

SternFA

Bally EE-Era & Stern · FPGA MPU

User Manual

Software Version x.04 · Hardware Version 3 / 4 / Cyclone 10

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⚠ **WARNING** SternFA can damage your pinball machine if installed or configured incorrectly. This is a community project with no commercial backing. The author accepts no liability for any damage that may result from its use. Proceed at your own risk.

1. Introduction

SternFA is an FPGA-based drop-in replacement for Bally EE-era and Stern MPU boards. It replaces the original MPU directly, providing hardware emulation with fast boot times and faithful original behaviour. Speech board titles retain their voice output through the original speech board.

2. Installation

SternFA boards use the same connectors and mounting holes as the original Bally/Stern MPU boards. Swap is a direct drop-in — no rewiring or mechanical modification required.

⚠ **IMPORTANT** Contact us before ordering to confirm your specific machine is supported. Not all Bally and Stern variants have been tested.

3. DIP Switch Settings

3.1 S1 — Game Select

S1 selects which ROM image SternFA loads from the SD card. Set the switches to match your machine using Appendix A.

3.2 S2 — Board Options

Default setting is all switches OFF.

DIP	Label	Description
Dip 1	Zero Cross Emulator	When ON, SternFA emulates the zero-cross signal normally supplied by the 12 V power supply. This allows bench testing with only a 5 V supply. Note: timing differs from a live machine when this option is active.
Dip 2	Save NVRAM to EEPROM	SternFA stores NVRAM content (high scores, game settings) per game on an EEPROM. Set ON momentarily to force a save during bench testing. During normal play, NVRAM is saved automatically on game-over, credit button press, and test switch activation.
Dip 3	Force Bally Mode	When running Bally ROMs from a Bally SD image, set this ON to prevent SternFA from applying Stern double-clock speed to entries below position 32. Not required when using the standard SternFA SD image, which includes both Stern and Bally titles.
Dip 4	Anti-Flicker (LED Displays)	When ON, adjusts the zero-cross timing to eliminate LED flicker on Bally machines. This removes the need to fit parallel resistors at each LED position.
Dip 5	Not Used	Not implemented.
Dip 6	Init NVRAM	When ON, clears all NVRAM for the selected game during boot. Use on first power-up or to perform a full factory reset. Turn OFF after initialisation is complete.

Boot Sequence

On power-up, SternFA runs through three boot phases. Progress is shown on the playfield displays.

Phase 1 — Initialisation

Immediately after power-on, the playfield displays show:

- Player 1: FPGA program version.
- Player 2: Selected game number (a leading '2' indicates an MPU-200 game).
- Player 3: lisy.dev FPGA board identifier.
- Player 4: Option DIP bank value.
- Credit display: Countdown from 5 to 1.

Phase 2 — SD Card Read

The board reads the SD card and loads the ROM image selected by the game select DIP bank.

> ℹ **NOTE** If the SD card cannot be read, the red SD Error LED illuminates. The first digit of the status display shows the error code: 1 = CRC error; 2 = general SD card failure. Verify the card is seated correctly.

Phase 3 — Game Execution

The ROM indicated by the game select switch is loaded and executed.
The selected ROM is loaded and executed. The green Bally LED begins blinking (normal Bally boot sequence). When the game is running, the green ON LED illuminates.

Appendix A — Supported Game List

Positions 38–63 and 88–95 are unassigned — do not use them. Freeplay and Special variants use modified ROM images.

No	ON Switches	Game	Remark
0	all OFF	Meteor	Stern MPU-200
1	S1	Galaxy	Stern MPU-200
2	S2	Ali	Stern MPU-200
3	S1,S2	Big Game	Stern MPU-200
4	S3	Seawitch	Stern MPU-200
5	S1,S3	Cheetah	Stern MPU-200
6	S2,S3	Quicksilver	Stern MPU-200
7	S1,S2,S3	Stargazer	Stern MPU-200
8	S4	Nine Ball	Stern MPU-200
9	S1,S4	Iron Maiden	Stern MPU-200
10	S2,S4	Viper	Stern MPU-200
11	S1,S2,S4	Dragonfist	Stern MPU-200
12	S3,S4	Cue	Stern MPU-200
13	S1,S3,S4	Flight 2000	Stern MPU-200

No	ON Switches	Game	Remark
14	S2,S3,S4	Freefall	Stern MPU-200
15	S1,S2,S3,S4	Lightning	Stern MPU-200
16	S5	Split Second	Stern MPU-200
17	S1,S5	Catacomb	Stern MPU-200
18	S2,S5	Orbitor 1	Stern MPU-200
19	S1,S2,S5	Meteor	Stern MPU-200 Freeplay
20	S3,S5	Galaxy	Stern MPU-200 Freeplay
21	S1,S3,S5	Ali	Stern MPU-200 Freeplay
22	S2,S3,S5	Big Game	Stern MPU-200 Freeplay
23	S1,S2,S3,S5	Seawitch	Stern MPU-200 Freeplay
24	S4,S5	Cheetah	Stern MPU-200 Freeplay
25	S1,S4,S5	Quicksilver	Stern MPU-200 Freeplay
26	S2,S4,S5	Stargazer	Stern MPU-200 Freeplay
27	S1,S2,S4,S5	Nine Ball	Stern MPU-200 Freeplay
28	S3,S4,S5	Iron Maiden	Stern MPU-200 Freeplay
29	S1,S3,S4,S5	Viper	Stern MPU-200 Freeplay
30	S2,S3,S4,S5	Dragonfist	Stern MPU-200 Freeplay
31	S1,S2,S3,S4,S5	Cue	Stern MPU-200 Freeplay
32	S6	Flight 2000	Stern MPU-200 Freeplay
33	S1,S6	Freefall	Stern MPU-200 Freeplay
34	S2,S6	Lightning	Stern MPU-200 Freeplay
35	S1,S2,S6	Split Second	Stern MPU-200 Freeplay
36	S3,S6	Catacomb	Stern MPU-200 Freeplay
37	S1,S3,S6	Orbitor 1	Stern MPU-200 Freeplay
64	S7	Pinball	Stern
65	S1,S7	Stingray	Stern
66	S2,S7	Stars	Stern
67	S1,S2,S7	Memory Lane	Stern
68	S3,S7	Lectronamo	Stern
69	S1,S3,S7	Wild Fyre	Stern
70	S2,S3,S7	Nugent	Stern
71	S1,S2,S3,S7	Dracula	Stern

No	ON Switches	Game	Remark
72	S4,S7	Trident	Stern
73	S1,S4,S7	Hot Hand	Stern
74	S2,S4,S7	Magic	Stern
75	S1,S2,S4,S7	Cosmic Princess	Stern
76	S3,S4,S7	Pinball	Stern Freeplay
77	S1,S3,S4,S7	Stingray	Stern Freeplay
78	S2,S3,S4,S7	Stars	Stern Freeplay
79	S1,S2,S3,S4,S7	Memory Lane	Stern Freeplay
80	S5,S7	Lectronamo	Stern Freeplay
81	S1,S5,S7	Wild Fyre	Stern Freeplay
82	S2,S5,S7	Nugent	Stern Freeplay
83	S1,S2,S5,S7	Dracula	Stern Freeplay
84	S3,S5,S7	Trident	Stern Freeplay
85	S1,S3,S5,S7	Hot Hand	Stern Freeplay
86	S2,S3,S5,S7	Magic	Stern Freeplay
87	S1,S2,S3,S5,S7	Cosmic Princess	Stern Freeplay
96	S6,S7	Freedom	Bally
97	S1,S6,S7	Nightrider	Bally
98	S2,S6,S7	Evel Knievel	Bally
99	S1,S2,S6,S7	Eight Ball	Bally
100	S3,S6,S7	Power Play	Bally
101	S1,S3,S6,S7	Mata Hari	Bally
102	S2,S3,S6,S7	Blackjack	Bally
103	S1,S2,S3,S6,S7	Strikes and Spares	Bally
104	S4,S6,S7	Lost World	Bally
105	S1,S4,S6,S7	Six Million Dollar Man	Bally
106	S2,S4,S6,S7	Playboy	Bally
107	S1,S2,S4,S6,S7	Voltan	Bally
108	S3,S4,S6,S7	Supersonic	Bally
109	S1,S3,S4,S6,S7	Star Trek	Bally
110	S2,S3,S4,S6,S7	Kiss	Bally
111	S1,S2,S3,S4,S6,S7	Paragon	Bally
112	S5,S6,S7	Harlem Globetrotters	Bally
113	S1,S5,S6,S7	Dolly Parton	Bally
114	S2,S5,S6,S7	Future Spa	Bally
115	S1,S2,S5,S6,S7	Nitro Groundshaker	Bally
116	S3,S5,S6,S7	Silverball Mania	Bally
117	S1,S3,S5,S6,S7	Space Invaders	Bally
118	S2,S3,S5,S6,S7	Rolling Stones	Bally
119	S1,S2,S3,S5,S6,S7	Mystic	Bally
120	S4,S5,S6,S7	Hot Doggin'	Bally
121	S1,S4,S5,S6,S7	Viking	Bally
122	S2,S4,S5,S6,S7	Skateball	Bally
123	S1,S2,S4,S5,S6,S7	Frontier	Bally
124	S3,S4,S5,S6,S7	Xenon	Bally
125	S1,S3,S4,S5,S6,S7	Flash Gordon	Bally

No	ON Switches	Game	Remark
126	S2,S3,S4,S5,S6,S7	Eight Ball Deluxe	Bally
127	S1–S7	Fireball II	Bally
128	S8	Embryon	Bally
129	S1,S8	Fathom	Bally
130	S2,S8	Medusa	Bally
131	S1,S2,S8	Centaur	Bally
132	S3,S8	Elektra	Bally
133	S1,S3,S8	Vector	Bally
134	S2,S3,S8	Mr. & Mrs. Pac-Man	Bally
135	S1,S2,S3,S8	Spectrum	Bally
136	S4,S8	Speakeasy	Bally
137	S1,S4,S8	BMX	Bally
138	S2,S4,S8	Grand Slam (2-player)	Bally
139	S1,S2,S4,S8	Gold Ball	Bally
140	S3,S4,S8	X's and O's	Bally
141	S1,S3,S4,S8	Spy Hunter	Bally
142	S2,S3,S4,S8	Kings of Steel	Bally
143	S1,S2,S3,S4,S8	Black Pyramid	Bally
144	S5,S8	Fireball Classic	Bally
145	S1,S5,S8	Cybernaut	Bally
211	S1,S2,S5,S7,S8	Eight Ball Deluxe	Special
212	S3,S5,S7,S8	Embryon	Special
213	S1,S3,S5,S7,S8	Vector	Special
214	S2,S3,S5,S7,S8	Fathom	Special
215	S1,S2,S3,S5,S7,S8	Nitro Groundshaker	Special w. Siren Patch
216	S4,S5,S7,S8	Pinball	Stern
217	S1,S4,S5,S7,S8	Stingray	Stern
218	S2,S4,S5,S7,S8	Stars	Stern
219	S1,S2,S4,S5,S7,S8	Memory Lane	Stern
224	S6,S7,S8	Tigerrag	Bell Games
225	S1,S6,S7,S8	Eight Ball Deluxe V32	Bally
228	S3,S6,S7,S8	Saturn 2	Bell Games
229	S1,S3,S6,S7,S8	Lectronamo	Stern
233	S1,S4,S6,S7,S8	Baby Pac-Man	
234	S2,S4,S6,S7,S8	Baby Pac-Man	Okaegi version
235	S1,S2,S4,S6,S7,S8	Grand Slam (4-player)	
236	S3,S4,S6,S7,S8	Grand Slam (2-player)	Freeplay
237	S1,S3,S4,S6,S7,S8	Grand Slam (4-player)	Freeplay