

S1C17 Family Application Library
S1C17 Series
Steps Calculation Library

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1. Overview

This manual is intended to describe the specification for Epson's original steps calculation library for S1C17 series that is used to calculate the number of steps, walking distance, consumed calories, and others based on the tri-axis acceleration input. This section describes the features of this library.

1) Steps calculation with wrist mount is supported

In the steps calculation, this library supports not only the mounting on the body trunk, such as the chest and waist, and installation in a bag or pocket but also the wrist mount.

2) False detection due to other than walking vibration is suppressed

The algorithm is adopted that enables stable steps calculation by suppressing the false step detection due to other than walking vibration, such as a car.

3) Walking speed is automatically estimated

The walking distance, exercise, and others are calculated by estimating walking speed based on the user's body height and weight.

The table below lists the I/O data specification of this library.

Table 1-1 I/O data specification

Item	Specification	Remarks
Input acceleration	Accelerometer: Tri-axis x 16 bit Sampling: 25 Hz Acceleration range: ± 4 G/ ± 8 G/ ± 16 G	The acceleration range is selectable
Item calculated	Number of steps	The data is updated each time a step is detected
	Walking distance [1/256 m]	
	Walking speed [1/256 m/s]	
	Walking duration [sec]	The data is updated every second
	Exercise [1/256]	
	Consumed calories [1/256 Kcal]	
	Amount of fat burnt [1/256 g]	
METs [1/256]		

2. File Configuration

2. File Configuration

This section describes the file configuration of the S1C17 series steps calculation library.

Table 2-1 File configuration

File	Description
PedoLib/	Steps calculation library folder
pedo.c	Steps calculation program
pedo.h	Steps calculation header file
calo.c	Consumed calories calculation program
calo.h	Header file for consumed calories calculation
walkdist.c	Walking distance calculation program
walkdist.h	Header file for walking distance calculation
stepcade.c	Cadence calculation program
stepcade.h	Header file for cadence calculation
steplib.c	Walking detection program
steplib.h	Walking detection header file
steplibdef.h	Header file for internal library variables

3. Memory Size Requirement

The table below lists the memory sizes required by the S1C17 series steps calculation library.

Table 3-1 Memory size requirement

Section name	Size (Byte)	Description
.bss	80	Variable without initial value
.data	0	Variable with initial value
.rodata	166	Constant table
.text	3868	Program

4. API Function List

4. API Function List

The table below lists the API functions supported by the S1C17 series steps calculation library.

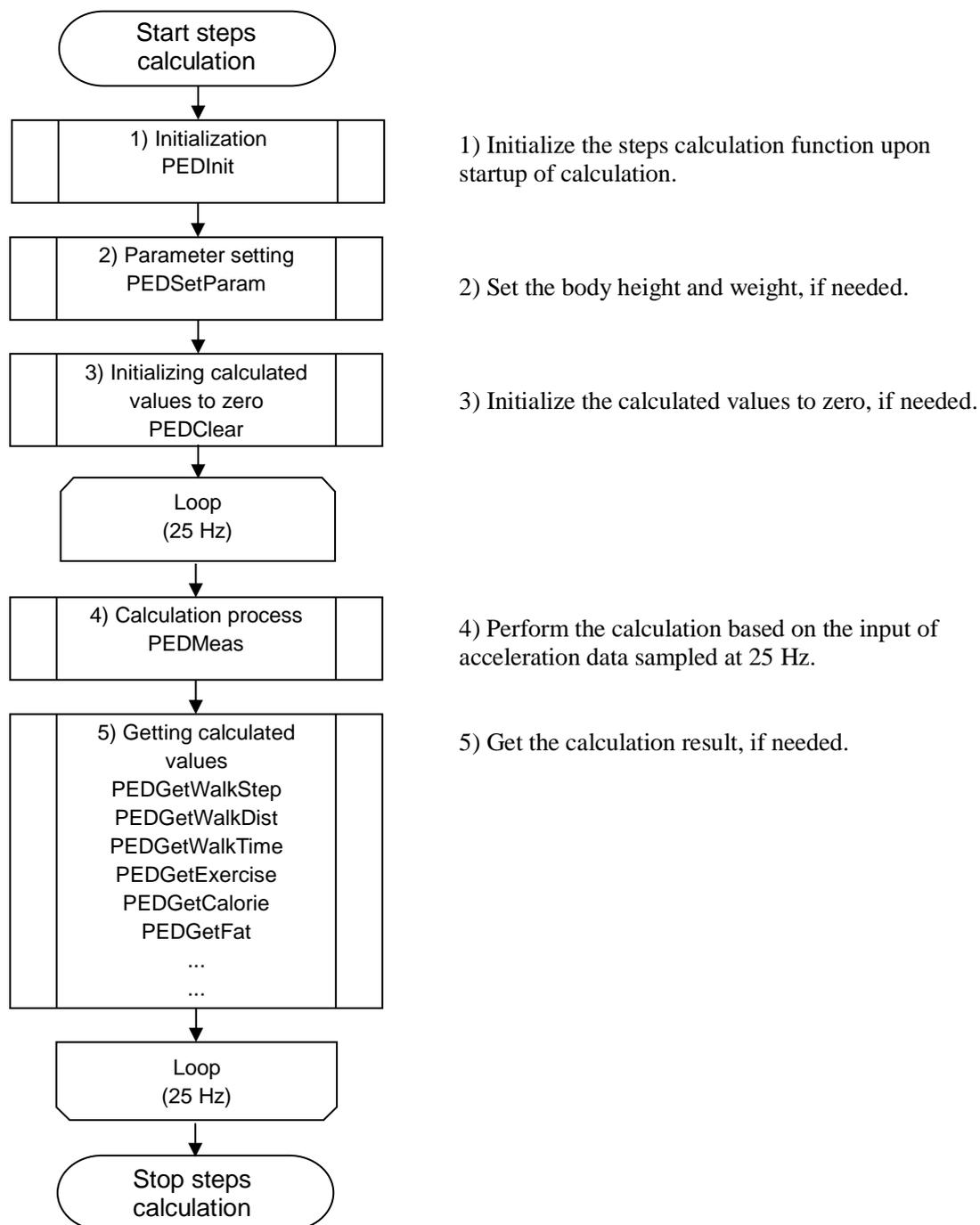
Table 4-1 API Function List

API function	Functional overview
PEDReset	Initializes all variables.
PEDInit	Initializes variables except for calculated values, such as the number of steps and consumed calories.
PEDClear	Initializes calculated values to zero, such as the number of steps and consumed calories.
PEDMeas	The steps are calculated based on the acceleration data sampled at 25 Hz.
PEDSetParam	Sets the user's body height and weight.
PEDGetWalkStep	Gets the number of steps calculated.
PEDGetWalkDist	Gets the walking distance calculated.
PEDGetWalkTime	Gets the walking duration calculated.
PEDGetExercise	Gets the walking exercise calculated.
PEDGetCalorie	Gets the consumed calories by the walking calculated.
PEDGetFat	Gets the amount of fat burnt by the walking calculated.
PEDGetWalkSpeed	Gets the walking speed calculated.
PEDGetMETs	Gets METs of the walking calculated.
PEDGetCadence	Gets the walking cadence calculated.

5. Operation Flow

This section describes basic operation flow of the S1C17 series steps calculation library.

Figure 5-1 Basic operation flow



6. API Function Details

6. API Function Details

PEDReset

Include

```
#include "pedo.h"
```

Format void PEDReset(void)

Argument

None

Return Value

None

Description

This function initializes all internal variables. Basically, this function is performed once at system startup. To initialize only the calculated data (number of steps, walking duration, walking distance, exercise amount, consumed calories, and amount of fat burnt) and calculation state, perform the PEDClear and PEDInit functions.

PEDInit

Include

```
#include "pedo.h"
```

Format void PEDInit(void)

Argument

None

Return Value

None

Description

This function performs the initialization process required when restarting from stopped state. The calculated data (number of steps, walking duration, walking distance, exercise amount, consumed calories, and amount of fat burnt) is not initialized.

PEDClear

Include

```
#include "pedo.h"
```

Format void PEDClear(void)

Argument

None

Return Value

None

Description

The calculated data accumulated (number of steps, walking duration, walking distance, exercise amount, consumed calories, and amount of fat burnt) is cleared by zero. Also, METs is cleared to 1.0.

PEDMeas

Include

```
#include "pedo.h"
```

Format int PEDMeas(short ai16XYZ[3], int iRadixPt)

Argument

ai16XYZ[3] Tri-axis acceleration data sampled at 25 Hz

iRadixPt Number of bits for fractional part of numeric value corresponding to 1 G of acceleration data

Specify a number from 11 to 13 according to the table below

Table 6-1 Setting value of argument iRadixPt

Measurement range of accelerometer	Sensor value corresponding to 1 G	iRadixPt value
±4 G	8192	13
±8 G	4096	12
±16 G	2048	11

Return Value

The return value represents whether the calculated information is updated. The value represents whether the number of steps, walking distance, consumed calories, and others are updated. One if the calculated information is updated, and zero otherwise.

Table 6-2 Return value of function PEDMeas

Return Value	Update of steps calculation
0	None
1	Yes

Description

The walking distance, consumed calories, and others are calculated by calculating the number of steps based on the tri-axis acceleration data sampled at 25 Hz. Call this function at the same sampling frequency of 25 Hz as the acceleration data.

The number of steps, walking speed, walking distance, and walking duration are updated each time a step is detected. The exercise amount, consumed calories, amount of fat burnt, and METs are updated every second while detecting steps. Also, the calculated values are updated even when the user stops.

6. API Function Details

PEDSetParam

Include

```
#include "pedo.h"
```

Format void PEDSetParam(int iHeight, int iWeight)

Argument

<i>iHeight</i>	Body height (cm)	(setting range: 120 to 255)
<i>iWeight</i>	Body weight (kg)	(setting range: 0 to 255)

Return Value

None

Description

This function sets the user's body height and weight. Here, these setting values are initialized to defaults (body height: 165 cm, body weight: 60 kg) when the PEDReset function is performed. If the setting value is out of range, the value is clipped to upper or lower limit.

PEDGetWalkStep

Include

```
#include "pedo.h"
```

Format unsigned long PEDGetWalkStep(void)

Argument

None

Return Value

Returns the number of steps calculated.

Description

Returns the accumulated number of steps calculated from the time initialized by the PEDClear function up to now. This function is executable asynchronously with the interrupt handler.

PEDGetWalkDist

Include

```
#include "pedo.h"
```

Format unsigned long PEDGetWalkDist(void)

Argument

None

Return Value

Returns the walking distance. The unit is meter (m) and fractional part is represented in 8 bits (Q8 format).

Description

Returns the accumulated walking distance calculated from the time initialized by the PEDClear function up to now. This function is executable asynchronously with the interrupt handler.

PEDGetWalkTime

Include

```
#include "pedo.h"
```

Format unsigned long PEDGetWalkTime(void)

Argument

None

Return Value

Returns the walking duration. The unit is second.

Description

Returns the accumulated walking duration calculated from the time initialized by the PEDClear function up to now. This function is executable asynchronously with the interrupt handler.

PEDGetExercise

Include

```
#include "pedo.h"
```

Format unsigned long PEDGetExercise(void)

Argument

None

Return Value

Returns the exercise. The fractional part is represented in 8 bits (Q8 format).

Description

Returns the exercise amount calculated from the time initialized by the PEDClear function up to now. This function is executable asynchronously with the interrupt handler.

6. API Function Details

PEDGetCalorie

Include

```
#include "pedo.h"
```

Format unsigned long PEDGetCalorie(void)

Argument

None

Return Value

Returns the consumed calories. The unit is Kcal and fractional part is represented in 8 bits (Q8 format).

Description

Returns the consumed calories calculated from the time initialized by the PEDClear function up to now. This function is executable asynchronously with the interrupt handler.

PEDGetFat

Include

```
#include "pedo.h"
```

Format unsigned long PEDGetFat(void)

Argument

None

Return Value

Returns the amount of fat burnt. The unit is gram (g) and fractional part is represented in 8 bits (Q8 format).

Description

Returns the amount of fat burnt calculated from the time initialized by the PEDClear function up to now. This function is executable asynchronously with the interrupt handler.

PEDGetWalkSpeed

Include

```
#include "pedo.h"
```

Format unsigned short PEDGetWalkSpeed(void)

Argument

None

Return Value

Returns current walking speed. The unit is m/sec and fractional part is represented in 8 bits (Q8 format).

Description

Current walking speed is returned. Zero is returned at a stop.

PEDGetMETs

Include

`#include "pedo.h"`

Format unsigned short PEDGetMETs(void)

Argument

None

Return Value

Returns METs of current walking. The fractional part is represented in 8 bits (Q8 format).

Description

Returns METs of current walking. The number 1.0 (0x100) is returned at a stop.

PEDGetCadence

Include

`#include "pedo.h"`

Format unsigned char PEDGetCadence(void)

Argument

None

Return Value

Returns the cadence of current walking (steps/minute).

Description

Returns the cadence of current walking. Zero is returned at a stop.

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