



|                                         |     |                     |
|-----------------------------------------|-----|---------------------|
| Trenz<br><board_series>_board_files.csv | 1.4 |                     |
| Trenz apps_list.csv                     | 2.6 |                     |
| Trenz zip_ignore_list.csv               | 1.0 |                     |
| Trenz mod_bd.csv                        | 1.1 | internal usage only |
| Trenz prod_cfg_list.csv                 | 1.0 | internal usage only |
| Trenz zip.info                          | 1.0 |                     |

## Currently limitations of functionality

- Important Note: QSPI Programming, see [AR#00002 - QSPI Programming issues](#)
- Linux OS only: Vivado project generation fails:
  - Reason: Vivado need "en\_US.UTF-8"
  - Workaround: Check language in ":\$ locale" and change language in "/etc/default/locale"
- Linux OS only: HLS generated IPs creates : [IP\_Flow 19-4318 IP] ACT warning
  - Reason: Missing Libs
  - Workaround: Install Libraries like GCC, clib6-dev....
- Linux OS only: Vitis software generation failed.
  - Reason: start "gmake" failed, alias is not set on Ubuntu
  - Workaround: "sudo ln -s /usr/bin/make /usr/bin/gmake" to generate alias or use SDK GUI to generate applications and boot files.
- Linux OS only: Function, which used external programs.
  - Reason: Currently only set correctly for Win OS.
  - Workaround: Change TCL scripts program path manually.
- Linux OS (Ubuntu 18.04 ) only: Project generation fails, in case language is not English
  - Workaround: Set LC\_NUMERIC=en\_US.UTF-8 for bash
- WSL Ubuntu 22.04 xterm
  - install missing fonts with:
    - sudo apt-get install -y x11-xserver-utils
    - sudo apt-get install -y xfonts-base

## Directory structure

| File or Directory                              | Type           | Description                                                                                                                                                                            |
|------------------------------------------------|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <project folder>                               | base directory | Base directory with predefined batch files (*.cmd) to generate or open VIVADO-Project                                                                                                  |
| <project folder>/block_design/                 | source         | Script to generate Block Design in Vivado (*_bd.tcl). (optional)<br>Some board part designs used subfolder<br><board_file_shortname> with Board Part specific Block Design (*_bd.tcl). |
| <project folder>/board_files/                  | source         | Local board part files repository and a list of available board part files<br>(<board_series>_board_files.csv)                                                                         |
| <project folder>/board_files/carrier_extension | source         | (Optional) Additional TCL-Scripts to extend Board Part PS-Preset with carrier board specific settings.                                                                                 |

|                                             |          |                                                                                                                                                                                                                                                                  |
|---------------------------------------------|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <project folder>/console                    | source   | folder with different console command files. Use <code>_create_win_setup.cmd</code> or <code>_create_linux_setup.sh</code> to generate files on top folder.                                                                                                      |
| <project folder>/constraints/               | source   | Project constrains (*.xdc). Some board part designs used subfolder <code>&lt;board_file_shortname&gt;</code> with additional constrains (*.xdc)                                                                                                                  |
| <project folder>/doc/                       | source   | Documentation                                                                                                                                                                                                                                                    |
| <project folder>/hdl/                       | source   | HDL-File and XCI-Files. Advanced usage only!                                                                                                                                                                                                                     |
| <project folder>/firmware/                  | source   | ELF-File Location for MicroBlaze Firmware. Additional sub folder is used for MicroBlaze identification.                                                                                                                                                          |
| <project folder>/ip_lib/                    | source   | Local Vivado IP repository                                                                                                                                                                                                                                       |
| <project folder>/misc/                      | source   | (Optional) Directory with additional sources                                                                                                                                                                                                                     |
| <project folder>/prebuilt/                  | prebuilt | Contains a readme with location information of different assembly variants                                                                                                                                                                                       |
| <project folder>/prebuilt/<br>/boot_images/ | prebuilt | Directory with prebuilt boot images (*.bin) and configuration files (*.bif) for zynq and configured hardware files (*.bit and *.mcs) for micoblaze included in sub-folders: default or <code>&lt;board_file_shortname&gt;</code> / <code>&lt;app_name&gt;</code> |
| <project folder>/prebuilt/<br>/hardware/    | prebuilt | Directory with prebuilt hardware sources (*.bit, *.xsa, *.mcs) and reports included in subfolders: default or <code>&lt;board_file_shortname&gt;</code>                                                                                                          |
| <project folder>/prebuilt/<br>/software/    | prebuilt | (Optional) Directory with prebuilt software sources (*.elf) included in subfolders: default or <code>&lt;board_file_shortname&gt;</code> / <code>&lt;app_name&gt;</code>                                                                                         |
| <project folder>/prebuilt/os/               | prebuilt | (Optional) Directory with predefined OS images included in subfolders " <code>&lt;os_name&gt;</code> / <code>&lt;board_file_shortname&gt;</code> " or " <code>&lt;os_name&gt;</code> / <code>&lt;ddr size&gt;</code> "                                           |
| <project folder>/scripts/                   | source   | TCL scripts to build a project                                                                                                                                                                                                                                   |
| <project folder>/settings/                  | source   | (Optional) Additional design settings: <code>zip_ignore_list.csv</code> , vivado project settings, SDSOC settings                                                                                                                                                |
| <project folder>/software/                  | source   | (Optional) Directory with additional software                                                                                                                                                                                                                    |

|                                                 |                 |                                                                                                                                                                                                             |
|-------------------------------------------------|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <project folder>/os/                            | source          | (Optional) Directory with additional os sources in in subfolders "<os_name>"                                                                                                                                |
| <project folder>/sw_lib/                        | source          | (Optional) Directory with local Vitis software IP repository and a list of available software (apps_list.csv)                                                                                               |
| <project folder>/v_log/                         | generated       | (Temporary) Directory with vivado log files (used only when Vivado is started with predefined command files (*.cmd) from base folder otherwise this logs will be written into the vivado working directory) |
| <project folder>/vivado/                        | work, generated | (Temporary) Working directory where Vivado project is created. Vivado project file is <project folder>.xpr                                                                                                  |
| <project folder>/vivado_lab/                    | work, generated | (Optional/Temporary) Working directory where Vivado LabTools is created. LabTools project file is <project folder>.lpr                                                                                      |
| <del>&lt;project folder&gt;/workspace/hsi</del> | obsolete        | (Optional/Temporary) Directory where hsi project is created                                                                                                                                                 |
| <project folder>/workspace/sdk                  | work, generated | (Optional) Directory where Vitis project is created                                                                                                                                                         |
| <project folder>/tmp/                           | work, generated | (Optional) Directory for some tasks                                                                                                                                                                         |
| <project folder><br>/_binaries_<articlenumber>  | generated       | export directory for binaries (run "_create_win_setup.cmd" and follow instructions)                                                                                                                         |
| <del>&lt;project folder&gt;/.../SDSoC_PFM</del> | obsolete        | (Optional) Directory where SDSOC project is created                                                                                                                                                         |
| <project folder>/backup/                        | generated       | (Optional) Directory for project backups                                                                                                                                                                    |

## Command Files

Command files will be generated with "\_create\_win\_setup.cmd" on Windows and "\_create\_linux\_setup.sh" on Linux OS. Linux shell files are currently not available for this release.

## Windows Command Files

| File Name         | Status | Description |
|-------------------|--------|-------------|
| Design + Settings |        |             |

|                           |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|---------------------------|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| _create_win_setup.cmd     | available | Use to create bash files. With 2018.3 and newer also "Module Selection Guide" is included and with 2023.2 prebuilt export for the selected variant                                                                                                                                                                                                                                                                                                                                                                                                                          |
| _use_virtual_drive.cmd    | available | (Option) Create virtual drive for project execution. See Xilinx <a href="#">AR #52787</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| design_basic_settings.cmd | available | <p>Settings for the other *.cmd files. Following Settings are available:</p> <ul style="list-style-type: none"> <li>• General Settings: <ul style="list-style-type: none"> <li>◦ (optional) <b>DO_NOT_CLOSE_SHELL</b>: Shell do not closed after processing</li> <li>◦ (optional) <b>ZIP_PATH</b>: Set Path to installed Zip-Program. Currently 7-Zip are supported. Used for predefined TCL-function to Backup project.</li> <li>◦ (optional) <b>ENABLE_SDSOC</b>: Enable SDSOC Setting. Currently only for some reference project as beta version!</li> </ul> </li> </ul> |

- Xilinx Setting:
  - **XILDIR:** Set Xilinx installation path (Default: c:\Xilinx).
  - **VIVADO\_VERSION:** Current Vivado /LabTool/SDK Version (Example: 2023.2). Don't change Vivado Version.
    - Xilinx Software will be searched in:
    - VIVADO (optional for project creation and programming): %XILDIR%\Vivado\%VIVADO\_VERSION%\
    - Vitis (optional for software projects and programming): %XILDIR%\Vitis\%VIVADO\_VERSION%\
    - LabTools (optional for programming only): %XILDIR%\Vivado\_Lab\%VIVADO\_VERSION%\
  - **USE\_XILINX\_BOARD\_STORE:** use Xilinx GIT for board files instead of local version

- Board Setting:
    - **PARTNUMBER**: Set Board part number of the project which should be created
      - Available Numbers: (you can use ID, PRODID, BOARDNAME or SHORTNAME from TExxxx\_board\_file.csv list)
      - Used for project creation and programming
      - To create empty project without board part, used PARTNUMBER=-1 (use GUI to create your project. No block design tcl-file should be in /block\_design)
      - Example TE0726 Module :
      - USE ID           |USE PRODID
- PARTNUMBER=1  
|PARTNUMBER=te0726-01

|                                 |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|---------------------------------|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                 |           | <ul style="list-style-type: none"> <li>Programming Settings (program*file.cmd): <ul style="list-style-type: none"> <li><b>SWAPP:</b> Select Software App, which should be configured. <ul style="list-style-type: none"> <li>Use the folder name of the "<code>&lt;project folder&gt;/prebuilt/boot_image/&lt;partname&gt;/*.bin, *.mcs or *.bit</code>" from this folder will be used.</li> <li>If you will configure the raw *.bit or *.mcs *.bin from the "<code>&lt;project folder&gt;/prebuilt/hardware/&lt;partname&gt;/"</code> folder, use <code>@set SWAPP=NA</code> or <code>@set SWAPP=""</code>.</li> <li>Example:<br/> SWAPP=hello_world<br/> used the file from "<code>&lt;project folder&gt;/prebuilt/boot_image/&lt;partname&gt;/hello_world</code>"<br/> SWAPP=NA<br/> used the file from "<code>&lt;project folder&gt;/prebuilt/boot_image/&lt;partname&gt;/"</code>"</li> </ul> </li> <li><b>PROGRAM_ROOT_FOLDER_FILE:</b><br/> If you want to program design file from the rootfolder "<code>&lt;project folder&gt;</code>", set to 1 <ul style="list-style-type: none"> <li>Attention: it should be only one *.bit, *.mcs or *.bin file in the root folder.</li> </ul> </li> </ul> </li> </ul> |
| design_clear_design_folders.cmd | available | (optional) Attention: Delete " <code>&lt;project folder&gt;/v_log/</code> ", " <code>&lt;project folder&gt;/vivado/</code> ", " <code>&lt;project folder&gt;/vivado_lab/</code> ", " <code>&lt;project folder&gt;/sdsoc/</code> ", and " <code>&lt;project folder&gt;/workspace/</code> " directory with related documents! Type "Y" into the command line input to start deleting files                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

|                                           |           |                                                                                                                                                                                                                                                                                                                                                                                                         |
|-------------------------------------------|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| design_run_project_batchmode.cmd          | available | <p>(optional) Create Project with setting from "design_basic_settings.cmd" and source folders. Build all Vivado hardware and software files if the sources are available.</p> <p>Delete "&lt;project folder&gt;/vivado /", and "&lt;project folder&gt;/workspace/sdk/" directory with related documents before Project will created.</p>                                                                |
| <b>Hardware Design</b>                    |           |                                                                                                                                                                                                                                                                                                                                                                                                         |
| vivado_create_project_gui mode.cmd        | available | <p>Create Project with setting from "design_basic_settings.cmd" and source folders. Vivado GUI will be opened during the process.</p> <p>Delete "&lt;project folder&gt;/vivado /", and "&lt;project folder&gt;/workspace/" directory with related documents before Project will created.</p> <p>If old vivado project exists, type "y" into the command line input to start project creation again.</p> |
| vivado_create_project_batchmode.cmd       | available | <p>(optional) Create Project with setting from "design_basic_settings.cmd" and source folders.</p> <p>Delete "&lt;project folder&gt;/vivado /", and "&lt;project folder&gt;/workspace/" directory with related documents before Project will created.</p> <p>If old vivado project exists, type "y" into the command line input to start project creation again.</p>                                    |
| vivado_open_existing_project_gui mode.cmd | available | <p>Opens an existing Project "&lt;project folder&gt;/vivado /&lt;design_name&gt;.xpr" and restore Script-Variables.</p>                                                                                                                                                                                                                                                                                 |
| <b>Software Design</b>                    |           |                                                                                                                                                                                                                                                                                                                                                                                                         |
| sdk_create_prebuilt_project_gui mode.cmd  | available | <p>(optional) Create Vitis project with hardware definition file from prebuild folder. It used the *.xsa from: "&lt;project folder&gt;/prebuilt/hardware /&lt;board_file_shortname&gt;.". Set "&lt;board_file_shortname&gt;" and "&lt;app_name&gt;" in "design_basic_settings.cmd".</p>                                                                                                                 |
| <b>Programming</b>                        |           |                                                                                                                                                                                                                                                                                                                                                                                                         |

|                                    |           |                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|------------------------------------|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| program_flash.cmd                  | available | (optional) Programming Flash Memory via JTAG with specified *.bin (Zynq devices) or *.mcs (native FPGA). Used LabTools Programmer (Vivado or LabTools only). Default, it used the boot.bin from: "<project folder>/prebuilt/boot_images/<board_file_shortname>/<app_name>". Settings are done in "design_basic_settings.cmd".                                                                                                    |
| program_flash_binfile.cmd          | obsolete  | <del>(optional) For Zynq Systems only. Programming Flash Memory via JTAG with specified Boot.bin. Used SDK Programmer (Same as SDK "Program Flash") or LabTools Programmer (Vivado or LabTools only), depends on installation settings. Default, it used the boot.bin from: "&lt;project folder&gt;/prebuilt/boot_images/&lt;board_file_shortname&gt;/&lt;app_name&gt;". Settings are done in "design_basic_settings.cmd".</del> |
| program_flash_mcsfile.cmd          | obsolete  | <del>(optional) For Non Zynq Systems only. Programming Flash Memory via JTAG with specified "&lt;project folder&gt;.mcs". Used LabTools Programmer (Vivado or LabTools only), depends on installation settings. Default, it used the &lt;design_name&gt;.mcs from: "&lt;project folder&gt;/prebuilt/hardware/&lt;board_file_shortname&gt;". Settings are done in "design_basic_settings.cmd".</del>                              |
| program_fpga_bitfile.cmd           | available | (optional) Programming FPGA via JTAG with specified "<design_name>.bit". Used LabTools Programmer (Vivado or LabTools only), depends on installation settings. Default, it used the "<design_name>.bit" from: "<project folder>/prebuilt/hardware/<board_file_shortname>". Settings are done in "design_basic_settings.cmd".                                                                                                     |
| labtools_open_project_gui.mode.cmd | available | (optional) Create or open an existing Vivado Lab Tools Project. (Additional TCL functions from Programming and Utilities Group are usable). Settings are done in "design_basic_settings.cmd".                                                                                                                                                                                                                                    |

| Intenal Development                               |                    |                                                             |
|---------------------------------------------------|--------------------|-------------------------------------------------------------|
| development_design_run_prebuilt_all_batchmode.cmd | internal available | (only Trenz Internal) Create files for all variants         |
| development_utilities_backup.cmd                  | internal available | (only Trenz Internal) Create ZIP file                       |
| development_xsct_console.cmd                      | internal available | (only Trenz Internal) Start XSCT Console on Vitis workspace |

## Linux Command Files

| File Name                | Status    | Description                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--------------------------|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Design + Settings        |           |                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| _create_linux_setup.sh   | available | Use to create bash files. With 2018.3 and newer also "Module Selection Guide" is included and with 2022.2 prebuilt export for the selected variant                                                                                                                                                                                                                                                                                         |
| design_basic_settings.sh | available | <p>Settings for the other *.cmd files. Following Settings are available:</p> <ul style="list-style-type: none"> <li>General Settings: <ul style="list-style-type: none"> <li>(optional) <b>DO_NOT_CLOSE_SHELL</b>: Shell do not closed after processing</li> <li>(optional) <b>ZIP_PATH</b>: Set Path to installed Zip-Program. Currently 7-Zip are supported. IUsed for predefined TCL-function to Backup project.</li> </ul> </li> </ul> |

- Xilinx Setting:
  - **XILDIR**: Set Xilinx installation path (Default: /opt/Xilinx/).
  - **VIVADO\_VERSION**: Current Vivado /LabTool/SDK Version (Example: 2023.2). Don't change Vivado Version.
    - Xilinx Software will be searched in:
    - VIVADO (optional for project creation and programming): %XILDIR%/Vivado /%VIVADO\_VERSION%/ and for SDSoc on %XILDIR%\SDx\%VIVADO\_VERSION%\Vivado\
    - Vitis (optional for software projects and programming): %XILDIR%\SDK\%VIVADO\_VERSION%/
    - LabTools (optional for programming only): %XILDIR%\Vivado\_Lab/%VIVADO\_VERSION%/
  - **USE\_XILINX\_PETALINUX**: Betaversion, use TE TCL commands to build linux from template and export binaries to the prebuilt folder
  - **ALTERNATIVE\_PETALINUX\_XSETTINGS**: alternative path for petalinux in case it's not installed with unified installer from xilinx

- Board Setting:
  - **PARTNUMBER**: Set Board part number of the project which should be created
    - Available Numbers: (you can use ID, PRODID, BOARDNAME or SHORTNAME from TExxxx\_board\_file.csv list)
    - Used for project creation and programming
    - To create empty project without board part, used PARTNUMBER=-1 (use GUI to create your project. No block design tcl-file should be in /block\_design)
    - Example TE0726 Module :
    - USE ID |USE PRODID PARTNUMBER=1 |PARTNUMBER=te0726-01
  - **USE\_XILINX\_BOARD\_STORE**: use Xilinx GIT for board files instead of local version

|                                |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--------------------------------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                |               | <ul style="list-style-type: none"> <li>Programming Settings (program*file.cmd): <ul style="list-style-type: none"> <li><b>SWAPP:</b> Select Software App, which should be configured. <ul style="list-style-type: none"> <li>Use the folder name of the "&lt;project folder&gt;/prebuilt/boot_image/&lt;partname&gt;/" subfolder. The *bin, *.mcs or *.bit from this folder will be used.</li> <li>If you will configure the raw *.bit or *.mcs *.bin from the "&lt;project folder&gt;/prebuilt/hardware/&lt;partname&gt;/" folder, use @set SWAPP=NA or @set SWAPP="".</li> <li>Example:<br/>SWAPP=hello_world used the file from prebuilt/boot_image/&lt;partname&gt;/hello_world<br/>SWAPP=NA used the file from &lt;project folder&gt;/prebuilt/boot_image/&lt;partname&gt;/</li> </ul> </li> <li><b>PROGRAM_ROOT_F OLDER_FILE:</b><br/>If you want to program design file from the rootfolder "&lt;project folder&gt;", set to 1 <ul style="list-style-type: none"> <li>Attention: it should be only one *.bit, *.msc or *.bin file in the root folder.</li> </ul> </li> </ul> </li> </ul> |
| design_clear_design_folders.sh | not available | (optional) Attention: Delete "<project folder>/v_log/", "<project folder>/vivado/", "<project folder>/vivado_lab/", "<project folder>/sdsoc/", and "<project folder>/workspace/" directory with related documents! Type "Y" into the command line input to start deleting files                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

|                                          |               |                                                                                                                                                                                                                                                                                                                                                                                                         |
|------------------------------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| design_run_project_bashmode.sh           | available     | <p>(optional) Create Project with setting from "design_basic_settings.cmd" and source folders. Build all Vivado hardware and software files if the sources are available.</p> <p>Delete "&lt;project folder&gt;/vivado /", and "&lt;project folder&gt;/workspace/sdk/" directory with related documents before Project will created.</p>                                                                |
| <b>Hardware Design</b>                   |               |                                                                                                                                                                                                                                                                                                                                                                                                         |
| vivado_create_project_guiemode.sh        | available     | <p>Create Project with setting from "design_basic_settings.cmd" and source folders. Vivado GUI will be opened during the process.</p> <p>Delete "&lt;project folder&gt;/vivado /", and "&lt;project folder&gt;/workspace/" directory with related documents before Project will created.</p> <p>If old vivado project exists, type "y" into the command line input to start project creation again.</p> |
| vivado_create_project_bashmode.sh        | not available | <p>(optional) Create Project with setting from "design_basic_settings.cmd" and source folders.</p> <p>Delete "&lt;project folder&gt;/vivado /", and "&lt;project folder&gt;/workspace/" directory with related documents before Project will created.</p> <p>If old vivado project exists, type "y" into the command line input to start project creation again.</p>                                    |
| vivado_open_existing_project_guiemode.sh | available     | <p>Opens an existing Project "&lt;project folder&gt;/vivado /&lt;design_name&gt;.xpr" and restore Script-Variables.</p>                                                                                                                                                                                                                                                                                 |
| <b>Software Design</b>                   |               |                                                                                                                                                                                                                                                                                                                                                                                                         |
| sdk_create_prebuilt_project_guiemode.sh  | not available | <p>(optional) Create SDK project with hardware definition file from prebuild folder. It used the *.hdfxsa from: "&lt;project folder&gt;/prebuilt/hardware /&lt;board_file_shortname&gt;.". Set "&lt;board_file_shortname&gt;" and "&lt;app_name&gt;" in "design_basic_settings.cmd".</p>                                                                                                                |
| <b>Programming</b>                       |               |                                                                                                                                                                                                                                                                                                                                                                                                         |

|                                                  |                    |                                                                                                                                                                                                                                                                                                                             |
|--------------------------------------------------|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| program_flash.sh                                 | not available      | (optional) Programming Flash Memory via JTAG with specified *.bin (Zynq devices) or *.mcs (native FPGA). Used LabTools Programmer (Vivado or LabTools only. Default, it used the boot.bin from: "<project folder>/prebuilt/boot_images/<board_file_shortname>/<app_name>". Settings are done in "design_basic_settings.sh". |
| labtools_open_project_gui.mode.sh                | not available      | (optional) Create or open an existing Vivado Lab Tools Project. (Additional TCL functions from Programming and Utilities Group are usable). Settings are done in "design_basic_settings.cmd".                                                                                                                               |
| <b>Intenal Development</b>                       |                    |                                                                                                                                                                                                                                                                                                                             |
| development_design_run_prebuilt_all_batchmode.sh | internal available | (only Trenz Internal) Create files for all variants                                                                                                                                                                                                                                                                         |
| development_utilities_backup.sh                  | internal available | (only Trenz Internal) Create ZIP file                                                                                                                                                                                                                                                                                       |

## TE-TCL-Extentions

| Name                          | Options                                                                                                                             | Description (Default Configuration)                                                                                                                                                                                        |
|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| TE::help                      |                                                                                                                                     | Display currently available functions. Important: Use only displayed functions and no functions from sub-namespaces                                                                                                        |
| <b>Hardware Design</b>        |                                                                                                                                     |                                                                                                                                                                                                                            |
| TE::hw_blockdesign_create_bd  | [-bd_name] [-msys_local_mem] [-msys_ecc] [-msys_cache] [-msys_debug_module] [-msys_axi_periph] [-msys_axi_intc] [-msys_clk] [-help] | Create new Block-Design with initial Setting for PS, for predefined bd_names: fsysFabric Only, msysMicroblaze, zsys7Series Zynq, zusysUltraScale+ Zynq<br><br>Type TE::hw_blockdesign_create_bd -help for more information |
| TE::hw_blockdesign_export_tcl | [-no_mig_contents] [-no_validate] [-mod_tcl] [-svntxt <arg>] [-board_part_only] [-help]                                             | Export Block Design to project folder "<project folder>/block_design/" . Old *bd.tcl will be overwritten!                                                                                                                  |

|                           |                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| TE::hw_build_design       | \[-disable_synth\] \[-disable_bitgen\] \[-disable_hdf\] \[-disable_mcsген\] \[-disable_reports\] \[-export_prebuilt\] \[-export_prebuilt_only\] \[-help\] | Run synthesis, Implement, and generate Bit-file, optional MCS-file and some report files                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Software Design</b>    |                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <del>TE::sw_run_hsi</del> | [-run_only] [-prebuilt_hdf <arg>] [-no_hsi] [-no_bif] [-no_bin] [-no_bitmcs] [-clear] [-help]                                                             | <p><b>obsolete</b></p> <p>Copies current Hardware files and reports from the vivado project to the prebuilt folder, if -prebuilt_hdf &lt;arg&gt; isn't set. Copy the Hardware Definition file to the working directory: "&lt;project folder&gt;/workspace/hsi" Run HSI in "&lt;project folder&gt;/workspace/hsi" for all Programs listed in "&lt;project folder&gt;/sw_lib/apps_list.csv" If HSI is finished, BIF-GEN and BIN-Gen are running for these Apps in the prebuilt folders "&lt;project folder&gt;/prebuilt/..." You can deactivate different steps with following args :</p> <ul style="list-style-type: none"> <li>• -no_hsi : *.elf files generation is disabled</li> <li>• -no_bif : *.bif files generation is disabled</li> <li>• -no_bin : *.bin files generation is disabled</li> <li>• -no_bitmcs: *.bit and *.mcs file (with software design) is disabled</li> </ul> |
| <del>TE::sw_run_sdk</del> | [-open_only] [-update_hdf_only] [-prebuilt_hdf <arg>] [-clear] [-help]                                                                                    | <p><b>obsolete</b></p> <p>Copies current Hardware files and reports from the vivado project to the prebuilt folder, if -prebuilt_hdf &lt;arg&gt; isn't set. Copy the Hardware Definition file to the working directory: "&lt;project folder&gt;/workspace/sdk" Start SDK GUI in this workspace</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

|                  |                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|------------------|-------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| TE::sw_run_vitis | <p>[-all] [-gui_only] [-no_gui] [-workspace_only] [-prebuilt_xsa_only] [-prebuilt_xsa &lt;arg&gt;] [-clear] [-help]</p> | <p>Copies current Hardware files and reports from the vivado project to the prebuilt folder, if -prebuilt_xsa &lt;arg&gt; or -prebuilt_xsa_only isn't selected.</p> <p>Copy the XSA File to the working directory: "&lt;project folder&gt;/workspace/sdk"</p> <p>Generates Vitis workspace with platform project and start Vitis. Optional parameter</p> <ul style="list-style-type: none"> <li>• -all : generate all apps defined in apps_list.csv and export results into the prebuild folder</li> <li>• -gui_only : open only Vitis on the default workspace</li> <li>• -no_gui : Vitis will not opened after project generation</li> <li>• -workspace_only : copy XSA file only into the workspace</li> <li>• -prebuilt_xsa* : use prebuilt XSA</li> </ul> |
|------------------|-------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                              |                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| TE::sw_run_plx               | [-run] [-config] [-u-boot] [-kernel]<br>[-rootfs] [-bootscr_opt <arg1><br><arg2> <arg3> <arg4>] [-<br>devicetree <arg>] [-app <arg>]<br>[-disable_clear] [-clear] [-help] | <b>Attention: Beta usage only<br/>for Linux OS</b> <ul style="list-style-type: none"> <li>-run: generated whole project from OS folder and export linux binaries to prebuilt</li> <li>-config: run petalinux-config</li> <li>-u-boot: run petalinux-config -c u-boot</li> <li>-kernel: run petalinux-config -c kernel</li> <li>-rootfs: run petalinux-config -c rootfs</li> <li>-bootscr_opt: change bootscr option(default will be run if not defined).<br/>arg1=def,ign,mod, if arg1=mod add also<br/>arg2=imageub_addr<br/>arg3=imageub_flash_addr<br/>arg4=imageub_flash_size</li> <li>-devicetree &lt;arg&gt;: open device tree with<br/>gvim unse &lt;arg&gt;=system for linux and &lt;arg&gt;=u-boot for u-boot device tree</li> <li>-app &lt;arg&gt;: run petalinux-create -t apps -n &lt;arg&gt; -- enable Note this generates only simple hello world project which must be modified manually</li> <li>-disable_clear: disable automatically project clearing after run</li> <li>-clear: run project clearing</li> </ul> |
| <b>Programming</b>           |                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| TE::pr_init_hardware_manager | [-help]                                                                                                                                                                   | Open Hardware manager, autoconnect target device and initialise flash memory with configuration from *_board_files.csv.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| TE::pr_program_jtag_bitfile  | [-used_board <arg>] [-swapp<br><arg>] [-available_apps] [-<br>used_basefolder_bitfile] [-help]                                                                            | If "-used_basefolder_bitfile" is set, the Bitfile (*.bit) from the base folder ("<project folder>") is used instead of the prebuilds. Attention: Take only one Bitfile in the basefolder!<br><br>(MicroBlaze only) If "-swapp" is set, the Bitfile with *.elf configuration is used from<br>"<project_folder>/prebuilt<br>/boot_images<br>/<board_file_shortcode><br>/<app_name>"                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

|                              |                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| TE::pr_program_flash         | [-swapp <arg>] [-swapp_av] [-reboot] [-erase] [-setup] [-used_board] [-basefolder] [-def_fsbl] [-help]                                    | <p>Program flash with the given swapp from the prebuilt folder ("<del>&lt;project folder&gt;/prebuilt</del> /boot_images /&lt;board_file_shortname&gt; /&lt;app_name&gt;").</p> <p>Available app can be checked with -swapp_av, specify app with -swapp &lt;app_name&gt;</p> <p>Erase flash only with -erase</p>                                                                                                                                                                                                                                                                                                                                                                                            |
| TE::pr_putty                 | [-available_com] [-com] [-speed] [-help]                                                                                                  | <p>Show available COM ports and open automatically the UART COM port, in case only one is selectable</p> <p>Important:</p> <ul style="list-style-type: none"> <li>• Need putty installed in global path enviroments</li> <li>• Linux currently not supported</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| TE::pr_program_flash_binfile | <del>{no_reboot} {used_board &lt;arg&gt;} {swapp &lt;arg&gt;} {available_apps} {force_hw_manager} {used_basefolder_binfile} [-help]</del> | <p><del>Attention: For Zynq Systems only!</del></p> <p><del>Program the Bootbin from "<del>&lt;project folder&gt;/prebuilt</del> /boot_images /&lt;board_file_shortname&gt; /&lt;app_name&gt;" to the fpga device.</del></p> <p><del>Appname is selected with: swapp &lt;app_name&gt;</del></p> <p><del>After programming device reboot from memory will be done.</del></p> <p><del>Default SDK Programmer is used, if not available LabTools-Programmer is used.</del></p> <p><del>If "used_basefolder_binfile" is set, the Binfile (*.bin) rom the base folder (&lt;project folder&gt;) is used instead of the prebuilts.</del></p> <p><del>Attention: Take only one Binfile in the basefolder!</del></p> |

|                                  |                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|----------------------------------|------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| TE::pr_program_flash_mcsfile     | [-no_reboot] [-used_board <arg>] [-swapp <arg>] [-available_apps] [-used_basefolder_mcsfile] [-help] | <p>Copies current Hardware files and reports from the vivado project to the prebuilt folder, if used_board &lt;arg&gt; isn't set (Vivado only).<br/>Initialise flash memory with configuration from *_board_files.esv<br/>Programming MCSfile from "<br/>" &lt;project folder&gt; /prebuilt /hardware<br/>/ &lt;board_file_shortcode&gt; " to the Flash Device.<br/>After programming device reboot from memory will be done.<br/>If "used_basefolder_binfile" is set, the MCSfile (*.mcs) from the base folder (&lt;project folder&gt;) is used instead of the prebuilds. Attention: Take only one MCSfile in the basefolder!<br/><br/>(MicroBlaze only) If "swapp" is set, the MCSfile with *.elf configuration is used from "<br/>" &lt;project folder&gt; /prebuilt /boot_images<br/>/ &lt;board_file_shortcode&gt; / &lt;app_name&gt; "</p> |
| Utilities                        |                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| TE::util_zip_project             | [-save_all] [-remove_prebuilt] [-manual_filename <arg>] [-help]                                      | <p>Make a Backup from your Project in "&lt;project folder&gt; /backup/"</p> <p>Zip-Program Variable must be set in start_settings.cmd.<br/>Currently only 7-Zip is supported.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| TE::util_editor                  | [-file <arg>] [-help]                                                                                | open file with editor which is set on "TE_EDITOR" Enviroment variable                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| TE::util_terminal                | [-help]                                                                                              | linux only. open new terminal                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| TE::util_package_length          | [-help]                                                                                              | Export Package IO length information to *.csv on the doc folder                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| TE::util_svn                     | [-status] [-update] [-add <arg>] [-remove <arg>] [-commit <arg>] [-commit\] [-help]                  | <p>start svn commands on the current project(project must be under SVN Version)</p> <p>On Win OS: Need Tortouise SVN with command line tools installation</p> <p>On Linux: Need subversion installed, for example <b>sudo apt-get install subversion -y</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Beta Test (Advanced usage only!) |                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

|                                        |                                                                                          |                                                                                                                                                                           |
|----------------------------------------|------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| TE::ADV::<br>beta_util_sdsoe_project   | <code>[-check_only] [-help]</code>                                                       | <del>Create SDSOC Workspace.<br/>Currently only on some<br/>Reference Designs available.<br/>Run <code>[-check_only]</code> option to<br/>check SDSOC ready state.</del>  |
| TE::ADV::<br>beta_hw_remove_board_part | <code>[-permanent] [-help]</code>                                                        | Reconfigure Vivado project as project without board part. Generate XDC-File from board part IO definitions and change ip board part properties. No all IPs are supported. |
| TE::ADV::beta_hw_export_rtl_ip         | <code>[-help]</code>                                                                     | Save IPs used on rtl designs as *.xci in "<project folder>hdl/xci". If sub folder "<board_file_shortname>" is defined this will be saved there.                           |
| TE::ADV::<br>beta_hw_create_board_part | <code>[-series &lt;arg&gt;] [-all] [-preset] [-existing_ps] [-help]</code>               | create PS or preset.xml PS settings from external tcl scripts                                                                                                             |
| TE::ADV::<br>beta_hw_export_binary     | <code>[-mode &lt;arg&gt;] [-app &lt;arg&gt;] [-folder &lt;arg&gt;] [-all] [-help]</code> | export prebuilt files to an given folder (based from project folder). Special folder is used, if empty                                                                    |

## Design Environment: Usage

### Reference-Design: Getting Started

- Install **Xilinx Vivado Design Suite** or **Xilinx Vivado Webpack** (free license for some FPGA only: see <http://www.xilinx.com/products/design-tools/vivado/vivado-webkit.html>) (optional) Install **Xilinx Vivado LabTools** (Lab Edition)
- Automatically configuration of the reference-designs (only with 2018.3 scripts and newer):
  - Run "`_create_win_setup.cmd`" or "`_create_linux_setup.sh`"
    - select "module selection guide" and follow instructions.
      - "`design_basic_settings.cmd`" will be configured over this menu
- (optional for 18.3 or newer) Manual Configure the reference-design (Note: batch/bash files works only in the basefolder of the project, use `_create_*_setup.cmd/sh` or copy manually):
  1. Open "`design_basic_settings.cmd`" with a text-editor:
    - a. Set correct Xilinx Environment:
 

```
@set XILDIR=C:/Xilinx
@set VIVADO_VERSION=2023.2
```

 Program settings will be search in :
 

```
%XILDIR%/VIVADO/%VIVADO_VERSION%/
%XILDIR%/Vivado_Lab/%VIVADO_VERSION%/
%XILDIR%/Vitis/%VIVADO_VERSION%/
```

 Example directory: `c:/Xilinx/Vivado/2023.2/`  
**Attention:** Scripts are supported only with predefined Vivado Version!
    - b. Set the correct module part-number:
 

```
@set PARTNUMBER=x
```

 You found the available Module Numbers in "<project folder>/board\_files  
/board\_series>\_board\_files.csv"
    - c. Set Application name (for programming with batch-files only):
 

```
@set SWAPP=NA
```

 NA (No Software Project) used \*.bit or \*.mcs from "<project folder>/prebuilt/hardware  
/board\_file\_shortname>"  
 <app\_name> (Software Project) used \*.bit or \*.mcs or \*.bin from "<project folder>/prebuilt  
/boot\_images/<board\_file\_shortname>/<app\_name>"

- Create all prebuilt files in one step:
  2. Run **"design\_run\_project\_batchmode.cmd"**
- (optional to Step 2) Create all prebuilt files in single steps:
  3. Run **"vivado\_create\_project\_gui mode.cmd"**:  
A Vivado Project will be create and open in ./vivado
  4. Type **"TE::hw\_build\_design"** on Vivado TCL-Console:  
Run synthesis, Implement and create Bitfile and optional MCSfile
  5. Type **"TE::sw\_run\_vitis -all -no\_gui"** on Vivado TCL-Console:  
Create all Software Applications from "<project folder>/sw\_lib/apps\_list.csv"
  6. (optional to Step 5) Type **"TE::sw\_run\_vitis"** on Vivado TCL-Console:  
Create a SDK Project in "<project folder>/workspace/sdk"  
Include Hardware-Definition-File, Bit-file and local Software-libraries from "<project folder>/sw\_lib/sw\_apps"
- Programming FPGA or Flash Memory with prebuilt Files:
  7. Connect your Hardware-Modul with PC via JTAG.  
With Batch-file:
  8. (optional) Zynq-Devices Flash Programming (\*.bin) or FPGA-Device Flash Programming (\*.mcs):  
Run **"program\_flash.cmd"**
  10. (optional) FPGA-Device Programming (\*.bit):  
Run **"program\_fpga\_bitfile.cmd"**  
With Vivado/Labtools TCL-Console:
  11. Run **"vivado\_open\_existing\_project\_gui mode.cmd"** or **"labtools\_open\_project\_gui mode.cmd"** to open Vivado or LabTools
  12. (optional) Zynq-Devices Flash Programming (\*.bin):  
Type **"TE::pr\_program\_flash -swap <app\_name>"** on Vivado TCL-Console  
Used **.bin(Zynq)/.mcs(native FPGA)** "<project folder>/prebuilt/boot\_images /<board\_file\_shortcode>/<app\_name>"
  13. (optional) FPGA-Device Programming (\*.bit):  
Type **"TE:: pr\_program\_jtag\_bitfile -swap <app\_name>"** on Vivado TCL-Console  
Used \*.bit from "<project folder>/prebuilt/boot\_images/<board\_file\_shortcode> /<app\_name>"

## Basic Design Settings

### Initialise TE-scripts on Vivado/LabTools

- Variant 1 (recommended):
  - Start the project with the predefined command file (**vivado\_open\_existing\_project\_gui mode.cmd**) respectively LabTools with (**labtools\_open\_project\_gui mode.cmd**)
- Variant 2:
  - Create your own Initialisation Button on the Vivado GUI:
    - Tools Customize Commands Customize Commands...
    - Push 
    - Type Name ex.: Init Scripts
    - Press Enter
    - Select Run command and insert:
      - for Vivado: cd [get\_property DIRECTORY [current\_project]]; source -notrace "../scripts/reinitialise\_all.tcl"
      - for LabTool: cd [pwd]; source -notrace "../scripts/reinitialise\_all.tcl"
    - Press Enter
    - A new Button is shown on the Vivado GUI: All Scripts are reinitialised, if you press this Button.
- Variant 3:
  - Reinitialise Script on Vivado TCL-Console:
    - Type: source ../scripts/reinitialise\_all.tcl

### Use predefined TE-Script functions

- Variant 1 (recommended):
  - Type function on Vivado TCL Console, ex.: TE::help
  - TE::help

- Show all predefined TE-Script functions.
  - TE:<function\_name> -help
    - Show short description of this function.
    - **Attention:** If -help argument is set, all other args will be ignored.
- Variant 2:
  - Create your own function Button on the Vivado GUI:
    - Tools Customize Commands Customize Commands...
    - Push +
    - Type Name ex.: Run SDK
    - Press Enter
    - Select Run command and insert function:
      - Variante 1 (no Vivado request window for args):
        - insert function and used args, ex.: TE::sw\_program\_zynq -swapp hello\_world
      - Variant 2 (Vivado request window for args):
        - insert function, ex.: TE::sw\_program\_zynq
        - Press Define Args...
        - For every arg:
          - Push +
          - Type Name, Comment, Default Value and set optional
          - Press Enter
          - Example for args:
            - Push +
            - Index, Key Name, -swapp, ✓
            - Push +
            - Appname, Arg, hello\_world, ✓
- Press Enter
- A new Button is shown on the Vivado GUI.

## Environment Variables

### Local

| Files                                                     | Note                                                      |
|-----------------------------------------------------------|-----------------------------------------------------------|
| <project folder>/ <b>design_basic_settings.cmd/sh</b>     | General local variables for project generation            |
| <project folder>/settings/ <b>design_settings.tcl</b>     | Design setting like Device Filter, UART Speed and Port    |
| <project folder>/settings/ <b>development_setting.tcl</b> | Development settings which can manipulate execution steps |

### Global

| Name            | Value   | Note                                                                           |
|-----------------|---------|--------------------------------------------------------------------------------|
| TE_SERIAL_PS    | <path>  | Internal usage only                                                            |
| TE_COM          | <path>  | path to putty, in case it's not installed global                               |
| TE_TIMEOUT      | <time>  | timeout for jobs, unit in minutes, def 120                                     |
| TE_RUNNING_JOBS | <count> | max jobs (depends on available CPUs) which can be started by Vivado, default 4 |

|                             |        |                                                                                                                                                                                                                                                       |
|-----------------------------|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| TE_WSL_USAGE                | 1/0    | 1 use Windows programs for some external processes                                                                                                                                                                                                    |
| TE_GUI_DISABLED             | 1/0    | <ul style="list-style-type: none"> <li>• default 0 GUI mode always enabled.</li> <li>• Set environment in case external scripts run processes</li> <li>• has effects on shell prints and other processes</li> <li>• Currently betaversion!</li> </ul> |
| TE_EDITOR                   | <name> | Text Editor which should be started for some TE functions                                                                                                                                                                                             |
| TE_PLX_SSTATE_CACHE_DOWLOAD | <path> | <p>Local version of SSTATE, file available on the download area from Xilinx petalinux, example:</p> <pre>TE_PLX_SSTATE_CACHE_DOWLOAD="--/design/sstate-cache/downloads_2023.2/downloads"</pre>                                                        |
| PLX_SSTATE_CACHE_AARCH64    | <path> | <p>Local version of SSTATE for U+ Zynq and Versal, file available on the download area from Xilinx petalinux, example:</p> <pre>TE_PLX_SSTATE_CACHE_DOWLOAD="--/design/sstate-cache/downloads_2023.2/downloads"</pre>                                 |
| PLX_SSTATE_CACHE_ARM        | <path> | <p>Local version of SSTATE for Zynq 7000, file available on the download area from Xilinx petalinux, example:</p> <pre>PLX_SSTATE_CACHE_ARM="--/design/sstate-cache/sstate_arm_2023.2/arm"</pre>                                                      |
| PLX_SSTATE_CACHE_MB_FULL    | <path> | <p>Local version of SSTATE for Microblaze, file available on the download area from Xilinx petalinux, example:</p> <pre>PLX_SSTATE_CACHE_ARM="--/design/sstate-cache/sstate_mb_full_2023.2/mb_full"</pre>                                             |
| PLX_SSTATE_CACHE_MB_LITE    | <path> | currently not supported                                                                                                                                                                                                                               |

## Hardware Design

### Board Part Files

More details see [TE Board Part Files](#)

## Structure Board Parts

Board Parts are located on subfolder "board\_files", with the name of the special board. Revisions are split in the subfolder of the board part <boardpart\_name><version>

Every Version of a Board Parts consists of four files:

- board.xml
- part0\_pins.xml
- preset.xml
- picture.jpg or picture.png

## Board Part or Design Extension

Board Part Extensions are TCL-Scripts, which can be sourced in Vivado Block Design. They are usable with TE-Scripts only. It contains additional settings of PS-settings or special carrier-board design changes.

Use Reference Designs or Vivado TCL-Console (TE-Script extensions, see [Initialise TE-scripts on Vivado /LabTools](#)): **TE::hw\_blockdesign\_create\_bd -help** to create PS with full settings. Or source the TCL file manually direct after "Run Block Automation"

Possible:

- Board Part PS settings are located on subfolder "board\_files/preset\_extension/" with file name \*\_preset.tcl.
- Design modifications are located on subfolder "board\_files/bd\_mod/" with file name \*\_bd.tcl.

## Board Part CSV Description

Board Part csv file is used for TE-Scripts only.

| Name          | Description                                                                                    | Value                                                                                                                                                                       |
|---------------|------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ID            | ID to identify the board variant of the module series, used in TE-Scripts                      | Number, should be unique in csv list                                                                                                                                        |
| PRODID        | Product ID                                                                                     | Product Name                                                                                                                                                                |
| PARTNAME      | FPGA Part Name, used in Vivado and TE-Scripts                                                  | Part Name, which is available in Vivado, ex. xc7z045ffg900-2                                                                                                                |
| BOARDNAME     | Board Part Name, used in Vivado and TE-Scripts                                                 | set Board Part Name or "NA", which is available in Vivado, NA is not defined to run without board part and board part ex. <a href="#">tre nz.biz:te0782-02-45:part0:1.0</a> |
| SHORTNAME     | Subdirectory name, used for multi board projects to get correct sources and save prebuilt data | name to save prebuilt files or search for sources                                                                                                                           |
| ZYNQFLASHSTYP | Flash type used for programming Zynq-Devices via SDK-Programming Tools (program_flash)         | "qspi_single" or "NA", NA is not defined                                                                                                                                    |
| FPGAFLASHSTYP | Flash type used for programming Devices via Vivado/LabTools                                    | "<Flash Name from Vivado> <SPI Interface> <Flash Size in MB>" or "NA", NA is not defined, ex. s25fl256s-3.3v-qspi-x4-single SPIx4 32                                        |

|                  |                                                                                                                                                                                                                                                                                  |                                                                                                                                                   |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
|                  |                                                                                                                                                                                                                                                                                  | Flash Name is used for programming, SPI Interface and Size in MB is used for *.mcs build.<br><br>For Zynq and ZynqMO only Flash name is necessary |
| PCB_REV          | Supported PCB Revision                                                                                                                                                                                                                                                           | "<supported PCB Revision> <supported PCB Revision>", for ex. "REV02" or "REV03 REV02"                                                             |
| DDR_SIZE         | Size of Module DDR                                                                                                                                                                                                                                                               | use GB or MB, for ex. "2GB" or "512MB" or "NA" if not available                                                                                   |
| FLASH_SIZE       | Size of Module Flash                                                                                                                                                                                                                                                             | use MB, for ex. "64MB" or "NA" if not available                                                                                                   |
| EMMC_SIZE        | Size of Module EMMC                                                                                                                                                                                                                                                              | use GB or MB, for ex. "4GB" or "NA" if not available                                                                                              |
| OTHERS           | Other module relevant changes to distinguish assembly variants                                                                                                                                                                                                                   |                                                                                                                                                   |
| NOTES            | Additional Notes                                                                                                                                                                                                                                                                 |                                                                                                                                                   |
| DESIGN           | Specify the allowed variants for different designs.                                                                                                                                                                                                                              | see also <design folder>\settings\design_settings.tcl                                                                                             |
| CONFIG_SW_EXTPLL | Optional parameter to support different PLL Versions which can be programmed<br><br>Replace all files with the same file name on sw_lib folder with the specified one<br>Will be copied once on project generation with "_create_*_setup.*" from misc folder to fsbl source code | relativ path to the source file, for example ".\misc\PLL\SI5345_D\te_Si5345-Registers.h"                                                          |

## Block Design Conventions

- Only one Block-Design per project is supported
- Recommended BD-Names (currently importend for some TE-Scripts):

| Name  | Description                                                                                                   |
|-------|---------------------------------------------------------------------------------------------------------------|
| zsys  | Identify project as Zynq Project with processor system (longer name with *zsys* are supported too)            |
| zusys | Identify project as UltraScaleZynq Project with processor system (longer name with *zusys* are supported too) |
| msys  | Identify project as Microblaze Project with processor system (longer name with *msys* are supported too)      |
| fsys  | Identify project as FPGA-fabric Project without processor system (longer name with *fsys* are supported too)  |

- Create Basic Block Design with PS Board-Part Preset and Carrier-Board extended settings (only if subfolder carrier\_extension with tcl files is available), use **TE::hw\_blockdesign\_create\_bd -help**

## XDC Conventions

- All \*.xdc from <project folder>/constrains/ are load into the vivado project on project creation.  
**Attention:** If subfolder <project folder>/constrains/<board\_file\_shortname> is defined, it will be used the subfolder constrains only for this module!
- Recommended XDC-Names (used for Vivado XDC-options):

| Property             | Name part | Description                           |
|----------------------|-----------|---------------------------------------|
| Set Processing Order | *_e_*     | set to early                          |
|                      | *_l_*     | set to late                           |
|                      |           | set to normal                         |
| Set Used In          | *_s_*     | used in synthesis only                |
|                      | *_i_*     | used in implement only                |
|                      |           | used in both, synthesis and implement |

## Backup Block Design as TCL-File

- Backup your Block-Design with TCL-Command "**TE::hw\_blockdesign\_export\_tcl**" in <project folder>/block\_design/  
It will be saved as \*\_bd.tcl  
**Attention:** If subfolder <project folder>/block\_design/<board\_file\_shortname> or <project folder>/block\_design/PCB Revision> is defined, it will be saved there!  
Only one \*.tcl file should be in the backup folder respectively the subfolder <board\_file\_shortname>

## Microblaze Firmware

- Microblaze Firmware (\*.elf) can be add to the source folder <project folder>/firmware  
</Microblaze IP Instance>.
- For MCS-Core use MCS IP Instance Name. This name must use \*mcs\* or \*syscontrol\* in the name.

## Software Design

### Vitis: Generate predefined software from libraries

- To generate predefined software from libraries, run "**TE::sw\_run\_vitis -all -no\_gui**" on Vivado TCL-Console
- All programs in in <project folder>/sw\_lib/apps\_list.csv are generated automaticity
- Supported are local application libraries from <project folder>/sw\_lib/sw\_apps or the most Xilinx SDK Applications found in %XILDIR%/SDK/%VIVADO\_VERSION%/data/embeddedsw/lib/sw\_app

## VITIS: Create user software project

- To start SDK project, run **"TE::sw\_run\_vitis"** on Vivado TCL-Console or run **"TE::sw\_run\_vitis - workspace\_only"** on Vivado TCL-Console  
Include Hardware-Definition-File (XSA), Bit-file and local Software-libraries from "**<project folder>/sw\_lib/sw\_apps**"
- To use Hardware-Definition-File, Bit-file from prebuilt folder without building the vivado hardware project, run **"sdk\_create\_prebuilt\_project\_gui mode.cmd"** or type **"TE::sw\_run\_vitis - prebuilt\_xsa <board\_number>"** on Vivado-TCL-Console
- To open an existing SDK-project without update HDF-Data, type **"TE::sw\_run\_vitis -gui\_only"** on Vivado-TCL-Console

## Advanced Usage

Attention not all features of the TE-Scripts are supported in the advanced usage!

### User defined board part csv file

To modify current board part csv list, make a copy of the original csv and rename with suffix "\_mod.csv", ex. TE0782\_board\_files.csv as TE0782\_board\_files\_mod.csv. Scripts used modified csv instead of the original file.

See [Chapter Board Part Files](#) for more information.

### User defined Settings

- Vivado settings:
  - Vivado Project settings (corresponding TCL-Commands) can be saved as a user defined file "**<project folder>/settings/project\_settings.tcl**". This file will be loaded automatically on project creation.
- Script settings:
  - Additional script settings (only some predefined variables) can be saved as a user defined file "**<project folder>/settings/development\_settings.tcl**". This file will be loaded automatically on script initialisation.
- Design settings:
  - Additional script settings (only some predefined variables) can be saved as a user defined file "**<project folder>/settings/design\_settings.tcl**". This file will be loaded automatically on script initialisation.
- ZIP ignore list:
  - Files which should not be added in the backup file can be defined in this file: "**<project folder>/settings/zip\_ignore\_list.tcl**". This file will be loaded automatically on script initialisation.
- SDSOC settings:
  - SDSOC settings will be deposited on the following folder: "**<project folder>/settings/sdsoc**"

### User defined TCL Script

TCL Files from "**<project folder>/settings/usr**" will be loaded automatically on script initialisation.

### SDSOC-Template

SDSOC description and files to generate SDSoc project are deposited on the following folder: "**<project folder>/settings/sdsoc**"

## HDL-Design

HDL files can be saved in the subfolder "<project folder>/hdl/" as single files or <project folder>/hdl/folder/ and all subfolders or "<project folder>/hdl/<shortname>" and all subfolders of "<project folder>/hdl/<shortname>". They will be loaded automatically on project creation. Available formats are \*.vhd, \*.v and \*.sv. A own top-file must be specified with the name "<project folder>\_top.v" or "<project folder>\_top.vhd".

To set file attributes, the file name must include "\_simonly\_" for simulation only and "\_synonly\_" for synthesis only.

IP-cores (\*.xci). can be saved in the subfolder "<project folder>/hdl/xci" or "<project folder>/hdl/xci/<shortname>". They will be loaded automatically on project creation.

IP -TCL description (\*\_preset.tcl). can be saved in the subfolder "<project folder>/hdl/tcl" or "<project folder>/hdl/tcl/<shortname>". They will be loaded automatically on project creation.

- \*\_preset.tcl must include
  - TCL part for IP creation: create\_ip -name ...
  - TCL part for IP configuration: set\_property -dict...
  - TCL part for IP target generation: generate\_target {instantiation\_template} .....

## Checklist / Troubleshoot

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1. Are you using exactly the same Vivado version? If not then the scripts will not work, no need to try.
2. Are you using Vivado in Windows PC? Vivado works in Linux also, but the scripts are tested on Windows only.
3. Is you PC OS Installation English? Vivado may work on national versions also, but there have been known problems.
4. Win OS only: Use short path name, OS allows only 256 characters in normal path.
5. Linux OS only: Use bash as shell and add access rights to bash files. Check with "ls /bin/sh". It should be display: /bin/sh -> bash. Access rights can be changed with "chmod"
6. Are space character on the project path? Sometimes TCL-Scripts can't handle this correctly. Remove spaces from project path.
7. Did you have the newest reference design build version? Maybe it's only a bug from a older version.
8. Check <project folder>/v\_log/vivado.log? If no logfile exist, wrong xilinx paths are set in [design\\_basic\\_settings.cmd](#)
9. On project creation process old files will be deleted. Sometimes the access will be denied by os (synchronisation problem) and the scripts cancelled. Please try again.
10. If nothing helps, send a mail to Trenz Electronic Support ([support\[at\]trenz-electronic.de](mailto:support[at]trenz-electronic.de)) with subject line "[TE-Reference Designs] ", the complete zip-name from your reference design and the last log file (<project folder>/v\_log/vivado.log)

## References

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1. Vivado Design Suite User Guide - Getting Started (UG910)
2. Vivado Design Suite User Guide - Using the Vivado IDE (UG893)
3. Vivado Design Suite User Guide - I/O and Clock Planning (UG899)
4. Vivado Design Suite User Guide - Programming and Debugging (UG908)
5. Zynq-7000 All Programmable SoC Software Developers Guide (UG821)
6. SDSoC Environment User Guide - Getting Started (UG1028)
7. SDSoC Environment - User Guide (UG1027)
8. SDSoC Environment User Guide - Platforms and Libraries (UG1146)

## Document Change History

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

| Date                                                                                                                                                        | Revision                                                                                                                                                    | Vivado Version | Authors                                                                                                                                                     | Description        |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
|                                                                                                                                                             |                                                                                                                                                             | 2022.2         |                                                                                                                                                             | working in process |
| Err<br>or<br>ren<br>der<br>ing<br>ma<br>cro<br>'pa<br>ge-<br>inf<br>o'                                                                                      | Err<br>or<br>ren<br>der<br>ing<br>ma<br>cro<br>'pa<br>ge-<br>inf<br>o'                                                                                      |                | Err<br>or<br>ren<br>der<br>ing<br>ma<br>cro<br>'pa<br>ge-<br>inf<br>o'                                                                                      |                    |
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| 2023-08-15                                                                                                                                                                        | v.176                                                                                                                                                                             | 2022.2 | John Hartfiel                                                                                                                                                                     | Last Vivado 2022.2 supported project delivery version |
| 2023-02-06                                                                                                                                                                        | v.171                                                                                                                                                                             | 2021.2 | John Hartfiel                                                                                                                                                                     | Last Vivado 2021.2 supported project delivery version |
| 2021-05-06                                                                                                                                                                        | v.162                                                                                                                                                                             | 2020.2 | Manuela Strücker                                                                                                                                                                  | Last Vivado 2020.2 supported project delivery version |
| 2020-11-26                                                                                                                                                                        | v.157                                                                                                                                                                             | 2019.2 | John Hartfiel                                                                                                                                                                     | Last Vivado 2019.2 supported project delivery version |
| 2019-12-18                                                                                                                                                                        | v.148                                                                                                                                                                             | 2018.2 | John Hartfiel                                                                                                                                                                     | Last Vivado 2018.3 supported project delivery version |
| ---                                                                                                                                                                               | ---                                                                                                                                                                               | 2018.2 | John Hartfiel                                                                                                                                                                     | Last Vivado 2018.2 supported project delivery version |

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|            |       |        |                                                                                                                                                                                                      | <ul style="list-style-type: none"><li>no document update was done</li></ul> |
| 2019-07-10 | v.142 | 2017.4 | John Hartfiel                                                                                                                                                                                        | Last Vivado 2017.4 supported project delivery version                       |
| 2017-11-03 | v.134 | 2017.2 | John Hartfiel                                                                                                                                                                                        | Last Vivado 2017.2 supported project delivery version                       |
| 2017-09-12 | v.131 | 2017.1 | John Hartfiel                                                                                                                                                                                        | Last Vivado 2017.1 supported project delivery version                       |
| 2017-04-12 | v.126 | 2016.4 | John Hartfiel                                                                                                                                                                                        | Last Vivado 2016.4 supported project delivery version                       |
| 2017-01-16 | v.114 | 2016.2 | John Hartfiel                                                                                                                                                                                        | Last Vivado 2016.2 supported project delivery version                       |
| 2016-06-21 | v.83  | 2015.4 | John Hartfiel                                                                                                                                                                                        | Last Vivado 2015.4 supported project delivery version                       |
| 2013-03-11 | v.1   | ---    | Antti Lukats                                                                                                                                                                                         | Initial release                                                             |
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