

PortMidi

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# Contents

<b>1</b>	<b>Module Index</b>	<b>1</b>
1.1	Modules . . . . .	1
<b>2</b>	<b>Data Structure Index</b>	<b>3</b>
2.1	Data Structures . . . . .	3
<b>3</b>	<b>Module Documentation</b>	<b>5</b>
3.1	Input/Output Devices Handling . . . . .	5
3.1.1	Function Documentation . . . . .	5
3.1.1.1	Pm_GetDeviceInfo . . . . .	5
3.1.1.2	Pm_OpenInput . . . . .	5
3.2	Events and Filters Handling . . . . .	7
3.2.1	Define Documentation . . . . .	9
3.2.1.1	PM_FILT_REALTIME . . . . .	9
3.2.1.2	Pm_Message . . . . .	9
3.2.2	Function Documentation . . . . .	9
3.2.2.1	Pm_Abort . . . . .	9
3.2.2.2	Pm_Close . . . . .	9
3.2.2.3	Pm_SetChannelMask . . . . .	10
3.3	Reading and Writing Midi Messages . . . . .	11
3.3.1	Function Documentation . . . . .	11
3.3.1.1	Pm_Read . . . . .	11
3.3.1.2	Pm_Write . . . . .	11
3.3.1.3	Pm_WriteShort . . . . .	12
<b>4</b>	<b>Data Structure Documentation</b>	<b>13</b>
4.1	PmEvent Struct Reference . . . . .	13
4.1.1	Detailed Description . . . . .	13



# Chapter 1

## Module Index

### 1.1 Modules

Here is a list of all modules:

Input/Output Devices Handling . . . . .	5
Events and Filters Handling . . . . .	7
Reading and Writing Midi Messages . . . . .	11



## Chapter 2

# Data Structure Index

### 2.1 Data Structures

Here are the data structures with brief descriptions:

[PmEvent](#) (All midi data comes in the form of [PmEvent](#) structures ) . . . . . 13





# Chapter 3

## Module Documentation

### 3.1 Input/Output Devices Handling

#### Functions

- const PmDeviceInfo \* **Pm\_GetDeviceInfo** (PmDeviceID id)  
*Pm\_GetDeviceInfo()* returns a pointer to a PmDeviceInfo structure referring to the device specified by id.
- PmError **Pm\_OpenInput** (PortMidiStream \*\*stream, PmDeviceID inputDevice, void \*inputDriverInfo, long bufferSize, PmTimeProcPtr time\_proc, void \*time\_info)  
*Pm\_OpenInput()* and *Pm\_OpenOutput()* open devices.
- PmError **Pm\_OpenOutput** (PortMidiStream \*\*stream, PmDeviceID outputDevice, void \*outputDriverInfo, long bufferSize, PmTimeProcPtr time\_proc, void \*time\_info, long latency)

#### 3.1.1 Function Documentation

##### 3.1.1.1 const PmDeviceInfo\* Pm\_GetDeviceInfo (PmDeviceID id)

**Pm\_GetDeviceInfo()** returns a pointer to a PmDeviceInfo structure referring to the device specified by id.

If id is out of range the function returns NULL.

The returned structure is owned by the PortMidi implementation and must not be manipulated or freed. The pointer is guaranteed to be valid between calls to Pm\_Initialize() and Pm\_Terminate().

Definition at line 183 of file portmidi.c.

##### 3.1.1.2 PmError Pm\_OpenInput (PortMidiStream \*\* stream, PmDeviceID inputDevice, void \* inputDriverInfo, long bufferSize, PmTimeProcPtr time\_proc, void \* time\_info)

**Pm\_OpenInput()** and **Pm\_OpenOutput()** open devices.

stream is the address of a PortMidiStream pointer which will receive a pointer to the newly opened stream.

inputDevice is the id of the device used for input (see PmDeviceID above).

inputDriverInfo is a pointer to an optional driver specific data structure containing additional information for device setup or handle processing. inputDriverInfo is never required for correct operation. If not used

inputDriverInfo should be NULL.

outputDevice is the id of the device used for output (see PmDeviceID above.)

outputDriverInfo is a pointer to an optional driver specific data structure containing additional information for device setup or handle processing. outputDriverInfo is never required for correct operation. If not used outputDriverInfo should be NULL.

For input, the buffersize specifies the number of input events to be buffered waiting to be read using [Pm\\_Read\(\)](#). For output, buffersize specifies the number of output events to be buffered waiting for output. (In some cases – see below – PortMidi does not buffer output at all and merely passes data to a lower-level API, in which case buffersize is ignored.)

latency is the delay in milliseconds applied to timestamps to determine when the output should actually occur. (If latency is  $< 0$ , 0 is assumed.) If latency is zero, timestamps are ignored and all output is delivered immediately. If latency is greater than zero, output is delayed until the message timestamp plus the latency. (NOTE: the time is measured relative to the time source indicated by time\_proc. Timestamps are absolute, not relative delays or offsets.) In some cases, PortMidi can obtain better timing than your application by passing timestamps along to the device driver or hardware. Latency may also help you to synchronize midi data to audio data by matching midi latency to the audio buffer latency.

time\_proc is a pointer to a procedure that returns time in milliseconds. It may be NULL, in which case a default millisecond timebase (PortTime) is used. If the application wants to use PortTime, it should start the timer (call Pt\_Start) before calling Pm\_OpenInput or Pm\_OpenOutput. If the application tries to start the timer \*after\* Pm\_OpenInput or Pm\_OpenOutput, it may get a ptAlreadyStarted error from Pt\_Start, and the application's preferred time resolution and callback function will be ignored. time\_proc result values are appended to incoming MIDI data, and time\_proc times are used to schedule outgoing MIDI data (when latency is non-zero).

time\_info is a pointer passed to time\_proc.

Example: If I provide a timestamp of 5000, latency is 1, and time\_proc returns 4990, then the desired output time will be when time\_proc returns timestamp+latency = 5001. This will be  $5001 - 4990 = 11$ ms from now.

return value: Upon success Pm\_Open() returns PmNoError and places a pointer to a valid PortMidiStream in the stream argument. If a call to Pm\_Open() fails a nonzero error code is returned (see PmError above) and the value of port is invalid.

Any stream that is successfully opened should eventually be closed by calling [Pm\\_Close\(\)](#).

Definition at line 669 of file portmidi.c.

References PM\_FILT\_ACTIVE.

## 3.2 Events and Filters Handling

### Data Structures

- struct [PmEvent](#)

*All midi data comes in the form of [PmEvent](#) structures.*

### Defines

- #define [PM\\_FILT\\_ACTIVE](#) (1 << 0x0E)  
*filter active sensing messages (0xFE):*
- #define [PM\\_FILT\\_SYSEX](#) (1 << 0x00)  
*filter system exclusive messages (0xF0):*
- #define [PM\\_FILT\\_CLOCK](#) (1 << 0x08)  
*filter MIDI clock message (0xF8)*
- #define [PM\\_FILT\\_PLAY](#) ((1 << 0x0A) | (1 << 0x0C) | (1 << 0x0B))  
*filter play messages (start 0xFA, stop 0xFC, continue 0xFB)*
- #define [PM\\_FILT\\_TICK](#) (1 << 0x09)  
*filter tick messages (0xF9)*
- #define [PM\\_FILT\\_FD](#) (1 << 0x0D)  
*filter undefined FD messages*
- #define [PM\\_FILT\\_UNDEFINED](#) PM\_FILT\_FD  
*filter undefined real-time messages*
- #define [PM\\_FILT\\_RESET](#) (1 << 0x0F)  
*filter reset messages (0xFF)*
- #define [PM\\_FILT\\_REALTIME](#)  
*filter all real-time messages*
- #define [PM\\_FILT\\_NOTE](#) ((1 << 0x19) | (1 << 0x18))  
*filter note-on and note-off (0x90-0x9F and 0x80-0x8F)*
- #define [PM\\_FILT\\_CHANNEL\\_AFTERTOUCH](#) (1 << 0x1D)  
*filter channel aftertouch (most midi controllers use this) (0xD0-0xDF)*
- #define [PM\\_FILT\\_POLY\\_AFTERTOUCH](#) (1 << 0x1A)  
*per-note aftertouch (0xA0-0xAF)*
- #define [PM\\_FILT\\_AFTERTOUCH](#) (PM\_FILT\_CHANNEL\_AFTERTOUCH | PM\_FILT\_POLY\_AFTERTOUCH)  
*filter both channel and poly aftertouch*

- #define **PM\_FILT\_PROGRAM** (1 << 0x1C)  
*Program changes (0xC0-0xCF).*
- #define **PM\_FILT\_CONTROL** (1 << 0x1B)  
*Control Changes (CC's) (0xB0-0xBF).*
- #define **PM\_FILT\_PITCHBEND** (1 << 0x1E)  
*Pitch Bender (0xE0-0xEF).*
- #define **PM\_FILT\_MTC** (1 << 0x01)  
*MIDI Time Code (0xF1).*
- #define **PM\_FILT\_SONG\_POSITION** (1 << 0x02)  
*Song Position (0xF2).*
- #define **PM\_FILT\_SONG\_SELECT** (1 << 0x03)  
*Song Select (0xF3).*
- #define **PM\_FILT\_TUNE** (1 << 0x06)  
*Tuning request (0xF6).*
- #define **PM\_FILT\_SYSTEMCOMMON** (PM\_FILT\_MTC | PM\_FILT\_SONG\_POSITION | PM\_FILT\_SONG\_SELECT | PM\_FILT\_TUNE)  
*All System Common messages (mtc, song position, song select, tune request).*
- #define **Pm\_Channel**(channel) (1 << (channel))
- #define **Pm\_Message**(status, data1, data2)  
*Pm\_Message() encodes a short Midi message into a long word.*
- #define **Pm\_MessageStatus**(msg) ((msg) & 0xFF)
- #define **Pm\_MessageData1**(msg) (((msg) >> 8) & 0xFF)
- #define **Pm\_MessageData2**(msg) (((msg) >> 16) & 0xFF)

## Typedefs

- typedef long **PmMessage**  
*see PmEvent*

## Functions

- PmError **Pm\_SetFilter** (PortMidiStream \*stream, long filters)
- PmError **Pm\_SetChannelMask** (PortMidiStream \*stream, int mask)  
*Pm\_SetChannelMask() filters incoming messages based on channel.*
- PmError **Pm\_Abort** (PortMidiStream \*stream)  
*Pm\_Abort() terminates outgoing messages immediately The caller should immediately close the output port; this call may result in transmission of a partial midi message.*

- PmError [Pm\\_Close](#) (PortMidiStream \*stream)  
*[Pm\\_Close\(\)](#) closes a midi stream, flushing any pending buffers.*

### 3.2.1 Define Documentation

#### 3.2.1.1 #define PM\_FILT\_REALTIME

**Value:**

```
(PM_FILT_ACTIVE | PM_FILT_SYSEX | PM_FILT_CLOCK | \
 PM_FILT_PLAY | PM_FILT_UNDEFINED | PM_FILT_RESET | PM_FILT_TICK)
```

filter all real-time messages

Definition at line 386 of file portmidi.h.

#### 3.2.1.2 #define Pm\_Message(status, data1, data2)

**Value:**

```
(((((data2) << 16) & 0xFF0000) | \
 (((data1) << 8) & 0xFF00) | \
 ((status) & 0xFF))
```

[Pm\\_Message\(\)](#) encodes a short Midi message into a long word.

If data1 and/or data2 are not present, use zero.

Pm\_MessageStatus(), Pm\_MessageData1(), and Pm\_MessageData2() extract fields from a long-encoded midi message.

Definition at line 454 of file portmidi.h.

### 3.2.2 Function Documentation

#### 3.2.2.1 PmError Pm\_Abort (PortMidiStream \* stream)

[Pm\\_Abort\(\)](#) terminates outgoing messages immediately The caller should immediately close the output port; this call may result in transmission of a partial midi message.

There is no abort for Midi input because the user can simply ignore messages in the buffer and close an input device at any time.

Definition at line 893 of file portmidi.c.

#### 3.2.2.2 PmError Pm\_Close (PortMidiStream \* stream)

[Pm\\_Close\(\)](#) closes a midi stream, flushing any pending buffers.

(PortMidi attempts to close open streams when the application exits – this is particularly difficult under Windows.)

Definition at line 860 of file portmidi.c.

### 3.2.2.3 PmError Pm\_SetChannelMask (PortMidiStream \* *stream*, int *mask*)

[Pm\\_SetChannelMask\(\)](#) filters incoming messages based on channel.

The mask is a 16-bit bitfield corresponding to appropriate channels. The Pm\_Channel macro can assist in calling this function. i.e. to set receive only input on channel 1, call with Pm\_SetChannelMask(Pm\_Channel(1)); Multiple channels should be OR'd together, like Pm\_SetChannelMask(Pm\_Channel(10) | Pm\_Channel(11))

All channels are allowed by default

Definition at line 831 of file portmidi.c.

## 3.3 Reading and Writing Midi Messages

### Functions

- int [Pm\\_Read](#) (PortMidiStream \*stream, [PmEvent](#) \*buffer, long length)  
*Pm\_Read()* retrieves midi data into a buffer, and returns the number of events read.
- PmError [Pm\\_Poll](#) (PortMidiStream \*stream)  
*Pm\_Poll()* tests whether input is available, returning TRUE, FALSE, or an error value.
- PmError [Pm\\_Write](#) (PortMidiStream \*stream, [PmEvent](#) \*buffer, long length)  
*Pm\_Write()* writes midi data from a buffer.
- PmError [Pm\\_WriteShort](#) (PortMidiStream \*stream, PmTimestamp when, long msg)  
*Pm\_WriteShort()* writes a timestamped non-system-exclusive midi message.
- PmError [Pm\\_WriteSysEx](#) (PortMidiStream \*stream, PmTimestamp when, unsigned char \*msg)  
*Pm\_WriteSysEx()* writes a timestamped system-exclusive midi message.

### 3.3.1 Function Documentation

#### 3.3.1.1 int Pm\_Read (PortMidiStream \* stream, PmEvent \* buffer, long length)

[Pm\\_Read\(\)](#) retrieves midi data into a buffer, and returns the number of events read.

Result is a non-negative number unless an error occurs, in which case a PmError value will be returned.

Buffer Overflow

The problem: if an input overflow occurs, data will be lost, ultimately because there is no flow control all the way back to the data source. When data is lost, the receiver should be notified and some sort of graceful recovery should take place, e.g. you shouldn't resume receiving in the middle of a long sysex message.

With a lock-free fifo, which is pretty much what we're stuck with to enable portability to the Mac, it's tricky for the producer and consumer to synchronously reset the buffer and resume normal operation.

Solution: the buffer managed by PortMidi will be flushed when an overflow occurs. The consumer ([Pm\\_Read\(\)](#)) gets an error message (pmBufferOverflow) and ordinary processing resumes as soon as a new message arrives. The remainder of a partial sysex message is not considered to be a "new message" and will be flushed as well.

Definition at line 357 of file portmidi.c.

#### 3.3.1.2 PmError Pm\_Write (PortMidiStream \* stream, PmEvent \* buffer, long length)

[Pm\\_Write\(\)](#) writes midi data from a buffer.

This may contain:

- short messages or
- sysex messages that are converted into a sequence of [PmEvent](#) structures, e.g. sending data from a file or forwarding them from midi input.

Use [Pm\\_WriteSysEx\(\)](#) to write a sysex message stored as a contiguous array of bytes.

Sysex data may contain embedded real-time messages.

Definition at line 448 of file portmidi.c.

Referenced by [Pm\\_WriteShort\(\)](#), and [Pm\\_WriteSysEx\(\)](#).

### **3.3.1.3 PmError Pm\_WriteShort (PortMidiStream \* *stream*, PmTimestamp *when*, long *msg*)**

[Pm\\_WriteShort\(\)](#) writes a timestamped non-system-exclusive midi message.

Messages are delivered in order as received, and timestamps must be non-decreasing. (But timestamps are ignored if the stream was opened with latency = 0.)

Definition at line 581 of file portmidi.c.

References [Pm\\_Write\(\)](#).



# Chapter 4

## Data Structure Documentation

### 4.1 PmEvent Struct Reference

All midi data comes in the form of [PmEvent](#) structures.

```
#include <portmidi.h>
```

#### Data Fields

- [PmMessage](#) message
- PmTimestamp timestamp

#### 4.1.1 Detailed Description

All midi data comes in the form of [PmEvent](#) structures.

A sysex message is encoded as a sequence of [PmEvent](#) structures, with each structure carrying 4 bytes of the message, i.e. only the first [PmEvent](#) carries the status byte.

Note that MIDI allows nested messages: the so-called "real-time" MIDI messages can be inserted into the MIDI byte stream at any location, including within a sysex message. MIDI real-time messages are one-byte messages used mainly for timing (see the MIDI spec). PortMidi retains the order of non-real-time MIDI messages on both input and output, but it does not specify exactly how real-time messages are processed. This is particularly problematic for MIDI input, because the input parser must either prepare to buffer an unlimited number of sysex message bytes or to buffer an unlimited number of real-time messages that arrive embedded in a long sysex message. To simplify things, the input parser is allowed to pass real-time MIDI messages embedded within a sysex message, and it is up to the client to detect, process, and remove these messages as they arrive.

When receiving sysex messages, the sysex message is terminated by either an EOX status byte (anywhere in the 4 byte messages) or by a non-real-time status byte in the low order byte of the message. If you get a non-real-time status byte but there was no EOX byte, it means the sysex message was somehow truncated. This is not considered an error; e.g., a missing EOX can result from the user disconnecting a MIDI cable during sysex transmission.

A real-time message can occur within a sysex message. A real-time message will always occupy a full [PmEvent](#) with the status byte in the low-order byte of the [PmEvent](#) message field. (This implies that the byte-order of sysex bytes and real-time message bytes may not be preserved – for example, if a real-time message arrives after 3 bytes of a sysex message, the real-time message will be delivered first. The first

word of the sysex message will be delivered only after the 4th byte arrives, filling the 4-byte [PmEvent](#) message field.

The timestamp field is observed when the output port is opened with a non-zero latency. A timestamp of zero means "use the current time", which in turn means to deliver the message with a delay of latency (the latency parameter used when opening the output port.) Do not expect PortMidi to sort data according to timestamps – messages should be sent in the correct order, and timestamps **MUST** be non-decreasing. See also "Example" for `Pm_OpenOutput()` above.

A sysex message will generally fill many [PmEvent](#) structures. On output to a PortMidiStream with non-zero latency, the first timestamp on sysex message data will determine the time to begin sending the message. PortMidi implementations may ignore timestamps for the remainder of the sysex message.

On input, the timestamp ideally denotes the arrival time of the status byte of the message. The first timestamp on sysex message data will be valid. Subsequent timestamps may denote when message bytes were actually received, or they may be simply copies of the first timestamp.

Timestamps for nested messages: If a real-time message arrives in the middle of some other message, it is enqueued immediately with the timestamp corresponding to its arrival time. The interrupted non-real-time message or 4-byte packet of sysex data will be enqueued later. The timestamp of interrupted data will be equal to that of the interrupting real-time message to insure that timestamps are non-decreasing.

Definition at line 528 of file portmidi.h.

The documentation for this struct was generated from the following file:

- portmidi.h

# Index

Events and Filters Handling, [7](#)

grp\_device

    Pm\_GetDeviceInfo, [5](#)

    Pm\_OpenInput, [5](#)

grp\_events\_filters

    Pm\_Abort, [9](#)

    Pm\_Close, [9](#)

    PM\_FILT\_REALTIME, [9](#)

    Pm\_Message, [9](#)

    Pm\_SetChannelMask, [9](#)

grp\_io

    Pm\_Read, [11](#)

    Pm\_Write, [11](#)

    Pm\_WriteShort, [12](#)

Input/Output Devices Handling, [5](#)

Pm\_Abort

    grp\_events\_filters, [9](#)

Pm\_Close

    grp\_events\_filters, [9](#)

PM\_FILT\_REALTIME

    grp\_events\_filters, [9](#)

Pm\_GetDeviceInfo

    grp\_device, [5](#)

Pm\_Message

    grp\_events\_filters, [9](#)

Pm\_OpenInput

    grp\_device, [5](#)

Pm\_Read

    grp\_io, [11](#)

Pm\_SetChannelMask

    grp\_events\_filters, [9](#)

Pm\_Write

    grp\_io, [11](#)

Pm\_WriteShort

    grp\_io, [12](#)

PmEvent, [13](#)

Reading and Writing Midi Messages, [11](#)