User Guide: Installing a Multi-Output Frequency Oscillator

Comprehensive Installation and Safety Instructions for PlayStation Clock Mod

Disclaimer

This guide is for informational purposes only. Modifying electronic hardware requires advanced skills such as soldering. Information here may be inaccurate, and the author is not responsible for any equipment damage, injury, or losses from use. Always follow safety precautions and accept all risks when working with electronics.

Important Warnings & Safety Notes

Before attempting this modification, please note that it involves working with electrical components, which can be hazardous if not handled properly. Always turn off and unplug the console before beginning work. Use a grounded workspace to prevent electrostatic discharge and proceed only if you have prior experience with soldering. This modification is designed for enthusiasts and hobbyists and is not officially supported or endorsed by Sony.

Introduction

The Multi Output Frequency Oscillator (MOFO) is a dual clock modification for the PlayStation console that automatically switches between PAL and NTSC clock frequencies, as well as RGB subcarrier clocks. This hardware ensures proper video signals and colour encoding when playing games from different regions, resolving issues such as distorted colours or unstable refresh rates. Additionally, the MOFO enables PAL60 mode for televisions that do not support NTSC, ensuring smoother gameplay and consistent colour reproduction.

Tools & Materials Required

To complete this modification, you will need the following tools:

- Phillips #1 screwdriver
- Fine-tip soldering iron
- Solder (0.5–0.7 mm diameter)
- Flux pen
- Tweezers
- Side cutters
- Multimeter
- ESD wrist strap

Materials required:

- Multi-output frequency oscillator module
- 30 AWG wires
- Double-sided tape
- Isopropyl alcohol

1. Understanding the Upgrade

The oscillator module acts as a stable replacement clock signal for the console. It must be connected to the power supply, ground, and the PlayStation's clock input point. This setup ensures reliable signal output for the desired video mode.

2. Installation Overview

a) **Prepare Workspace**

1. Disconnect the console from power.

2. Gather and organise all necessary tools.

3. Use electrostatic discharge (ESD) protection, such as a wrist strap.

b) Identify which model Playstation and Motherboard you have

The model number can be located on the bottom of your PlayStation as shown: Look for a sticker or engraved label near the serial barcode, typically positioned close to the ventilation slots or feet. This number is essential for identifying your console's specific revision before proceeding with the upgrade.

An excellent resource for identifying your specific variant is available at: https://www.psdevwiki.com/ps1/Motherboards

3. Open the Console

    a) Remove the six screws from the bottom of the console.

    b) Carefully lift off the top shell.

   c) If needed, remove the drive assembly for better access.

Check out this detailed teardown guide:
https://www.ifixit.com/Teardown/Sony+PlayStation+Teardown/128089

4. Locate Original Oscillator

    a) Identify the board's clock reference source, which may vary depending on your PlayStation model.

        1. To access the crystal oscillator and remove the necessary components, it is essential to desolder the six connections securing the RF shield at the top of the console.

        2. Remove the 220-ohm resistor between X201 and GPU pins 192 & 196 to fully detach the clock from the GPU, preparing it for the MOFO GPU clock.

        3. To prevent the subcarrier clock produced within the GPU from reaching the RGB Encoder, disconnect the 2.2Kohm resistor linking GPU Pin 153 to RGB Encoder Pin.

        4.

On the PU22 the crystal is located as shown:

Remove 220ohm resistor
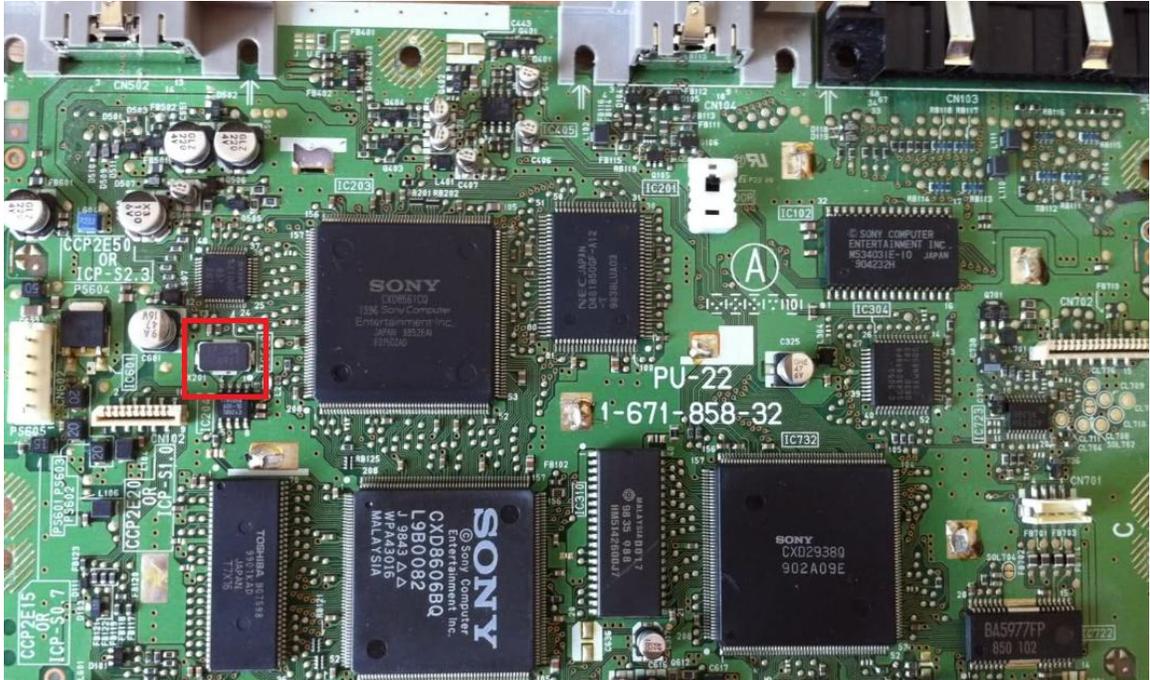
5. Prepare Oscillator Module

1. Inspect the module for defects.
2. Pre-tin the connection pads with solder.
3. Cut wires to a length of 3–5 cm as needed for installation.

6. Wiring Connections

a) Connect the 3V3 pad on the module to the appropriate supply voltage.
b) Connect the GND pad to the console's ground.
c) Connect the MOFO GPU pad to the console's GPU Pins 192 and 196, providing a region-dependent GPU clock frequency.
d) Connect MOFO S0 pad to the console's GPU Pin 157, which switches between Ground and 3.3V depending on the game region. This controls MOFO's GPU clock frequency.
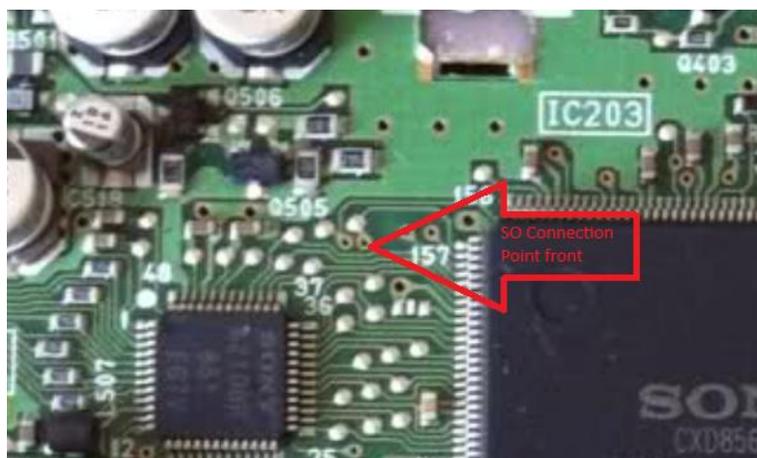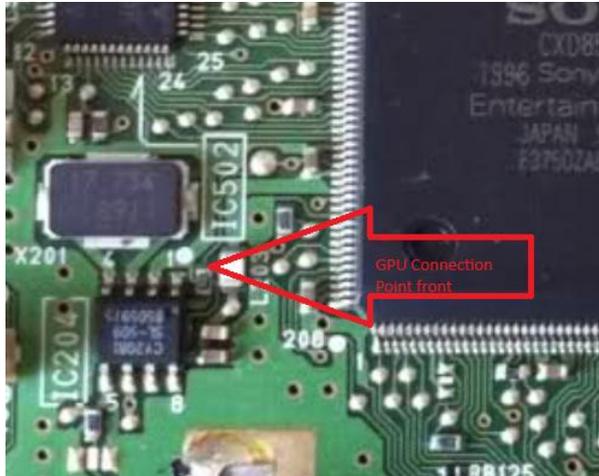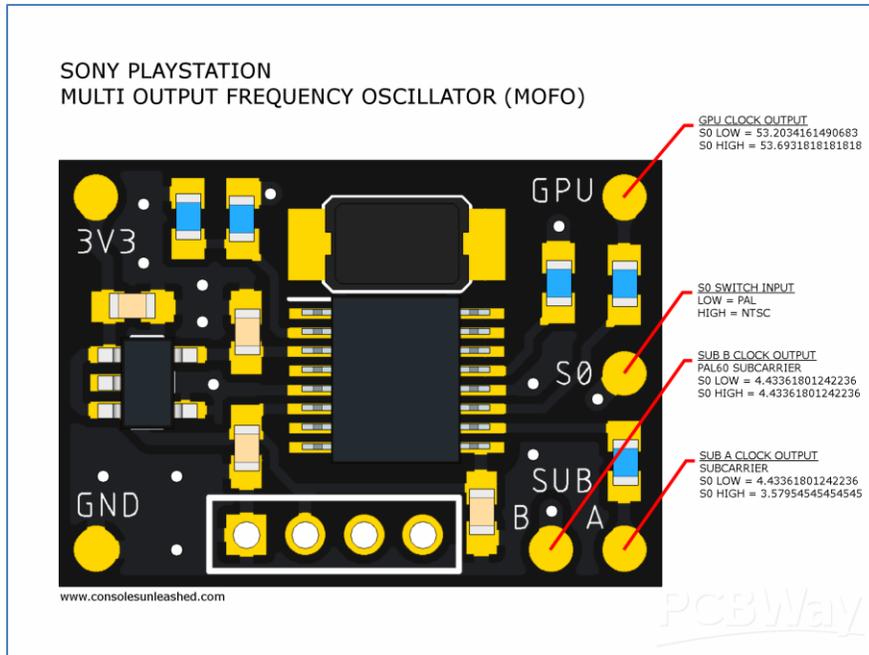
If you want to switch the GPU clock and RGB only the above is all that is required. If you want to use the full capabilities of the modification the following options are available:

For motherboards: PU-20 / PU-22 / PU-23 / PM-41

a) For composite video & a dual format PAL/NTSC TV you will need to attach Sub-A clock output
b) For composite video and single-format TVs, connect Sub-B output to supply the fixed PAL subcarrier clock for PAL60.
c) Connect RGB Encoder Pin 7 to Pin 1 to force the encoder into PAL mode for PAL60 operation.

For the PU18 motherboard

a) For composite video & a single format TV you will need to attach Sub-B output
b) Connect RGB Encoder Pin 7 to Pin 1 to force the encoder into PAL mode for PAL60 operation.

SONY PLAYSTATION
MULTI OUTPUT FREQUENCY OSCILLATOR (MOFO)

GPU CLOCK OUTPUT
S0 LOW = 53.2034161490683
S0 HIGH = 53.6931818181818

S0 SWITCH INPUT
LOW = PAL
HIGH = NTSC

SUB B CLOCK OUTPUT
PAL60 SUBCARRIER
S0 LOW = 4.43361801242236
S0 HIGH = 4.43361801242236

SUB A CLOCK OUTPUT
SUBCARRIER
S0 LOW = 4.43361801242236
S0 HIGH = 3.57954545454545

www.consolesunleashed.com

Curtsey of PCBway

7. Mount Module

a) Secure the oscillator module inside the console using adhesive, ensuring that it does not cause shorts with other components.

8. Inspection & Checks

a) Verify that there are no electrical shorts and that wiring is clean and tidy.
b) Check for electrical continuity using a multimeter.

9. Reassembly

a) Reinstall the drive assembly (if removed), replace the top shell, and secure all screws.

10. Power-On Test

a) Check that the console boots normally.
b) Ensure stable disc reading.
c) Verify there are no unexpected resets or video noise.

11. Troubleshooting Guide

- If there is no power, check the VCC wiring connection.
- If the boot sequence is distorted, verify that the oscillator is set to the correct frequency.
- If you encounter issues reading discs, inspect the wiring for proper connections.
- Random resets may indicate insufficient grounding—improve ground connections as needed.

- Video noise can often be resolved by shortening the connecting wires.

Maintenance Notes

To ensure the longevity of your modified console, keep it in a dry and cool environment, and avoid subjecting it to mechanical stress or impacts.

12. Compatibility

PU-8 / PU-18

- GPU output is necessary for correct GPU clock in 50Hz and 60Hz console modes.
- Sub-A output is not necessary because the GPU creates the correct PAL & NTSC subcarrier clocks in all regions.
- Sub-B output can be used to force PAL60 operation for use with TVs that are incompatible with NTSC signals.

PU-20 / PU-22 / PU-23 / PM-41

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- Sub-A output is necessary to get correct PAL & NTSC subcarrier clocks in all regions.
- Sub-B output can be used to force PAL60 operation for use with TVs that are incompatible with NTSC signals.

IC203
CX05610
GPU

Ref A

Ref B

Ref A
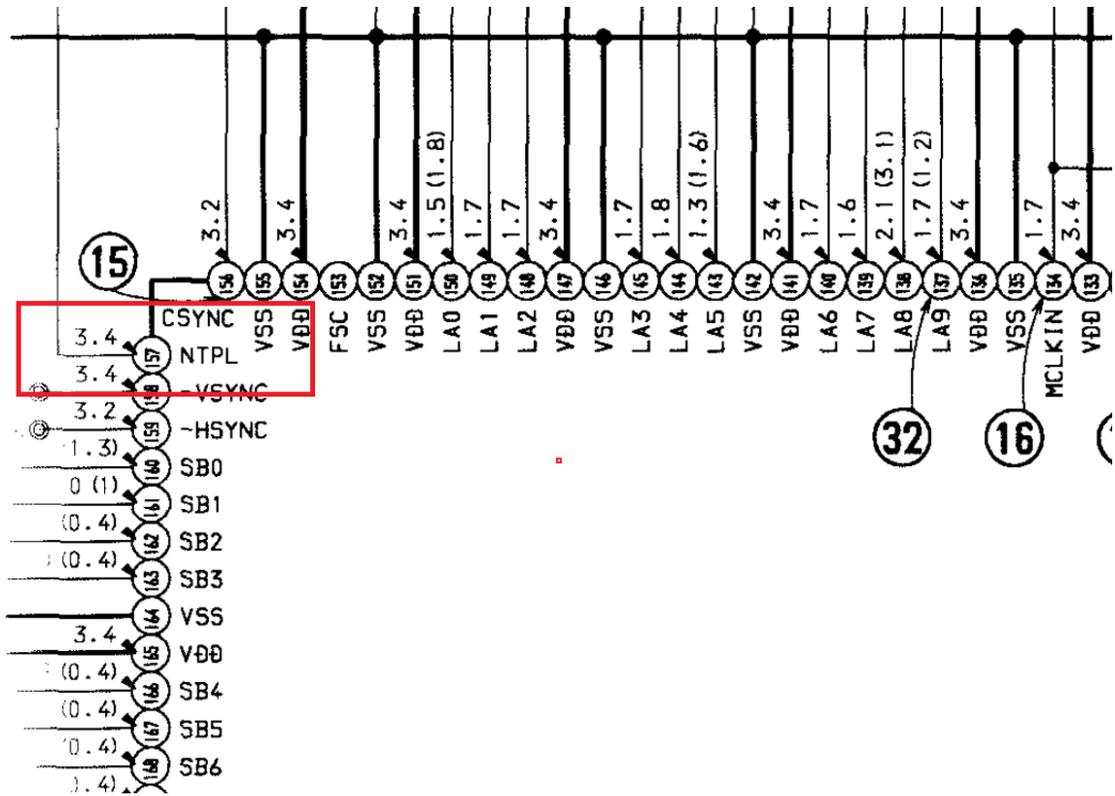
Ref B

Sources:

Consoles Unleased Github: https://github.com/consolesunleashed/sony-playstation-multi-output-frequency-oscillator/blob/main/README.md

PCBway Shared Projects: https://www.pcbway.com/project/shareproject/Sony_PlayStation_Multi_Output_Frequency_Oscillator_MOFO_v1_6cf21e45.html

Playstation Dev Wiki: https://www.psdevwiki.com/ps1/Motherboards

Gaming Doc Org: https://gamingdoc.org/repairs/consoles/sony-playstation/components/motherboard/pu-22/

William Quade Blog: https://quade.co/ps1-modchip-guide/dfo/pu-22/