# AM0010 Test Board

Revision v.11

Exported on 2024-01-24

Online version of this document:

https://wiki.trenz-electronic.de/display/PD/AM0010+Test+Board

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# 4 Overview

Refer to http://trenz.org/am0010-info[1] for the current online version of this manual and other available documentation.

## 4.1 Key Features

- Vitis/Vivado 2022.2
- PetaLinux
- SD (2.0)
- ETH
- USB (2.0)
- I2C
- eMMC
- FMeter

## 4.2 Revision History

**Expand List**

| Date | Vivado | Project Built | Authors | Description |
|---|---|---|---|---|
| 2023-08-25 | 2022.2 | AM0010-test_board-vivado_2022.2-build_7_20230825125934.zip<br>AM0010-test_board_noprebuilt-vivado_2022.2-build_7_20230825125934.zip | Manuela Strücker | • Update Vivado 2022.2<br>• new assembly variants |
| 2021-11-19 | 2020.2 | AM0010-test_board-vivado_2020.2-build_9_20211119071538.zip<br>AM0010-test_board_noprebuilt-vivado_2020.2-build_9_20211119072230.zip | Mohsen Chamanbaz / John Hartfiel | • initial release |

**Table 1: Design Revision History**

1 https://wiki.trenz-electronic.de/display/PD/AM0010+Resources

## 4.3 Release Notes and Know Issues

| Issues | Description | Workaround | To be fixed version |
|---|---|---|---|
| USB | USB3 Stick does not work on USB2 Interface, only USB2 Stick | --- | --- |

**Table 2: Known Issues**

## 4.4 Requirements

### 4.4.1 Software

| Software | Version | Note |
|---|---|---|
| Vitis | 2022.2 | needed, Vivado is included into Vitis installation |
| PetaLinux | 2022.2 | needed |

**Table 3: Software**

### 4.4.2 Hardware

Basic description of TE Board Part Files is available on TE Board Part Files.[2]

Complete List is available on "<project folder>\board_files*_board_files.csv"

Design supports following modules:

**Expand List**

| Module Model | Board Part Short Name | PCB Revision Support | DDR | QSPI Flash | EMMC | Others | Notes |
|---|---|---|---|---|---|---|---|
| AM0010-01-3BI21FA | 3eg_1i_4gb | REV01 | 4GB | 128MB | 8GB | NA | NA |

2 https://wiki.trenz-electronic.de/display/PD/TE+Board+Part+Files

| Module Model | Board Part Short Name | PCB Revision Support | DDR | QSPI Flash | EMMC | Others | Notes |
|---|---|---|---|---|---|---|---|
| AM0010-01-3BI21MA* | 3eg_1i_4gb | REV01 | 4GB | 128MB | 8GB | NA | NA |
| AM0010-01-4DE21MA | 4ev_1e_4gb | REV01 | 4GB | 128MB | 8GB | NA | NA |
| AM0010-01-S001 | 4ev_1e_4gb | REV01 | 4GB | 128MB | 8GB | NA | NA |
| AM0010-01-S002 | 4ev_1e_4gb | REV01 | 4GB | 128MB | 8GB | NA | CS |
| AM0010-01-S003 | 4ev_1e_4gb | REV01 | 4GB | 128MB | 8GB | NA | CS reduced comp |
| AM0010-02-3BE21MA | 3eg_1e_4gb | REV02 | 4GB | 128MB | 8GB | NA | NA |
| AM0010-02-4DE21MA | 4ev_1e_4gb | REV02 | 4GB | 128MB | 8GB | NA | NA |
| AM0010-02-5DE21MA | 5ev_1e_4gb | REV02 | 4GB | 128MB | 8GB | NA | NA |

**Table 4: Hardware Modules**
*used as reference

Design supports following carriers:

| Carrier Model | Notes |
|---|---|
| AMB0010-01* | |

**Table 5: Hardware Carrier**
*used as reference

Additional HW Requirements:

| Additional Hardware | Notes |
|---|---|
| TE0790 (XMOD FTDI JTAG Adapter) | |
| Heat sink | |
| Mini-USB cable | |
| 12V Power supply | |
| SD card | |

**Table 6: Additional Hardware**
*used as reference

## 4.5 Content

For general structure and usage of the reference design, see Project Delivery - AMD devices[3]

### 4.5.1 Design Sources

| Type | Location | Notes |
|---|---|---|
| Vivado | <project folder>\block_design<br><project folder>\constraints<br><project folder>\ip_lib<br><project folder>\board_files | Vivado Project will be generated by TE Scripts |

3 https://wiki.trenz-electronic.de/display/PD/Project+Delivery+-+AMD+devices

| Type | Location | Notes |
|---|---|---|
| Vitis | <project folder>\sw_lib | Additional Software Template for Vitis and apps_list.csv with settings automatically for Vitis app generation |
| PetaLinux | <project folder>\os\petalinux | PetaLinux template with current configuration |

**Table 7: Design sources**

### 4.5.2 Additional Sources

| Type | Location | Notes |
|---|---|---|
| init.sh | <project folder>\misc\sd\ | Additional Initialization Script for Linux |

**Table 8: Additional design sources**

### 4.5.3 Prebuilt

| File | File-Extension | Description |
|---|---|---|
| BIF-File | *.bif | File with description to generate Bin-File |
| BIN-File | *.bin | Flash Configuration File with Boot-Image (Zynq-FPGAs) |
| BIT-File | *.bit | FPGA (PL Part) Configuration File |
| Boot Script-File | *.scr | Distro Boot Script file |
| DebugProbes-File | *.ltx | Definition File for Vivado/Vivado Labtools Debugging Interface |
| Diverse Reports | --- | Report files in different formats |
| Device Tree | *.dts | Device tree (2 possible, one for u-boot and one for linux) |

| File | File-Extension | Description |
|---|---|---|
| Hardware-Platform-Description-File | *.xsa | Exported Vivado hardware description file for Vitis and PetaLinux |
| LabTools Project-File | *.lpr | Vivado Labtools Project File |
| OS-Image | *.ub | Image with Linux Kernel (On Petalinux optional with Devicetree and RAM-Disk) |
| Software-Application-File | *.elf | Software Application for Zynq or MicroBlaze Processor Systems |

**Table 9: Prebuilt files (only on ZIP with prebuilt content)**

### 4.5.4 Download

Reference Design is only usable with the specified Vivado/Vitis/PetaLinux version. Do never use different Versions of Xilinx Software for the same Project.

Reference Design is available on:

- AM0010 "Test Board" Reference Design[4]

4 https://shop.trenz-electronic.de/Download/?path=Trenz_Electronic/Modules_and_Module_Carriers/4x5.64/AM0010/Reference_Design/2022.2/test_board

# 5 Design Flow

> Reference Design is available with and without prebuilt files. It's recommended to use TE prebuilt files for first launch.

Trenz Electronic provides a tcl based built environment based on Xilinx Design Flow.

See also:

- AMD Development Tools[5]
- Vivado Projects - TE Reference Design[6]
- Project Delivery.[7]

The Trenz Electronic FPGA Reference Designs are TCL-script based project. Command files for execution will be generated with "_create_win_setup.cmd" on Windows OS and "_create_linux_setup.sh" on Linux OS.

TE Scripts are only needed to generate the vivado project, all other additional steps are optional and can also executed by Xilinx Vivado/Vitis GUI. For currently Scripts limitations on Win and Linux OS see: Project Delivery Currently limitations of functionality[8]

> **Caution!** Win OS has a 260 character limit for path lengths which can affect the Vivado tools. To avoid this issue, use Virtual Drive or the shortest possible names and directory locations for the reference design (for example "x:\<project folder>")

1. Run _create_win_setup.cmd/_create_linux_setup.sh and follow instructions on shell:

**_create_win_setup.cmd/_create_linux_setup.sh**

```
------------------------Set design paths----------------------------
-- Run Design with: _create_win_setup
-- Use Design Path: <absolute project path>
--------------------------------------------------------------------
-------------------------TE Reference Design---------------------------
--------------------------------------------------------------------
-- (0)  Module selection guide, project creation...prebuilt export...
-- (1)  Create minimum setup of CMD-Files and exit Batch
-- (2)  Create maximum setup of CMD-Files and exit Batch
-- (3)  (internal only) Dev
-- (4)  (internal only) Prod
-- (c)  Go to CMD-File Generation (Manual setup)
-- (d)  Go to Documentation (Web Documentation)
-- (g)  Install Board Files from Xilinx Board Store (beta)
-- (a)  Start design with unsupported Vivado Version (beta)
-- (x)  Exit Batch (nothing is done!)
----
Select (ex.:'0' for module selection guide):
```

2. Press 0 and enter to start "Module Selection Guide"
3. Create project and follow instructions of the product selection guide, settings file will be configured automatically during this process.

5 https://wiki.trenz-electronic.de/display/PD/AMD+Development+Tools#AMDDevelopmentTools-XilinxSoftware-BasicUserGuides
6 https://wiki.trenz-electronic.de/display/PD/Vivado+Projects+-+TE+Reference+Design
7 https://wiki.trenz-electronic.de/display/PD/Project+Delivery+-+AMD+devices
8 https://wiki.trenz-electronic.de/display/PD/Project+Delivery+-+AMD+devices#ProjectDeliveryAMDdevices-Currentlylimitationsoffunctionality

- optional for manual changes: Select correct device and Xilinx install path on "design_basic_settings.cmd" and create Vivado project with "vivado_create_project_guimode.cmd"

  ⚠ Note: Select correct one, see also Vivado Board Part Flow[9]

4. Create hardware description file (.xsa file) for PetaLinux project and export to prebuilt folder

**run on Vivado TCL (Script generates design and export files into "\prebuilt\hardware\")**

```
\prebuilt\hardware\")">
TE::hw_build_design -export_prebuilt
```

ⓘ Using Vivado GUI is the same, except file export to prebuilt folder.

5. Create and configure your PetaLinux project with exported .xsa-file, see PetaLinux KICKstart[10]
   - use TE Template from "<project folder>\os\petalinux"
   - use exported .xsa file from "<project folder>\prebuilt\hardware\<short name>" . **Note:** HW Export from Vivado GUI creates another path as default workspace.
   - The build images are located in the "<plnx-proj-root>/images/linux" directory
6. Configure the **boot.scr** file as needed, see Distro Boot with Boot.scr[11]
7. Generate Programming Files with Vitis (recommended)
   a. Copy PetaLinux build image files to prebuilt folder
      - copy **u-boot.elf**, **system.dtb**, **image.ub** and **boot.scr** from "<plnx-proj-root>/images/linux" to prebuilt folder

        ⓘ "<project folder>\prebuilt\os\petalinux\<ddr size>" or "<project folder>\prebuilt\os\petalinux\<short name>"

   b. Generate Programming Files with Vitis

**run on Vivado TCL (Script generates applications and bootable files, which are defined in "test_board\sw_lib\apps_list.csv")**

```
TE::sw_run_vitis -all
TE::sw_run_vitis (optional; Start Vitis from Vivado GUI or start with
TE Scripts on Vivado TCL)
```

⚠ TCL scripts generate also platform project, this must be done manually in case GUI is used. See Vitis[12]

8. Generate Programming Files with Petalinux (alternative), see PetaLinux KICKstart[13]

9 https://wiki.trenz-electronic.de/display/PD/Vivado+Board+Part+Flow
10 https://wiki.trenz-electronic.de/display/PD/PetaLinux+KICKstart
11 https://wiki.trenz-electronic.de/display/PD/Distro+Boot+with+Boot.scr
12 https://wiki.trenz-electronic.de/display/PD/Vitis
13 https://wiki.trenz-electronic.de/display/PD/PetaLinux+KICKstart

# 6 Launch

## 6.1 Programming

⚠ Check Module and Carrier TRMs for proper HW configuration before you try any design.
Reference Design is also available with prebuilt files. It's recommended to use TE prebuilt files for first launch.

Xilinx documentation for programming and debugging: Vivado/Vitis/SDSoC-Xilinx Software Programming and Debugging[14]

### 6.1.1 Get prebuilt boot binaries

1. Run _create_win_setup.cmd/_create_linux_setup.sh and follow instructions on shell
2. Press 0 and enter to start "Module Selection Guide"
   a. Select assembly version
   b. Validate selection
   c. Select create and open delivery binary folder

   ⓘ Note: Folder "<project folder>_binaries_<Article Name>" with subfolder "boot_<app name>" for different applications will be generated

### 6.1.2 QSPI-Boot mode

Option for **Boot.bin** on QSPI Flash and **image.ub** and **boot.scr** on **SD** or **USB**.

1. Connect **JTAG** and power on carrier with module
2. Open Vivado Project with "vivado_open_existing_project_guimode.cmd" or if not created, create with "vivado_create_project_guimode.cmd"

   **run on Vivado TCL (Script programs BOOT.bin on QSPI flash)**

   ```
   TE::pr_program_flash -swapp u-boot
   TE::pr_program_flash -swapp hello_am0010 (optional)
   ```

   ⚠ To program with Vitis/Vivado GUI, use special FSBL (fsbl_flash) on setup

3. Copy **image.ub** and **boot.scr** on **SD** or **USB**
   - use files from "<project folder>_binaries_<Article Name>\boot_linux" from generated binary folder,see: Get prebuilt boot binaries (see page 14)
   - or use prebuilt file location, see "<project folder>\prebuilt\file_location.txt"
4. Set Boot Mode to **QSPI-Boot** and insert **SD** or **USB**.
   - Depends on Carrier, see carrier TRM.

14 https://wiki.trenz-electronic.de/display/PD/AMD+Development+Tools#AMDDevelopmentTools-XilinxSoftwareProgrammingandDebugging

### 6.1.3 SD-Boot mode

1. Copy **image.ub**, **boot.src** and **Boot.bin** on **SD**
   - use files from "<project folder>_binaries_<Article Name>\boot_linux" from generated binary folder, see: Get prebuilt boot binaries (see page 14)
   - or use prebuilt file location, see "<project folder>\prebuilt\file_location.txt"
2. Set Boot Mode to SD-Boot.
   - Depends on Carrier, see carrier TRM.
3. Insert SD-Card in SD-Slot.

### 6.1.4 JTAG

Not used on this example.

## 6.2 Usage

1. Prepare HW like described on section Programming (see page 14)
2. Connect UART USB (most cases same as JTAG)
3. Select SD Card as Boot Mode (or QSPI - depending on step 1)

   Note: See TRM of the Carrier, which is used.

   Starting with Petalinux version 2020.1, the industry standard "Distro-Boot" boot flow for U-Boot was introduced, which significantly expands the possibilities of the boot process and has the primary goal of making booting much more standardised and predictable.
   The boot options described above describe the common boot processes for this hardware; other boot options are possible.
   For more information see Distro Boot with Boot.scr[15]

4. Power On PCB
   **boot process**

   1. ZynqMP Boot ROM loads FSBL from SD/QSPI into OCM,

   2. FSBL init the PS, programs the PL using the bitstream and loads PMU, ATF and U-boot from SD/QSPI into DDR,

   3. U-boot loads Linux (**image.ub**) from SD/QSPI/... into DDR

### 6.2.1 Linux

1. Open Serial Console (e.g. putty)
   - Speed: 115200
   - select COM Port

   Win OS, see device manager, Linux OS see dmesg |grep tty (UART is *USB1)

15 https://wiki.trenz-electronic.de/display/PD/Distro+Boot+with+Boot.scr

2. Linux Console:

```
# password disabled
petalinux login: root
Password: root
```

> Note: Wait until Linux boot finished

3. You can use Linux shell now.

```
i2cdetect -y -r 0   (check I2C 0 Bus)
i2cdetect -y -r 1   (check I2C 1 Bus)
udhcpc              (ETH0 check)
lsusb               (USB check)
```

4. Option Features
   - Webserver to get access to Zynq
     - insert IP on web browser to start web interface
   - init.sh scripts
     - add init.sh script on SD, content will be load automatically on startup (template included in "<project folder>\misc\SD")

### 6.2.2 Vivado HW Manager

Open Vivado HW-Manager and add VIO signal to dashboard (*.ltx located on prebuilt folder)

- Control: Dip switches and LEDs
- Monitoring: Output clock of SI53340 clock buffer with 2:1 input mux

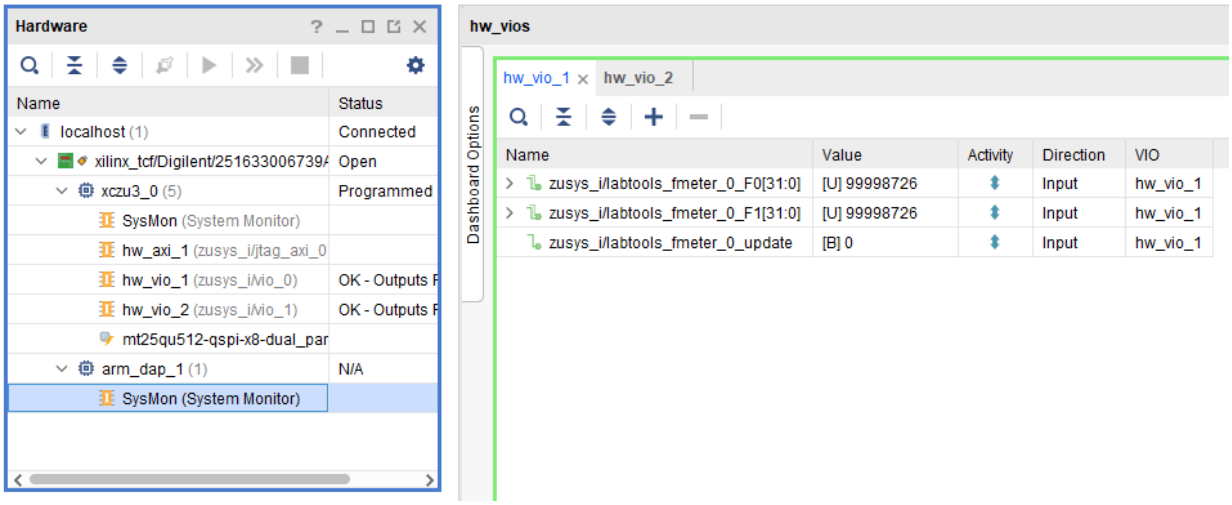
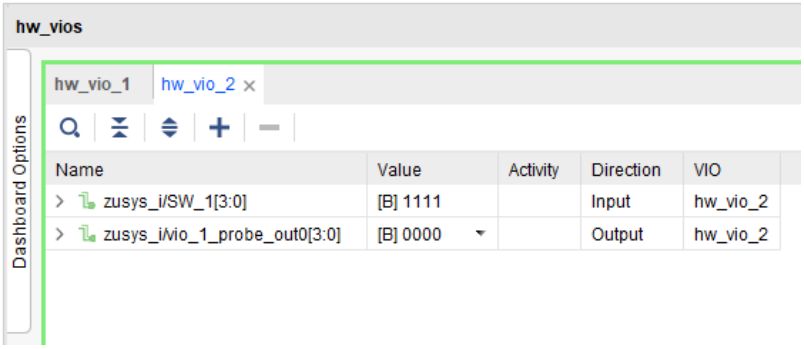



**Figure 1: Vivado Hardware Manager**



# 7 System Design - Vivado

## 7.1 Block Design

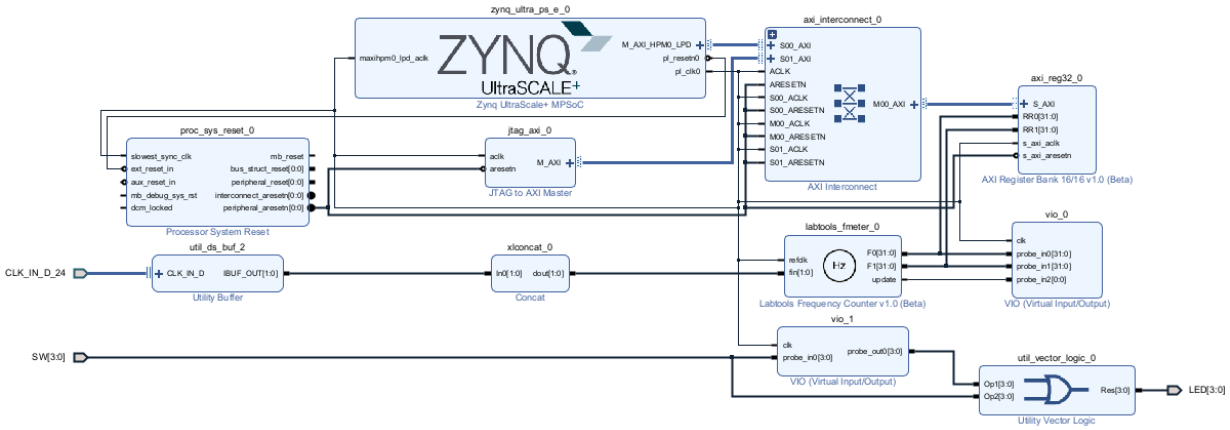



**Figure 2: Block Design**

### 7.1.1 PS Interfaces

Activated interfaces:

| Type | Note |
|---|---|
| DDR | |
| QSPI | MIO |
| SD0 (eMMC) | MIO |
| SD1 (as SD2.0) | MIO |
| I2C0 | MIO |
| I2C1 | MIO |
| UART0 | MIO |
| UART1 | MIO |

| Type | Note |
|---|---|
| GPIO0..2 | MIO |
| SWDT0..1 | |
| TTC0..3 | |
| GEM3 | MIO |
| USB0 (as USB2.0) | MIO |

**Table 10: PS Interfaces**

## 7.2 Constrains

### 7.2.1 Basic module constrains

**_i_bitgen_common.xdc**

```
set_property BITSTREAM.GENERAL.COMPRESS TRUE [current_design]
set_property BITSTREAM.CONFIG.UNUSEDPIN PULLNONE [current_design]
```

### 7.2.2 Design specific constrain

**_i_io.xdc**

```
##############################################
#CLOCKs
##############################################
#   Y6       B224_CLK0_P
#   Y5       B224_CLK0_N
#   V6       B224_CLK1_P
#   V5       B224_CLK1_N
#set_property -dict { IOSTANDARD LVDS_25 PACKAGE_PIN Y6 } [get_ports
{CLK_IN_D_224_clk_p[0]}]
#set_property -dict { IOSTANDARD LVDS_25 PACKAGE_PIN V6 } [get_ports
{CLK_IN_D_224_clk_p[1]}]
#   AA13     B24_L7_P
#   AB13     B24_L7_N
#   AC14     B24_L6_P
#   AC13     B24_L6_N
```

```
set_property -dict { IOSTANDARD LVDS_25 PACKAGE_PIN AA13 } [get_ports
{CLK_IN_D_24_clk_p[0]}]
set_property -dict { IOSTANDARD LVDS_25 PACKAGE_PIN AC14 } [get_ports
{CLK_IN_D_24_clk_p[1]}]

##############################################
#LED and DIP Switch
##############################################
#   D15      USER_LED[0]
#   D14      USER_LED[1]
#   G15      USER_LED[2]
#   G14      USER_LED[3]
set_property -dict { IOSTANDARD LVCMOS33 PACKAGE_PIN D15 } [get_ports {LED[0]}]
set_property -dict { IOSTANDARD LVCMOS33 PACKAGE_PIN D14 } [get_ports {LED[1]}]
set_property -dict { IOSTANDARD LVCMOS33 PACKAGE_PIN G15 } [get_ports {LED[2]}]
set_property -dict { IOSTANDARD LVCMOS33 PACKAGE_PIN G14 } [get_ports {LED[3]}]
#   F13      USER_SW[0]
#   G13      USER_SW[1]
#   E15      USER_SW[2]
#   F15      USER_SW[3]
set_property -dict { IOSTANDARD LVCMOS33 PACKAGE_PIN F13 } [get_ports {SW[0]}]
set_property -dict { IOSTANDARD LVCMOS33 PACKAGE_PIN G13 } [get_ports {SW[1]}]
set_property -dict { IOSTANDARD LVCMOS33 PACKAGE_PIN E15 } [get_ports {SW[2]}]
set_property -dict { IOSTANDARD LVCMOS33 PACKAGE_PIN F15 } [get_ports {SW[3]}]
##############################################
#HYPERRAM
##############################################
# #CK
# set_property PACKAGE_PIN AG10 [get_ports CLK_P]
# #CKN/RFU
# set_property PACKAGE_PIN AH10 [get_ports CLK_N]
# #DQ0..7
# set_property PACKAGE_PIN AB9  [get_ports {D[0]}]
# set_property PACKAGE_PIN AC11 [get_ports {D[1]}]
# set_property PACKAGE_PIN Y10  [get_ports {D[2]}]
# set_property PACKAGE_PIN AA8  [get_ports {D[3]}]
# set_property PACKAGE_PIN Y9   [get_ports {D[4]}]
# set_property PACKAGE_PIN AD11 [get_ports {D[5]}]
# set_property PACKAGE_PIN AB10 [get_ports {D[6]}]
# set_property PACKAGE_PIN AF10 [get_ports {D[7]}]
# #RWDS/RDS
# set_property PACKAGE_PIN AA10 [get_ports RWDS]
# #CSN
# set_property PACKAGE_PIN AD10 [get_ports CS0_N ]
# #RFU
# set_property PACKAGE_PIN AE10 [get_ports CS1_N]
# #RESETN
# set_property PACKAGE_PIN AB11 [get_ports RESET_N]
# #INT
# set_property PACKAGE_PIN AA11 [get_ports INT_N ]
```

# 8 Software Design - Vitis

For Vitis project creation, follow instructions from:

Vitis[16]

## 8.1 Application

Template location: "<project folder>\sw_lib\sw_apps\"

### 8.1.1 zynqmp_fsbl

TE modified 2022.2 FSBL

General:

- Modified Files: xfsbl_main.c, xfsbl_hooks.h/.c, xfsbl_board.h/.c (search for 'TE Mod' on source code)
- Add Files: te_xfsbl_hooks.h/.c (for hooks and board)
- General Changes:
    - Display FSBL Banner and Device Name

Module Specific:

- Add Files: all TE Files start with te_*
    - ETH+OTG Reset over MIO
    - USB Reset over MIO
    - eMMC Reset over MIO

### 8.1.2 zynqmp_pmufw

Xilinx default PMU firmware.

---

General Example:

### 8.1.3 hello_am0010

Hello AM0010 is a Xilinx Hello World example as endless loop instead of one console output.

### 8.1.4 u-boot

U-Boot.elf is generated with PetaLinux. Vitis is used to generate Boot.bin.

16 https://wiki.trenz-electronic.de/display/PD/Vitis

# 9 Software Design - PetaLinux

For PetaLinux installation and project creation, follow instructions from:

- PetaLinux KICKstart[17]

## 9.1 Config

Start with **petalinux-config** or **petalinux-config --get-hw-description**

Changes:

- select SD default instead of eMMC:
  - CONFIG_SUBSYSTEM_PRIMARY_SD_PSU_SD_1_SELECT=y
- add new flash partition for bootscr and sizing
  - CONFIG_SUBSYSTEM_FLASH_PSU_QSPI_0_BANKLESS_PART0_SIZE=0xA00000
  - CONFIG_SUBSYSTEM_FLASH_PSU_QSPI_0_BANKLESS_PART1_SIZE=0x2000000
  - CONFIG_SUBSYSTEM_FLASH_PSU_QSPI_0_BANKLESS_PART2_SIZE=0x40000
  - CONFIG_SUBSYSTEM_FLASH_PSU_QSPI_0_BANKLESS_PART3_NAME="bootscr"
  - CONFIG_SUBSYSTEM_FLASH_PSU_QSPI_0_BANKLESS_PART3_SIZE=0x80000
- Identification
  - CONFIG_SUBSYSTEM_HOSTNAME="Trenz"
  - CONFIG_SUBSYSTEM_PRODUCT="AM0010"

## 9.2 U-Boot

Start with **petalinux-config -c u-boot**

Changes:

- MAC from eeprom together with uboot and device tree settings:
  - CONFIG_ENV_OVERWRITE=y
  - CONFIG_ZYNQ_MAC_IN_EEPROM is not set
  - CONFIG_NET_RANDOM_ETHADDR is not set
- Boot Modes:
  - CONFIG_QSPI_BOOT=y
  - CONFIG_SD_BOOT=y
  - CONFIG_ENV_IS_IN_FAT is not set
  - CONFIG_ENV_IS_IN_NAND is not set
  - CONFIG_ENV_IS_IN_SPI_FLASH is not set
  - CONFIG_SYS_REDUNDAND_ENVIRONMENT is not set
  - CONFIG_BOOT_SCRIPT_OFFSET=0x2A40000
- Identification
  - CONFIG_IDENT_STRING=" AM0010"

Change platform-top.h:

17 https://wiki.trenz-electronic.de/display/PD/PetaLinux+KICKstart

## 9.3 Device Tree

```
/include/ "system-conf.dtsi"


/*------------------ SD --------------------*/
// eMMC
// &sdhci0 {
//     // disable-wp;
//     no-1-8-v;
// };

// SD card
&sdhci1 {
    disable-wp;
    no-1-8-v;
};


/*-------------------- USB 2.0 only ----------------*/
&dwc3_0 {
    status = "okay";
    dr_mode = "host";
    maximum-speed = "high-speed";
    /delete-property/phy-names;
    /delete-property/phys;
    /delete-property/snps,usb3_lpm_capable;
    snps,dis_u3_susphy_quirk;
    snps,dis_u2_susphy_quirk;
};

&usb0 {
    status = "okay";
    /delete-property/ clocks;
    /delete-property/ clock-names;
    clocks = <0x3 0x20>;
    clock-names = "bus_clk";
};


/*------------------ ETH PHY --------------------*/
 &gem3 {
    /delete-property/ local-mac-address;
    phy-handle = <&phy0>;

    nvmem-cells = <&eth0_addr>;
    nvmem-cell-names = "mac-address";

    phy0: phy@0x3 {
        device_type = "ethernet-phy";
        reg = <0x3>;
    };
};
```

```
/*------------------ QSPI -------------------- */
&qspi {
    #address-cells = <1>;
    #size-cells = <0>;
    status = "okay";
    flash0: flash@0 {
        compatible = "jedec,spi-nor";
        reg = <0x0>;
        #address-cells = <1>;
        #size-cells = <1>;
    };
};


/*------------------ I2C --------------------- */
&i2c0 {

    // needs a special wakeup sequence, i2c-detect and similar will not work
    // https://github.com/Infineon/optiga-trust-m/
    // optiga: optiga@30 {
    //     compatible = "";
    //     reg = <0x30>;
    // };

    eeprom: eeprom@53 {
        compatible = "microchip,24aa025", "atmel,24c02";
        reg = <0x53>;

        #address-cells = <1>;
        #size-cells = <1>;
        eth0_addr: eth-mac-addr@FA {
          reg = <0xFA 0x06>;
        };
    };

    // needs a special wakeup sequence, i2c-detect and similar will not work
    // crypto: crypto@60 {
    //     compatible = "atmel,atecc508a", "atmel,atecc608a";
    //     reg = <0x60>;
    // };
};

//&i2c1 {
//  extern: extern@<> {
//     compatible = "";
//     reg = <>;
//  };
//};
```

## 9.4 Kernel

Start with **petalinux-config -c kernel**

Changes:

- Only needed to fix JTAG Debug issue:
  - # CONFIG_CPU_FREQ is not set

## 9.5 Rootfs

Start with **petalinux-config -c rootfs**

Changes:

- For web server app:
  - CONFIG_busybox-httpd=y
- For additional test tools only:
  - CONFIG_i2c-tools=y
  - CONFIG_packagegroup-petalinux-utils=y (util-linux,cpufrequtils,bridge-utils,mtd-utils,usbutils,pciutils,canutils,i2c-tools,smartmontools,e2fsprogs)
- For auto login:
  - CONFIG_auto-login=y
  - CONFIG_ADD_EXTRA_USERS="root:root;petalinux:;"

## 9.6 FSBL patch (alternative for vitis fsbl trenz patch)

See "<project folder>\os\petalinux\project-spec\meta-user\recipes-bsp\embeddedsw"

## 9.7 Applications

See "<project folder>\os\petalinux\project-spec\meta-user\recipes-apps\"

### 9.7.1 startup

Script App to load init.sh from SD Card if available.

### 9.7.2 webfwu

Webserver application suitable for ZynqMP access. Need busybox-httpd

# 10 Additional Software

No additional software is needed.

# 11 App. A: Change History and Legal Notices

## 11.1 Document Change History

To get content of older revision go to "Change History" of this page and select older document revision number.

| Date | Document Revision | Authors | Description |
|---|---|---|---|
| 2023-08-25 | v.11 (see page 6) | Manuela Strücker[18] | • Update Vivado 2022.2<br>• new assembly variants |
| 2021-11-19 | v.10 | John Hartfiel | • initial release |
| -- | all | Mohsen Chamanbaz[19] , John Hartfiel[20] , Manuela Strücker[21] | -- |

**Table 11: Document change history.**

## 11.2 Legal Notices

## 11.3 Data Privacy

Please also note our data protection declaration at https://www.trenz-electronic.de/en/Data-protection-Privacy

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18 https://wiki.trenz-electronic.de/display/~m.struecker
19 https://wiki.trenz-electronic.de/display/~M.Chamanbaz
20 https://wiki.trenz-electronic.de/display/~j.hartfiel
21 https://wiki.trenz-electronic.de/display/~m.struecker

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**RoHS**

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**WEEE**

22 http://guidance.echa.europa.eu/
23 https://echa.europa.eu/candidate-list-table
24 http://www.echa.europa.eu/

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