SB-PWM - Sandbox PWM

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The FPGA sandbox PWM block allows driving the PWM output from a user-made modulator from within the FPGA.

Information on FPGA edition is available on Editing the FPGA firmware (sandbox) (PN116)

Usage examples of the FPGA sandbox PWM block are available on:

- FPGA-based direct torque control using Vivado HLS (TN133)
- FPGA-based hysteresis current control (TN120)

Because the user-generated FPGA signals still go through the PWM output chain, it supports **dead time generation** and can be **activated or deactivated**. More information is available on the PWM page.

Simulink block

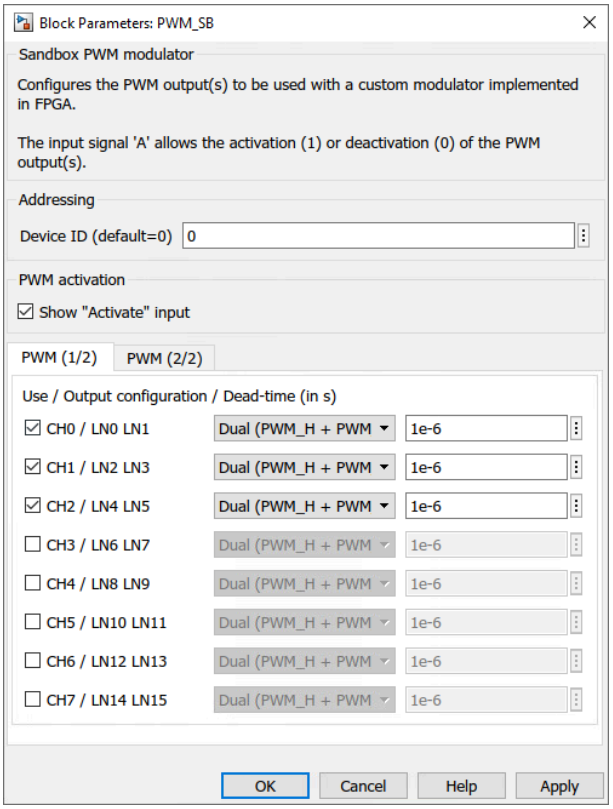
Signal specification

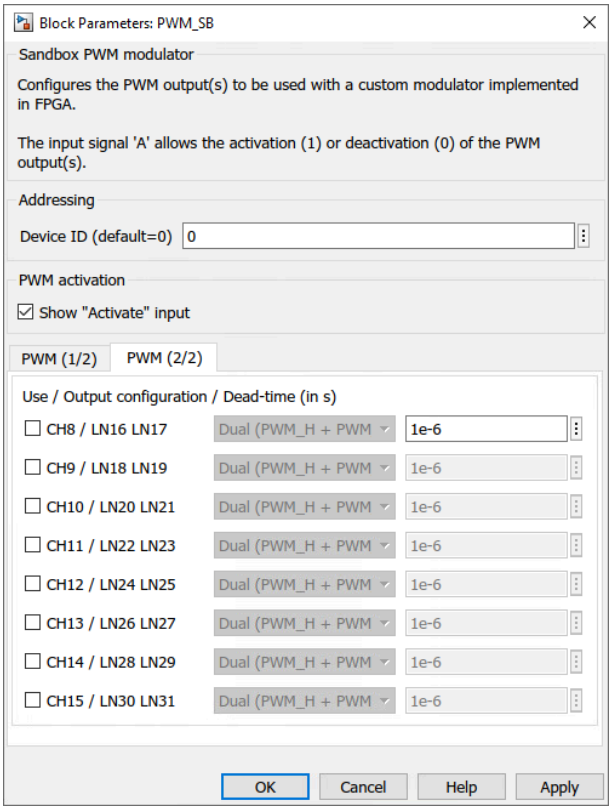
The input `A` allows the activation (>0) or deactivation (<=0) of the PWM output(s).

Parameters

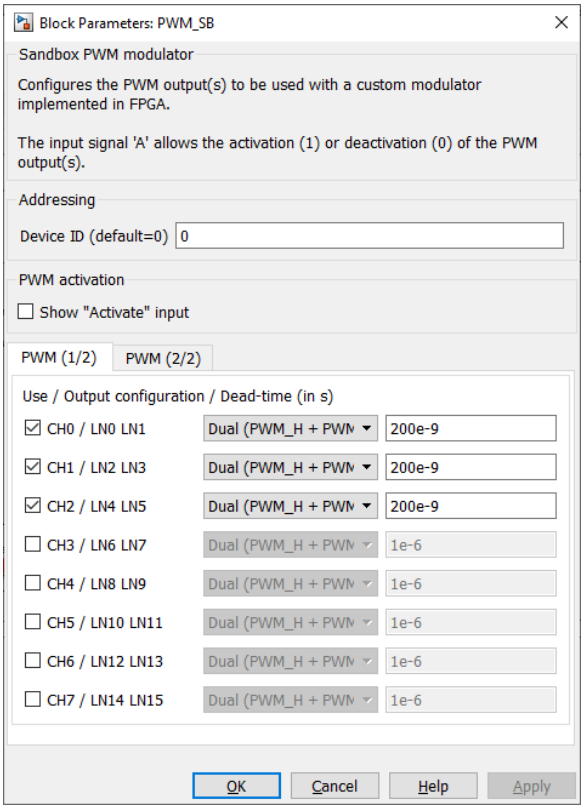
- `Device ID`: selects which device to address when used in a multi-device configuration.
- `Show "activate" input`: makes the `A` signal input visible. If not checked, the CB-PWM block is active by default.
- Output configuration:
  - `use` checkbox: selects which PWM outputs are driven from the FPGA sandbox
  - `output configuration`: selects between a single PWM signal or complementary signals with a deadtime.
  - `dead-time`: configures the dead-time duration if the `Output mode` is set at *Dual (PWM_H + PWM_L)*.

The parameters `output mode`, `addressed PWM`, `dead-time` and `show "activate" input` are common to all PWM blocks and are further documented on the PWM page.

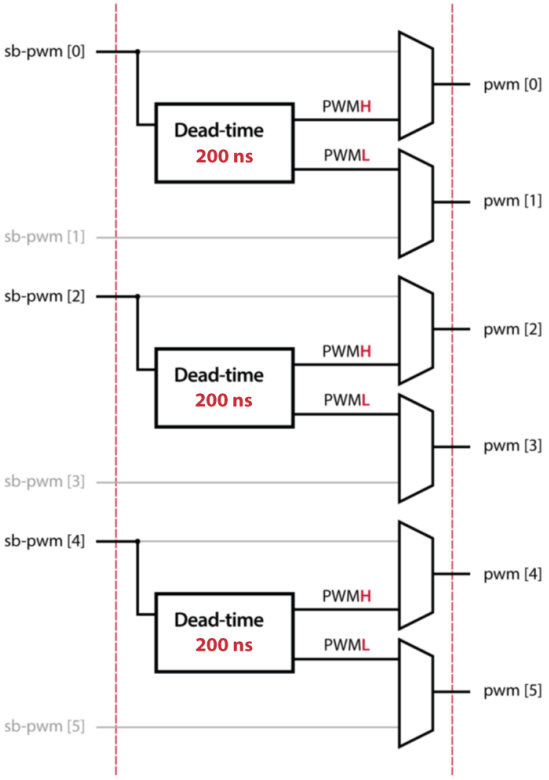




Example of SB PWM configuration



Configuration of the SB-PWM block in Simulink

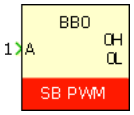


Mapping between sb_pwm and pwm ports of the imperix IP in Vivado

PLECS block

Signal specification

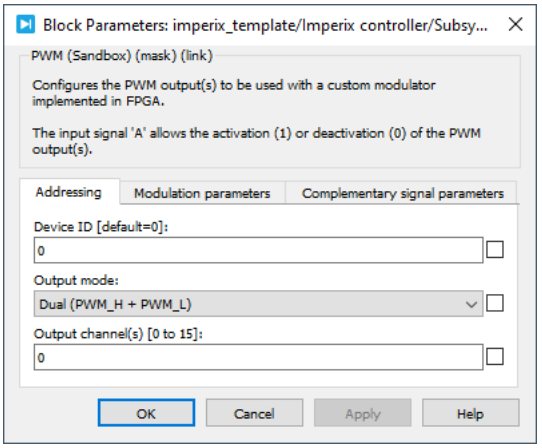
The input A allows the activation (>0) or deactivation (<=0) of the PWM output(s).

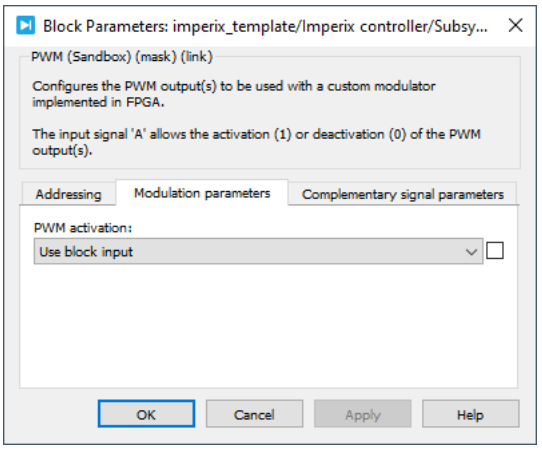


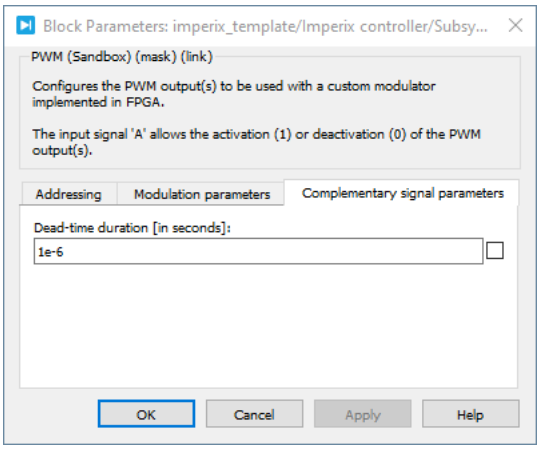
Parameters

- `Device ID` selects which device to address when used in a multi-device configuration.
- `Output mode` selects between a single PWM signal or complementary signals with a deadtime.
- `Output lane(s)` or `Output channel(s)`(vectorizable) selects which PWM outputs are driven from the FPGA sandbox.
- `PWM activation` makes the `A` signal input visible if the option *Use block input* is selected. If not, the CB-PWM block is activated by default.
- `Dead-time duration` configures the dead-time duration if the `Output mode` is set at *Dual (PWM_H + PWM_L)*.

The parameters `output mode`, `addressed PWM`, `dead time` and `PWM activation` are common to all PWM blocks and are further documented on the PWM page.







C++ functions

Functions specific to the sandbox PWM

There is no function specific to the sandbox PWM. The function `SbPwm_ConfigureOutputMode()` must be used to select the PWM outputs to be driven from the FPGA sandbox.

Functions common to all PWM drivers

These functions are common to all PWM blocks. Further documentation is available on the PWM page.

`SbPwm_ConfigureOutputMode` — Select the PWM output mode

```
void SbPwm_ConfigureOutputMode(tPwmOutput output, tPwmOutMode outMode, unsigned int device=0);Code language: C++ (cpp)
```

Selects the PWM output mode.

If the output mode selected is *COMPLEMENTARY*, a dead-time must be configured using the `CbPwm_ConfigureDeadTime()` function.

Can only be called in `UserInit()`.

Parameters

- `output`: the PWM channel or lane to address
- `outMode`: the output mode to use (*COMPLEMENTARY*, *INDEPENDENT* or *PWMH_ACTIVE*)
- `device`: the ID of the addressed device (optional, used in multi-device configuration only)

`SbPwm_ConfigureDeadTime` — Configure the dead time

```
void SbPwm_ConfigureDeadTime(tPwmOutput output, float deadTime, unsigned int device=0);Code language: C++ (cpp)
```

Configures the dead-time duration if the output mode is set as *COMPLEMENTARY.*

Can only be called in `UserInit()`.

Parameters

- `output`: the PWM channel or lane to address
- `outMode`: the output mode to use (*COMPLEMENTARY*, *INDEPENDENT* or *PWMH_ACTIVE*)
- `device`: the ID of the addressed device (optional, used in multi-device configuration only)

`SbPwm_Activate` — Activate the PWM outputs

```
void SbPwm_Activate(tPwmOutput output, unsigned int device=0);
Code language: C++ (cpp)
```

Activates the addressed PWM output(s). If the addressed PWM output has been set as *COMPLEMENTARY* or *PWMH_ACTIVE* this function acts on both outputs.

Can be called in `UserInit()` or in the interrupt routine.

Parameters

- `output`: the PWM channel or lane to address
- `device`: the ID of the addressed device (optional, used in multi-device configuration only)

`SbPwm_Deactivate` — Deactivate the PWM outputs

```
void SbPwm_Deactivate(tPwmOutput output, unsigned int device=0);Code language: C++ (cpp)
```

Deactivates the addressed PWM output(s). If the addressed PWM output has been set as *COMPLEMENTARY* or *PWMH_ACTIVE* this function acts on both outputs.

Can be called in `UserInit()` or in the interrupt routine.

Parameters

- `output`: the PWM channel or lane to address
- `device`: the ID of the addressed device (optional, used in multi-device configuration only)