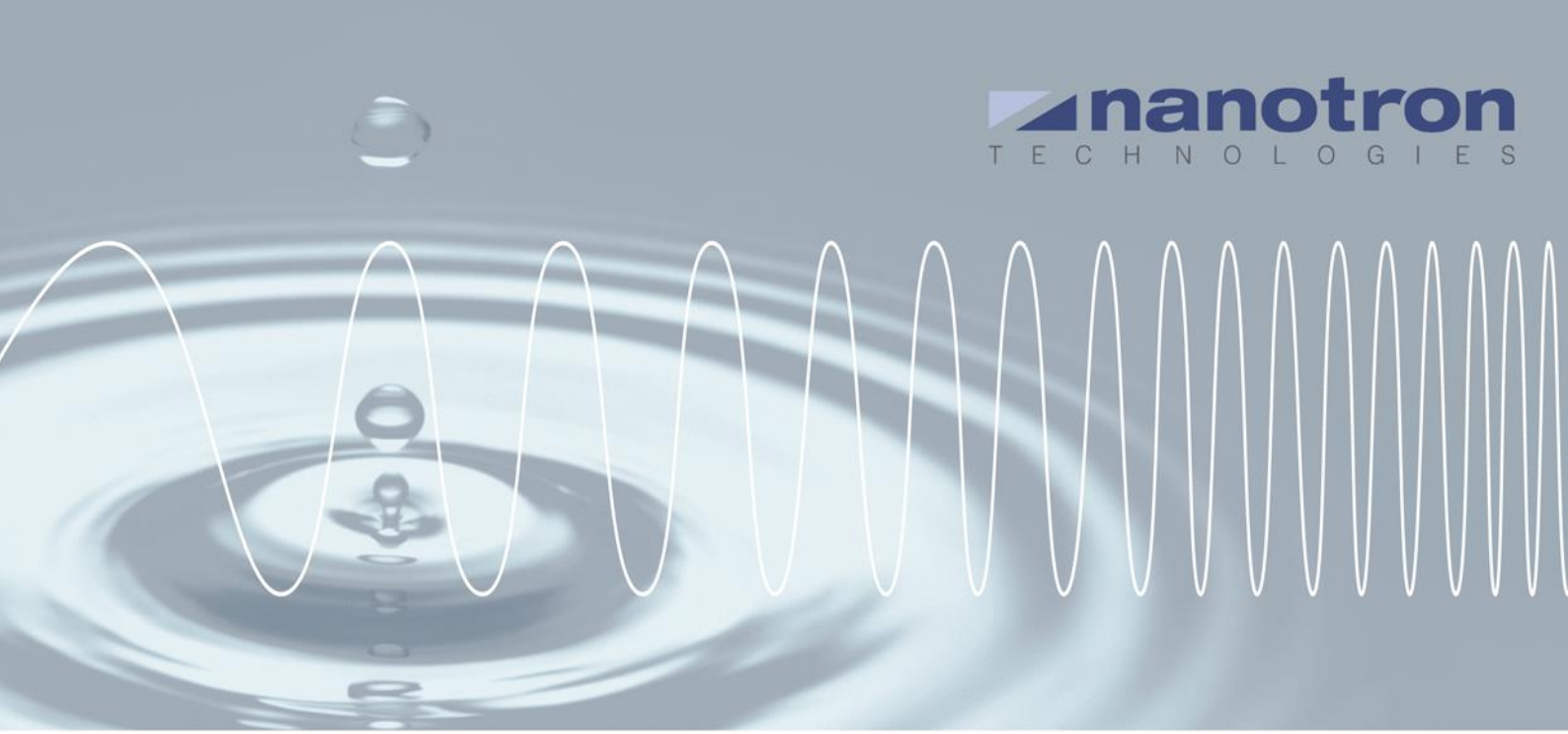

AN0511 - swarm bee Alternative Blink Interval

1.0

NA-15-0356-0035

Document Information

Document Title:	AN0511 - swarm bee Alternative Blink Interval
Document Version:	1.0
Current Date:	2016-03-03
Print Date:	2016-03-03
Document ID:	NA-15-0356-0035
Document Author:	MLA

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1. Introduction

The main function of swarm bee is to announce itself by sending periodic nodeID blinks. This allows other devices in the area to know the presence of this particular swarm device and, if necessary, to estimate how far it is, in case of another swarm bee, or estimate its position, in case the detecting device is part of an RTLS. How often the swarm bee sends the nodeID blink depends on the application requirements. It is not the same a swarm always moving very fast or a swarm that is standing still most of the time and only moves occasionally at a limited speed. Moreover, there can be cases, where the optimal blink interval of a swarm device varies depending on its behavior or that of the environment. For this cases, the alternative blink interval functionality has been developed and new commands have been added to the swarm API. This is included in swarm firmware versions 3.0 and later.
This document explains the difference between the default, or 'normal', blink interval and the alternative one. It lists the different means to change the blink interval and shows how to do it step by step.

2. What is the alternative blink interval?

The blink interval is a parameter that can be set in any swarm bee. Both on-line and off-line the user (or a host controller) can decide to change it either via the UART interface or over-the-air, as any other swarm parameter.
With the alternative blink interval functionality the new temporary blink interval can be triggered by the swarm bee's internal MEMS and the GPIOs. The user (or again a host controller) can pre-assign the alternative blink intervals required for the application and so that the swarm device will decide at each moment which interval to use. Thus it does not require any external device or host controller to analyze the situation and decide whether to change or not. This allows the swarm bee not only to be independent but also to react faster to any event.

3. How to set different blink intervals

Alternative blink intervals can be triggered by 5 different sources (MEMS and GPIO0, GPIO1, GPIO2 and GPIO3), all of them independent from each other.
It is possible to assign different priority level to each source, so that it is clear which blink interval the device will have when more than one has been triggered.

3.1. MEMS

The swarm bee can be configured to switch to an alternative blink interval when the MEMS generates an interrupt. The alternative interval will be kept as long as the device is moving. Once the MEMS does not detect movement for longer than a predefined period of time, timeout, the device will go back to its 'normal' blink interval.
The API commands used to configure an alternative blink interval triggered by the MEMS are:

ICFG <setting> where <setting> is a mask from 0 to FFFF indicating what interrupts are allowed.
Bit 0 = PA0 = DIO_0 = Rising edge enabled/disabled
Bit 1 = PA0 = DIO_0 = falling edge enabled/disabled
Bit 2 = PA2 = DIO_1 = Rising edge enabled/disabled
Bit 3 = PA2 = DIO_1 = falling edge enabled/disabled
Bit 4 = PA3 = DIO_2 = Rising edge enabled/disabled
Bit 5 = PA3 = DIO_2 = falling edge enabled/disabled
Bit 6 = PA8 = DIO_3 = Rising edge enabled/disabled
Bit 7 = PA8 = DIO_3 = falling edge enabled/disabled
Bit 8 = MEMS interrupt enabled/disabled

SMAI <Interval> <Priority> <Timeout> where <interval> in milliseconds, from 0 to 65000
<Priority> from 0 to 255
Lower number indicates higher priority
<Timeout> in milliseconds, from 0 to 65000

More details about the API commands can be found in [1].

Example 1.1: The MEMS is the only source of interrupt and the required alternative blink is 100 milliseconds with a time-out of 1 minute and the highest priority (1):

```
ICFG 100
SMAI 100 1 60000
SSET
```

Example 1.2: The 'normal' blink interval is 15 seconds. When the device is moving the blink interval switches to 1 seconds, until no movement is detected for more than 5 seconds.

```
SBIV 15000
ICFG 100
SMAI 1000 1 5000
SSET
```

3.2. GPIOs

Each GPIO pin can be independently configured to trigger an alternative blink interval any time it goes active. This alternative blink interval will be applied as long as the selected GPIO pin remains active. While in this mode, the pin cannot be set as output
To set the GPIOs in this mode the user needs first to enable interrupts triggered by them. The used API commands are the following:

ICFG <setting> where <setting> is a mask from 0 to FFFF indicating what interrupts are allowed.
Bit 0 = PA0 = DIO_0 = Rising edge enabled/disabled
Bit 1 = PA0 = DIO_0 = falling edge enabled/disabled
Bit 2 = PA2 = DIO_1 = Rising edge enabled/disabled
Bit 3 = PA2 = DIO_1 = falling edge enabled/disabled
Bit 4 = PA3 = DIO_2 = Rising edge enabled/disabled
Bit 5 = PA3 = DIO_2 = falling edge enabled/disabled
Bit 6 = PA8 = DIO_3 = Rising edge enabled/disabled
Bit 7 = PA8 = DIO_3 = falling edge enabled/disabled
Bit 8 = MEMS interrupt enabled/disabled

GPIO <Pin> <Mode=3> <Interval> <ActiveState> <Priority>

where	<Interval>	is the alternative blink interval in milliseconds, form 0 to 65000
	<ActiveState>	defines whether the pin is low or high active, 0 or 1
	<Priority>	from 0 to 255. Lower number indicates higher priority.

More details about the API commands can be found in [1].

Example 2.1: The user would like to configure pin GPIO 1 to trigger a 10 millisecond blink interval when it is high, and pin GPIO 2 to trigger a 50 millisecond blink interval when it is low. When both pins are active, pin 1 should have priority. The user should enter:

```
ICFG 03C
GPIO 1 3 10 1 5
GPIO 2 3 50 0 10
SSET
```

Example 2.2: During normal operation the swarm device should blink every second. During battery charging the GPIO will be set to low, so that the swarm bee knows that it is in charging mode and the blink interval should be increase to 30 seconds.

```
SBIV 1000
ICFG 00C
GPIO 1 3 30000 0 5
SSET
```

4. Response time depending on the power mode

When a swarm device is configured to have one or more alternative blink intervals, this will change as soon as the required GPIO is active or the MEMS detects movement. In order to do so, the swarm device needs to continuously monitor them; what is normally done when the device is active (power mode 0), sleep state (power mode 1) and in nap state (power mode 3).
When the device is in power mode 2, however, MEMS and GPIOs are only during active state. Thus, the blink interval only changes if the GPIO is kept active or the sensor detects movement at the very moment when they are checked before transmitting a blink.

5. References

[1] swarm API 3.0, nanotron Technologies, 2016
[2] AN0513 – swarm bee Power Modes, nanotron Technologies, 2016

Document History

Date	Author	Version	Description
3/3/2016	MLA	1.0	Initial version

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