

BallyFA

Bally MPU based on FPGA

Software Version 1.09

user manual

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05.11.2020

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Important remark

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

1. Introduction

BallyFA use a (low cost) FPGA which emulates the hardware of a Bally MPU with the exception of 'J5' meaning BallyFA can not be used with Stern games having connected the soundboard via J5.

Later versions of BallyFA may have the Soundboard integrated.

- BallyFA is a 100% hobby project. This makes the solution cheap, depending on where you buy your components it is possible to create your Bally replacement MPU for less than 50€.

What do you need?

- Basic soldering skills (SMD components can be ordered pre-assembled I most shops)
- Possibility to read/write micro SD cards
- A PC with an USB port in order to be able to program the FPGA

2. Quickstart

1. Download latest versions of the SD card Image and the FPGA program from lisy.dev
2. Write the image to a SD card
3. Program the FPGA
4. Configure switch 'game select' according to your pinball (Appendix A)
5. Replace your original Bally MPU with BallyFA
6. Switch the Game ON
7. Enjoy

3. Put the BallyFA Image to the SD card

On my website you will find the latest version of BallyFA an (zipped) image file. After unpacking the image can be put on a SD card. I do recommend using Win32DiskImager for doing that.

This article uses content from the eLinux wiki page [RPI Easy SD Card Setup](#), which is shared under the [Creative Commons Attribution-ShareAlike 3.0 Unported license](#)

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

BallyFA boards have the same connectors and same mounting holes as the original Bally/Stern MPUs, so replacing of the board can be done in seconds.

5. Dip Switch Settings

5.1. DIP Switch S1: game select

Here you can select what game BallyFA should run. This depends on the roms placed on the SD card. See Appendix A for a full list and Chapter 'SD card' for an explanation of the structure of the SD card content.

5.2. DIP Switch S2: options

Default setting is all ,OFF'

5.2.1. S2-Dip1 -> Zero Cross Emulator

Bally MPU need to have a 'Zero Cross' signal in order to work properly, this signal is coming from the 12Volt power supply. The existence of this signal is checked during boot. With dip 1 to ,ON' BallyFA will emulate this signal, so for testing on the bench you only need 5 Volt supply. Note that timing is different with emulated zero cross!

5.2.2. S2-Dip2 -> Save nvram content to eeprom

BallyFA does use an eeprom to save the nvram content (e.g. Highscores and extended settings). Each game has its own area on the eeprom. For bench testing dip2 can be set momentarily to ON, which results in BallyFA saving the current nvram content to eeprom. During normal gameplay nvram content is saved automatically by test switch, game over really and credit button.

5.2.3. S2-Dip3 -> not used

Not implemented yet.

5.2.4. S2-Dip4 -> not used

Not implemented yet.

5.2.5. S2-Dip5 -> Coin validator

With this dip to ON, the coin validator is activated. Note: do not activate this in case no validator is connected.

5.2.6. S2-Dip6 -> init nvram

With dip6 to ,ON' BallyFa during boot will initialize the nvram ram for the selected game to zero. This is useful if you want to reset ALL ram content.

6. boot sequence

6.1. phase 1: init

Immediately after switching on the pinball with BallyFA inserted you will see the following output on the display of your pinball machine

Player 1: version of the FPGA program running

Player 2: value of selected game on S1

Player 3: lisy.dev unique identifier for FPGA based MPUs

Player 4: version of image on inserted SD card (not implemented yet)

Credit Display: counter, counts down from 5 ... 1

6.2. phase 2: SD card read

BallyFA tries to read the SD card content, if this fails the red LED 'SD card error' will go ON. On success the current version of the SD card image is shown at display 4.

6.3. phase 3: program execution

The code indicated by the Dip switch 'game select' is read from the SD card and executed. This starts the normal Bally boot sequence by blinking the green 'Bally' LED. If the code runs (regular interrupts are seen) the green 'ON' LED will go ON.

7. programming the FPGA

To program the FPGA you need the Quartus Programmer.

7.1. programmer software

It can be downloaded from the Intel Website for free. You just need to create a user account.

<https://fpgasoftware.intel.com/13.0sp1/?edition=web>

Go to Additional Software and Download **Quartus II Programmer and SignalTap II**

Note: Use version 13.0sp1! **Do not use newer versions of the programmer.** The used FPGA for BallyFA is quite old (and therefore cheap) but is not supported by latest versions of the programmer.

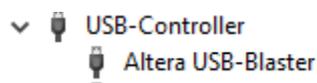
7.2. install the driver for your USB Blaster

When connecting your USB Blaster the first time it will not be recognized correctly by Windows.



You also need to install the driver for your USB Blaster. The driver comes together with the installation of the programmer and is located in the 'driver' subdirectory.

- Right click on the entry in the device manager and choose 'update driver' (Treiber aktualisieren)
- Choose 'search for driver on this PC' (auf dem Computer nach Treibersoftware suchen)
- For a default installation select 'C:\altera\13.0sp1\qprogrammer\drivers'
- Confirm installation
- Now the Altera USB Blaster should be visible und 'USB-Controller'

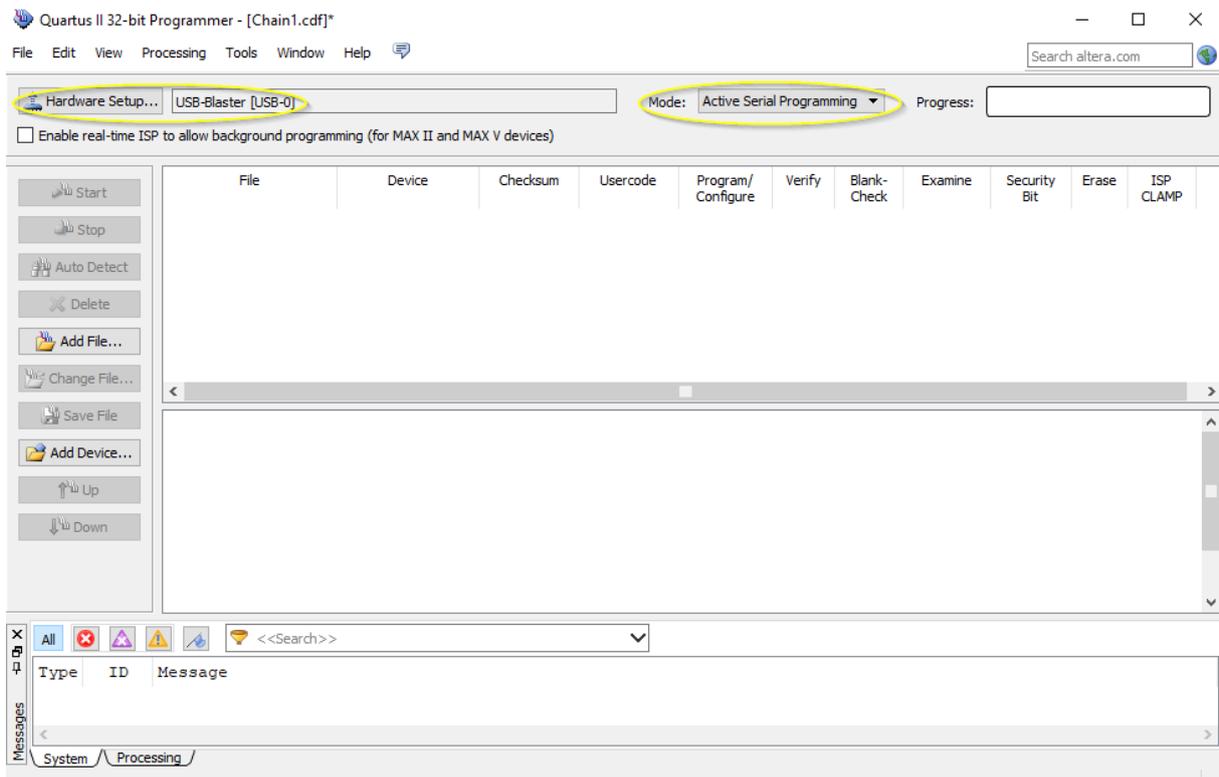


7.3. program your FPGA

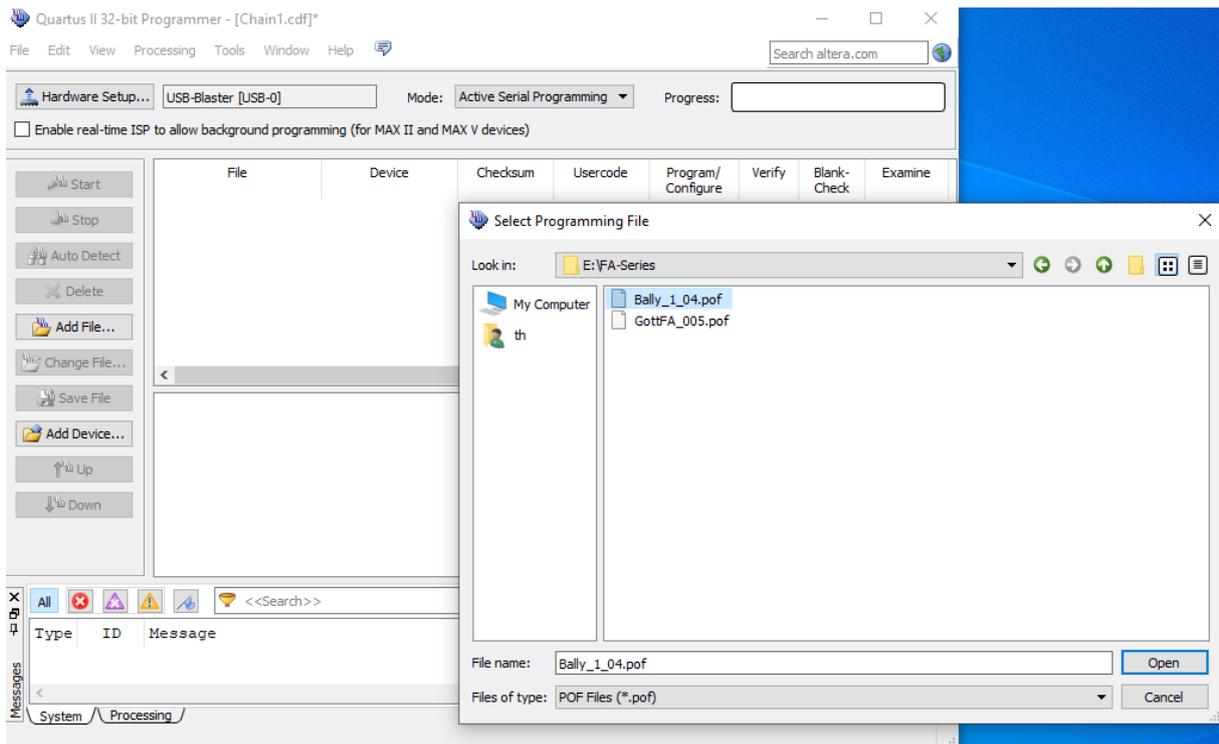
- 1) Connect the USB Blaster to the PC



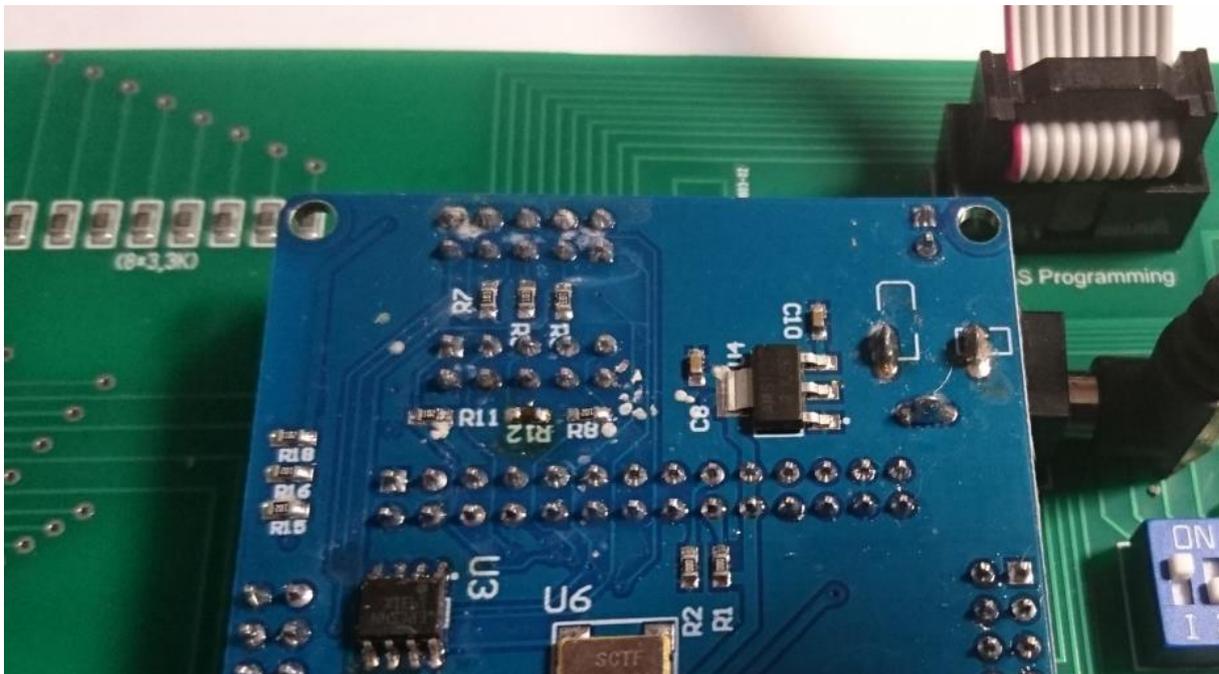
- 2) Start the programmer, make sure in the Hardware setup ,USB-Blaster' is visible and set the Mode to ,Activeserial Programming'



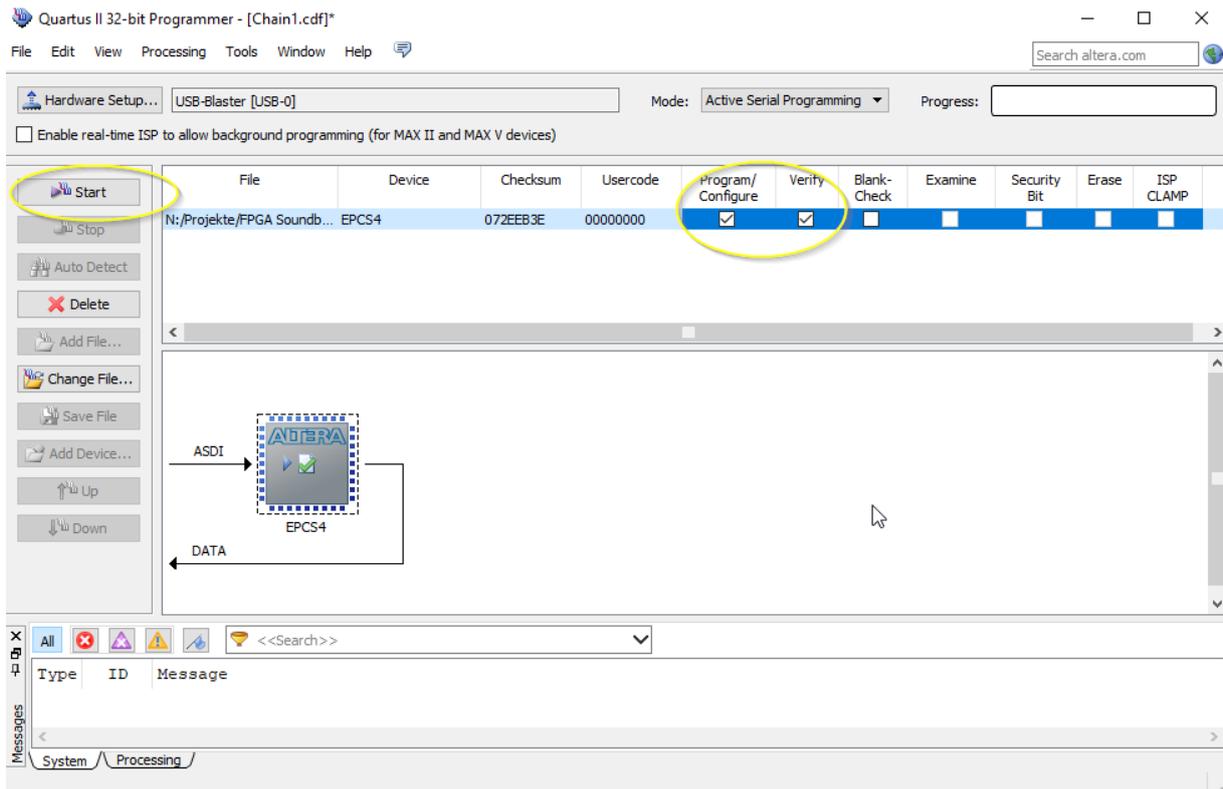
- 3) Select ,Add File' and choose the right ,pof' file for your game



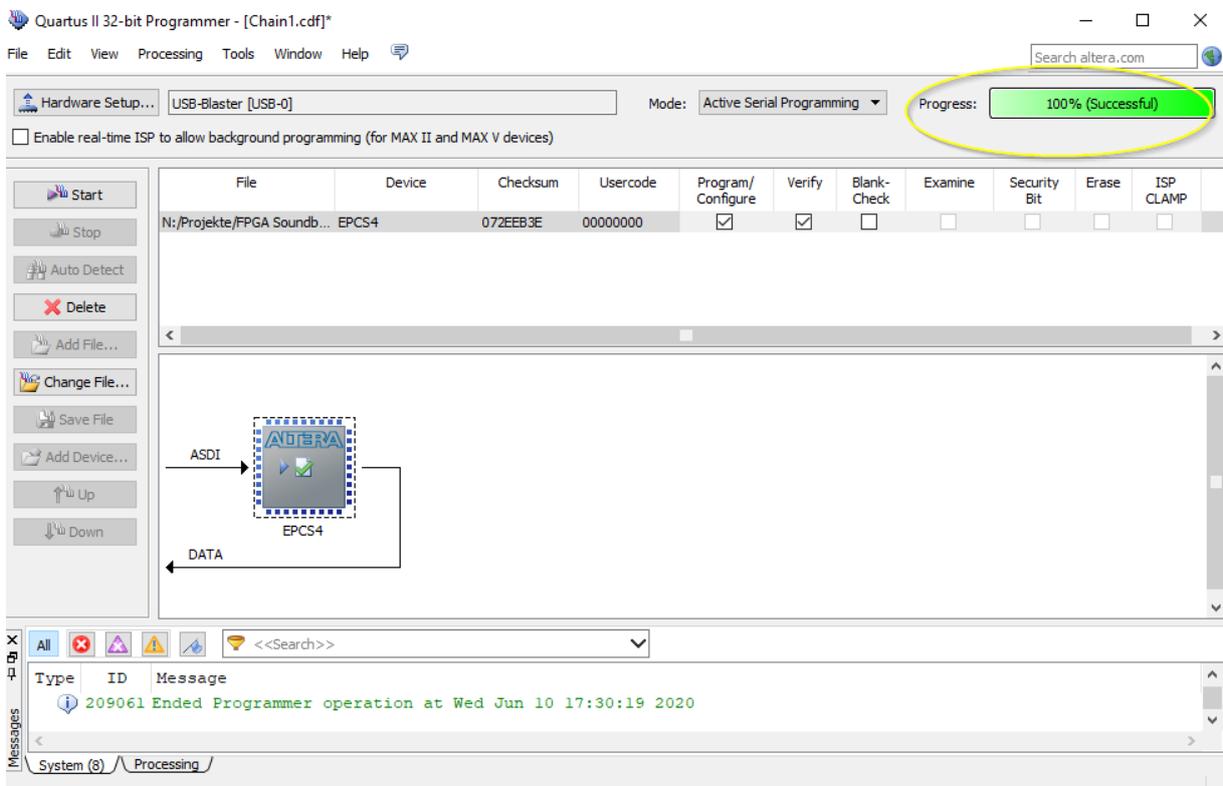
- 4) Power the FPGA with 5 Volt (middle pin ,+‘, outer pin ,-,) and connect the USB Blaster to the ,AS programming‘ connector on the BallyFA PCB



- 5) Select ,Program/Configure‘ and , Verify‘



6) Push start, wait for progress 100%



That's it!

8. coin validator (optional)

You can connect a standard coin validator (e.g. NRI-G13) to the connector on the bottom of the BallyFA PCB. To activate the coin validator set Dip5 of the 'options' DIP Switch bank to ON.

Bally switch / channel assignments for BallyFA:

Switch #9 right chute -> Channel 6

Switch #10 left chute -> Channel 4

Switch #11 middle chute -> Channel 5

9. structure of SD card

Due to limitations of the SD card read routine in the FPGA (it does read fix sector numbers instead of looking for filenames) it is necessary to use my SD-card image (128 Mbyte). You can write the image to a SD-card of your choice.

With game select all '0' ballyFa will try to read the first rom image at sector number 660. With my 128MB BallyFa image this is the location of the first file you write to an empty SD card.

The Bally roms need to be in the 'U2 / U6' format which have 4Kbyte each, meaning one rom image usable for BallyFA have 8Kbyte of size.

9.1. BallyFA image

My BallyFA SD card image has almost all available roms 'on board'. See appendix A for a gamelist and appendix B for a description of the special roms.

9.2. use your own roms

So for example lets assume you have a Bally KISS pinball and the rom files U2: KISS2732.U2 and U6: 720-3032.U6. You can create your BallyFA rom an windows command line with:

```
copy /b KISS2732.U2 + 720-3032.U6 BallyFA_Kiss.rom
```

Delete ALL files on your BallyFA SD card and copy BallyFA_Kiss.rom to it.

Now by selecting '0' on Game select you will have a KISS pinball running.

Appendix A 'game select'

No	game select								Game	Option
	S1	S2	S3	S4	S5	S6	S7	S8		
0	off	off	off	off	off	off	off	off	FREEDOM	
1	on	off	NIGHTRIDER							
2	off	on	off	off	off	off	off	off	EVELKNIEVEL	
3	on	on	off	off	off	off	off	off	EIGHTBALL	
4	off	off	on	off	off	off	off	off	POWERPLAY	
5	on	off	on	off	off	off	off	off	MATAHARI	
6	off	on	on	off	off	off	off	off	BLACKJACK	
7	on	on	on	off	off	off	off	off	STRIKES_SPARES	
8	off	off	off	on	off	off	off	off	LOSTWORLD	
9	on	off	off	on	off	off	off	off	6MILLIONMAN	
10	off	on	off	on	off	off	off	off	PLAYBOY	
11	on	on	off	on	off	off	off	off	VOLTAN	
12	off	off	on	on	off	off	off	off	SUPERSONIC	
13	on	off	on	on	off	off	off	off	STARTREK	
14	off	on	on	on	off	off	off	off	KISS	
15	on	on	on	on	off	off	off	off	PARAGON	
16	off	off	off	off	on	off	off	off	HARLEMGLOBE	
17	on	off	off	off	on	off	off	off	DOLLYPARTON	
18	off	on	off	off	on	off	off	off	FUTURESPA	
19	on	on	off	off	on	off	off	off	NITROGROUND	
20	off	off	on	off	on	off	off	off	SILVERBALLMANIA	
21	on	off	on	off	on	off	off	off	SPACEINVADERS	
22	off	on	on	off	on	off	off	off	ROLLINGSTONES	
23	on	on	on	off	on	off	off	off	MYSTIC	
24	off	off	off	on	on	off	off	off	HOTDOGGIN	
25	on	off	off	on	on	off	off	off	VIKING	
26	off	on	off	on	on	off	off	off	SKATEBALL	
27	on	on	off	on	on	off	off	off	FRONTIER	
28	off	off	on	on	on	off	off	off	XENON	
29	on	off	on	on	on	off	off	off	FLASHGORDON	
30	off	on	on	on	on	off	off	off	8BALLDELUXE	
31	on	on	on	on	on	off	off	off	FIREBALLII	
32	off	off	off	off	off	on	off	off	EMRYRON	
33	on	off	off	off	off	on	off	off	FATHOM	
34	off	on	off	off	off	on	off	off	MEDUSA	
35	on	on	off	off	off	on	off	off	CENTAUR	
36	off	off	on	off	off	on	off	off	ELEKTRA	
37	on	off	on	off	off	on	off	off	VECTOR	
38	off	on	on	off	off	on	off	off	MR_MRSPACMAN	

39	on	on	on	off	off	on	off	off	SPECTRUM	
40	off	off	off	on	off	on	off	off	SPEAKEASY	
41	on	off	off	on	off	on	off	off	BMX	
42	off	on	off	on	off	on	off	off	GRANDSLAM	
43	on	on	off	on	off	on	off	off	GOLDBALL	
44	off	off	on	on	off	on	off	off	XandOs	
45	on	off	on	on	off	on	off	off	SPYHUNTER	
46	off	on	on	on	off	on	off	off	KINGSOFSTEEL	
47	on	on	on	on	off	on	off	off	BLACKPYRAMID	
48	off	off	off	off	on	on	off	off	FIREBALLCLASSIC	
49	on	off	off	off	on	on	off	off	CYBERNAUT	
50	off	on	off	off	on	on	off	off	NIGHTRIDER	Freeplay
51	on	on	off	off	on	on	off	off	EVELKNIEVEL	Freeplay
52	off	off	on	off	on	on	off	off	EIGHTBALL	Freeplay
53	on	off	on	off	on	on	off	off	POWERPLAY	Freeplay
54	off	on	on	off	on	on	off	off	MATAHARI	Freeplay
55	on	on	on	off	on	on	off	off	BLACKJACK	Freeplay
56	off	off	off	on	on	on	off	off	STRIKES_SPARES	Freeplay
57	on	off	off	on	on	on	off	off	LOSTWORLD	Freeplay
58	off	on	off	on	on	on	off	off	6MILLIONMAN	Freeplay
59	on	on	off	on	on	on	off	off	PLAYBOY	Freeplay
60	off	off	on	on	on	on	off	off	VOLTAN	Freeplay
61	on	off	on	on	on	on	off	off	SUPERSONIC	Freeplay
62	off	on	on	on	on	on	off	off	STARTREK	Freeplay
63	on	on	on	on	on	on	off	off	KISS	Freeplay
64	off	off	off	off	off	off	on	off	PARAGON	Freeplay
65	on	off	off	off	off	off	on	off	HARLEMGLOBE	Freeplay
66	off	on	off	off	off	off	on	off	DOLLYPARTON	Freeplay
67	on	on	off	off	off	off	on	off	FUTURESPA	Freeplay
68	off	off	on	off	off	off	on	off	NITROGROUND	Freeplay
69	on	off	on	off	off	off	on	off	SILVERBALLMANIA	Freeplay
70	off	on	on	off	off	off	on	off	SPACEINVADERS	Freeplay
71	on	on	on	off	off	off	on	off	ROLLINGSTONES	Freeplay
72	off	off	off	on	off	off	on	off	MYSTIC	Freeplay
73	on	off	off	on	off	off	on	off	HOTDOGGIN	Freeplay
74	off	on	off	on	off	off	on	off	VIKING	Freeplay
75	on	on	off	on	off	off	on	off	SKATEBALL	Freeplay
76	off	off	on	on	off	off	on	off	FRONTIER	Freeplay
77	on	off	on	on	off	off	on	off	XENON	Freeplay
78	off	on	on	on	off	off	on	off	FLASHGORDON	Freeplay
79	on	on	on	on	off	off	on	off	8BALLDELUXE	Freeplay
80	off	off	off	off	on	off	on	off	FIREBALLII	Freeplay

81	on	off	off	off	on	off	on	off	EMRYRON	Freeplay
82	off	on	off	off	on	off	on	off	FATHOM	Freeplay
83	on	on	off	off	on	off	on	off	MEDUSA	Freeplay
84	off	off	on	off	on	off	on	off	CENTAUR	Freeplay
85	on	off	on	off	on	off	on	off	ELEKTRA	Freeplay
86	off	on	on	off	on	off	on	off	VECTOR	Freeplay
87	on	on	on	off	on	off	on	off	MR_MRSPACMAN	Freeplay
88	off	off	off	on	on	off	on	off	SPECTRUM	Freeplay
89	on	off	off	on	on	off	on	off	SPEAKEASY	Freeplay
90	off	on	off	on	on	off	on	off	BMX	Freeplay
91	on	on	off	on	on	off	on	off	GOLDBALL	Freeplay
92	off	off	on	on	on	off	on	off	XandOs	Freeplay
93	on	off	on	on	on	off	on	off	SPYHUNTER	Freeplay
94	off	on	on	on	on	off	on	off	KINGSOFSTEEL	Freeplay
95	on	on	on	on	on	off	on	off	BLACKPYRAMID	Freeplay
96	off	off	off	off	off	on	on	off	FIREBALCLASSIC	Freeplay
97	on	off	off	off	off	on	on	off	CYBERNAUT	Freeplay
98	off	on	off	off	off	on	on	off	6MILLIONMAN	6digit option
99	on	on	off	off	off	on	on	off	PLAYBOY	6digit option
100	off	off	on	off	off	on	on	off	VOLTAN	6digit option
101	on	off	on	off	off	on	on	off	SUPERSONIC	6digit option
102	off	on	on	off	off	on	on	off	STARTREK	6digit option
103	on	on	on	off	off	on	on	off	KISS	6digit option
104	off	off	off	on	off	on	on	off	PARAGON	6digit option
105	on	off	off	on	off	on	on	off	HARLEMGLOBE	6digit option
106	off	on	off	on	off	on	on	off	DOLLYPARTON	6digit option
107	on	on	off	on	off	on	on	off	FUTURESPA	6digit option
108	off	off	on	on	off	on	on	off	NITROGROUND	6digit option
109	on	off	on	on	off	on	on	off	SILVERBALLMANIA	6digit option
110	off	on	on	on	off	on	on	off	SPACEINVADERS	6digit option
111	on	on	on	on	off	on	on	off	ROLLINGSTONES	6digit option
112	off	off	off	off	on	on	on	off	MYSTIC	6digit option
113	on	off	off	off	on	on	on	off	HOTDOGGIN	6digit option
114	off	on	off	off	on	on	on	off	VIKING	6digit option
115	on	on	off	off	on	on	on	off	XENON	Special
116	off	off	on	off	on	on	on	off	EMBRYON	Special
117	on	off	on	off	on	on	on	off	VECTOR	Special
118	off	on	on	off	on	on	on	off	FATHOM	Special
119	on	on	on	off	on	on	on	off	NITROGROUND	Special w. Sirene Patch
120	off	off	off	on	on	on	on	off	not used	
121	on	off	off	on	on	on	on	off	not used	
122	off	on	off	on	on	on	on	off	not used	

123	on	on	off	on	on	on	on	off	not used
124	off	off	on	on	on	on	on	off	not used
125	on	off	on	on	on	on	on	off	not used
126	off	on	on	on	on	on	on	off	not used
127	on	on	on	on	on	on	on	off	not used

Appendix B 'rom description'

2732 U2 & U6 GAME ROM LIST - 6/30/05

The following list of 1977-1985 Bally games is organized by U6 ROM type. Many games share the same U6 ROM, so the list is organized in that manner. Note at the end of this list there are a number of custom ROM files modified by Oliver. These give all Bally games a free play option. He has also modified a few other games to have different play features.

GAME	U2 POSITION	U6 POSITION
----	-----	-----
FREEDOM	FREE2732.U2	FREE2732.U6
NIGHT RIDER	NGHT2732.U2	720-2132.U6
EVEL KNIEVEL	EVEL2732.U2	720-2132.U6
EIGHTBALL	8BAL2732.U2	720-2132.U6
POWER PLAY	POWR2732.U2	720-2132.U6
MATA HARI	MATA2732.U2	720-2132.U6
BLACK JACK	BLKJ2732.U2	720-2132.U6
STRIKES/SPARES	STSP2732.U2	720-2132.U6
LOST WORLD	LOST2732.U2	720-2832.U6
\$6 MILLION MAN	6MIL2732.U2	720-3032.U6
PLAYBOY	PLAY2732.U2	720-3032.U6
VOLTAN	VOLT2732.U2	720-3032.U6

SUPERSONIC SURP2732.U2 720-3032.U6
 STAR TREK STAR2732.U2 720-3032.U6
 KISS KISS2732.U2 720-3032.U6
 PARAGON PARA2732.U2 720-3032.U6

 HARLEM GLOBE HARL2732.U2 720-3532.U6
 DOLLY PARTON DOLL2732.U2 720-3532.U6
 FUTURE SPA FSPA2732.U2 720-3532.U6
 NITRO GROUND NITR2732.U2 720-3532.U6
 SILVERBALLMANIA SILV2732.U2 720-3532.U6
 SPACE INVADERS INVA2732.U2 720-3532.U6
 ROLLING STONES ROLL2732.U2 720-3532.U6
 MYSTIC MYST2732.U2 720-3532.U6
 HOT DOGGIN HOTD2732.U2 720-3532.U6
 VIKING VIKG2732.U2 720-3532.U6

 SKATEBALL SKAT2732.U2 720-4032.U6
 FRONTIER FRNT2732.U2 720-4032.U6
 XENON XNON2732.U2 720-4032.U6

 FLASH GORDON FLSH2732.U2 720-5232.U6
 8 BALL DELUXE 8DLX2732.U2 720-5232.U6
 FIREBALL II FB2_2732.U2 720-5232.U6
 EMRYRON EMBY2732.U2 720-5232.U6

 FATHOM FATH2732.U2 720-5332.U6
 MEDUSA MDUS2732.U2 720-5332.U6
 CENTAUR CENT2732.U2 720-5332.U6

ELEKTRA ELEK2732.U2 720-5332.U6
VECTOR VECT2732.U2 720-5332.U6
MR/MRS PACMAN MR&S2732.U2 720-5332.U6
SPECTRUM SPEC2732.U2 720-5332.U6
SPEAKEASY EASY2732.U2 720-5332.U6
BMX BMX_2732.U2 720-5332.U6
GOLD BALL GOLD2732.U2 720-5332.U6
X's & O's X&OS2732.U2 720-5332.U6
SPY HUNTER SPY_2732.U2 720-5332.U6
KINGS OF STEEL KNGS2732.U2 720-5332.U6
BLACK PYRAMID BLKP2732.U2 720-5332.U6
FIREBAL CLASSIC FB_CLASS.U2 720-5332.U6
CYBERNAUT CYBE2732.U2 720-5332.U6

GRAND SLAM GRNDSLAM.U2 GRNDSLAM.U6

2005 New Additions:

=====

720F3132.U6 by Oliver

This file replace the 720-3132.U6 for the following games

(the game specific U2 is unchanged):

NIGHT RIDER NGHT2732.U2 720-2132.U6

EVEL KNIEVEL EVEL2732.U2 720-2132.U6
EIGHTBALL 8BAL2732.U2 720-2132.U6
POWER PLAY POWR2732.U2 720-2132.U6
MATA HARI MATA2732.U2 720-2132.U6
BLACK JACK BLKJ2732.U2 720-2132.U6
STRIKES/SPARES ST&S2732.U2 720-2132.U6

version date remark

2 09/19/04 add free play

recalculate checksum

installation notes:

burn the file on 2732 eprom

after power on you will see the version number in the one player display

if dip switch 17 = on and dip switch 18 = on and dip switch 19 = on

freeplay is enable: decrease credits not lower then 01

720F2832.U6 by Oliver

This file replace the 720-2832.U6 for the following games

(the game specific U2 is unchanged):

LOST WORLD LOST2732.U2 720-2832.U6

version date remark

2 10/25/04 add free play

recalculate checksum

installation notes:

burn the file on 2732 eprom

after power on you will see the version number in the one player displays

if dip switch 19 = on and dip switch 18 = on and dip switch 17 = on

freeplay is enable: decrease credits not lower then 01

720F3032.U6 by Oliver

This file replace the 720-3032.U6 for the following games

(the game specific U2 is unchanged):

\$6 MILLION MAN 6MI\$2732.U2 720-3032.U6

PLAYBOY PLAY2732.U2 720-3032.U6

VOLTAN VOLT2732.U2 720-3032.U6

SUPERSONIC SURP2732.U2 720-3032.U6

STAR TREK STAR2732.U2 720-3032.U6

KISS KISS2732.U2 720-3032.U6

PARAGON PARA2732.U2 720-3032.U6

version date remark

3 09/11/04 add free play

recalculate checksum

installation notes:

burn the file on 2732 eprom

after power on you will see the version number in the one player displays

if dip switch 17 = on and dip switch 18 = on and dip switch 19 = on

freeplay is enable: decrease credits not lower then 01

720F3532.U6 by Oliver

This file replace the 720-3532.u6 for the following games:

HARLEM GLOBE HARL2732.U2 720-3532.U6

DOLLY PARTON DOLL2732.U2 720-3532.U6

FUTURE SPA FSPA2732.U2 720-3532.U6

NITRO GROUND NITR2732.U2 720-3532.U6

SILVERBALLMANIA SILV2732.U2 720-3532.U6

SPACE INVADERS INVA2732.U2 720-3532.U6

ROLLING STONES ROLL2732.U2 720-3532.U6

MYSTIC MYST2732.U2 720-3532.U6

HOT DOGGIN HOTD2732.U2 720-3532.U6

VIKING VIKG2732.U2 720-3532.U6

version date remark

9 09/25/04 installation notes:

correct fake 0 handling (corrected with version 6)

Display only 00 instead of 000 during game (corrected with version 7)

Correct match routine for hotdogging and mystic (corrected with version 8)

new dip switches with version 9

dip switch 25 = on and dip switch 26 = on enables freegame

decrease credits not lower then 01

dip switch 22 = on 3 freegames, off = 0 freegame if breaking high score to date

This files allows the usage of 7-digit displays instead of 6-digit, if desired.

Replace the four player 6-digit displays with 7-digit displays (only if dip switch 21 = on)

Install a little pcb (only if dip switch 21 = on)

Look here for the hardware part (only if dip switch 21 = on)

http://www.pinball4you.ch/okaegi/pro_d7.html

after power on you will see the version number in the one player displays

dip switch 21 = off and use original 6 digit displays with

the maximum player score of 999,990)

dip switch 21 = on 7 digit scoring

After the install erase the stored freegames and the highscore (setting 01 - 04).

720F4032.U6 by Oliver

This file replace the 720-4032.U6 for the following games

(the game specific U2 is unchanged):

SKATEBALL SKAT2732.U2 720-4032.U6

FRONTIER FRNT2732.U2 720-4032.U6

XENON XNON2732.U2 720-4032.U6

version date remark

1 10/03/04 add free play

recalculate checksum

installation notes:

burn the file on 2732 eprom

after power on you will see the version number in the one player displays

if dip switch 25 = on and dip switch 26 = on

freeplay is enable: decrease credits not lower then 01

720F5232.U6 by Oliver

This file replace the 720-5232.U6 for the following games

(the game specific U2 is unchanged):

FLASH GORDON FLSH2732.U2 720-5232.U6

8 BALL DELUXE 8DEL2732.U2 720-5232.U6

FIREBALL II FB2-2732.U2 720-5232.U6

EMRYRON EMBY2732.U2 720-5232.U6

** For embryon a custom ROM version with new features and 7 digit scoring
switchable is available.

version date remark

1 10/06/04 add free play

 recalculate checksum

 installation notes:

 burn the file on 2732 eprom

 after power on you will see the version number in the one player displays

 if dip switch 25 = on and dip switch 26 = on

 freeplay is enable: decrease credits not lower then 01

720F5332.U6 by Oliver

This file replace the 720-5332.U6 for the following games

(the game specific U2 is unchanged):

FATHOM * FATH2732.U2 720-5332.U6

MEDUSA	MDUS2732.U2	720-5332.U6
CENTAUR	CENT2732.U2	720-5332.U6
ELEKTRA	ELEK2732.U2	720-5332.U6
VECTOR *	VECT2732.U2	720-5332.U6
MR/MRS PACMAN	MR&S2732.U2	720-5332.U6
SPECTRUM	SPEC2732.U2	720-5332.U6
SPEAKEASY	EASY2732.U2	720-5332.U6
BMX	BMX-2732.U2	720-5332.U6
GOLD BALL	GOLD2732.U2	720-5332.U6
X's & O's	X&OS2732.U2	720-5332.U6
SPY HUNTER	SPY-2732.U2	720-5332.U6
KINGS OF STEELKNGS	2732.U2	720-5332.U6
BLACK PYRAMID	BLKP2732.U2	720-5332.U6
FIREBAL CLASSIC	FB-CLASS.U2	720-5332.U6
CYBERNAUT	CYBE2732.U2	720-5332.U6

* For Fathom and Vector a custom ROM versions with new features are available.

version date remark

1 10/16/04 add free play

 recalculate checksum

 installation notes:

 burn the file on 2732 eprom

 after power on you will see the version number in the one player displays

 if dip switch 25 = on and dip switch 26 = on

 freeplay is enable: decrease credits not lower then 01

EIGHT BALL DELUXE Deluxe Custom ROM files by Oliver.

8DLX_v24.U2 (2732 EPROM)

8DLX_v24.U6 (2732 EPROM)

version date remark

24 06/04/05 add free play

add version nummber,

recalculate checksum

installation notes:

burn the U2 and U6 file on 2732/2532 eproms

after power on you will see the version number in the one player displays

if dip switch 25 = on and dip switch 26 = on

freeplay is enable: decrease credits not lower then 01

Bonus bug for player 2 and 4 fixed (from production rom):

If the 56K or 112K bonus holdover light is lit while the bonus is being scored, the game scores bonus for *9* balls for a total bonus count of 63K instead of 56K and 128K instead of 112K. This bug is fixed.

The ontime for the solenoid expander lamp is enlarged.

A new skill shot is implemented:

1) When all the right horseshoes targets are down and the eight ball is hit, the deluxe targets are lit. (as production rom)

No deluxe target is flashing at the beginning.

2) After you hit any of the lit deluxe target, the flashing sequence

starts. The next target deluxe is flashing. (For example if you hit de"L"uxe then the "U" is flashing).

3) If you hit a flashing deluxe target, then you get 15'000 point and the next deluxe target flashes. (In this case the "X").

4) If you hit a dark deluxe target, the deluxe target keeps flashing.

5) if you hit another lit deluxe target, the flashing stops.

6) When you hit the last flashing deluxe target, you score 550'000 points and you hear "eight ball deluxe".

EMBRYON Custom ROM files by Oliver.

EMBY_v9.U2 (2732 EPROM)

EMBY_v9.U6 (2732 EPROM)

version date remark

9 10/07/04

add 7-digit displays for player 1 - 4, add version nummber,

recalculate checksum

installation notes:

burn the two files on 2732 eprom

additional installation notes

if you want 7 digit scoring, dip switch 32 = off:

replace the four player 6-digit displays with 7-digit displays

Add an additional wire from A4 (mpu) J1 Pin 7 to every player display pin 12
(don't connect the credit display !)

after power on you will see the version number in the one player displays

dip switch 27 = on -> Give two embryon letters

dip switch 31 = on -> 5 ball

dip switch 31 = off -> 3 ball

dip switch 32 = off -> 7 digit scoring

dip switch 32 = on -> 6 digit scoring (original with 6 digit displays, maximum player score is 999'990)

Credit Display always on,

A lightshow added with multiball start

also reset left targetbank for extraball

if dip switch 25 = on and dip switch 26 = on

freeplay is enable: decrease credits not lower than 01

delay before multiball start is a little bit longer

VECTOR Custom ROM files by Oliver.

VECT_v5.U2 (2732 EPROM)

VECT_v5.U6 (2732 EPROM)

version date remark

5 10/16/04 freegame setting if (dip 25 / 26) = 1, adjust timing from speech
(weak shoot, incredibel shoot, great shoot, new vector record..)

Vector Skill Plunger Shot.

Adds a potential skill shot to the Standard Vector Ruleset and incorporates the unused "Super Shot" voice quote.

Game awards a skill shot value (75K) if the ball shot from the plunger goes over the rollover button. Feature is cancelled when any other switch is hit. Every light of the right bonus ladder is lit when a new ball is served. After successful hit, 25k + 5k is lit.

"[1,2,3] captured!"

Incorporates the unused "[1,2] captured" voice quotes into the ball lock sequence. Remove the "energy stored" phrases

Rules:

- 1st ball locked: Game voices out "1 captured"
- 2nd ball locked: Game voices out "2 captured!"
- 3rd ball locked: Game voices out "3 captured!"

After 1 and 2 ball captured, the next quote "Shoot for hype targets" is used.

After the 3 ball is locked, then the next quote "powerballs released" is used.

Quick Multiball

Incorporates the unused "Strategy Changed!" voice quote into gameplay, which better defines the quick multiball feature which is started via the H-Y-P-E targets when a ball is currently locked.

When Quick Multiball (2-Ball or 3-Ball) is started via the H-Y-P-E targets, the game voices out "Strategy Changed!".

"Welcome to Vectordome!"

Incorporates the unused "Welcome to Vectordome!" voice quote.

When START is pressed for Player 2, 3, or 4, the game voices out this quote.

"Double Vectorscan Value!"

Incorporates the unused "Double Vectorscan Value" voice quote into normal gameplay.

When the player achieves 2X on the Vectorscan multiplier (via H-Y-P-E targets), the game voices out this quote.

"Triple Vectorscan Value!"

Incorporates the unused "Triple Vectorscan Value" voice quote into normal gameplay.

When the player achieves 3X on the Vectorscan multiplier (via H-Y-P-E targets), the game voices out this quote.

"new vector record"

Add the "new vector record" voice quote at the end of a play when the high score is beaten.

"Right rollover button"

Enlarge the scoring possibilities on the right rollover button.

The normal counting sequence (5 -> 10 -> 15 -> 20 -> 25 is enlarged with 5,25 -> 5,10,25 -> 5,10,15,25 -> 5,10,15,20,25)

"Period completed!"

Incorporates the unused "Period completed!" voice quote into normal gameplay.

After the player achieves 3X on the Vectorscan multiplier (via H-Y-P-E targets), and no energy is in storage the game voices out this quote.

Use of "Energy Stored" Quote after outline special

FATHOM Custom ROM files by Oliver.

FATH_v5.U2 (2732 EPROM)

FATH_v5.U6 (2732 EPROM)

version date remarks

5 10/16/04 freegame setting if dip 25 / 26 = 1

Skill Shot:

At the start of each new ball, the A-B-C rollover lanes will cycle.

Try to get the ball through the lit lane on your opening shot.

(The lane-change feature is disabled in the skill shot mode.)

Making the skill shot lights two 50k arrows.

DIP switch 24 on the MPU board is now disabled to allow this feature to work.

"Air supply gone"

This phrase is now spoken by the game when the extra ball is lit, and you don't collect it after 6 or 12 seconds.

"Air gone"

This phrase is now spoken by the machine when you lose the first ball during multiball mode.

"The trap is set"

This phrase is now spoken by the machine if you start a ball with no balls locked. Otherwise, the standard "Sea nymphs await!" phrase is spoken (for 1st player up).

"Aahh!"

This phrase is now spoken by the game when starting for the
2nd player added.

"Aahh, yes!"

This phrase is now spoken by the game when starting for
3rd and 4th players added.