Turbo Thunder – Revision G

General

The „Turbo Thunder" is a combination of an IDE interface and quad flash ROM for the Atari TT. Compared to the previous Thunder Revision E (or E1) and Turbo Thunder Rev. F the actual Turbo Thunder Revision G is a strictly further development. All functions of the previous Revision are also implemented. And some features more! The Turbo Thunder Rev. G gives you the opportunity to flash and use your individual Operating System (OS) in a few seconds, as already possible in revision F. The painful burning of EPROMs is a thing of the past!

The new feature of Revision G is that switching between the 4 FlashROM banks is now done conveniently via software (TOSWIT_T.TOS). The jumpers F1 and F2 have been omitted.

By using a CF-Card as hard disk drive with the Turbo Thunder you can plug the IDE to CF-Card adapter directly into the Turbo Thunder. No IDE cable is needed and you have a compact solution for your Atari TT.

The Turbo Thunder is a partial plug and play solution. The extension card is plugged onto the TT-RAM socket of the Atari TT (internal slot in front of the power supply, 96-pin connector). It is only necessary to connect the Turbo Thunder with three cables to the mainboard of the TT and optional one more cable if you want to choose between mainboard ROM or FlashROM.
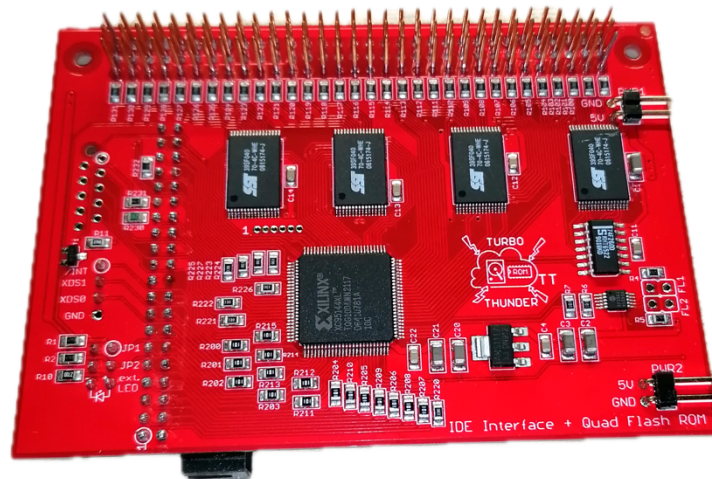
More Features

- Further development from the established Thunder Revision F
- IDE interface for the usage with 1 or 2 IDE devices (master / slave)
- 100% compatible with the Atari Falcon IDE bus
- Currently up to 5,75 MB/s transmission rate (tested with CF card)
- Special support from the HDDriver from version 10 (or above), with which the driver can be loaded into the Fast-RAM and the transmission rate can be accelerated enormously
- Protection of the TT bus against overload by buffered data, address and control lines
- Compact design, only 9.9 cm x 6.9 cm (3.9 inch x 2,75 inch)
- Central element is a programmable logic block (CPLD) from Xilinx
- Pass-through TT-RAM socket, for other expansion cards like Storm-TT or other TT Fast-RAM cards
- Compatible with other Fast-RAM cards, even with those of Atari
- 3 IDE operating modes selectable via jumper block:
    - Falcon compatible (normal mode)
    - ppera compatible (twisted mode)
    - PC and Mac compatible (smart swap mode)
- Also works in accelerated TT, thus further performance increase
    - tested with 20 MHz bus and 40 MHz CPU
   - tested with 16 MHz bus and 48 MHz CPU together with "Super Storm TT"

Description

On the Turbo Thunder, the 96-pin Fast-RAM socket is passed through and a coded 40-pin standard socket for IDE devices is installed perpendicular to the Fast-RAM socket. This allows to plug a CF-Card adapter directly into the IDE socket. All relevant electronic components are on the solder side of the PCB. So there is no component in way to do so. Of course, you can also connect an IDE device via a standard (40 pin or 80 pin) ribbon cable.
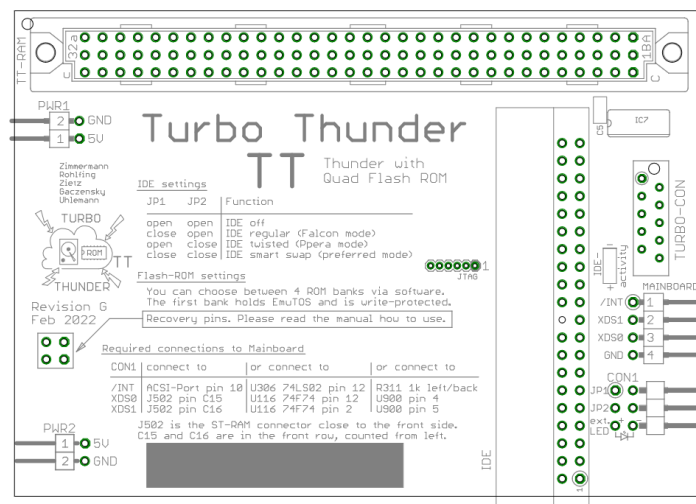
Bottom view

Top view
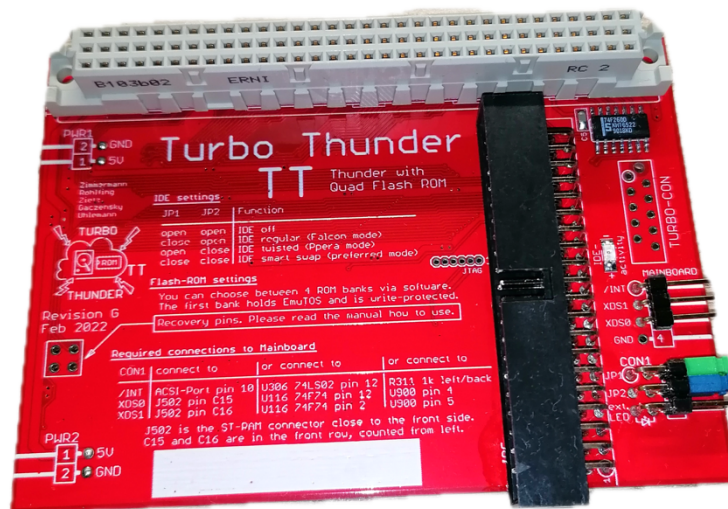
labeling

On the right side of the PCB you will find three connectors. In top the connector side the "Turbo-CON" - reserved for future features. In the middle the connector is for the three required connections to the mainboard: /INT, XDS0 and XDS1. The jumper block "CON1" which gives you to opportunity to define the operation mode of IDE and the option of connecting a second IDE activity LED.

The activity LED on the PCB will give you the information, if a transmission to the IDE port is process.

In the free place of the PCB you will find a short instruction for using the Turbo Thunder.

Installation

1. Disconnect your TT from the power supply and disassemble it. Be careful with the components inside your TT.

2. If you use a Fast-RAM Card inside your Atari TT, remove it. It is useful to put the Turbo Thunder in first order inside of the TT-RAM-Connector of the mainboard. This is not required for electrical reasons, but helpful for mechanical reasons, because the Turbo Thunder is in most cases smaller than an original Fast-RAM-Card. Also the Fast-RAM-Card need in all cases more space above the PCB. The Turbo Thunder has a special 96-pin connector with longer, gold contacts on the bottom. In TTs with Daughterboard or with a PGA CPU it is advisable to isolate the underside of the Turbo Thunder for safety reasons, in order to avoid short circuits. A separate power supply of the Turbo Thunder is not necessary.

3. Three wired connections (signal lines: /INT, XDS1 and XDS0) are required to use the Turbo Thunder. One end of each cable is plugged into Pin 1, Pin 2 and Pin 3 of the "Mainboard Connector". Better is, to keep the lines short as possible!

   Note: Pin 4 of the Mainboard-Connector (Ground potential) normally is not used. You can leave it open.

   The other ends of the three required cables are attached to the following two points on the mainboard. It is best to solder them.

   First step: connect /INT to Pin 10 of ACSI-Port (all types of TT)

   or

   - to rear side of the resistor R311 near the ACSI-Port for a TT with a SMD CPU (case A)

   - to the right side of R311 for TT's with daughterboard or PGA CPU (case B)

Case A:

(SMD
CPU TT)

Solder INT here (rear connection of this resistor near the ACSI socket
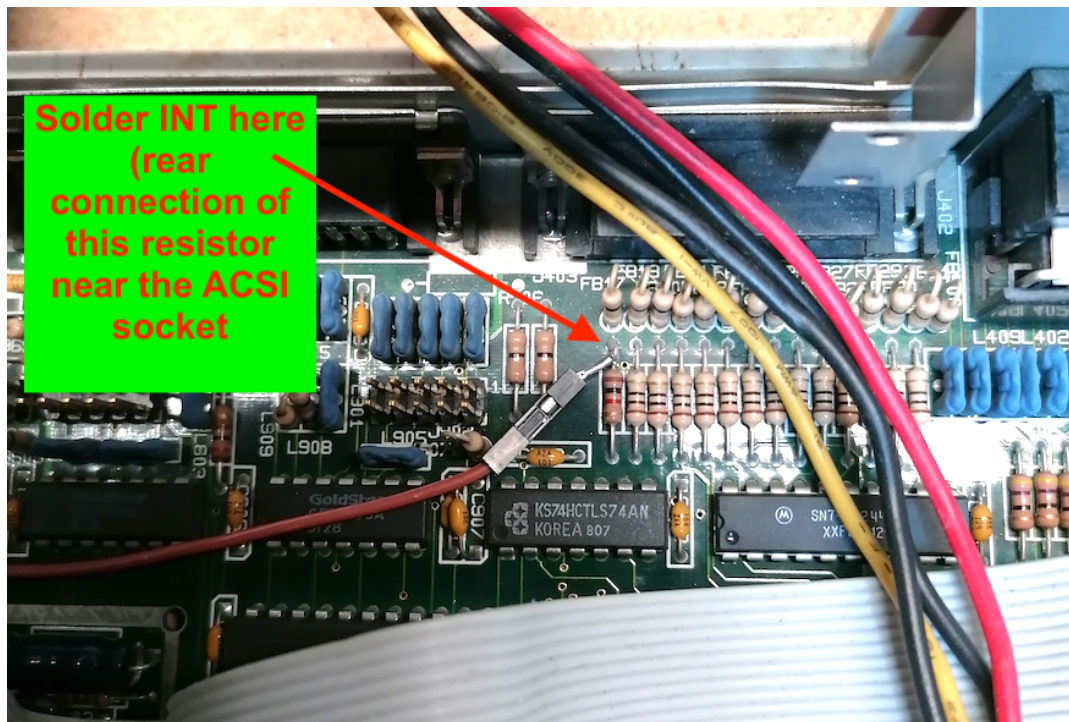
You should remove the VME metal cage before. The soldering point is located underneath and is not easy to reach otherwise.

Case B:

(PGA/
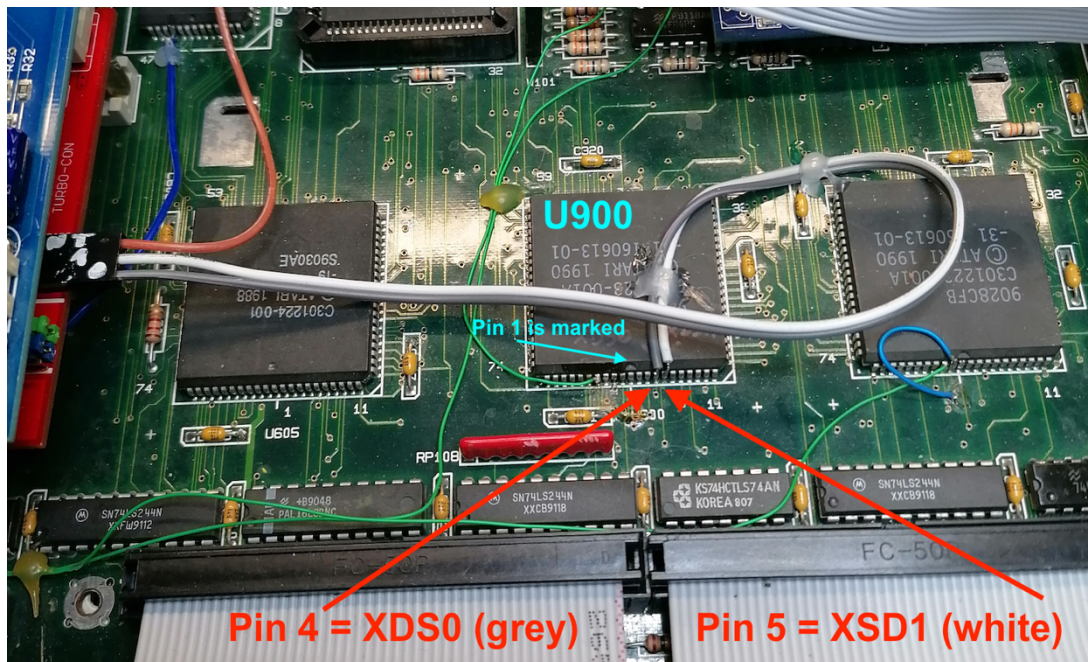DB TT)

solder INT at the right side of R311
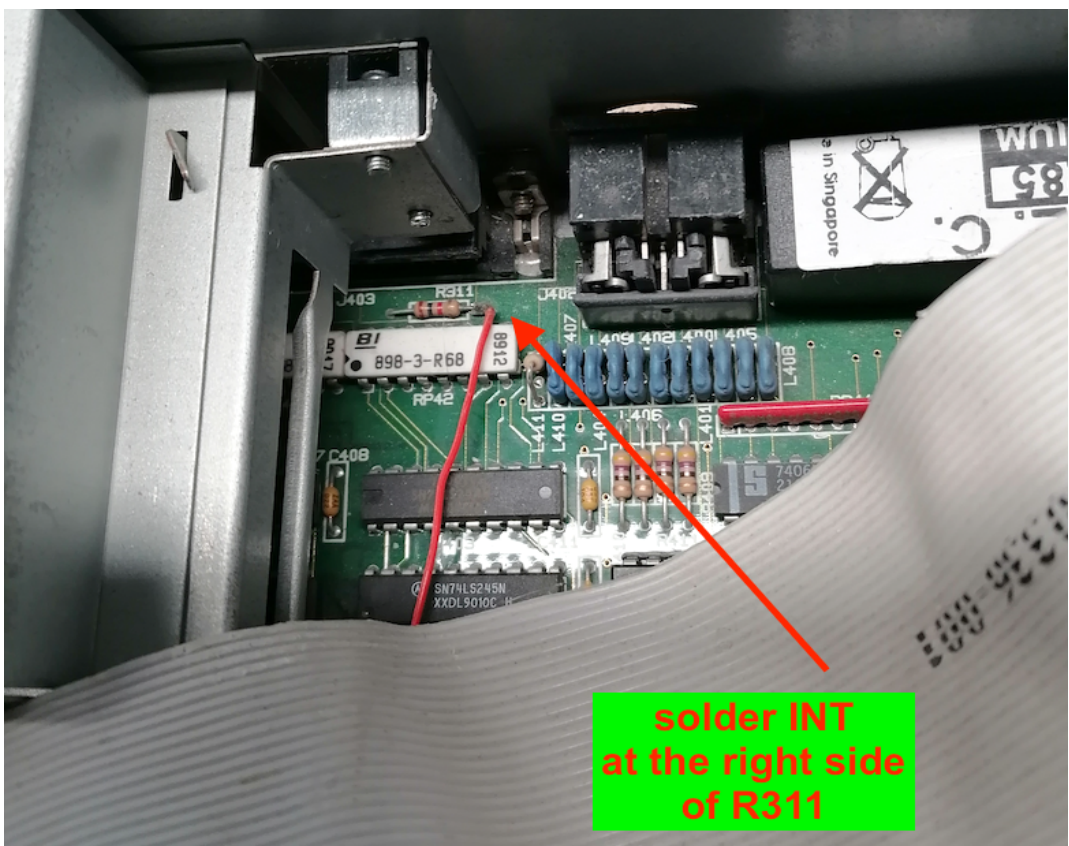
With a little skill you can lay the cable under the VME metal cage. You will find R311 at the rear edge next to the external floppy socket. In case B this location is reasonably easy to access.

→ Second step: connect XDS1 to Pin 5 of U900 Pin 5 and XDS0 to Pin 4 of U900.

Depending on the TT there are two different cases:

Case A:

(SMD
CPU TT)

💡 In both cases, the XDS0 and XDS1 cables are connected to the square IC U900 and there to pins 4 and 5. The two pictures are only about XDS0 (grey/green) and XDS1 (white/orange). Please don't let the other cables and installations in the picture confuse you. It may look different for you, but it has nothing to do with the Turbo Thunder. U900 is in a slightly different location depending on the TT and may be rotated. Pin 1 is always marked, which makes counting (clockwise) easier.

Case B:

(PGA/
DB TT)
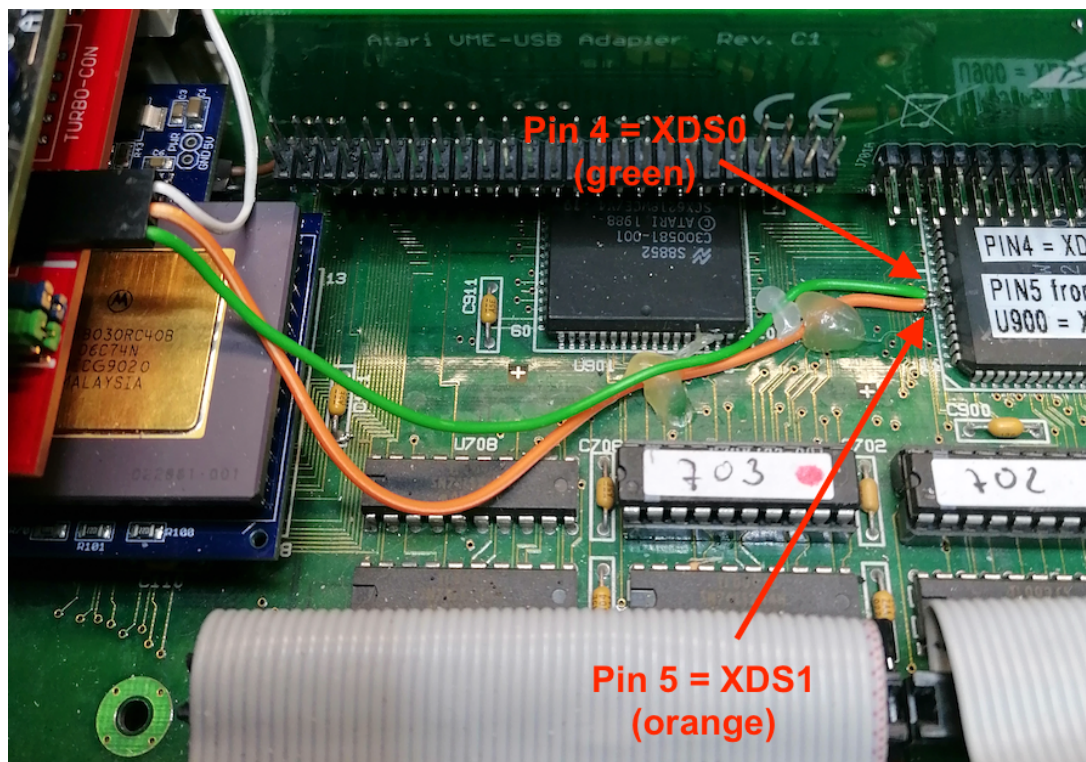
We know it's not necessarily easy to solder to such small contacts on an IC. **We strongly recommend checking the pins in relation to each other and to neighboring pins. There must be no short circuit.**

To prevent the /INT, XDS1 and XDS0 lines from being interchanged despite the color code, remember the following crib:

> *On the Turbo Thunder the /INT is the "rear/behind" pin – the signal cable also comes "from behind" on the mainboard. The both /XDS signals on the Thunder is in "front" – the signals cables comes also "from the front" on the mainboard.*

Tip: it's advisable to fix the cables with a little hot glue.

Additional information: In older installations guides, we give you the alternative information, that XDS0 and XDS1 are also available at the ST-RAM connector. This signal line may be too long and can cause incorrect behaviour! Therefore, please do not use this connection point primarily, but prefer the connection XDS0 with pin 4 of U900 and XDS1 with pin 5 of U900!

4. All you have to do now is position the Turbo Thunder correctly on the 96-pin connector in front of the power supply on the mainboard and carefully push it in, not all the way down. By the way, this is where most mistakes are made! Don't laugh, but that's how it is. Be sure to ensure it is seated correctly, do not insert it out of place! Double check that you did not misalign the connector. The Turbo Thunder is now ready for use.

   If you want, you can also fix the Turbo Thunder using suitable screws.

5. Now place your Fast-RAM card -if you own one- on top of Turbo Thunder inside of the Fast-RAM slot of your Atari TT. Please check, if the case could be closed easily. Please be careful regarding cables and other expansions of your TT.

Optional: one more cable for choose between mainboard ROM or FlashROM

There's not much you need to do to use the Turbo Thunder's FlashROM:

You can either deactivate your old OS inside the EPROMs of the mainboard by simply removing these EPROMs. The Turbo Thunder will automatically detect this and activate its FlashROM. This gives you the choice of four operating systems, namely the 4 FlashROM banks of the Turbo Thunder.

Or you connect pin 2 (middle pin) of Jumper W603 on the mainboard to VCC (5V). This way you even have 5 options for operating systems, because in addition to the 4 FlashROM banks of the Turbo Thunder, the TOS can also be used on the mainboard.

One point worth knowing is, that the original TOS 3.06 is not able to support an IDE port. So, you should use a TOS 3.06 which is patched (TS-TOS 3.06) for using IDE devices or EmuTOS. Both OS you will find inside of the Flash-ROM of your Turbo Thunder, ready to use!

Here, too, there are <u>two different cases</u> depending on the TT, where W603 is located.

In case A (SMD CPU TT W603 is located between the mainboard ROMs front left on the mainboard.

In case B (PGA and DB CPU TT) W603 is located right next to the front ST-RAM connector.

The same applies to both cases:

- The meaning of W603 is always the same.
- Make a note of the jumper setting of W603 for a possible reassembly.
- Remove the W603 jumper and connect the cable from 5V of the Turbo Thunder to the middle pin (2) of W603. The pins (1) and (3) remain free.
- Leave W601 and W602 untouched.

<u>Background and important for you to know in case of problems with the Flashrom:</u>

The middle pin can be connected to ground or to 5V.

If the pin is connected to ground, the mainboard ROM is active. This corresponds to the current jumper position of W603. However, if you connect the middle pin to 5V (this should be the default setting on the Turbo Thunder), then the Flashrom on the Turbo Thunder is activated.

Configuration, meanings and contexts

IDE Interface

The Thunder was tested with various HDD drivers. The best performance is provided by the Thunder IDE interface, together with the Storm Fast-RAM card, when the hard disk driver is loaded into the Fast-RAM. For HDDriver version 10 or higher, a feature was introduced under File -> HDDRUTIL settings (HDDRIVER.SYS in Alternate RAM). Furthermore, in the HDDriver (also before version 10) the accelerated mode can be set for IDE devices under Settings -> SCSI driver (Atari / Milan IDE, accelerated mode), which not only offers speed advantages for hard drives but also for CF cards (+ 400 Kbytes / s in accelerated mode).

Note: when using HDDriver, the C: partition must not be set up with byteswap, otherwise from C: cannot be booted. But you can use the ‚smart swap' mode of the Thunder IDE interface instead as described below.

Flash ROM

Four Flash-ROM banks or spaces are available onto Turbo Thunder. Each FlashROM bank can be overwritten by the user itself, e.g. with a newer, future version of EmuTOS or after installation of further patches in TS-TOS 3.06.

In order to rewrite a FlashROM bank, it must be selected (see below). It doesn't matter whether the mainboard ROM is active or the FlashROM itself. Images up to 512k are supported. To flash, simply drag the image onto the **FLASH_TT.PRG** program and confirm the prompt with Y. The flashing process only takes a few moments and the screen flickers wildly. The TT then carries out a reset or requests a reset. The new operating system is available after the restart, provided the FlashROM is active (middle pin of W603 is at 5V).

Recovery mode

What should you do in the worst case, i.e. if an image file is corrupt, or does not work on the TT?

For recovery please activate the mainboard ROM (middle pin of W603 to ground) and from there re-flash a non-corrupt image with **FLASH_TI.PRG** as usual. After the reset, switch off the TT and activate FlashROM bank (middle pin of W603 back to 5V). The newly written operating system should now report itself.

Reminder:

> Use FLASH_TT.PRG if you have the FlashROM active and want to overwrite the existing (working) content of the active FlashROM bank.

> Use FLASH_TI.PRG if the mainboard ROM is active and you want to rewrite the non-functioning content of the FlashROM bank (recovery).

It is recommended to use the 512k version of EmuTOS in the desired language for these recovery purposes.

Jumpersettings

First of all: We have changed the function of Jumpers in relation to previous Revisions of the Thunder TT card. This reduces the jumpers for setting IDE functions and now the jumpers are compatible to the Lightning ST card. The setting items are still the same as in past.

All jumpers are established an CON1:

- Jumper 1 (green) and Jumper 2 (blue) set the IDE function.

    JP 1 open   JP 2 open   = IDE off
    JP 1 close   JP 2 open   = IDE regular (Falcon mode)
    JP 1 open   JP 2 close   = IDE twisted (Ppera mode)
    JP 1 close   JP 2 close   = IDE smart swap (preferred mode)

- Additionally, on CON1 you will find to pins to connect an external IDE activity LED.

If you hesitate to decide, which IDE mode you preferred, here a short help:

> If you interchange data with your Atari Falcon or with your Milan Computer, it is useful to use the "regular" mod (or called Falcon mode). The CF card (which is formatted in this setting) could plug also inside of your TT or inside your Falcon or Milan (surely respectively depending on the software inside your CF-Card).

> If you use another Atari with a ppera interface, you could formatted your CF Card with the twisted mode (ppera mode). In this case, it is easy to plug this CF Card also on your ppera interface. Byteswap is called a mode in which the data lines are twisted (the IDE cable is twisted), this means the lower byte is exchanged with the upper byte during transmission. This technique offers the possibility to read partitions created on the PC without detour on the TT without the CPU having to perform a software byte swap. This saves rendering performance. To use the byteswap mode, however, a special HD driver is required, for example that from ppera or EmuTOS.
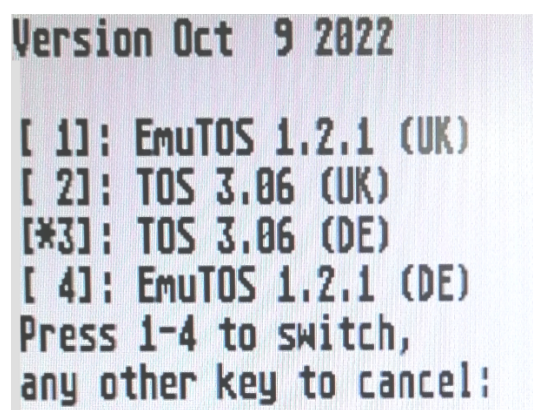
> If you interchange data with your PC or with your Mac computer it is useful to use the "smart swap" mode. The CF card (which is formatted in this setting) could plug also inside of your TT or inside of your PC/Mac computer.

Selection of one of the 4 FlashROM banks

Unlike in the previous revision F, where switching was still carried out on the hardware side using jumpers F1 and F2, the selection and switching between the 4 FlashROM banks in revision G is carried out conveniently via software. The programme required for this is called **TOSWIT_T.TOS**. It is available for download.

After starting the programme, it lists whether and, if so, with which operating system each of the 4 FlashROM banks is written.

The currently selected FlashROM bank is marked with an "*".

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Version Oct  9 2022

[ 1]: EmuTOS 1.2.1 (UK)
[ 2]: TOS 3.06 (UK)
[*3]: TOS 3.06 (DE)
[ 4]: EmuTOS 1.2.1 (DE)
Press 1-4 to switch,
any other key to cancel:
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The selection is made by pressing the buttons 1 to 4.

If the FlashROM is active, a reset is performed automatically and the TT starts with the OS of the selected FlashROM bank.

If the mainboard ROM is active, the newly selected FlashROM bank is still selected. An automatic reset also takes place here. However, the mainboard ROM reports again. This is not an error, but system-related. If you want to use the selected FlashROM bank, switch off the TT, activate the FlashROM (switch the middle pin of W603 from ground to 5V) and restart the TT.

Note: the FlashROM banks can also be assigned the same OS or in different languages. There are many opportunities.

Best regards
Your Thunderstorm Team

Status: 04 February 2024