix B for Lisy80.

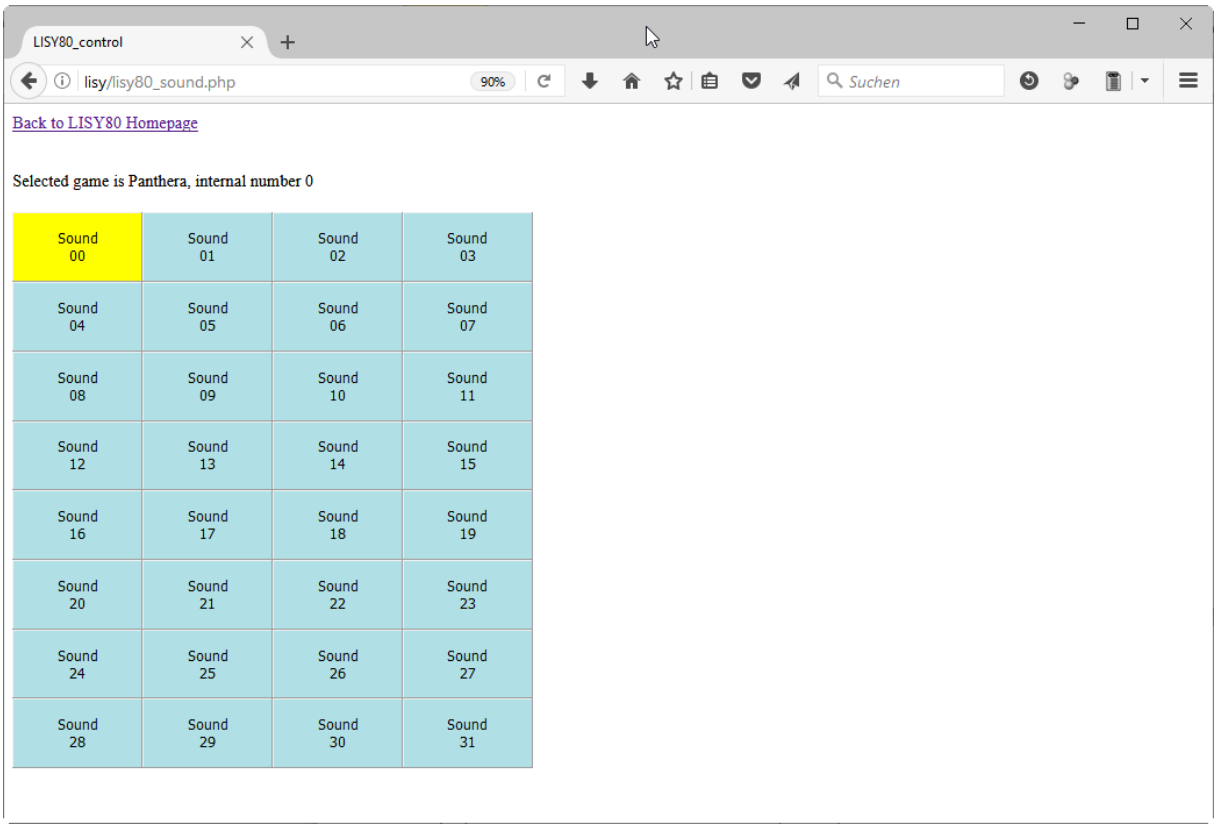
In case the system does not find a description file with the current Gottlieb game number, it will take the file default_lisy1_dips.csv‘; respective default_lisy80_dips.csv‘ for a system80 game.

For dip switches LISYcontrol can be used as an editor. Just type in the descriptions and press ‘set values’ at the end and LISYcontrol will store your descriptions. In case there is no current specific description file for yor pinball machine, LISYcontrol will create a new one.



9.8. Sound

Test your sounds. By pushing the button the selected sound will be played. Only one sound can be played at a time. Sound 0 means 'no sound' (default)



9.9. NVRAM information

LISY uses an 'eeprom' to store some statistic data, with this it can be displayed.

9.10. Software installed

Show (HW) Version of the LISY Board

9.11. Set hostname of the system

The default hostname of the system is 'lisy'. With this you can configure the hostname to any string you want. This can be useful if you have more than one LISY board

9.12. Initiate update of the system

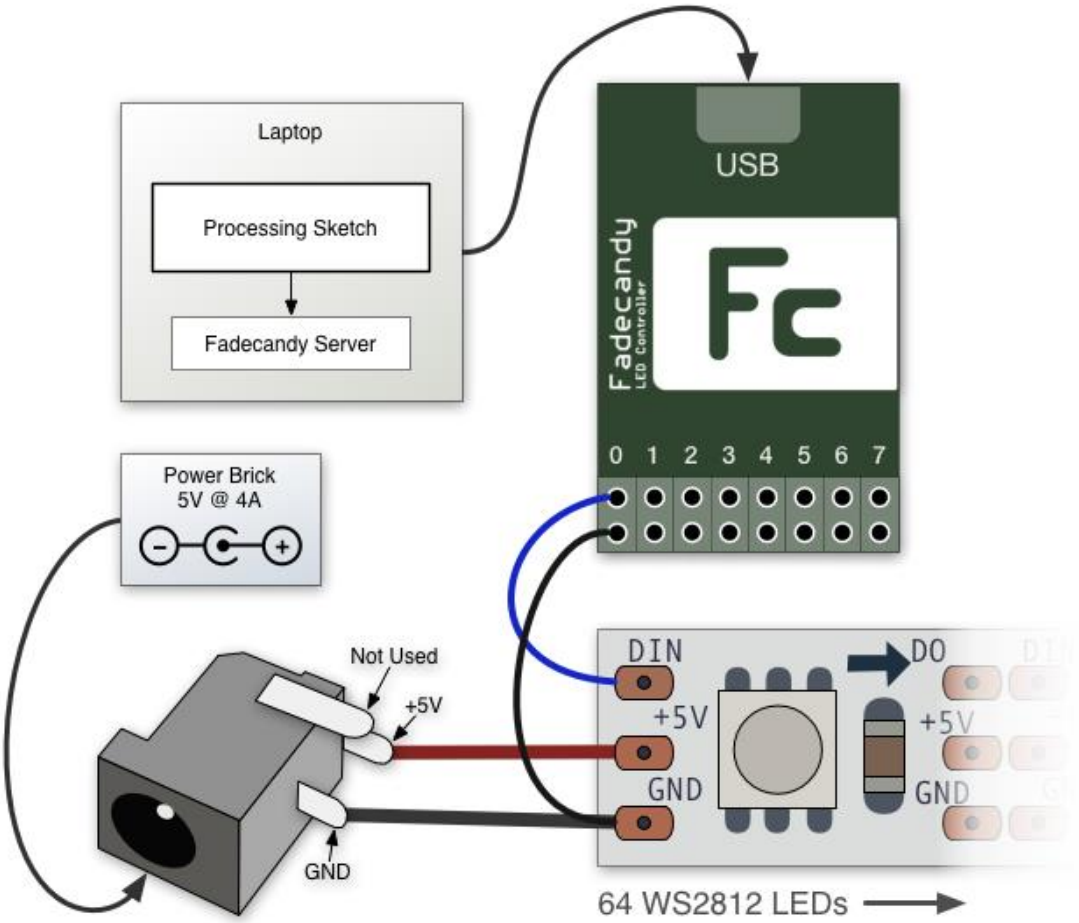
Usually you will write a whole new SD card when updating the system. With this point small updates can be done without loading/writing the whole image. Updates will be announced on lisy80.com webpage if needed.

9.13. Upload new lamp, coil or switch configuration files

In case you do not want it to do with writing onto the SD card via windows.

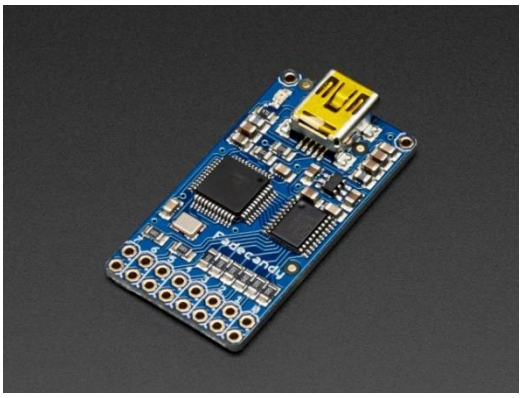
10. Fadecandy

With LISY version 4.08+ controlling LEDs via Fadecandy is supported. Fadecandy works with the popular WS2811/WS2812 LEDs. Each controller board supports up to 512 LEDs, arranged as 8 strips of 64 each. More information can be found here https://www.adafruit.com/product/1689 and here https://github.com/scanlime/fadecandy.



10.1. Hardware

You will need the Fadecandy board which can be purchased at Adafruit or at Digikey.



In addition you need an additional 5 Volt power supply like this one (5 Volt / 12 Ampere)

Calculate 60 mA for each LED you want to control. Meaning with the power supply above you can supply up to 200 LEDs.

10.2. Software, files to edit and/or add

The config file for fadecandy server (fcserver) is located under /lisy/lisy.json.

Here you can set general LED numbering, the whitepoint (set to 50% by default) and more. Please refer to the fcserver documentation on the fadecandy site for more details.

For each LED you can define the RGB value, if it is assigned to the GI or to controlled lamps.

In case of controlled lamps you can define which lamp is assigned and if the lamp should be driven in parallel. See appendix for example config files.

The assignments are configurable via the file ‘<NNN>_lisy1_fadecandy_GI.csv‘ & ‘<NNN>_lisy1_fadecandy_lamps.csv (folder /lisy1/fadecandy) for a system1 machine; respective ‘<NNN>_lisy80_fadecandy_GI.csv‘ & ‘<NNN>_lisy80_fadecandy_lamps.csv’ (folder /lisy80/fadecandy) for a system80 machine.

With NNN as the internal number of your Gottlieb game according, with leading zeros if it’s shorter than three digits, to appendix A for Lisy1 or appendix B for Lisy80.

11. Coil Options

For coils LISY offer an optional config file to adjust the ‘pulsetime’ of individual coils.

11.1. Pulse time mod for LISY1 coils

/boot/lisy1/coils/xxx_lisy1_coils.csv

11.2. Pulse time mod for LISY80 coils

/boot/lisy80/coils/xxx_lisy80_coils.csv

12. Option sound (BETA)

With LISY version 4.07or higher two sound modes are supported. The first uses the original sound emulation from pinmame, with the second it is possible to play its own 'wav-files' directly from the SD on the LISY board.

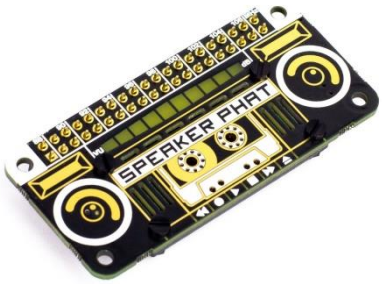
Switch S1								Mode
S1	S2	S3	S4	S5	S6	S7	S8	
*	on	*	off	*	off	*	off	Internal Sound (WAV - Files)
*	on	*	off	*	on	*	off	Pinmame Sound emulation

Even LISY uses an external soundcard, it has to be said that the pinmame sound emulation depends on the used game and need to be optimized. You can give it a try for your pinball machine but you may notice poor sounds, speed variances and 'clicking' between sounds.

12.1. Hardware

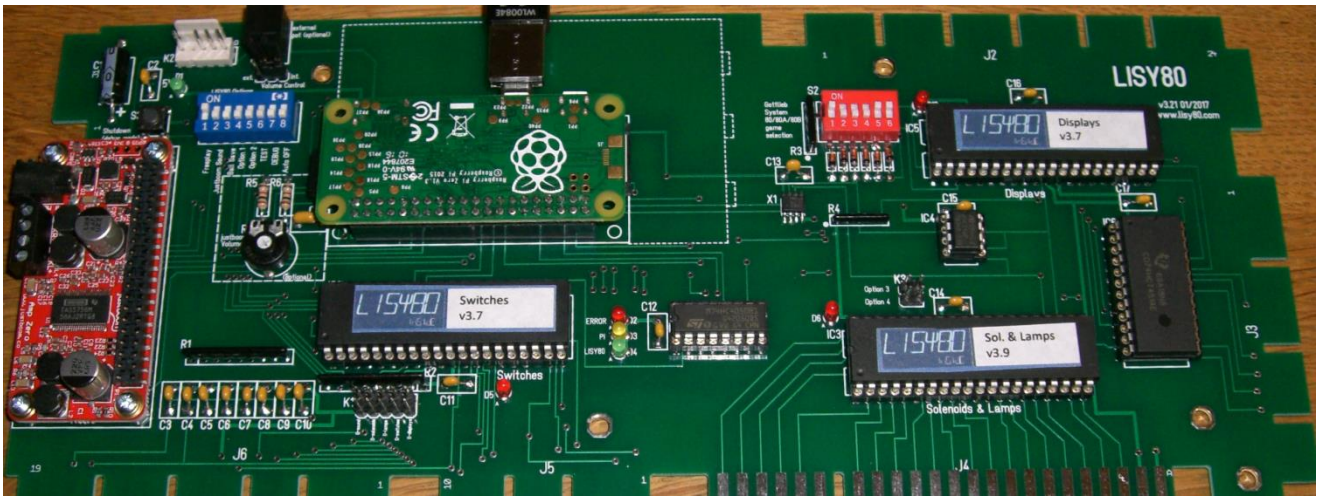
The LISYimage supports the 'Justboom Amp zero pHat' Sound Card, but any pHat compatible soundcard which works with the PI Zero can be used. By using another soundcard the config file 'config.txt' on the SD card needs to be edited. See excerpt from config.txt below

```
# and load the driver for the justboom soundcard
dtoverlay=justboom-dac
# for hifiberry and compatible ones ( e.g Speaker PHAT )load this one
# dtoverlay=hifiberry-dac
```



Justboom Soundcard & Speaker PHat

Solder the Sound Option 1 to your LISY1/LISY80 and add an extra wire from the Soundcard to the speakers and disconnect the original connection. With this the volume setting is done with the potentiometer on the LISY board. With Sound Option 2 you can also use an external potentiometer, however you will need to add an extra wire also for that.



LISY80, with Sound Option 1&2 and a 'Justboom Soundcard'

12.2. Software, files to edit and/or add

For pinmame sound emulation at the moment no configurations are possible. Later versions will support editing the 'virtual switches' on the soundcard via LISYcontrol or 'csv-file'.

12.2.1. LISY1

Gottlieb system1 games can only play 5 tones, you can map each of these tones to a .wav file of your choice. For LISY1 files the names for the 5 files are fix, and mapped to the usual 10, 100, 100 scoring tones. In addition a file for 'tilt' and 'game over' can be mapped. The wav files need to placed into the directory '**/lisy1/sounds/xxx'** on the SD card, where 'xxx' is the number of your game which you want to be emulated (e.g. 005 for Charlies Angels, see Appendix A).

boot (E:) › lisy1 › sounds › 005

Name	Änderungsdatum	Typ	Größe
10.wav	16.05.2018 13:33	WAV-Datei	26 KB
100.wav	16.05.2018 13:33	WAV-Datei	38 KB
1000.wav	16.05.2018 13:33	WAV-Datei	41 KB
gameover.wav	16.05.2018 13:33	WAV-Datei	35 KB
tilt.wav	16.05.2018 13:33	WAV-Datei	27 KB

LISY1 example sound files for a system1 Charlies Angels

12.2.2. LISY80

Gottlieb system80 games can play 30 tones, you can map each of these tones to a .wav file of your choice. For LISY80 files the names for the 30 files are fix and numbered from 1..15 and 17..31 (there is no soundnumber 16). The wav files need to placed into the directory '/**lisy80/sounds/xxx'** on the SD card, where 'xxx' is the number of your game which you want to be emulated (e.g. 010 for Mars, see Appendix B). In addition to that you need to create a configfile (xxx_lisy80_sounds.csv) in which you configure if the sound can be interrupted by other sounds or not.

This is done by the second field. A zero (0) means that the sound will not be interrupted by other sounds, this is useful for longer sounds and/or speech. The other fields are for future use and will not be interpreted!

boot (E:) › lisy80 › sounds

Name	Änderungsdatum	Typ	Größe
010	26.02.2017 10:51	Dateiordner	
012	06.04.2017 12:04	Dateiordner	
014	20.02.2017 10:30	Dateiordner	
018	21.06.2017 12:27	Dateiordner	
036	17.02.2018 14:17	Dateiordner	
010_lisy80_sounds.csv	20.02.2017 14:57	Microsoft Excel-C...	1 KB
012_lisy80_sounds.csv	06.04.2017 12:02	Microsoft Excel-C...	1 KB
014_lisy80_sounds.csv	20.02.2017 14:57	Microsoft Excel-C...	1 KB
018_lisy80_sounds.csv	21.06.2017 12:27	Microsoft Excel-C...	1 KB
036_lisy80_sounds.csv	17.02.2018 14:18	Microsoft Excel-C...	1 KB

LISY80 example config files & directories for Mars, Volcano, Black Hole, Devils Dare & Eldorado

boot (E:) › lisy80 › sounds › 036

Name	Änderungsdatum	Typ	Größe
1.wav	17.02.2018 14:12	WAV-Datei	25 KB
2.wav	17.02.2018 14:14	WAV-Datei	24 KB
3.wav	17.02.2018 14:14	WAV-Datei	26 KB
4.wav	17.02.2018 14:14	WAV-Datei	28 KB
5.wav	17.02.2018 14:14	WAV-Datei	27 KB
6.wav	17.02.2018 14:14	WAV-Datei	30 KB
7.wav	17.02.2018 14:14	WAV-Datei	28 KB

LISY80 example sound files for a system80B eldorado

Sound	can_be_interrupted	loop	store & catch up	comment	Black Hole
1	0	0	0		
2	1	0	0		
3	0	0	0	Tilt Tilt Tilt	
4	1	0	0		
5	1	0	0		
6	1	0	0		
7	1	0	0		
8	1	0	0		
9	1	0	0		
10	1	0	0		
11	1	0	0		
12	1	1	0		
13	1	0	0		
14	1	0	0		
15	0	0	0	Oh nooo	
16	1	0	0	not used	
17	1	0	0		
18	1	0	0		
19	1	0	0		
20	1	0	0		
21	1	1	0		
22	1	1	0		
23	0	0	0	shoot captive hole	
24	0	0	0	complete bank for reentry	
25	0	0	0	enter gravity tunnel	
26	0	0	0	reentry attempt has failed	
27	0	0	0	reentry accomplished	
28	0	0	0	extra ball lit	
29	0	0	0	shoot for special	
30	0	0	0	gforce accelerated	
31	0	0	0	captured	

LISY80 example configuration file ‘014_lisy80_sounds.csv’ for a Black Hole

13. Option '7 digit'

LISY supports the use of '7digit' displays.

With LISY80 (System80) this is done via the pinmame roms created by Oliver.

For LISY1 (System1) this is done internally by LISY using the original roms.

This option can be switched on with Dip3 of Switch S1

Switch S1								Mode
S1	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	
x	x	on	x	off	off	x	off	7digit mode

13.1. LISY1

Can be used with all System1 games together with the original pinmame romset. Modification will be done internally in LISY.

13.1.1. Needed Hardware modification

TBD

13.2. LISY80

This option can only be used with System80 games. System80A games have 7 digit displays anyway and System80B games have complete different displays. By setting Dip3 to 'on' LISY will use the rom config file ‚/lisy80/cfg/lisy80games_7digit.csv' instead of config file ‚/lisy80/cfg/lisy80games.csv'

See Appendix for details, especially the names of the rom images you need to put in the ‚/lisy80/roms' folder.

13.2.1. Needed Hardware modification

A good description what you need to do can be found here:

https://pinside.com/pinball/forum/topic/converting-any-system-80-6-digit-gottlieb-to-80a-7-digit

and here (French)

https://www.flipperfrance.com/threads/7-digits-kit-adaptation.12361/

14. Image

The image is based on Raspberry ‚Jessie'. There are two configured user:

User : ‚**pi**', Password : ‚**lisy80**'

User : ‚**root**', Password: ‚**bontango**'

One partition (the ‚/boot' partition) is formatted in ‚Vfat'. Because of this you can read and write it with the help of a SD card reader for example under windows. With this you can adapt the different configuration files according to your needs/hardware.

The main sections are the same for LISY1 and LISY80; sitting either under /boot/lisy1 or /boot/lisy80.

Note: Within windows you will not see the '/boot/..' path as there you can only read the vfat partition. There you just see /lisy1 respective /lisy80 folders.

Folder ./debug/; files lisy1_debug.txt or lisy80_debug.txt -> debug files, automatically created if you start your LISY in debug mode.

./cfg/lisy80games.csv or lisy1games.csv -> list of supported Gottlieb games

14.1. Wireless config

At least for the internal webserver (LISYcontrol) you may want to have your system connected to your local network. LISY supports two modes: client mode & host mode; where client mode is the default mode.

14.1.1. Client mode

In client mode LISY will try to connect to your local (wireless) network.

In the image wireless is preconfigured with the following settings (file '/lisy/interfaces')

```
wpa-ssid : "LISY80"

wpa-psk : "EnErgie80"
```

You may want to configure this file to fit with your local (home) settings.

14.1.2. Host mode

In host mode, LISY will provide a wireless hotspot to be able to easily connect with your mobile phone or pad. For selecting host mode

After starting LISY you should be able to identify a new wireless network.

The network ID : '**LISY_Control**'

The keyphrase : '**lisy80_and_lisy1_rocks**'.

After successfully connected to this network, you can reach the LISY_control webserver by connecting to the IP address 192.168.80.1

Config files for hostmode are ‘hostapd.conf’ and ‘dnsmasq’ and can be found in folder ‘/lisy’ on the vfat section of the SD-Card.

14.2. Files in /boot/lisy1/roms & /boot/lisy80/roms

Here you have to put in your Gottlieb rom images (zip-format). **Due to copyright reasons, the image does not contain any Gottlieb rom code.** See appendix A or appendix B in order to select the right name/format for your specific game.

14.3. Files in /boot/lisy1/dips & /boot/lisy80/dips

Here you put your dip settings in a csv file to adjust the ‘behavior’ of your games. Settings are according your pinball manual.

See section LISYcontrol / dip settings for an explanation of this.

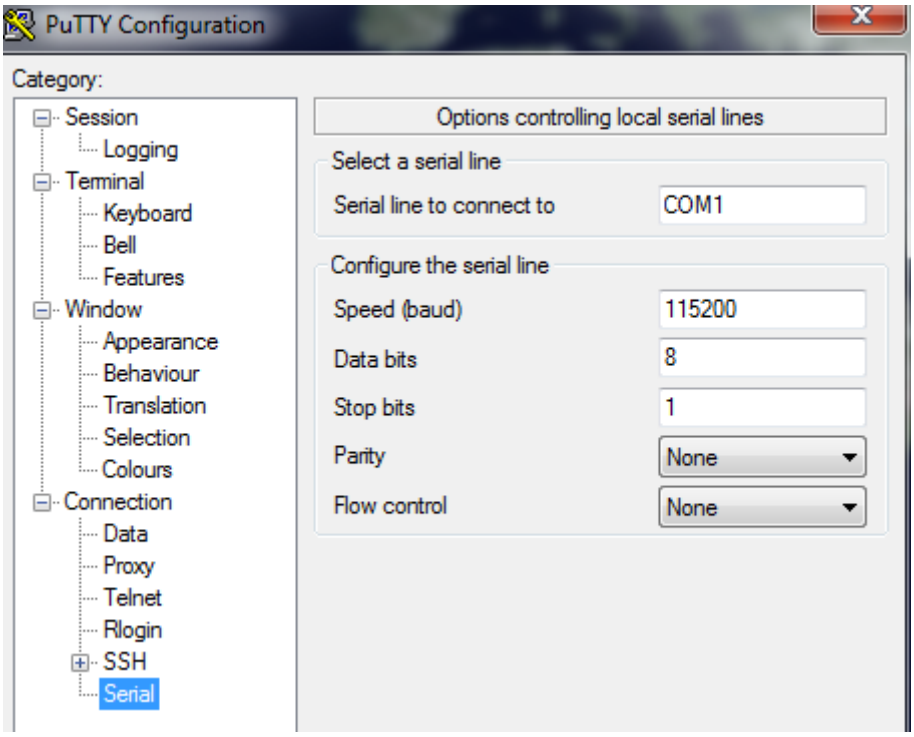
See Appendix B for a list of default settings.

14.4. Serial connection

Via ‚K2‘ the serial signals TxD & RxD of the raspberry Raspberry Pi can be connected.

Please note that these signals are 3.3 Volt and cannot be connected to a standard serial connector of e.g. a windows PC without doing damage to your PI.

However you can use a level converter and access the system e.g. with ‘putty’ using the following settings:



15. LISY and MPF ‚Mission Pinball Framework‘

With Version 4.x LISY Support Mission Pinball Framework.

From the website http://missionpinball.org/

The **Mission Pinball Framework** (“MPF”) is a free Python-based pinball software framework that’s used to run real pinball machines. It allows both casual builders and hard-core programmers to create the software to run their pinball machines—whether it’s new game code for an existing pinball machine, a “re-theme” of an old machine, or totally custom / homebrew machine built from scratch.

MPF is cross-platform and runs on Windows, Mac, Linux, and the Raspberry Pi. It's available in 32-bit and 64-bit versions and can be installed in minutes.

The LISY image support two modes, ‘slave mode’ and ‘master mode’. Usually while creating/developing a configuration for a given pinball machine, one will use the LISY ‘slave mode’. With this MPF is running on an external host and connected either via IP or direct USB cable to the Raspberry PI running LISY. With this it is easy to develop and test the MPF configuration file. Once finalized the configuration can be transferred to the SD card of the Raspberry PI and switched to ‘master mode’. In master mode MPF runs on the raspberry PI together with LISY, eliminating the need for an external host.

(Note: due to limited performance, only MPF can be run on the PI, not the Media Controller ‘MPF-MC’)

15.1. Connection in ‚master mode‘

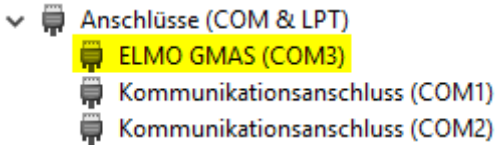
If you’re using the “master” mode where MPF runs on the LISY board itself, you need to get your MPF config installed onto the LISY board. You can do this via the SD card.

Place your MPF config in the folder `/boot/mpfcfg/lisyx/yyy/` on the SD Card (replace “x” with 1 for LISY1 and with “80” for LISY80. Replace “yyy” with your game number with leading zeros if it’s shorter than three digits). For instance with *Dare Devil*, the game would be at `/boot/mpfcfg/LISY80/018/` on the SD card.

15.2. Connection in ‚slave mode‘ (serial)

Connection to LISY can be made via IP or via direct USB connection. For the USB connection no special driver Software nor a special USB cable is needed, a ‘normal’ USB charging cable (USB Micro cable) will do the job. Once connected to the Host Computer (hopefully) will identify a new serial device, usually ‘COM3’ under windows or ‘/dev/ttyACM0’ under Linux.

Windows 10 screenshot hardware, device is COM3




```
config.yaml:

hardware:

  platform: lisy

lisy:

  connection: serial

  port: com3

  baud: 115200
```

Example: Linux (Ubuntu) 'dmesg' output, device is /dev/ttyACM0

usb 1-3: new high-speed USB device number 11 using ehci-pci

usb 1-3: New USB device found, idVendor=0525, idProduct=a4a7

usb 1-3: New USB device strings: Mfr=1, Product=2, SerialNumber=0

usb 1-3: Product: Gadget Serial v2.4

usb 1-3: Manufacturer: Linux 4.4.50+ with 20980000.usb

cdc_acm 1-3:2.0: ttyACM0: USB ACM device

usbcore: registered new interface driver cdc_acm

cdc_acm: USB Abstract Control Model driver for USB modems and ISDN adapters

```
config.yaml

hardware:
```

```
  platform: lisy


lisy:
  connection: serial
  port: /dev/ttyACM0
  baud: 115200
```

15.3. Connection in ‚slave mode' (IP)

LISY is listening on port '5963' on all available interfaces

```
Config.yaml:
hardware:
  platform: lisy
lisy:
  connection: network
  network_port: 5963
  network_host: lisy
```

LISY is configured to get its IP address by DHCP, the default hostname is 'lisy'. For WLAN your WLAN-Id and Password can be put into a text file on the SD-card. LISY will show the IP address on the first two displays of the pinball during boot time. (or 'NO IP' if no IP address could be found.

15.4. Jumper settings on LISY board

As usual set your dip switches of Switch 'S2' according to your hardware (pinball machine). See Appendix A and B for details.

With switch 'S1' you can select either slave or master mode.

Switch S1								Mode
S1	S2	S3	S4	S5	S6	S7	S8	
off	off	off	on	off	off	off	on	MPF Master Mode
off	off	off	on	off	on	off	on	MPF Slave Mode (Serial)
off	on	off	on	off	on	off	on	MPF Slave Mode (Network)

The dip switch settings are only interpreted at boot time, so if you want to switch between master & slave mode you have to reboot the Raspberry PI. For doing that it is safe to just to switch 'off' and the switch 'on' the pinball machine, as the LISY image is 'read only'.

Note: If you are using a USB connection you have also to disconnect this one in order to be able to reboot, as with a powered up Host the Raspberry PI will be powered by the USB connection.

15.5. Special configuration statements

15.5.1. Using lamp driver as coils (LISY1 & LISY80)

As Gottlieb was 'running out' on coil drivers in later games they used lamp drivers with an 'extra transistor' to solve that problem. In MPF these 'lamps' need to be controlled in the same way as coils. For LISY1 & LISY80 you can define a lamp as a coil by adding '100' to the lamp number.

Example for 'config.yaml'

```
coils:

  c_trough_release:   # trough is a 'lamp' (L12), so we add 100 to the number

  number: 112
```

This is for Gottlieb Devils Dare, in this game the ball release coil is controlled by lamp driver #12. So the 'virtual' coil 'c_trough_release' is defined with number 112 (100 + 12).

15.5.2. Switches with LISY1

LISY1 supports the System 1 switch matrix which consists of a maximum of 40 switches, the switch number in the Manual can be used within mpf. However some of the switches in Gottlieb System1 games are NOT part of the switch matrix. These are the outhole switch, the SLAM switch and the 'RESET' switch on the board itself. The mpfserver for LISY1 is numbering these switches in the same way as pinmame does it:

SLAM: #76

Outhole: #66

Reset: #56

Note: As the SLAM switch is usually closed, the logic is 'reversed' here. A closed SLAM switch is interpreted as open within mpfserver.

15.5.3. Switches with LISY80

LISY80 supports the System 80 switch matrix which consists of a maximum of 64 switches, the switch number in the Manual can be used within mpf.

You may not find all switches in your game manual as some switches are equal along all System80/80A/80B games and Gottlieb there for decided not to document them ;-)

These switches are (taken from pinwiki.com):

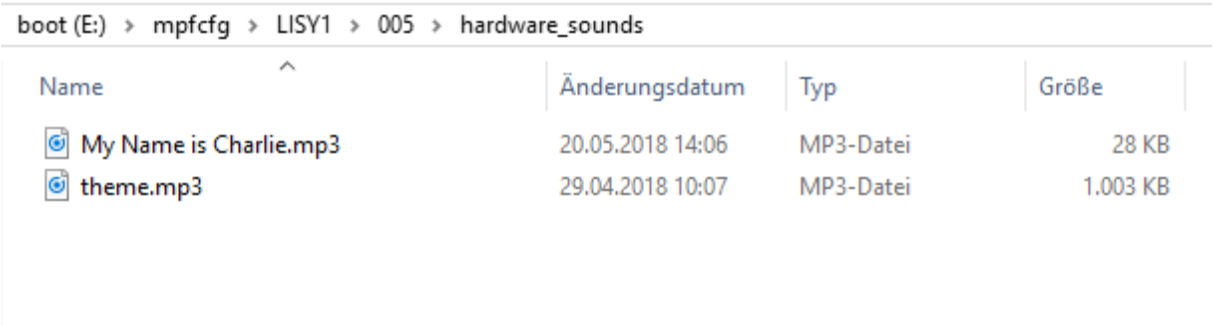
06 - left advance button (Sys80B only)
07 - play / test switch
16 - right advance button (Sys80B only)

17 - left coin switch
27 - right coin switch
37 - center coin switch
47 - replay button
57 - plumb bob and ball roll tilts (these have the same switch assignment as the playfield tilt switch)

Note: The SLAM switch in system80, which is NOT part of the switch matrix, cannot be used in mpfserver for LISY80 in the current release.

15.5.4. sounds

Soundfiles need to be placed in the mpf config directory **on the SD card of the LISY** system in the subdirectory 'hardwaresounds' For LISY1 this is '/boot/mpfcfg/LISY1/xxx' and for LISY80 this is '/boot/mpfcfg/LISY80/xxx', where xxx is the game number set via S2 according to the appendix.



Example sound config for a system1 Charlies Angels (game number 5)

Example mpf config:

```
hardware_sound_systems:
    default:
        label: LISY

hardware_sound_player:
    test2:
        2:
            action: play
    play_file:
        "some_file": play_file
    play_file_loop:
        "some_file":
          action: play_file
          platform_options:
            loop: True
            no_cache: False
    play_text:
        text:
          action: text_to_speech
          value: "Hello MPF"
          platform_options:
            loop: False
```

```
        no_cache: True
volume_05:
    set_volume:
      action: set_volume
      value: 0.5
increase_volume:
    0.1: increase_volume
decrease_volume:
    decrease_volume:
      action: decrease_volume
      value: 0.01
test3:
    3: play
test_stop: stop
```

Appendix A ‚Gamelist' LISY1

No	Dip Switch S3				Mame Name	Long Name
	S1	S2	S3	S4		
0	off	off	off	off	cleoptra	Cleopatra
1	on	off	off	off	sinbad	Sinbad
2	off	on	off	off	jokrpokr	Joker Poker
3	on	on	off	off	dragon	Dragon
4	off	off	on	off	closeenc	Close Encounters of the Third Kind
5	on	off	on	off	charlies	Charlie's Angels
6	off	on	on	off	solaride	Solar Ride
7	on	on	on	off	countdwn	Count-Down
8	off	off	off	on	pinpool	Pinball Pool
9	on	off	off	on	totem	Totem
10	off	on	off	on	hulk	The Incredible Hulk
11	on	on	off	on	genie	Genie
12	off	off	on	on	buckrgrs	Buck Rogers
13	on	off	on	on	torch	Torch
14	off	on	on	on	roldisco	Roller Disco
15	on	on	on	on	astannie	Asteroid Annie and the Aliens

Appendix B ‚Gamelist' LISY80

No	Dip Switch S2						Mame Name	Type	Long Name	GTB NO
	S1	S2	S3	S4	S5	S6				
0	off	off	off	off	off	off	panthera	SYS80	Panthera	652
1	on	off	off	off	off	off	spidermn	SYS80	Spiderman	653
2	off	on	off	off	off	off	circus	SYS80	Circus	654
3	on	on	off	off	off	off	cntforce	SYS80	Counterforce	656
4	off	off	on	off	off	off	starrace	SYS80	Star Race	657
5	on	off	on	off	off	off	jamesb	SYS80	James Bond Timed Play	658
6	off	on	on	off	off	off	jamesb2	SYS80	James Bond 3/5-Ball	658
7	on	on	on	off	off	off	timeline	SYS80	Time Line	659
8	off	off	off	on	off	off	forceii	SYS80	Force II	661
9	on	off	off	on	off	off	pnkpnthr	SYS80	Pink Panther	664
10	off	on	off	on	off	off	mars	SYS80	Mars - God of War Speech	666
11	on	on	off	on	off	off	mars2	SYS80	Mars - God of War Soundonly	666
12	off	off	on	on	off	off	vlcno_ax	SYS80	Volcano speech rev4	667
13	on	off	on	on	off	off	vlcno_1b	SYS80	Volcano Soundonly	667
14	off	on	on	on	off	off	blckhole	SYS80	Black Hole	668
15	on	on	on	on	off	off	blkholea	SYS80	Black Hole Soundonly	668
16	off	off	off	off	on	off	hh	SYS80	Haunted House	669
17	on	off	off	off	on	off	eclipse	SYS80	Eclipse	671
18	off	on	off	off	on	off	dvlsdre	SYS80A	Devils DareSpeech	670
19	on	on	off	off	on	off	dvlsdre2	SYS80A	Devils Dare Soundonly	670
20	off	off	on	off	on	off	rocky	SYS80A	Rocky	672
21	on	off	on	off	on	off	spirit	SYS80A	Spirit	673
22	off	on	on	off	on	off	punk	SYS80A	Punk	674
23	on	on	on	off	on	off	striker	SYS80A	Striker	675
24	off	off	off	on	on	off	krull	SYS80A	Krull	676
25	on	off	off	on	on	off	qbquest	SYS80A	Q*Bert's Quest	677
26	off	on	off	on	on	off	sorbit	SYS80A	Super Orbit	680
27	on	on	off	on	on	off	rflshdlx	SYS80A	Royal Flush Deluxe	681
28	off	off	on	on	on	off	goinnuts	SYS80A	Goin' Nuts	682
29	on	off	on	on	on	off	amazonh	SYS80A	Amazon Hunt	684
30	off	on	on	on	on	off	rackemup	SYS80A	Rack 'Em Up	685
31	on	on	on	on	on	off	raimfire	SYS80A	Ready...Aim...Fire!	686
32	off	off	off	off	off	on	jack2opn	SYS80A	Jacks To Open	687
33	on	off	off	off	off	on	touchdn	SYS80A	Touchdown	688
34	off	on	off	off	off	on	alienstr	SYS80A	Alien Star	689
35	on	on	off	off	off	on	thegames	SYS80A	The Games	691
36	off	off	on	off	off	on	eldorado	SYS80A	El Dorado City of Gold	692

37	on	off	on	off	off	on	icefever	SYS80A	Ice Fever	695
38	off	on	on	off	off	on	notused1	SYS80A	notused1	1
39	on	on	on	off	off	on	notused2	SYS80A	notused2	2
40	off	off	off	on	off	on	bountyh	SYS80B	Bounty Hunter	694
41	on	off	off	on	off	on	triplay	SYS80B	Chicago Cubs Triple Play	696
42	off	on	off	on	off	on	tagteam	SYS80B	Tag Team	698
43	on	on	off	on	off	on	rock	SYS80B	Rock	697
44	off	off	on	on	off	on	raven	SYS80B	Raven	702
45	on	off	on	on	off	on	rock_enc	SYS80B	Rock Encore	704
46	off	on	on	on	off	on	hlywoodh	SYS80B	Hollywood Heat	703
47	on	on	on	on	off	on	genesis	SYS80B	Genesis	705
48	off	off	off	off	on	on	goldwing	SYS80B	Gold Wings	707
49	on	off	off	off	on	on	mntecrlo	SYS80B	Monte Carlo	708
50	off	on	off	off	on	on	sprbreak	SYS80B	Spring Break	706
51	on	on	off	off	on	on	arena	SYS80B	Arena	709
52	off	off	on	off	on	on	victory	SYS80B	Victory	710
53	on	off	on	off	on	on	diamond	SYS80B	Diamond Lady	711
54	off	on	on	off	on	on	txsector	SYS80B	TX Sector	712
55	on	on	on	off	on	on	robowars	SYS80B	Robo War	714
56	off	off	off	on	on	on	excalibr	SYS80B	Excalibur	715
57	on	off	off	on	on	on	badgirls	SYS80B	Bad Girls	717
58	off	on	off	on	on	on	bighouse	SYS80B	Big House	713
59	on	on	off	on	on	on	hotshots	SYS80B	Hot Shots	718
60	off	off	on	on	on	on	bonebstr	SYS80B	Bone Busters Inc.	719
61	on	off	on	on	on	on	nmoves	SYS80B	Night Moves	C-103
62	off	on	on	on	on	on	notused3	SYS80B	notused3	3
63	on	on	on	on	on	on	notused4	SYS80B	notused4	4

Appendix C ‚Gamelist' LISY80 7digit

No	Dip Switch S3						Mame Name	Type	Long Name	GTB NO
	S1	S2	S3	S4	S5	S6				
0	off	off	off	off	off	off	panther7	SYS80	Panthera	652
1	on	off	off	off	off	off	spiderm7	SYS80	Spiderman	653
2	off	on	off	off	off	off	circus7	SYS80	Circus	654
3	on	on	off	off	off	off	cntforc7	SYS80	Counterforce	656
4	off	off	on	off	off	off	starrac7	SYS80	Star Race	657
5	on	off	on	off	off	off	jamesb7	SYS80	James Bond Timed Play	658
6	off	on	on	off	off	off	jamesb7b	SYS80	James Bond 3/5-Ball	658
7	on	on	on	off	off	off	timelin7	SYS80	Time Line	659
8	off	off	off	on	off	off	forceii7	SYS80	Force II	661
9	on	off	off	on	off	off	pnkpntr7	SYS80	Pink Panther	664
10	off	on	off	on	off	off	mars7	SYS80	Mars - God of War Speech	666
11	on	on	off	on	off	off	mars2	SYS80	Mars - God of War Soundonly	666
12	off	off	on	on	off	off	vlcno_a7	SYS80	Volcano speech rev4	667
13	on	off	on	on	off	off	vlcno_b7	SYS80	Volcano Soundonly	667
14	off	on	on	on	off	off	blkhole7	SYS80	Black Hole	668
15	on	on	on	on	off	off	blkhol7s	SYS80	Black Hole Soundonly	668
16	off	off	off	off	on	off	hh7	SYS80	Haunted House	669
17	on	off	off	off	on	off	eclipse7	SYS80	Eclipse	671

Appendix D: example dip switch setting ‘default_lisy1_dips.csv‘

Switch	ON_or_OFF	comment (Pinmame default: 0x0, 0x3F, 0x73)
1	OFF	
2	OFF	
3	OFF	
4	OFF	
5	OFF	
6	OFF	
7	OFF	
8	OFF	
9	ON	
10	ON	
11	ON	
12	ON	
13	ON	
14	ON	
15	OFF	
16	OFF	
17	ON	
18	ON	
19	OFF	
20	ON	
21	ON	
22	ON	
23	ON	
24	OFF	

Appendix E: example dip switch setting ‘default_lisy80_dips.csv‘

Switch	ON_or_OFF	comment
1	OFF	
2	ON	
3	OFF	
4	OFF	
5	OFF	
6	OFF	
7	OFF	
8	OFF	
9	ON	
10	ON	
11	OFF	
12	OFF	
13	OFF	
14	OFF	
15	OFF	
16	ON	
17	ON	
18	ON	
19	OFF	
20	ON	
21	ON	
22	OFF	
23	ON	
24	ON	
25	ON	
26	ON	
27	ON	
28	ON	
29	ON	
30	ON	
31	ON	
32	ON	

Appendix F: Fadecandy example mapping GI

LED	Mode	follower	Red	Green	Blue	Comment (GI full mapping example)
64	1	0	239	90	16	
65	1	1	239	90	16	
66	1	2	239	90	16	
67	1	3	239	90	16	
68	1	4	239	90	16	
69	1	5	239	90	16	
70	1	6	239	90	16	

Appendix G: Fadecandy example mapping lamps

Lamp	Exclusiv	LED	Red	Green	Blue	Comment (full mapping example)
2	1	80	255	255	255	Shoot again backbox
10	1	79	255	255	255	Game Over
11	1	82	255	255	255	high game to date

Appendix H: Error codes

In case of Error, the red ‘Error’ LED will went to ON and (if possible) LISY will display the Error code in one of the displays. In debug mode the Error code will also appear in the debug log.

#	short message	long message	possible solution
1		"Failed to initialize the wiringPi library"	
2		"Failed to open the I2C bus for displays"	check X1
3		"Unable to get bus access to talk to display slave"	
4	"I2C COIL PIC PROB"	"Failed to open the I2C bus for coils"	check X1
5	"I2C COIL PIC PROB"	"Unable to get bus access to talk to display slave"	
6	"I2C BUS PROB WRIT"	"Failed to write to the I2C bus display pic"	
7	"I2C BUS PROB WRIT"	"Failed to write to the I2C bus coil pic"	
8	"I2C BUS PROB READ"	"Failed to read from the I2C bus display pic"	check/replace display PIC
9	"I2C BUS PROB READ"	"Failed to read from the I2C bus coil pic"	check/replace coil PIC
10	"ROM MISSING "	"Failed to read ROM data for selected game"	put pinmame rom into folder
11	"INVALID HARDWARE "	"Could not determine Hardware revision"	check eeprom