

# **Xilinx Standalone Library Documentation**

## ***XilPM Library v3.0***

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## Appendix A: Additional Resources and Legal Notices

# XilPM APIs

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## Overview

Xilinx Power Management(XilPM) provides Embedded Energy Management Interface (EEMI) APIs for power management on Zynq® UltraScale+™ MPSoC. For more details about power management on Zynq Ultrascale+ MPSoC, see the Zynq UltraScale+ MPSoC Power Management User Guide (UG1199). For more details about EEMI, see the Embedded Energy Management Interface (EEMI) API User Guide(UG1200).

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## Modules

- [Error Status](#)

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## Data Structures

- struct [XPm\\_Notifier](#)
- struct [XPm\\_NodeStatus](#)
- struct [XPmClockSel2ClkIn](#)
- struct [XPmClockMux](#)
- struct [XPmClockModel](#)

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## Enumerations

- enum [XPmApild](#)
- enum [XPmApiCbld](#)
- enum [XPmNodeld](#)
- enum [XPmRequestAck](#)
- enum [XPmAbortReason](#)
- enum [XPmSuspendReason](#)
- enum [XPmRamState](#)
- enum [XPmOpCharType](#)

- enum [XPmBootTestStatus](#)
- enum [XPmResetAction](#)
- enum [XPmReset](#)
- enum [XPmNotifyEvent](#)
- enum [XPmClock](#)

## Functions

- XStatus [XPm\\_InitXilpm](#) (XlpiPsu \*lpiInst)
- void [XPm\\_SuspendFinalize](#) (void)
- enum [XPmBootTestStatus](#) [XPm\\_GetBootTestStatus](#) (void)
- XStatus [XPm\\_RequestSuspend](#) (const enum [XPmNodeId](#) target, const enum [XPmRequestAck](#) ack, const u32 latency, const u8 state)
- XStatus [XPm\\_SelfSuspend](#) (const enum [XPmNodeId](#) nid, const u32 latency, const u8 state, const u64 address)
- XStatus [XPm\\_ForcePowerDown](#) (const enum [XPmNodeId](#) target, const enum [XPmRequestAck](#) ack)
- XStatus [XPm\\_AbortSuspend](#) (const enum [XPmAbortReason](#) reason)
- XStatus [XPm\\_RequestWakeUp](#) (const enum [XPmNodeId](#) target, const bool setAddress, const u64 address, const enum [XPmRequestAck](#) ack)
- XStatus [XPm\\_SetWakeUpSource](#) (const enum [XPmNodeId](#) target, const enum [XPmNodeId](#) wkup\_node, const u8 enable)
- XStatus [XPm\\_SystemShutdown](#) (u32 type, u32 subtype)
- XStatus [XPm\\_SetConfiguration](#) (const u32 address)
- XStatus [XPm\\_InitFinalize](#) (void)
- void [XPm\\_InitSuspendCb](#) (const enum [XPmSuspendReason](#) reason, const u32 latency, const u32 state, const u32 timeout)
- void [XPm\\_AcknowledgeCb](#) (const enum [XPmNodeId](#) node, const XStatus status, const u32 oppoint)
- void [XPm\\_NotifyCb](#) (const enum [XPmNodeId](#) node, const enum [XPmNotifyEvent](#) event, const u32 oppoint)
- XStatus [XPm\\_RequestNode](#) (const enum [XPmNodeId](#) node, const u32 capabilities, const u32 qos, const enum [XPmRequestAck](#) ack)
- XStatus [XPm\\_ReleaseNode](#) (const enum [XPmNodeId](#) node)
- XStatus [XPm\\_SetRequirement](#) (const enum [XPmNodeId](#) nid, const u32 capabilities, const u32 qos, const enum [XPmRequestAck](#) ack)
- XStatus [XPm\\_SetMaxLatency](#) (const enum [XPmNodeId](#) node, const u32 latency)
- XStatus [XPm\\_GetApiVersion](#) (u32 \*version)
- XStatus [XPm\\_GetNodeStatus](#) (const enum [XPmNodeId](#) node, [XPm\\_NodeStatus](#) \*const nodestatus)
- XStatus [XPm\\_RegisterNotifier](#) ([XPm\\_Notifier](#) \*const notifier)
- XStatus [XPm\\_UnregisterNotifier](#) ([XPm\\_Notifier](#) \*const notifier)
- XStatus [XPm\\_GetOpCharacteristic](#) (const enum [XPmNodeId](#) node, const enum [XPmOpCharType](#) type, u32 \*const result)
- XStatus [XPm\\_ResetAssert](#) (const enum [XPmReset](#) reset, const enum [XPmResetAction](#) resetaction)
- XStatus [XPm\\_ResetGetStatus](#) (const enum [XPmReset](#) reset, u32 \*status)
- XStatus [XPm\\_MmioWrite](#) (const u32 address, const u32 mask, const u32 value)

- XStatus [XPm\\_MmioRead](#) (const u32 address, u32 \*const value)
- XStatus [XPm\\_ClockEnable](#) (const enum [XPmClock](#) clock)
- XStatus [XPm\\_ClockDisable](#) (const enum [XPmClock](#) clock)
- XStatus [XPm\\_ClockGetStatus](#) (const enum [XPmClock](#) clock, u32 \*const status)
- XStatus [XPm\\_ClockSetDivider](#) (const enum [XPmClock](#) clock, const u32 divider)
- XStatus [XPm\\_ClockGetDivider](#) (const enum [XPmClock](#) clock, u32 \*const divider)
- XStatus [XPm\\_ClockSetParent](#) (const enum [XPmClock](#) clock, const enum [XPmClock](#) parent)
- XStatus [XPm\\_ClockGetParent](#) (const enum [XPmClock](#) clock, enum [XPmClock](#) \*const parent)
- XStatus [XPm\\_ClockSetRate](#) (const enum [XPmClock](#) clock, const u32 rate)
- XStatus [XPm\\_ClockGetRate](#) (const enum [XPmClock](#) clock, u32 \*const rate)
- XStatus [XPm\\_PllSetParameter](#) (const enum [XPmNodeId](#) node, const enum XPmPllParam parameter, const u32 value)
- XStatus [XPm\\_PllGetParameter](#) (const enum [XPmNodeId](#) node, const enum XPmPllParam parameter, u32 \*const value)
- XStatus [XPm\\_PllSetMode](#) (const enum [XPmNodeId](#) node, const enum XPmPllMode mode)
- XStatus [XPm\\_PllGetMode](#) (const enum [XPmNodeId](#) node, enum XPmPllMode \*const mode)
- XStatus [XPm\\_PinCtrlRequest](#) (const u32 pin)
- XStatus [XPm\\_PinCtrlRelease](#) (const u32 pin)
- XStatus [XPm\\_PinCtrlSetFunction](#) (const u32 pin, const enum XPmPinFn fn)
- XStatus [XPm\\_PinCtrlGetFunction](#) (const u32 pin, enum XPmPinFn \*const fn)
- XStatus [XPm\\_PinCtrlSetParameter](#) (const u32 pin, const enum XPmPinParam param, const u32 value)
- XStatus [XPm\\_PinCtrlGetParameter](#) (const u32 pin, const enum XPmPinParam param, u32 \*const value)
- XStatus [XPm\\_NotifierAdd](#) ([XPm\\_Notifier](#) \*const notifier)
- XStatus [XPm\\_NotifierRemove](#) ([XPm\\_Notifier](#) \*const notifier)
- void [XPm\\_NotifierProcessEvent](#) (const enum [XPmNodeId](#) node, const enum [XPmNotifyEvent](#) event, const u32 oppoint)
- XStatus [XPm\\_GetClockParentBySelect](#) (const enum [XPmClock](#) clockId, const u32 select, enum [XPmClock](#) \*const parentId)
- XStatus [XPm\\_GetSelectByClockParent](#) (const enum [XPmClock](#) clockId, const enum [XPmClock](#) parentId, u32 \*const select)
- u8 [XPm\\_GetClockDivType](#) (const enum [XPmClock](#) clock)
- u8 [XPm\\_MapDivider](#) (const enum [XPmClock](#) clock, const u32 div, u32 \*const div0, u32 \*const div1)

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## PM Version Number macros

- #define **PM\_VERSION\_MAJOR** 1
- #define **PM\_VERSION\_MINOR** 1
- #define **PM\_VERSION** ((PM\_VERSION\_MAJOR << 16) | PM\_VERSION\_MINOR)

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## Capabilities for RAM

- #define **PM\_CAP\_ACCESS** 0x1U
- #define **PM\_CAP\_CONTEXT** 0x2U
- #define **PM\_CAP\_WAKEUP** 0x4U

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## Node default states macros

- #define **NODE\_STATE\_OFF** 0
- #define **NODE\_STATE\_ON** 1

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## Processor's states macros

- #define **PROC\_STATE\_FORCEDOFF** 0
- #define **PROC\_STATE\_ACTIVE** 1
- #define **PROC\_STATE\_SLEEP** 2
- #define **PROC\_STATE\_SUSPENDING** 3

---

## Maximum Latency/QOS macros

- #define **MAX\_LATENCY** (~0U)
- #define **MAX\_QOS** 100U

---

## System shutdown/Restart macros

- #define **PMF\_SHUTDOWN\_TYPE\_SHUTDOWN** 0U
- #define **PMF\_SHUTDOWN\_TYPE\_RESET** 1U
- #define **PMF\_SHUTDOWN\_SUBTYPE\_SUBSYSTEM** 0U
- #define **PMF\_SHUTDOWN\_SUBTYPE\_PS\_ONLY** 1U
- #define **PMF\_SHUTDOWN\_SUBTYPE\_SYSTEM** 2U

---

## PM API Min and Max macros

- #define **PM\_API\_MIN** PM\_GET\_API\_VERSION

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## Payload Packets

Assigning of argument values into array elements. `pause` and `pm_dbg` are used for debugging and should be removed in final version.

- #define **PACK\_PAYLOAD**(pl, arg0, arg1, arg2, arg3, arg4, arg5, rsvd)
- #define **PACK\_PAYLOAD0**(pl, api\_id) **PACK\_PAYLOAD**(pl, (api\_id), 0U, 0U, 0U, 0U, 0U, 0U)
- #define **PACK\_PAYLOAD1**(pl, api\_id, arg1) **PACK\_PAYLOAD**(pl, (api\_id), (arg1), 0U, 0U, 0U, 0U, 0U)
- #define **PACK\_PAYLOAD2**(pl, api\_id, arg1, arg2) **PACK\_PAYLOAD**(pl, (api\_id), (arg1), (arg2), 0U, 0U, 0U, 0U)
- #define **PACK\_PAYLOAD3**(pl, api\_id, arg1, arg2, arg3) **PACK\_PAYLOAD**(pl, (api\_id), (arg1), (arg2), (arg3), 0U, 0U, 0U)
- #define **PACK\_PAYLOAD4**(pl, api\_id, arg1, arg2, arg3, arg4) **PACK\_PAYLOAD**(pl, (api\_id), (arg1), (arg2), (arg3), (arg4), 0U, 0U)



- #define **PACK\_PAYLOAD5**(pl, api\_id, arg1, arg2, arg3, arg4, arg5) **PACK\_PAYLOAD**(pl, (api\_id), (arg1), (arg2), (arg3), (arg4), (arg5), 0U)

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## Data Structure Documentation

### struct XPm\_Notifier

[XPm\\_Notifier](#) - Notifier structure registered with a callback by app

### Data Fields

- void(\*const [callback](#) )(struct XPm\_Ntfier \*const notifier)
- enum [XPmNodeId](#) node
- enum [XPmNotifyEvent](#) event
- u32 [flags](#)
- volatile u32 [oppoint](#)
- volatile u32 [received](#)
- struct XPm\_Ntfier \* [next](#)

### Field Documentation

**void(\*const callback) (struct XPm\_Ntfier \*const notifier)** Custom callback handler to be called when the notification is received. The custom handler would execute from interrupt context, it shall return quickly and must not block! (enables event-driven notifications)

**enum XPmNodeId node** Node argument (the node to receive notifications about)

**enum XPmNotifyEvent event** Event argument (the event type to receive notifications about)

**u32 flags** Flags

**volatile u32 oppoint** Operating point of node in question. Contains the value updated when the last event notification is received. User shall not modify this value while the notifier is registered.

**volatile u32 received** How many times the notification has been received - to be used by application (enables polling). User shall not modify this value while the notifier is registered.

**struct XPm\_Ntfier\* next** Pointer to next notifier in linked list. Must not be modified while the notifier is registered. User shall not ever modify this value.

### struct XPm\_NodeStatus

[XPm\\_NodeStatus](#) - struct containing node status information

## Data Fields

- u32 [status](#)
- u32 [requirements](#)
- u32 [usage](#)

## Field Documentation

**u32 status** Node power state

**u32 requirements** Current requirements asserted on the node (slaves only)

**u32 usage** Usage information (which master is currently using the slave)

## struct XPmClockSel2ClkIn

Pair of multiplexer select value and selected clock input

## Data Fields

- enum [XPmClock clkIn](#)
- const u8 [select](#)

## Field Documentation

**enum XPmClock clkIn** ID of the clock that is selected with the 'select' value

**const u8 select** Select value of the clock multiplexer

## struct XPmClockMux

MUX select values to clock input mapping

## Data Fields

- const [XPmClockSel2ClkIn](#) \*const [inputs](#)
- const u8 [size](#)
- const u8 [bits](#)
- const u8 [shift](#)

## Field Documentation

**const XPmClockSel2ClkIn\* const inputs** Mux select to pll mapping at the input of the multiplexer

**const u8 size** Size of the inputs array

**const u8 bits** Number of bits of mux select

**const u8 shift** Number of bits to shift 'bits' in order to get mux select mask

## struct XPmClockModel

Clock model

## Data Fields

- enum [XPmClock id](#)
- const [XPmClockMux](#) \*const [mux](#)
- const u8 [type](#)
- const struct XPmClkModel \*const [next](#)

## Field Documentation

**enum XPmClock id** Clock ID

**const XPmClockMux\* const mux** Pointer to the mux model

**const u8 type** Type specifying the available divisors

**const struct XPmClkModel\* const next** Next clock in the list

---

# Enumeration Type Documentation

## enum XPmApild

APIs for Miscellaneous functions, suspending of PUs, managing PM slaves and Direct control.

## enum XPmApiCbld

PM API Callback Id Enum

## enum XPmNodeId

PM Node ID Enum

## **enum XPmRequestAck**

PM Acknowledge Request Types

## **enum XPmAbortReason**

PM Abort Reasons Enum

## **enum XPmSuspendReason**

PM Suspend Reasons Enum

## **enum XPmRamState**

PM RAM States Enum

## **enum XPmOpCharType**

PM Operating Characteristic types Enum

## **enum XPmBootTestStatus**

Boot Status Enum

## **enum XPmResetAction**

PM Reset Action types

## **enum XPmReset**

PM Reset Line IDs

## **enum XPmNotifyEvent**

PM Notify Events Enum

## **enum XPmClock**

PM Clock IDs

## Function Documentation

### XStatus XPm\_InitXilpm ( XlpiPsu \* *IpInst* )

Initialize xilpm library.

#### Parameters

<i>IpInst</i>	Pointer to IPI driver instance
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#### Returns

XST\_SUCCESS if successful else XST\_FAILURE or an error code or a reason code

#### Note

None

### void XPm\_SuspendFinalize ( void )

This Function waits for PMU to finish all previous API requests sent by the PU and performs client specific actions to finish suspend procedure (e.g. execution of wfi instruction on A53 and R5 processors).

#### Note

This function should not return if the suspend procedure is successful.

### enum XPmBootStatus XPm\_GetBootStatus ( void )

This Function returns information about the boot reason. If the boot is not a system startup but a resume, power down request bitfield for this processor will be cleared.

#### Returns

Returns processor boot status

- PM\_RESUME : If the boot reason is because of system resume.
- PM\_INITIAL\_BOOT : If this boot is the initial system startup.

#### Note

None

### XStatus XPm\_RequestSuspend ( const enum XPmNodeId *target*, const enum XPmRequestAck *ack*, const u32 *latency*, const u8 *state* )

This function is used by a PU to request suspend of another PU. This call triggers the power management controller to notify the PU identified by 'nodeID' that a suspend has been requested. This will allow said PU to

gracefully suspend itself by calling `XPm_SelfSuspend` for each of its CPU nodes, or else call `XPm_AbortSuspend` with its PU node as argument and specify the reason.

#### Parameters

<i>target</i>	Node ID of the PU node to be suspended
<i>ack</i>	Requested acknowledge type
<i>latency</i>	Maximum wake-up latency requirement in us(micro sec)
<i>state</i>	Instead of specifying a maximum latency, a PU can also explicitly request a certain power state.

#### Returns

XST\_SUCCESS if successful else XST\_FAILURE or an error code or a reason code

#### Note

If 'ack' is set to `PM_ACK_NON_BLOCKING`, the requesting PU will be notified upon completion of suspend or if an error occurred, such as an abort. `REQUEST_ACK_BLOCKING` is not supported for this command.

### **XStatus XPm\_SelfSuspend ( const enum XPmNodeId *nid*, const u32 *latency*, const u8 *state*, const u64 *address* )**

This function is used by a CPU to declare that it is about to suspend itself. After the PMU processes this call it will wait for the requesting CPU to complete the suspend procedure and become ready to be put into a sleep state.

#### Parameters

<i>nid</i>	Node ID of the CPU node to be suspended.
<i>latency</i>	Maximum wake-up latency requirement in us(microsecs)
<i>state</i>	Instead of specifying a maximum latency, a CPU can also explicitly request a certain power state.
<i>address</i>	Address from which to resume when woken up.

#### Returns

XST\_SUCCESS if successful else XST\_FAILURE or an error code or a reason code

#### Note

This is a blocking call, it will return only once PMU has responded

## XStatus XPm\_ForcePowerDown ( const enum XPmNodeId *target*, const enum XPmRequestAck *ack* )

One PU can request a forced poweroff of another PU or its power island or power domain. This can be used for killing an unresponsive PU, in which case all resources of that PU will be automatically released.

### Parameters

<i>target</i>	Node ID of the PU node or power island/domain to be powered down.
<i>ack</i>	Requested acknowledge type

### Returns

XST\_SUCCESS if successful else XST\_FAILURE or an error code or a reason code

### Note

Force power down may not be requested by a PU for itself.

## XStatus XPm\_AbortSuspend ( const enum XPmAbortReason *reason* )

This function is called by a CPU after a XPm\_SelfSuspend call to notify the power management controller that CPU has aborted suspend or in response to an init suspend request when the PU refuses to suspend.

### Parameters

<i>reason</i>	Reason code why the suspend can not be performed or completed <ul style="list-style-type: none"> <li>ABORT_REASON_WKUP_EVENT : local wakeup-event received</li> <li>ABORT_REASON_PU_BUSY : PU is busy</li> <li>ABORT_REASON_NO_PWRDN : no external powerdown supported</li> <li>ABORT_REASON_UNKNOWN : unknown error during suspend procedure</li> </ul>
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### Returns

XST\_SUCCESS if successful else XST\_FAILURE or an error code or a reason code

### Note

Calling PU expects the PMU to abort the initiated suspend procedure. This is a non-blocking call without any acknowledge.

## **XStatus XPm\_RequestWakeUp ( const enum XPmNodeId *target*, const bool *setAddress*, const u64 *address*, const enum XPmRequestAck *ack* )**

This function can be used to request power up of a CPU node within the same PU, or to power up another PU.

### Parameters

<i>target</i>	Node ID of the CPU or PU to be powered/woken up.
<i>setAddress</i>	Specifies whether the start address argument is being passed. <ul style="list-style-type: none"> <li>• 0 : do not set start address</li> <li>• 1 : set start address</li> </ul>
<i>address</i>	Address from which to resume when woken up. Will only be used if <i>set_address</i> is 1.
<i>ack</i>	Requested acknowledge type

### Returns

XST\_SUCCESS if successful else XST\_FAILURE or an error code or a reason code

### Note

If acknowledge is requested, the calling PU will be notified by the power management controller once the wake-up is completed.

## **XStatus XPm\_SetWakeUpSource ( const enum XPmNodeId *target*, const enum XPmNodeId *wkup\_node*, const u8 *enable* )**

This function is called by a PU to add or remove a wake-up source prior to going to suspend. The list of wake sources for a PU is automatically cleared whenever the PU is woken up or when one of its CPUs aborts the suspend procedure.

### Parameters

<i>target</i>	Node ID of the target to be woken up.
<i>wkup_node</i>	Node ID of the wakeup device.
<i>enable</i>	Enable flag: <ul style="list-style-type: none"> <li>• 1 : the wakeup source is added to the list</li> <li>• 0 : the wakeup source is removed from the list</li> </ul>



## Returns

XST\_SUCCESS if successful else XST\_FAILURE or an error code or a reason code

## Note

Declaring a node as a wakeup source will ensure that the node will not be powered off. It also will cause the PMU to configure the GIC Proxy accordingly if the FPD is powered off.

# XStatus XPm\_SystemShutdown ( u32 type, u32 subtype )

This function can be used by a privileged PU to shut down or restart the complete device.

## Parameters

<i>restart</i>	Should the system be restarted automatically? <ul style="list-style-type: none"> <li>PM_SHUTDOWN : no restart requested, system will be powered off permanently</li> <li>PM_RESTART : restart is requested, system will go through a full reset</li> </ul>
----------------	--

## Returns

XST\_SUCCESS if successful else XST\_FAILURE or an error code or a reason code

## Note

In either case the PMU will call XPm\_InitSuspendCb for each of the other PUs, allowing them to gracefully shut down. If a PU is asleep it will be woken up by the PMU. The PU making the XPm\_SystemShutdown should perform its own suspend procedure after calling this API. It will not receive an init suspend callback.

# XStatus XPm\_SetConfiguration ( const u32 address )

This function is called to configure the power management framework. The call triggers power management controller to load the configuration object and configure itself according to the content of the object.

## Parameters

<i>address</i>	Start address of the configuration object
----------------	---

## Returns

XST\_SUCCESS if successful, otherwise an error code

## Note

The provided address must be in 32-bit address space which is accessible by the PMU.

## XStatus XPm\_InitFinalize ( void )

This function is called to notify the power management controller about the completed power management initialization.

### Returns

XST\_SUCCESS if successful, otherwise an error code

### Note

It is assumed that all used nodes are requested when this call is made. The power management controller may power down the nodes which are not requested after this call is processed.

## void XPm\_InitSuspendCb ( const enum XPmSuspendReason *reason*, const u32 *latency*, const u32 *state*, const u32 *timeout* )

Callback function to be implemented in each PU, allowing the power management controller to request that the PU suspend itself.

### Parameters

<i>reason</i>	Suspend reason: <ul style="list-style-type: none"><li>• SUSPEND_REASON_PU_REQ : Request by another PU</li><li>• SUSPEND_REASON_ALERT : Unrecoverable SysMon alert</li><li>• SUSPEND_REASON_SHUTDOWN : System shutdown</li><li>• SUSPEND_REASON_RESTART : System restart</li></ul>
<i>latency</i>	Maximum wake-up latency in us(micro secs). This information can be used by the PU to decide what level of context saving may be required.
<i>state</i>	Targeted sleep/suspend state.
<i>timeout</i>	Timeout in ms, specifying how much time a PU has to initiate its suspend procedure before it's being considered unresponsive.

### Returns

None

### Note

If the PU fails to act on this request the power management controller or the requesting PU may choose to employ the forceful power down option.

## void XPm\_AcknowledgeCb ( const enum XPmNodeId *node*, const XStatus *status*, const u32 *oppoint* )

This function is called by the power management controller in response to any request where an acknowledge callback was requested, i.e. where the 'ack' argument passed by the PU was REQUEST\_ACK\_NON\_BLOCKING.

### Parameters

<i>node</i>	ID of the component or sub-system in question.
<i>status</i>	Status of the operation: <ul style="list-style-type: none"> <li>• OK: the operation completed successfully</li> <li>• ERR: the requested operation failed</li> </ul>
<i>oppoint</i>	Operating point of the node in question

### Returns

None

### Note

None

## void XPm\_NotifyCb ( const enum XPmNodeId *node*, const enum XPmNotifyEvent *event*, const u32 *oppoint* )

This function is called by the power management controller if an event the PU was registered for has occurred. It will populate the notifier data structure passed when calling XPm\_RegisterNotifier.

### Parameters

<i>node</i>	ID of the node the event notification is related to.
<i>event</i>	ID of the event
<i>oppoint</i>	Current operating state of the node.

### Returns

None

### Note

None

## XStatus XPm\_RequestNode ( const enum XPmNodeld *node*, const u32 *capabilities*, const u32 *qos*, const enum XPmRequestAck *ack* )

Used to request the usage of a PM-slave. Using this API call a PU requests access to a slave device and asserts its requirements on that device. Provided the PU is sufficiently privileged, the PMU will enable access to the memory mapped region containing the control registers of that device. For devices that can only be serving a single PU, any other privileged PU will now be blocked from accessing this device until the node is released.

### Parameters

<i>node</i>	Node ID of the PM slave requested
<i>capabilities</i>	Slave-specific capabilities required, can be combined <ul style="list-style-type: none"> <li>PM_CAP_ACCESS : full access / functionality</li> <li>PM_CAP_CONTEXT : preserve context</li> <li>PM_CAP_WAKEUP : emit wake interrupts</li> </ul>
<i>qos</i>	Quality of Service (0-100) required
<i>ack</i>	Requested acknowledge type

### Returns

XST\_SUCCESS if successful else XST\_FAILURE or an error code or a reason code

### Note

None

## XStatus XPm\_ReleaseNode ( const enum XPmNodeld *node* )

This function is used by a PU to release the usage of a PM slave. This will tell the power management controller that the node is no longer needed by that PU, potentially allowing the node to be placed into an inactive state.

### Parameters

<i>node</i>	Node ID of the PM slave.
-------------	--------------------------

### Returns

XST\_SUCCESS if successful else XST\_FAILURE or an error code or a reason code

### Note

None

## **XStatus XPm\_SetRequirement ( const enum XPmNodeId *nid*, const u32 *capabilities*, const u32 *qos*, const enum XPmRequestAck *ack* )**

This function is used by a PU to announce a change in requirements for a specific slave node which is currently in use.

### **Parameters**

<i>nid</i>	Node ID of the PM slave.
<i>capabilities</i>	Slave-specific capabilities required.
<i>qos</i>	Quality of Service (0-100) required.
<i>ack</i>	Requested acknowledge type

### **Returns**

XST\_SUCCESS if successful else XST\_FAILURE or an error code or a reason code

### **Note**

If this function is called after the last awake CPU within the PU calls SelfSuspend, the requirement change shall be performed after the CPU signals the end of suspend to the power management controller, (e.g. WFI interrupt).

## **XStatus XPm\_SetMaxLatency ( const enum XPmNodeId *node*, const u32 *latency* )**

This function is used by a PU to announce a change in the maximum wake-up latency requirements for a specific slave node currently used by that PU.

### **Parameters**

<i>node</i>	Node ID of the PM slave.
<i>latency</i>	Maximum wake-up latency required.

### **Returns**

XST\_SUCCESS if successful else XST\_FAILURE or an error code or a reason code

### **Note**

Setting maximum wake-up latency can constrain the set of possible power states a resource can be put into.

## XStatus XPm\_GetApiVersion ( u32 \* *version* )

This function is used to request the version number of the API running on the power management controller.

### Parameters

<i>version</i>	Returns the API 32-bit version number. Returns 0 if no PM firmware present.
----------------	---

### Returns

XST\_SUCCESS if successful else XST\_FAILURE or an error code or a reason code

### Note

None

## XStatus XPm\_GetNodeStatus ( const enum XPmNodeId *node*, XPm\_NodeStatus \*const *nodestatus* )

This function is used to obtain information about the current state of a component. The caller must pass a pointer to an [XPm\\_NodeStatus](#) structure, which must be pre-allocated by the caller.

### Parameters

<i>node</i>	ID of the component or sub-system in question.
<i>nodestatus</i>	Used to return the complete status of the node.

- status - The current power state of the requested node.
  - For CPU nodes:
    - 0 : if CPU is powered down,
    - 1 : if CPU is active (powered up),
    - 2 : if CPU is suspending (powered up)
  - For power islands and power domains:
    - 0 : if island is powered down,
    - 1 : if island is powered up
  - For PM slaves:
    - 0 : if slave is powered down,
    - 1 : if slave is powered up,
    - 2 : if slave is in retention
- requirement - Slave nodes only: Returns current requirements the requesting PU has requested of the node.
- usage - Slave nodes only: Returns current usage status of the node:
  - 0 : node is not used by any PU,

- 1 : node is used by caller exclusively,
- 2 : node is used by other PU(s) only,
- 3 : node is used by caller and by other PU(s)

## Returns

XST\_SUCCESS if successful else XST\_FAILURE or an error code or a reason code

## Note

None

# XStatus XPm\_RegisterNotifier ( XPm\_Notifier \*const *notifier* )

A PU can call this function to request that the power management controller call its notify callback whenever a qualifying event occurs. One can request to be notified for a specific or any event related to a specific node.

## Parameters

<i>notifier</i>	Pointer to the notifier object to be associated with the requested notification. The notifier object contains the following data related to the notification:
-----------------	---

- nodeID : ID of the node to be notified about,
- eventID : ID of the event in question, '-1' denotes all events ( - EVENT\_STATE\_CHANGE, EVENT\_ZERO\_USERS),
- wake : true: wake up on event, false: do not wake up (only notify if awake), no buffering/queueing
- callback : Pointer to the custom callback function to be called when the notification is available. The callback executes from interrupt context, so the user must take special care when implementing the callback. Callback is optional, may be set to NULL.
- received : Variable indicating how many times the notification has been received since the notifier is registered.

## Returns

XST\_SUCCESS if successful else XST\_FAILURE or an error code or a reason code

## Note

The caller shall initialize the notifier object before invoking the XPm\_RegisterNotifier function. While notifier is registered, the notifier object shall not be modified by the caller.

## **XStatus XPm\_UnregisterNotifier ( XPm\_Notifier \*const *notifier* )**

A PU calls this function to unregister for the previously requested notifications.

### **Parameters**

<i>notifier</i>	Pointer to the notifier object associated with the previously requested notification
-----------------	--

### **Returns**

XST\_SUCCESS if successful else XST\_FAILURE or an error code or a reason code

### **Note**

None

## **XStatus XPm\_GetOpCharacteristic ( const enum XPmNodeId *node*, const enum XPmOpCharType *type*, u32 \*const *result* )**

Call this function to request the power management controller to return information about an operating characteristic of a component.

### **Parameters**

<i>node</i>	ID of the component or sub-system in question.
<i>type</i>	Type of operating characteristic requested: <ul style="list-style-type: none"> <li>• power (current power consumption),</li> <li>• latency (current latency in us to return to active state),</li> <li>• temperature (current temperature),</li> </ul>
<i>result</i>	Used to return the requested operating characteristic.

### **Returns**

XST\_SUCCESS if successful else XST\_FAILURE or an error code or a reason code

### **Note**

None



## XStatus XPm\_ResetAssert ( const enum XPmReset *reset*, const enum XPmResetAction *resetaction* )

This function is used to assert or release reset for a particular reset line. Alternatively a reset pulse can be requested as well.

### Parameters

<i>reset</i>	ID of the reset line
<i>assert</i>	Identifies action: <ul style="list-style-type: none"> <li>PM_RESET_ACTION_RELEASE : release reset,</li> <li>PM_RESET_ACTION_ASSERT : assert reset,</li> <li>PM_RESET_ACTION_PULSE : pulse reset,</li> </ul>

### Returns

XST\_SUCCESS if successful else XST\_FAILURE or an error code or a reason code

### Note

None

## XStatus XPm\_ResetGetStatus ( const enum XPmReset *reset*, u32 \* *status* )

Call this function to get the current status of the selected reset line.

### Parameters

<i>reset</i>	Reset line
<i>status</i>	Status of specified reset (true - asserted, false - released)

### Returns

Returns 1/XST\_FAILURE for 'asserted' or 0/XST\_SUCCESS for 'released'.

## Note

None

## **XStatus XPm\_MmioWrite ( const u32 *address*, const u32 *mask*, const u32 *value* )**

Call this function to write a value directly into a register that isn't accessible directly, such as registers in the clock control unit. This call is bypassing the power management logic. The permitted addresses are subject to restrictions as defined in the PCW configuration.

### Parameters

<i>address</i>	Physical 32-bit address of memory mapped register to write to.
<i>mask</i>	32-bit value used to limit write to specific bits in the register.
<i>value</i>	Value to write to the register bits specified by the mask.

### Returns

XST\_SUCCESS if successful else XST\_FAILURE or an error code or a reason code

## Note

If the access isn't permitted this function returns an error code.

## **XStatus XPm\_MmioRead ( const u32 *address*, u32 \**const value* )**

Call this function to read a value from a register that isn't accessible directly. The permitted addresses are subject to restrictions as defined in the PCW configuration.

### Parameters

<i>address</i>	Physical 32-bit address of memory mapped register to read from.
<i>value</i>	Returns the 32-bit value read from the register

### Returns

XST\_SUCCESS if successful else XST\_FAILURE or an error code or a reason code

## Note

If the access isn't permitted this function returns an error code.

## XStatus XPm\_ClockEnable ( const enum XPmClock *clock* )

Call this function to enable (activate) a clock.

### Parameters

<i>clock</i>	Identifier of the target clock to be enabled
--------------	--

### Returns

Status of performing the operation as returned by the PMU-FW

### Note

If the access isn't permitted this function returns an error code.

## XStatus XPm\_ClockDisable ( const enum XPmClock *clock* )

Call this function to disable (gate) a clock.

### Parameters

<i>clock</i>	Identifier of the target clock to be disabled
--------------	---

### Returns

Status of performing the operation as returned by the PMU-FW

### Note

If the access isn't permitted this function returns an error code.

## XStatus XPm\_ClockGetStatus ( const enum XPmClock *clock*, u32 \*const *status* )

Call this function to get status of a clock gate state.

### Parameters

<i>clock</i>	Identifier of the target clock
<i>status</i>	Location to store clock gate state (1=enabled, 0=disabled)

### Returns

Status of performing the operation as returned by the PMU-FW

## **XStatus XPm\_ClockSetDivider ( const enum XPmClock *clock*, const u32 *divider* )**

Call this function to set divider for a clock.

### **Parameters**

<i>clock</i>	Identifier of the target clock
<i>divider</i>	Divider value to be set

### **Returns**

XST\_INVALID\_PARAM or status of performing the operation as returned by the PMU-FW

### **Note**

If the access isn't permitted this function returns an error code.

## **XStatus XPm\_ClockGetDivider ( const enum XPmClock *clock*, u32 \*const *divider* )**

Call this function to get divider of a clock.

### **Parameters**

<i>clock</i>	Identifier of the target clock
<i>divider</i>	Location to store the divider value

### **Returns**

XST\_INVALID\_PARAM or status of performing the operation as returned by the PMU-FW

## **XStatus XPm\_ClockSetParent ( const enum XPmClock *clock*, const enum XPmClock *parent* )**

Call this function to set parent for a clock.

### **Parameters**

<i>clock</i>	Identifier of the target clock
<i>parent</i>	Identifier of the target parent clock

### **Returns**

XST\_INVALID\_PARAM or status of performing the operation as returned by the PMU-FW.

## Note

If the access isn't permitted this function returns an error code.

## **XStatus XPm\_ClockGetParent ( const enum XPmClock *clock*, enum XPmClock \*const *parent* )**

Call this function to get parent of a clock.

### Parameters

<i>clock</i>	Identifier of the target clock
<i>parent</i>	Location to store clock parent ID

### Returns

XST\_INVALID\_PARAM or status of performing the operation as returned by the PMU-FW.

## **XStatus XPm\_ClockSetRate ( const enum XPmClock *clock*, const u32 *rate* )**

Call this function to set rate of a clock.

### Parameters

<i>clock</i>	Identifier of the target clock
<i>rate</i>	Clock frequency (rate) to be set

### Returns

Status of performing the operation as returned by the PMU-FW

## Note

If the action isn't permitted this function returns an error code.

## **XStatus XPm\_ClockGetRate ( const enum XPmClock *clock*, u32 \*const *rate* )**

Call this function to get rate of a clock.

### Parameters

<i>clock</i>	Identifier of the target clock
<i>rate</i>	Location where the rate should be stored

## Returns

Status of performing the operation as returned by the PMU-FW

**XStatus XPm\_PllSetParameter ( const enum XPmNodeId *node*, const enum XPmPllParam *parameter*, const u32 *value* )**

Call this function to set a PLL parameter.

## Parameters

<i>node</i>	PLL node identifier
<i>parameter</i>	PLL parameter identifier
<i>value</i>	Value of the PLL parameter

## Returns

Status of performing the operation as returned by the PMU-FW

## Note

If the access isn't permitted this function returns an error code.

**XStatus XPm\_PllGetParameter ( const enum XPmNodeId *node*, const enum XPmPllParam *parameter*, u32 \*const *value* )**

Call this function to get a PLL parameter.

## Parameters

<i>node</i>	PLL node identifier
<i>parameter</i>	PLL parameter identifier
<i>value</i>	Location to store value of the PLL parameter

## Returns

Status of performing the operation as returned by the PMU-FW

**XStatus XPm\_PllSetMode ( const enum XPmNodeId *node*, const enum XPmPllMode *mode* )**

Call this function to set a PLL mode.

## Parameters

<i>node</i>	PLL node identifier
<i>mode</i>	PLL mode to be set

## Returns

Status of performing the operation as returned by the PMU-FW

## Note

If the access isn't permitted this function returns an error code.

**XStatus XPm\_PllGetMode ( const enum XPmNodeId *node*,  
enum XPmPllMode \*const *mode* )**

Call this function to get a PLL mode.

## Parameters

<i>node</i>	PLL node identifier
<i>mode</i>	Location to store the PLL mode

## Returns

Status of performing the operation as returned by the PMU-FW

**XStatus XPm\_PinCtrlRequest ( const u32 *pin* )**

Call this function to request a pin control.

## Parameters

<i>pin</i>	PIN identifier (index from range 0-77)
------------	--

## Returns

Status of performing the operation as returned by the PMU-FW

**XStatus XPm\_PinCtrlRelease ( const u32 *pin* )**

Call this function to release a pin control.

## Parameters

<i>pin</i>	PIN identifier (index from range 0-77)
------------	--

## Returns

Status of performing the operation as returned by the PMU-FW

## **XStatus XPm\_PinCtrlSetFunction ( const u32 *pin*, const enum XPmPinFn *fn* )**

Call this function to set a pin function.

## Parameters

<i>pin</i>	Pin identifier
<i>fn</i>	Pin function to be set

## Returns

Status of performing the operation as returned by the PMU-FW

## Note

If the access isn't permitted this function returns an error code.

## **XStatus XPm\_PinCtrlGetFunction ( const u32 *pin*, enum XPmPinFn \*const *fn* )**

Call this function to get currently configured pin function.

## Parameters

<i>pin</i>	PLL node identifier
<i>fn</i>	Location to store the pin function

## Returns

Status of performing the operation as returned by the PMU-FW

## **XStatus XPm\_PinCtrlSetParameter ( const u32 *pin*, const enum XPmPinParam *param*, const u32 *value* )**

Call this function to set a pin parameter.



## Parameters

<i>pin</i>	Pin identifier
<i>param</i>	Pin parameter identifier
<i>value</i>	Value of the pin parameter to set

## Returns

Status of performing the operation as returned by the PMU-FW

## Note

If the access isn't permitted this function returns an error code.

# XStatus XPm\_PinCtrlGetParameter ( const u32 *pin*, const enum XPmPinParam *param*, u32 \*const *value* )

Call this function to get currently configured value of pin parameter.

## Parameters

<i>pin</i>	Pin identifier
<i>param</i>	Pin parameter identifier
<i>value</i>	Location to store value of the pin parameter

## Returns

Status of performing the operation as returned by the PMU-FW

# XStatus XPm\_NotifierAdd ( XPm\_Notifier \*const *notifier* )

Add notifier into the list.

## Parameters

<i>notifier</i>	Pointer to notifier object which needs to be added in the list
-----------------	--

## Returns

Returns XST\_SUCCESS if notifier is added / XST\_INVALID\_PARAM if given notifier argument is NULL

## Note

None

**XStatus XPm\_NotifierRemove ( XPm\_Notifier \*const *notifier* )**

Remove notifier from the list.

#### Parameters

<i>notifier</i>	Pointer to notifier object to be removed from list
-----------------	--

#### Returns

Returns XST\_SUCCESS if notifier is removed / XST\_INVALID\_PARAM if given notifier pointer is NULL / XST\_FAILURE if notifier is not found

#### Note

None

**void XPm\_NotifierProcessEvent ( const enum XPmNodeId *node*, const enum XPmNotifyEvent *event*, const u32 *oppoint* )**

Call to process notification event.

#### Parameters

<i>node</i>	Node which is the subject of notification
<i>event</i>	Event which is the subject of notification
<i>oppoint</i>	Operating point of the node in question

#### Returns

None

#### Note

None

**XStatus XPm\_GetClockParentBySelect ( const enum XPmClock *clockId*, const u32 *select*, enum XPmClock \*const *parentId* )**

Get parent clock ID for a given clock ID and mux select value.

## Parameters

<i>clockId</i>	ID of the target clock
<i>select</i>	Mux select value
<i>parentId</i>	Location to store parent clock ID

## Returns

Returns XST\_SUCCESS if parent clock ID is found, XST\_INVALID\_PARAM otherwise.

## Note

None

**XStatus XPm\_GetSelectByClockParent ( const enum XPmClock *clockId*, const enum XPmClock *parentId*, u32 \*const *select* )**

Get mux select value for given clock and clock parent IDs.

## Parameters

<i>clockId</i>	ID of the target clock
<i>parentId</i>	ID of the parent clock
<i>select</i>	Location to store mux select value

## Returns

Returns XST\_SUCCESS if select value is found, XST\_INVALID\_PARAM otherwise.

## Note

None

**u8 XPm\_GetClockDivType ( const enum XPmClock *clock* )**

Get number of divider that a given clock has.

## Parameters

<i>clock</i>	ID of the target clock
--------------	------------------------

## Returns

Encoded clock divider types. If the clock ID is invalid zero is returned.

## Note

None

**u8 XPm\_MapDivider ( const enum XPmClock *clock*, const u32 *div*, u32 \*const *div0*, u32 \*const *div1* )**

Map effective divider value for given clock on DIV0 and DIV1 dividers.

## Parameters

<i>clock</i>	ID of the target clock
<i>div</i>	Effective divider value
<i>div0</i>	Location to store mapped DIV0 value
<i>div1</i>	Location to store mapped DIV1 value

## Returns

Encoded mask of mapped dividers

## Note

The effective divider value may not be mappable on 2x 6-bit wide dividers. This is the case if a given divider value is higher than 6-bit divider (requires 2xdividers), but its a prime number (cannot be divided to get 2x divider values).

# Error Status

## Overview

This section lists the Power management specific return error statuses.

## Macros

- #define [XST\\_PM\\_INTERNAL](#) 2000L
- #define [XST\\_PM\\_CONFLICT](#) 2001L
- #define [XST\\_PM\\_NO\\_ACCESS](#) 2002L
- #define [XST\\_PM\\_INVALID\\_NODE](#) 2003L
- #define [XST\\_PM\\_DOUBLE\\_REQ](#) 2004L
- #define [XST\\_PM\\_ABORT\\_SUSPEND](#) 2005L
- #define [XST\\_PM\\_TIMEOUT](#) 2006L
- #define [XST\\_PM\\_NODE\\_USED](#) 2007L

## Macro Definition Documentation



### **#define XST\_PM\_INTERNAL 2000L**

An internal error occurred while performing the requested operation

### **#define XST\_PM\_CONFLICT 2001L**

Conflicting requirements have been asserted when more than one processing cluster is using the same PM slave

### **#define XST\_PM\_NO\_ACCESS 2002L**

The processing cluster does not have access to the requested node or operation

### **#define XST\_PM\_INVALID\_NODE 2003L**

The API function does not apply to the node passed as argument

### **#define XST\_PM\_DOUBLE\_REQ 2004L**

A processing cluster has already been assigned access to a PM slave and has issued a duplicate request for that PM slave

### **#define XST\_PM\_ABORT\_SUSPEND 2005L**

The target processing cluster has aborted suspend

### **#define XST\_PM\_TIMEOUT 2006L**

A timeout occurred while performing the requested operation

### **#define XST\_PM\_NODE\_USED 2007L**

Slave request cannot be granted since node is non-shareable and used

# Additional Resources and Legal Notices

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## Xilinx Resources

For support resources such as Answers, Documentation, Downloads, and Forums, see [Xilinx Support](#).

## Solution Centers

See the [Xilinx Solution Centers](#) for support on devices, software tools, and intellectual property at all stages of the design cycle. Topics include design assistance, advisories, and troubleshooting tips.

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