Installing the RTG driver

Overview

Apollo Team develops and maintains the `SAGA RTG driver` to be used with the `Digital Video Out` of the `Vampire` boards with Picasso96 installed on AmigaOS3. For AROS, there is no need for that driver.

1) Install the required files

1.1) Install the P96 RTG System

1. Download the free P96 archive.
2. Use the provided installer and follow the instructions carefully.
   - The original `Picasso96.lha` archive is hosted here legally, for preservation reasons. Its contents remain unchanged from the original, conforming to the license. You can update `LIBS:Picasso96/rtg.library` yourself from other sources, for stability improvements.

1.2) Install the SAGA RTG driver

1. Download the latest SAGA Drivers package.
2. Use the provided installer and follow the instructions carefully.

1.3) Install Universal ModeLine Calculator

1. Download UMC from Aminet.
2. Copy the file `umc/umc` to `C:umc`.

1.4) Reboot your computer

2) Configure the SAGA monitor

You can turn on/off scanlines for RTG screen modes using a tooltype in the `DEVS:Monitors/vampiregfx.info` file.

ToolType syntax:

```
Scanlines=xxx
; where xxx can be Yes or No.
```

The `SAGA Core` uses the FastRAM of the Vampire board to display the video on the screen. The driver allows you to configure how much of the FastRAM will be reserved for the Video FrameBuffer. The default is 8MB. This means, after driver initialization, your available FastRAM is (128MB - 8MB) = 120MB. You can configure this behavior by adding a tooltype to the `DEVS:Monitors/vampiregfx.info` file. This feature allows you to save unused memory by configuring the video memory size that fits your needs. Let's say someone will never use a screen larger than 960x540x24bits, then that person will need only 1.5MB.

You can easily calculate the video memory size using the following formula:

```
(Width*Height*BytesPerPixel)
where BytesPerPixel is 1 for 8bits, 2 for 15/16bits, 3 for 24bits, and 4 for
32bits.
```

ToolType syntax:

```
VideoMemSize=xxxxx
; where xxxx can be bytes, xxxxK (kilobytes), or xxxxM (megabytes).
; K, M are not case-sensitive.
```

Examples:

```
VideoMemSize=8M
VideoMemSize=4M
VideoMemSize=600K
```

Remark:

The `SYS:Prefs/Picasso96Mode` tool will automatically hide (disable) all the resolutions that need more memory than the memory allocated by the `SAGA RTG driver`.

3) Test desired screen modes

- You can test RTG screen modes from the `ScreenMode Preferences` of AmigaOS.
- You should use resolutions and refresh rates that work best with your monitor or TV. If you find

a screen mode that does not work, then you can set it to `inactive` in the `SYS:Prefs/Picasso96Mode` tool, so that it does not get accidentally selected.

- Some monitors and TVs have trouble displaying resolutions that are lower than 640×480, which is the minimum allowed value for Digital Video.
- If the horizontal resolution is less than or equal to 500, then the RTG driver will pixel-double the resolution horizontally. If the vertical resolution is less than or equal to 300, then the RTG driver will pixel-double the resolution vertically. This will help most low RTG resolutions to reach the minimum allowed Digital Video resolution (640×480), with the notable exception of 320×200, which will only reach 640×400.
- We recommend using 1280×720 or 960×540 for the best AmigaOS experience.
- If you have a Vampire Standalone, make sure you test 720×576@50Hz and 720×480@60Hz, to ensure that your monitor or TV works well with them. The Vampire Standalone outputs non-RTG screen modes to Digital Video in these two resolutions. (The former in PAL mode and the latter in NTSC mode.)

Creating new screen modes

The SAGA Drivers package already installs some commonly-used screen modes. But if the provided screen modes are not sufficient for your needs, you can create your own:

1. Open a Shell window (`newcli`).
2. Run `umc <width> <height> <refresh_rate> --rbt` to get the appropriate mode settings.
   - For example, if you want a 720×576@50Hz screen, run `umc 720 576 50 --rbt`.
   - You can request any mode from 320×200@200Hz up to 1920×1080@28Hz. However, there are some limitations, which you can ensure by reviewing the output of `umc`:
     - Higher resolutions and refresh rates require higher clock rates.
     - The clock rate should be at least 25MHz, which is the minimum allowed value for Digital Video.
       - Many monitors and TVs are flexible and support clock rates that are even lower than this minimum value.
     - The clock rate must be at most 65MHz, which is the maximum allowed value on Vampire boards.
     - The resolution should be at least 640×480, which is the minimum allowed value for Digital Video.
       - Many monitors and TVs are flexible and support resolutions that are even lower than this minimum value.
       - See "Test desired screen modes" above to understand how pixel-doubling helps low resolutions reach this minimum value.
     - The resolution, the horizontal frequency and the vertical frequency (refresh rate) should be within the specifications of your monitor or TV.
       - Usually, the monitor or TV supports a specific subset of standard refresh rates, like 24/25/30/50/60Hz.
     - The `--rbt` parameter is strongly recommended, because it will apply a special formula to reduce the blanking time and deliver the same resolution & refresh rate with a **lower** clock rate. In this way, you can save some bus bandwidth, and also create high resolutions & refresh rates that would otherwise be unreachable due to the upper limit of the clock rate.

- - If your monitor or TV does not work with "rbt" modes, you can try omitting the `--rbt` parameter. For example, if `--rbt` slightly reduces the desired horizontal/vertical frequencies, and the reduced values fall slightly below the minimum specifications of your monitor or TV, then you should omit it. Or, if you are creating a low resolution & refresh rate, and `--rbt` causes the clock rate to fall below the lower limit, then you should omit it. In these cases, even omitting `--rbt` might be insufficient, and you might need to add the `--margin=<percentage>` parameter. (For example: `--margin=20`)
  - With the limitations above, you will be able to achieve a refresh rate of 60Hz for all resolutions up to and including 1280×720. If you want to create a resolution higher than that, then, a refresh rate of 50Hz (or above) will exceed the upper limit of the clock rate, even with the help of the `--rbt` parameter. You will be forced to reduce the refresh rate down from 50Hz. Here are the maximum refresh rates you can achieve for a couple of example resolutions:
    - 1600×900: ≤40Hz
    - 1920×1080: ≤28Hz
  - Vampire 500 V2+ and Vampire 600 V2 boards have not been designed to handle clock rates higher than 40MHz reliably. This threshold will reduce the maximum reliable refresh rate for each resolution. Here are a couple of examples:
    - 800×600 or 960×540: ≤ 60Hz
    - 1280×720: ≤ 38Hz
    - 1600×900: ≤25Hz

3. Run `SYS:Prefs/Picasso96Mode`.
4. Create a new resolution.
5. Enter the width and height.
6. Create a new mode.
7. From the output of umc, take the values under `Picasso96Mode values` and apply them to the settings of the newly-created mode.
8. Select the color depth you want.
   - `Chunky (256 Colors)` is 8 bits/pixel.
   - `HiColor` is 16 bits/pixel.
   - `TrueColor` is 24 bits/pixel.
   - `TrueColor & Alpha` is 32 bits/pixel.
9. You can create multiple modes for the same resolution, each with a different color depth. Just make sure that the mode settings come from the output of umc.
10. Test all of your newly-created modes before saving.
    - If you have followed the instructions carefully, but your mode is still not working even though it seems like it should, then you can modify the mode settings (such as the clock rate) manually, in order to obtain a mode that works well with your monitor or TV.
11. After saving and rebooting, the new screen modes will be available in the `ScreenMode Preferences` of AmigaOS.

→ If you have a Vampire accelerator board connected to a classic Amiga, the line size must be aligned with the memory burst size, which is 32 bytes. In other words, the horizontal resolution multiplied by the color depth (in bytes) must be a multiple of 32.

→ If you have a Vampire Standalone, the line size is independent of the memory burst, but it must still be aligned to 8 bytes. In other words, the horizontal resolution multiplied by the color depth (in bytes) must be a multiple of 8.

Display power management

The RTG driver is compatible with the VESA Display Power Management Signaling (DPMS) standard. In particular, the "On" and "Off" states are supported, but the "Stand-by" and "Suspend" states are not.

You can use VControl DPMS to turn on/off the monitor or TV that is connected to the Vampire via Digital Video Out.

Also, you can use DPMSManager or a similar program to automate display power management. Note that the "Stand-by" and "Suspend" modes triggered by such programs will be interpreted as "Off".

Disabling RTG

If you are stuck with a non-working RTG screen mode (maybe because you accidentally saved a bad configuration, or you connected an incompatible monitor), you can disable RTG by holding down the Shift key while booting. The RTG driver will skip loading the RTG screen modes, and AmigaOS will boot into a default High Res 4-color screen mode. (This is the same screen mode used in the Amiga Early Startup Control.) Then you can switch to a more appropriate screen mode using the ScreenMode Preferences of AmigaOS.

Additional information

- Technical information: Isabel: SAGA Video Core
- SAGA RTG driver sources: saga.card
    - Covered under the MIT License.
- Forum: SAGA RTG driver news
- Video: Vampire RTG Mode Introduction
- Video: How to make your own resolution

Roadmap

1. Need deeper implementation of P96 subsystem, currently based on AROS.

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