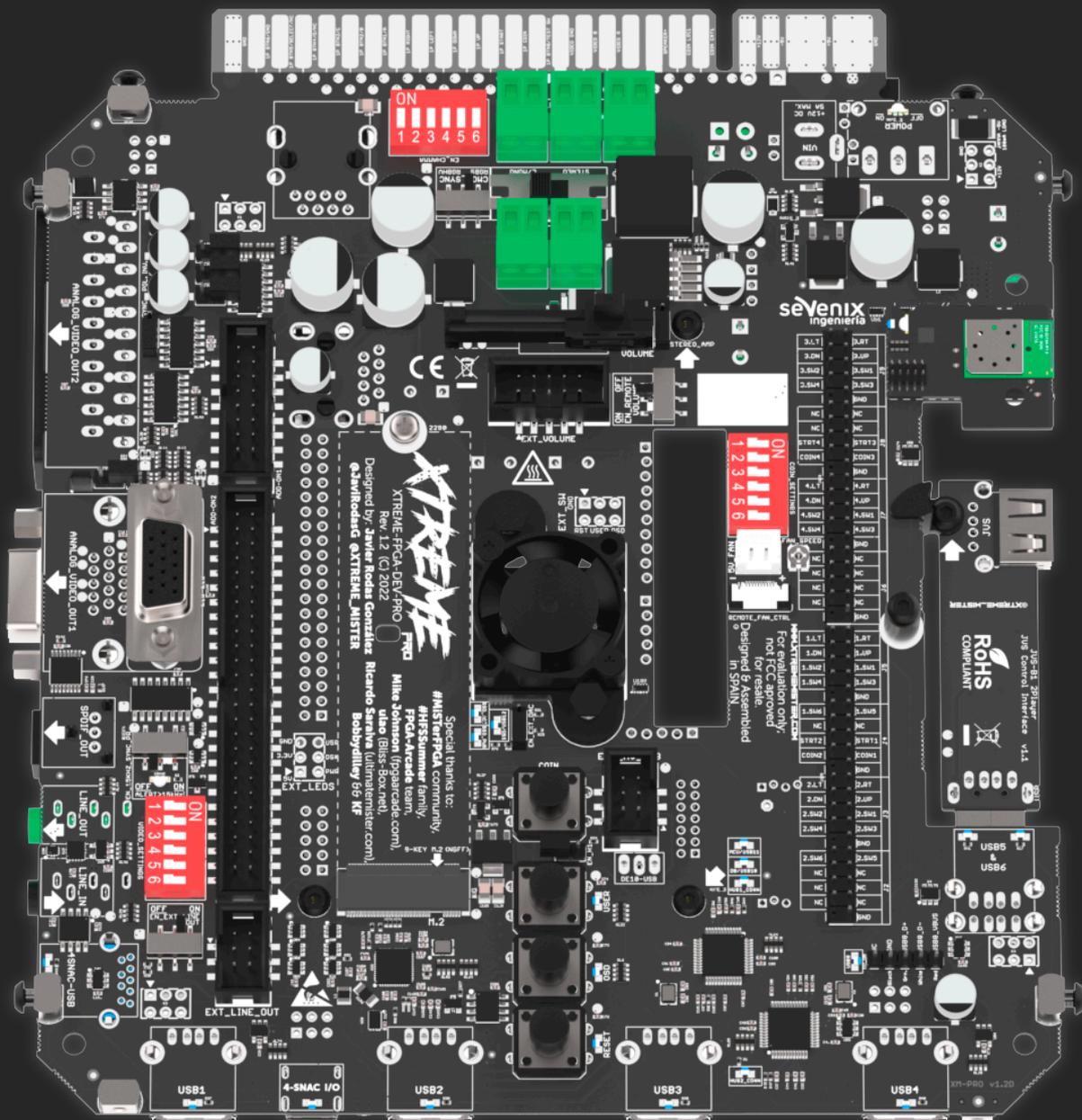# XM-PRO
Getting Started

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Assembly the XM-PRO kit to a DE10-Nano + SDRAM

1. Assemble the SDRAM M1 or M2 on the DE10-Nano. Make sure the SDRAM module is inserted on the GPIO0 connector (and not on the GPIO1) and, in the case of the M1, make sure the "THIS FACE OUTSIDE!" face is pointing to the outside of the DE10-Nano!.

2. Activate the **SW0 switch** to output I2S digital audio from the DE10 to the PCM5102 HiFi Audio DAC, to get analog audio at the LINE-OUT output, as well as at the stereo Audio Power Amplifier (connected to the JAMMA/MVS / terminal block outputs). Alternatively deactivate SW0 to get digital audio though the SPDIF/Toslink connector. Keep SW1, SW2 y SW3 disabled (at their default positions).

3. Assemble the [DE10-Nano + SDRAM] on the XM-PRO motherboard (at the bottom side).

4. Connect the USB-BRIDGE to join the 2x USB-HUBs of the XM-PRO to the DE10-Nano USB-OTG port.

5. Use 3 screws to fix the DE10-Nano in place over the XM-PRO.

6. Connect the internal RJ45-RJ45 cable (between the DE10 RJ45 female connector and the internal XM-PRO RJ45 female connector).

7. **Optionally** configure the power-jumpers at the BOTTOM side (to allow to power the XM-PRO from the JAMMA +5V/+12V por by default, or by using an auxiliary +12V power adapter).

8. **Optionally** configure the dip-switches at the TOP side ("video settings" that affect the first analog video output at the VGA / D-SUB15 connector, the COINS settings, the CHAMMA settings, the enable 15kHz SYNC protection...).

9. **Optionally** add an M.2 SATA SSD disk on TOP side (NOTE: the XM-PRO is not compatible with NVMe disks). This SSD disk (as well as any other external USB disks) can be comfortably formatted into ExFAT later, comfortably from the "**XtremeMiSTer Mobile Tool**" without the need to use the Linux terminal, or an auxiliary PC with an external M.2-to-USB adapter/cable. After formatting it to ExFAT you can copy your own ROM backups by SAMBA o SSH/FileZilla from your PC/Mac/Smartphone, copying them on the /media/usb0/games, /media/usb1/games (in case there are more than a single auxiliary SSD connected to the XM-PRO), etc.

10. **Optionally** add the ENCLOSURE plates:
    - Add the 4x HEX spacers at the corners. The Female-Female go at the TOP side, while the Male-Female are screwed to the previous ones from the BOTTOM side.
    - Fix the BOTTOM plate with 4 screws.
    - Fix the four LATERAL plates with 2 screws on each of them.
    - Fix the TOP plate with 4 screws.

Alternatively, it is possible to 3D print the different parts of an enclosure using the following [resources](https://github.com/XTREME-MISTER/XTREME_RESOURCES) https://github.com/XTREME-MISTER/XTREME_RESOURCES

Remember that you can connect up to 4 different displays at the same time to the XM-PRO (all the video and audio outputs are *buffered*). All the CRTs are by default without "upscaling" (at its native resolution, typically of 240p), while the HDMI is always "upscaled" (typically to 1080p) and optionally also with added "video filters" or "video masks" generated in real-time by the FPGA: The 3x CRTs with null added video-lag: (1) one DSUB15 output (it can be configured as RGBS or RGBHV or YPbPr, optionally with a CSYNC (combined SYNC) by hardware or by the DE10 FPGA, and with a configurable impedance of 75ohm or TTL), (2) the next output is for a SCART TV (typically 15kHz RGBS), (3) another output for an ARCADE CRT (15/24/31kHz RGBS via JAMMA or RGBS/RGBHV using the GREEN Terminal Blocks) and, finally, (4) a fourth "upscaled" HDTV output (by using an HDMI-HDMI or HDMI-DVI to connect to a modern TFT or LED/OLED TV), with an added video-lag that depends on the specific model/make of the modern TV.

For further information about the possible audio/video/JVS/JAMMA/other connections please review the [deployment diagram](https://xtrememister.com/wp-content/uploads/2023/08/XM-PRO-Lite-Connection-and-Deployment-1.pdf) https://xtrememister.com/wp-content/uploads/2023/08/XM-PRO-Lite-Connection-and-Deployment-1.pdf of the XM-PRO Lite.

Flash a #MiSTerFPGA image on the MicroSD, optimized for the @XTREME_MISTER hardware

METHOD 1: Use an Smartphone + XtremeMiSTer Mobile Tool + USB-OTG cable + MicroSD reader (provided)

- Use the smartphone to download and install the [XtremeMiSTer Mobile Tool v0.5-beta.apk](https://www.dropbox.com/scl/fi/7re0uvk6bhi8m71klyp1w/XtremeMiSTer-Mobile-Tool-v0.5-beta.apk?rlkey=0ivkxrnrgb731rxhj9u2d041e&dl=0) https://www.dropbox.com/scl/fi/7re0uvk6bhi8m71klyp1w/XtremeMiSTer-Mobile-Tool-v0.5-beta.apk?rlkey=0ivkxrnrgb731rxhj9u2d041e&dl=0

- Use the smartphone to download the [mr-fusion-v2.9__2023-12-28__XM-optimized.img](https://www.dropbox.com/scl/fi/hic7ffxqwcthwfhtersyd/mr-fusion-v2.9__2023-12-28__XM-optimized.img?rlkey=yyle2ytoqqi4w694z0kd3ey8v&dl=0) https://www.dropbox.com/scl/fi/hic7ffxqwcthwfhtersyd/mr-fusion-v2.9__2023-12-28__XM-optimized.img?rlkey=yyle2ytoqqi4w694z0kd3ey8v&dl=0 (it is recommended to download it to the "Downloads" folder, or to a shared Google Drive / Dropbox folder for convenience on next steps).

- Open the **XtremeMiSTer Mobile Tool** => Press at the "MicroSD" icon (at the top-right corner) to open the "**MicroSD card flash tools**" => Press on the first "**Burn a RAW image into the MicroSD...**" option => Insert the MicroSD card on the MicroSD card reader => Connect the USB-OTG cable to the MicroSD card reader to the smartphone => Select the "**mr-fusion-v2.9__2023-12-28__XM-optimized.img**" file (previously downloaded) => In case the connection is correctly detected by the Android smartphone (and the OS or smartphone are not too old), it will give us the option to choose a USB flash device

in the list => Else, a "No USB drives detected" warning message will appear, and we would need to use the METHOD 2 using an auxiliary Laptop/PC/Mac to flash the MicroSD card.
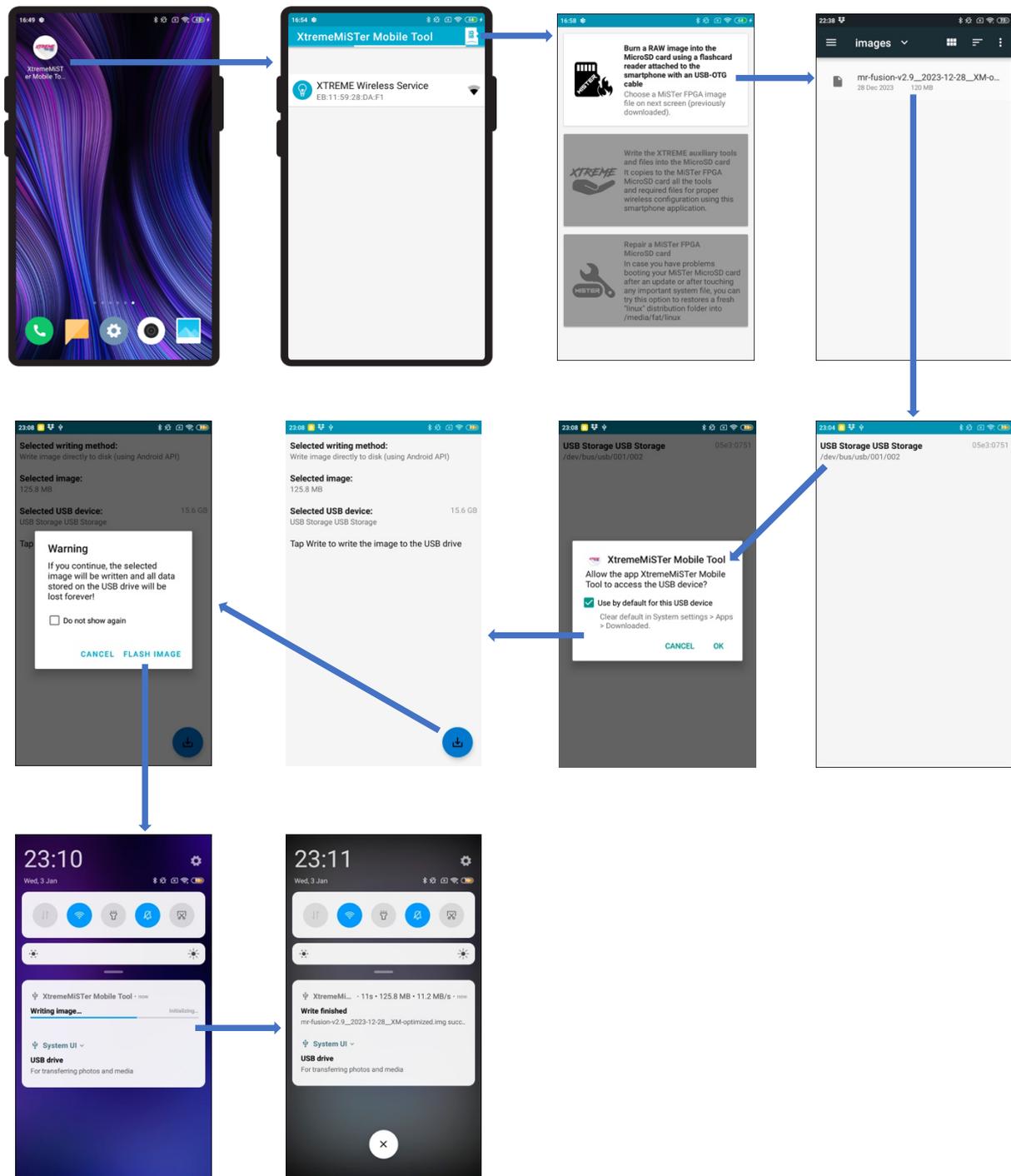
METHOD 2: Use an auxiliary Laptop/PC/Mac + the MicroSD card reader (provided)

- Use a Laptop/PC/Mac to download the mr-fusion-v2.9__2023-12-28__XM-optimized.img
  https://www.dropbox.com/scl/fi/hic7ffxqwcthwfhtersyd/mr-fusion-v2.9__2023-12-28__XM-optimized.img?rlkey=yyle2ytoqqi4w694z0kd3ey8v&dl=0
  on the Desktop (for convenience).
- Install and run Balena Etcher https://etcher.balena.io/ to flash the "mr-fusion-v2.9__2023-12-28__XM-optimized.img" file into a MicroSD card (at least 128GB size is recommended).

The previous Mr.Fusion image is optimized for the XTREME_MISTER hardware. It includes thousands of pre-configured input config files for the great majority of the MiSTer existing cores, services to attend the input encoders of JVS and the 4players BLE module (wirelessly), it comes with the latest updated distribution of MiSTer (from Dec 2023), as well as with several preloaded scripts, USB

fast-polling pre-activated, SSHD and Samba servers pre-activated, the latest version of the update_all ready for the user to update his MiSTer comfortably in few minutes from his smartphone (with just 4 clicks)...

RUN and Configure the [XM-PRO + DE10 + MicroSD]

1. Insert the previously programmed MicroSD at the BOTTOM side of the DE10.
2. Connect up to 4 screens/displays, audio cables and/or external stereo speaker's cables to the XM-PRO. For further information about the possible audio/video/JVS/JAMMA/other connections please review the deployment diagram https://xtrememister.com/wp-content/uploads/2023/08/XM-PRO-Lite-Connection-and-Deployment-1.pdf of the XM-PRO Lite.
3. Apply power though the JAMMA harness (or alternatively using a power adapter in case you are not connecting the XM-PRO to a cabinet). Remember that for using the external adapter 2 power jumpers at the BOTTOM side of the XM-PRO have to be moved).
4. Power ON by using the ON/OFF power switch (in case it was not already at the ON position).

Mr.FUSION

5. The first time the XM-PRO is powered up after inserting the MicroSD card with the "Mr.Fusion (optimized for XM)" image, the following splash image will appear at the HDMI output:


6. Two minutes will be required to expand the MicroSD partitions and copying some files internally. After that, we can connect to the BLE module using the "XtremeMiSTer Mobile Tool" app from the Android smartphone (even in case there is not an Ethernet or WiFi (which requires an external dongle), we will be able to wirelessly and comfortably configure our XM and launch FPGA cores without the need of any additional peripheral). Alternatively, we can always use the wireless keyboard/mouse by USB, or any other Keyboard/Gamepad by USB to manually move though the different folders and menus of the MiSTer.

CONFIGURATION WITH THE "XtremeMiSTer Mobile Tool"

7. We open the app, we may grant some permissions (the first time we open the app) and next we click on the "XTREME Wireless Service" cell that is detected => We navigate to the MAIN MENU.

8. NOTE: The first time we configure this app, we must choose the very last option of the menu called "SET XM SECURE PIN". We must set a secret numeric code of 8 digits. Once is set up, both the BLE module and the "XtremeMiSTer Mobile Tool" app will exchange messages using that private key. If the key is not set up or it is wrong or the BLE has a previous different key set up, we won't be able to communicate with it, neither change any parameter or diagnose the state of the hardware, etc. In case we forget the existing PIN and we reinstall the app (for instance), there is a FACTORY RESET mechanism available at the BLE module, that can be triggered by pressing and holding for more than 5 seconds the COIN switch (available at the TOP of the XM-PRO) while we perform a POWER-CYCLE. When the FACTORY-RESET is launched, the RGB LED will change its color 3 times until it gets fully INTENSE WHITE, and then it will reboot as usual in the DEFAULT mode (where the BLE and the 4player encoder are available simultaneously). Three small blinks in BLUE color indicate the default boot mode. After the FACTORY RESET we must open the app and press "SET XM SECURE PIN" one more time.
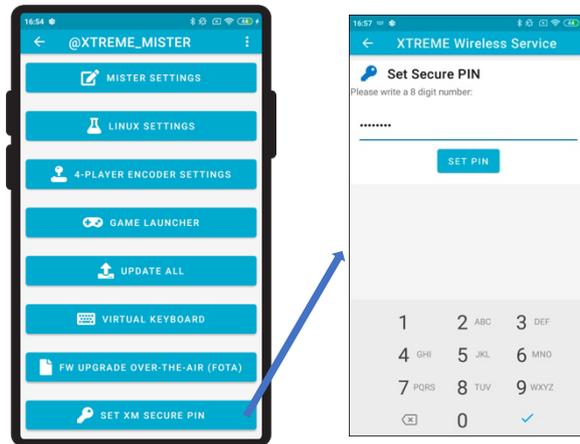

9. From here, we can do the next configuration / diagnose tasks wirelessly from the app:

A. **MISTER SETTINGS:** we can configure at high-level several of the MiSTer parameters, as an alternative to manually edit the "MiSTer.ini" file that is at the root of the MicroSD, or use an "ini_settings" script to manually toggle the different raw parameters. Typically, we would like to change the HDMI output resolution and refresh rate (upscaling from 240p 60Hz to something like 1080p 60Hz). We can leave the HDMI output on "Auto", to automatically detect the best resolution available at our LCD / TFT / OLED display. We can rotate 90 degrees the OSD menu, in case or main screen is oriented in TATE mode (instead of in YOKO orientation), choose the desired kind of vertical synchronization (to improve the compatibility with some types of panels, which would generate more or less added video-lag). We can force the *scandoubler* to go from 15kHz to 31kHz (in case we use a PC CRT monitor of 31kHz connected to the first D-SBU15 output. Please note that the *scandoubler* will also output a 31kHz signal though the other 2x CRT outputs, the SCART and the JAMMA. We can deactivate the framebuffer of the CRT outputs, which is helpful in case we don't have any HDTV connected and we would like to see the progress of the UPDATE_ALL on the CRTs (or on our cabinet JAMMA CRTs for instance...). Other options of the MiSTer.ini must be edited by using the "ini_settings" script, or by editing the MiSTer.ini file at the root of the MicroSD. We could add more MISTER SETTINGS to the "XtremeMiSTer Mobile Tool" app in the future, in case there is enough demand from the users of the platform...
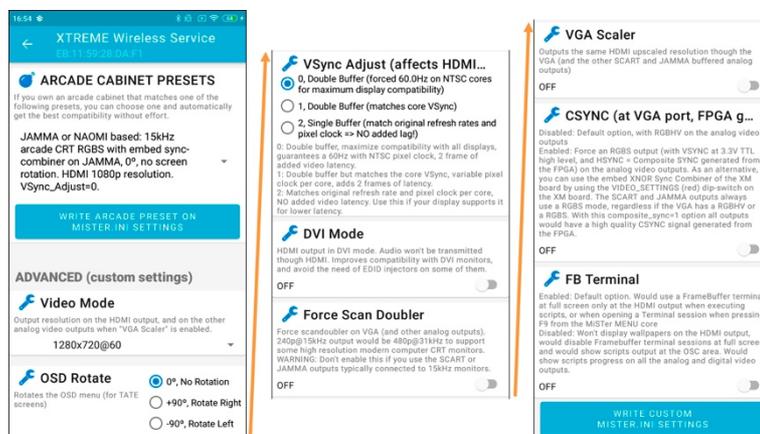
B. **LINUX SETTINGS:** we can diagnose at high level several different parameters of the ARM Linux (operating system) side of the DE10, such as the USB fast-polling (which affect the input-lag), the RTC and temperature sensors presence and values, the embedded and external M.2 SSD hardware presence / capacity / available space, the network connections such as the Ethernet, WiFi and/or BLE (these last two require an special USB dongle), the keyboard layout mapping and timezone, etc. In this section the app also automatically checks for available software updates on the cloud (for all the existing XM services installed), and in case there is an update, it will offer the option to upgrade with just 1 click confirmation (without the need of any deeper knowledge in IT or Linux, and without requiring any auxiliary PC/MAC computer).
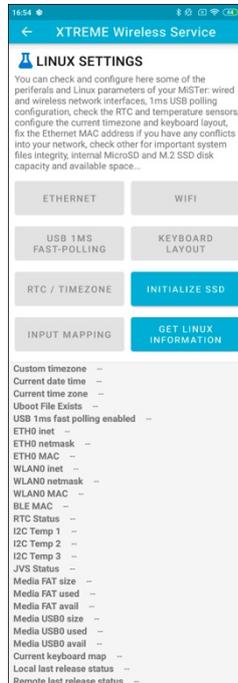

C. **4-PLAYER INPUT ENCODER:** in this section we can change several parameters of the input encoder, embedded in the BLE (Cortex-M4) module of the XM-PRO motherboard, capable of supporting 4-Players with a very low input latency of 0.74-0.78ms depending on the activated options. We allow to enable/disable the DEBOUNCE, and to globally REMAP/REORDER the 6 buttons "A,B,X,Y,R,L". This button remapping affects all the 4 players equally, and it's performed at FIRMWARE level, being 100% transparent to the MiSTer platform. It can be really helpful for certain users who have the 6 buttons wired to the JAMMA hardness in a different order than the one shown by default, to avoid the users to resolder/reconnect any hardware wire in their cabinets. NOTE: On the current firmware, any change on this button remap at the Android app will require a power cycle to allow the MiSTer to correctly recognize the new button order.


D. **UPDATE ALL:** we can launch in a really comfortable way the UPDATE_ALL from here, without the need to manually navigate through several MiSTer key combinations and scripts menus on the MiSTer, and right next continue using a "Virtual Keyboard" in case we need to tune any option of the UPDATE_ALL (by pressing "UP"... as it is indicated on the screen after

the UPDATE_ALL is executed). In case we only have CRT monitors connected to the XM-PRO (and not any HDTV), it is recommended to deactivate the "framebuffer" option at the first "MISTER SETTINGS" section (at the very bottom of that section), to be able to check the UPDATE_ALL progress on the CRTs. After disabling the "framebuffer" we lose the backgrounds of the MiSTer on the HDMI output, but that do not affect the CRT outputs anyway, and we can have real-time feedback about the UPDATE_ALL progress (which is really important). NOTE: Please make sure you are at the main MENU core when launching the UPDATE_ALL from the Android app, else you won't be able to see the progress on screen.
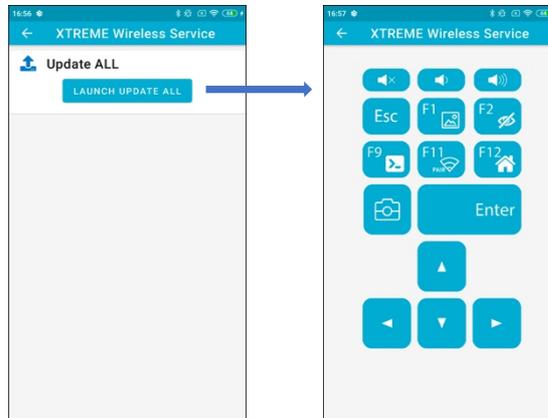
E. **VIRTUAL KEYBOARD:** this is a general-purpose VIRTUAL KEYBOARD, which key presses are converted into 100% USB-HID keyboard key presses. We can typically open the OSD menu, navigate through the different sub-menus to change any option, turn up/down the global volume level, take screenshots, pair BLE peripherals (in case we add an extra WiFi/BLE dongle), etc. We could offer a larger QWERTY keyboard but we thought it would be uncomfortable for the smartphone screen size, that is why we ended up providing the most common keys for a very comfortable WIRELESS REMOTE CONTROL.

F. **FIRMWARE UPGRADE OVER-THE-AIR (FOTA):** this option allows you to choose a binary file that would be uploaded encrypted (100% confidential) and WIRELESSLY to the BLE module, to upgrade its firmware to a more recent version.
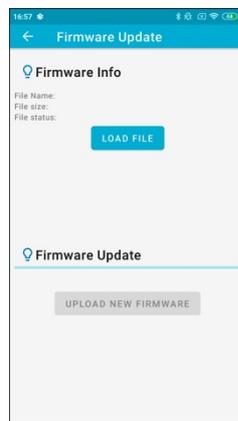
G. **SET XM SECURE PIN:** we can set a SECURE PIN the first time (after receive the brand-new XM-PRO, or after a FACTORY RESET). It is also possible to change the SECURE PIN from time to time, but only in case we had previously set a right PIN. Else, a "Wrong PIN" message will be shown.

H. **GAME LAUNCHER:** here the different platforms / categories / cores available at the XM-PRO are shown, and it allows you to comfortably launch them using your smartphone as wireless remote controller once again.

Future Lines of Work

- Publish the XtremeMiSTer Mobile Tool to the Android Market, to make it even easier to the user to manage and diagnose the configuration of their XTREME hardware. It will allow to make PUSH NOTIFICATIONS too.

- Give support to specific options of the NEXT-GEN FPGA gaming platform, in case the user mounts the XM-PRO (or PRO-Lite) on top of the NEXT-GEN FPGA gaming platform motherboard.

- Implement an iOS version of the XtremeMiSTer Mobile Tool.

- Make the XtremeMiSTer Mobile Tool source code available, in case the number of users of the platform end up being high enough.