



## congatec Application Note #9

<b>Affected Products</b>	All congatec products featuring RTC
<b>Subject</b>	Calculate the lifetime of RTC battery
<b>Confidential/Public</b>	Public
<b>Author</b>	SDA

## Revision History

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Revision	Date (yyyy-mm-dd)	Author	Changes
1.0	2006-10-04	RCH	Initial Release
1.1	2017-03-14	SDA	Completely revised

## Preface

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This application note is a short example of how to calculate the maximum battery service time when a specific RTC circuit battery type must be used. Additionally, it also describes how to determine the required RTC circuit battery capacity when a specific battery service time is required.

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## Intended Audience

This Application Note is intended for technically qualified personnel. It is not intended for general audiences.

## Electrostatic Sensitive Device

All congatec AG products are electrostatic sensitive devices and are packaged accordingly. Do not open or handle a congatec AG product except at an electrostatic-free workstation. Additionally, do not ship or store congatec AG products near strong electrostatic, electromagnetic, magnetic, or radioactive fields unless the device is contained within its original manufacturer's packaging. Be aware that failure to comply with these guidelines will void the congatec AG Limited Warranty.

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## Symbols

The following are symbols used in this application note.



*Notes call attention to important information that should be observed.*



*Cautions warn the user about how to prevent damage to hardware or loss of data.*



*Warnings indicate that personal injury can occur if the information is not observed.*

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## Terminology

Term	Description
RTC	Real Time Clock – battery backed circuit in PC-AT systems that keeps system time and date as well as certain system setup parameters. when the computer is not powered. It is normally supplied by a battery.

## 1 Introduction

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The following sections describe how to calculate:

- the lifetime of the installed RTC battery.
- the required RTC battery capacity when a specific life expectancy of the battery must be obtained.

For detailed information about the power consumption of the RTC circuit on the various congatec products, refer to respective User's Guide on the congatec website at [www.congatec.com](http://www.congatec.com).

The RTC Battery Power Consumption value is a measured value and may differ from the value listed in the chipset datasheet. The measurement for computer-on-modules (COM) is carried out with a congatec evaluation carrier board and therefore only valid with this setup.

To get the most accurate value for the RTC Battery Power Consumption, it is recommended to perform the measurement with customer's carrier board and in worst case situation. This means you should measure the value when the board is in G3 mode (mechanical off – no AC power connected), at highest specified ambient temperature and when a new battery is connected.

## 2 How to Calculate

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Section 2.1 shows how to calculate the maximum battery lifetime with a specific battery. Section 2.2 shows how to determine the nominal capacity when a specific battery lifetime has to be reached.

### 2.1 Calculating the maximum battery lifetime

The maximum lifetime of a battery supplying the RTC circuitry when AC power is switched off can be calculated by using following formula:

$$t_{\max} = \frac{Bat_{\text{NomCap}}}{24 \times 365 \times I_{\text{BatMax}}} \times 0.8$$

$t_{\max}$ :	Maximum battery lifetime in years.
$Bat_{\text{NomCap}}$ :	Nominal capacity of the installed battery in mAh.
$I_{\text{BatMax}}$ :	Maximum RTC battery current in $\mu\text{A}$ .

 **Note**

***Factor 0.8 considers the external impacts that can affect the battery lifetime. This factor can vary from 0.7 to 0.9 depending on the battery and operating conditions.***

**Caution**

***The lifetime of the battery begins at the date of manufacturing. The RTC starts as soon as the battery is installed to the system. Additionally the battery will discharge even when it is not installed to a system. If a battery is not installed to a system the nominal capacity will be decreased by approximately 1% per year.***

## 2.2 Calculating the nominal battery capacity

The nominal capacity of the battery supplying the RTC circuitry when AC power is switched off can be calculated by using following formula:

$$Bat_{NomCap} = t_{min} \times 24 \times 365 \times I_{BatMax} \times 1.2$$

$Bat_{NomCap}$ : Nominal capacity of the installed battery in mAh.

$t_{min}$ : Minimum battery lifetime in years.

$I_{BatMax}$ : Maximum RTC battery current in  $\mu A$ .



### Note

***Factor 1.2 considers the external impacts that can affect the battery lifetime. This factor can vary from 1.1 to 1.3 depending on the battery and operating conditions.***

## 3 Examples

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The following examples are based upon typical values. The first example determines the maximum battery lifetime for a specified battery type. The second example shows how to calculate the nominal battery capacity for a defined battery lifetime.

### 3.1 Example for specified battery lifetime

Battery type:	CR 2032
Nominal battery voltage in Volt:	3V
Nominal capacity $Bat_{NomCap}$ in mAh:	230 mAh
Maximum RTC battery current in $\mu A$ :	2.5 $\mu A$

$$t_{max} = \frac{Bat_{NomCap}}{24 \times 365 \times I_{BatMax}} \times 0.8$$

$$t_{max} = \frac{230 \text{ mAh}}{24 \times 365 \times 2.5 \mu A} \times 0.8$$

$$t_{max} = 8.4 \text{ years}$$

### 3.2 Example for specified service time

Required service time for battery in years:	15
Nominal battery voltage in Volt:	3
Maximum RTC battery current in $\mu A$ :	3

$$Bat_{NomCap} = t_{min} \times 24 \times 365 \times I_{BatMax} \times 1.2$$

$$Bat_{NomCap} = 15 \times 24 \times 365 \times 3 \times 1.2$$

$$Bat_{NomCap} = 473.04 \text{ mAh}$$

→ The battery should have a nominal capacity equal to or greater than 473.04 mAh (i.e. the Panasonic CR2477).

#### Note

***If you plan to use batteries for a longer service time, ensure that the battery is new and has its full nominal capacity. Batteries stored for a long time should not be used.***