Customer Training Workshop
Traveo™ II Real-Time Clock
Target Products

Target product list for this training material:

<table>
<thead>
<tr>
<th>Family Category</th>
<th>Series</th>
<th>Code Flash Memory Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traveo™ II Automotive Body Controller Entry</td>
<td>CYT2B6</td>
<td>Up to 576 KB</td>
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<tr>
<td>Traveo II Automotive Body Controller Entry</td>
<td>CYT2B7</td>
<td>Up to 1088 KB</td>
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<tr>
<td>Traveo II Automotive Body Controller Entry</td>
<td>CYT2B9</td>
<td>Up to 2112 KB</td>
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<tr>
<td>Traveo II Automotive Body Controller Entry</td>
<td>CYT2BL</td>
<td>Up to 4160 KB</td>
</tr>
<tr>
<td>Traveo II Automotive Body Controller High</td>
<td>CYT3BB/</td>
<td>Up to 4160 KB</td>
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<tr>
<td></td>
<td>CYT4BB</td>
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<tr>
<td>Traveo II Automotive Body Controller High</td>
<td>CYT4BF</td>
<td>Up to 8384 KB</td>
</tr>
<tr>
<td>Traveo II Automotive Cluster</td>
<td>CYT3DL</td>
<td>Up to 4160 KB</td>
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<tr>
<td>Traveo II Automotive Cluster</td>
<td>CYT4DN</td>
<td>Up to 6336 KB</td>
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Introduction to Traveo II Body Controller Entry

- The real-time clock (RTC) is a part of the System Resources block.
Introduction to Traveo II Body Controller High

The real-time clock (RTC) is a part of the System Resources block.

Review TRM chapter 21 for additional details.
Introduction to Traveo II Cluster

› The real-time clock (RTC) is a part of the System Resources block.

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Real-Time Clock Overview

› The Real-Time Clock system is an “always-on” function

› Features
  - Fully-featured RTC
  - Year, month, date, day-of-week, hour, minute, second fields (all fields integer)
  - Supports both 12-hour and 24-hour formats
  - Automatic leap-year correction
  - Configurable alarm function
  - Alarm on month, date, day-of-week, hour, minute, second fields
  - Two independent alarms
  - Calibration for 32768-Hz WCO and 4 MHz to 8 MHz LPECO
  - Calibration waveform output
  - Supports 512 Hz, 1 Hz, and 2 Hz
  - Backup registers¹

¹ Traveo II features four 32-bit backup registers that can be used to store important information/flags. This includes information that needs to be retained when the device enters Hibernate mode.
Real-time Clock Block Diagram

The RTC block consists of:
- Input clock
- Count field
- Alarm (Interrupt)
- Output (Calibration)
- Registers (Read/Write)

Review TRM chapter 21 for additional details.
RTC Input Clock Sources

› Watch-crystal oscillator (WCO)
  – 32.768-kHz external crystal oscillator (default)
  – Using external clock (32.768-kHz)
› Low-power External Crystal Oscillator (LPECO)
  – 4-8 MHz crystal oscillator that can be fractionally divided to 32.768 kHz
› Low-frequency clock (CLK_LF)
  – Can select ILO0 or ILO1

1 Refer to the datasheet for ILO0 and ILO1 accuracy details

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The RTC count fields consist of seven integer fields and one control bit:

- **RTC_SEC**: Calendar seconds, value range = 0-59
- **RTC_MIN**: Calendar minutes, value range = 0-59
- **RTC_HOUR**: Calendar hours, value depends on 12 or 24-hour format
- **CTRL_12HR**: Select the 12 or 24-hour mode
- **RTC_DAY**: Calendar day of the week, value range = 1-7, user defines meaning of values
- **RTC_DATE**: Calendar day of the month, value range = 1-31, automatic leap year correction until 2400
- **RTC_MON**: Calendar month, value range = 1-12
- **RTC_YEAR**: Calendar year, value range = 0-99

Review TRM chapter 21 for additional details.
Alarm (Interrupt)

Traveo II features two independent alarms. It can generate an interrupt for each alarm, which consists of six fields:

- **ALM_SEC**
  Alarm seconds, value range = 0–59
- **ALM_MIN**
  Alarm minutes, value range = 0–59
- **ALM_HOUR**
  Alarm hours, value depends on 12 or 24-hour format
- **ALM_DAY**
  Calendar day of the week, value range = 1–7, user defines meaning of values
- **ALM_DATE**
  Alarm day of the month, value range = 1–31, leap year corrected
- **ALM_MON**
  Alarm month, value range = 1–12

Use Cases

- **Alarm1**: October, 8, AM10:15 (BACKUP_ALM1_DATE.ALM_MON=10, BACKUP_ALM1_DATE.ALM_DATE=8, BACKUP_ALM1_TIME.ALM_HOUR=10, BACKUP_ALM1_TIME.ALM_MIN=15)
- **Alarm2**: November, 15, AM11:30 (BACKUP_ALM2_DATE.ALM_MON=11, BACKUP_ALM2_DATE.ALM_DATE=15, BACKUP_ALM2_TIME.ALM_HOUR=11, BACKUP_ALM2_TIME.ALM_MIN=30)

1 This alarm can be used as a wakeup source from Hibernate mode
RTC has a calibration waveform output that supports 512 Hz, 1 Hz, and 2 Hz.

Calibration procedure:

1. Measure the frequency of the RTC_CLK pin output.
2. Calculate the gap between the measured frequency and the expected value.
3. Feedback step 2 to register.

The Register TRM will give you additional details on BACKUP_CAL_CTL.

1 The Register TRM will give you additional details on BACKUP_CAL_CTL.
Register (Read Access)

- Software sets the BACKUP_RTC_RW.READ bit¹
- When this bit is set, the RTC registers will be copied to the user registers and frozen
- The software can safely read the RTC value
- The read transaction is completed by clearing the BACKUP_RTC_RW.READ bit

¹ The READ bit is described in the Register TRM (BACKUP_RTC_RW). It cannot be set in the following cases:
  - The RTC is still busy with a previous operation.
  - The BACKUP_RTC_RW.WRITE bit is set.
Register (Write Access)

› Software sets the BACKUP_RTC_RW.WRITE bit

› When the BACKUP_RTC_RW.WRITE bit is set, data can be written into the RTC user registers

› After the BACKUP_RTC_RW.WRITE bit is cleared, the hardware will copy all the new data to the RTC registers

1 The WRITE bit is described in the Register TRM (BACKUP_RTC_RW). It cannot be set in the following cases:

- The RTC is still busy with a previous operation.
- The BACKUP_RTC_RW.READ bit is set.
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## Revision History

<table>
<thead>
<tr>
<th>Revision</th>
<th>ECN</th>
<th>Submission Date</th>
<th>Description of Change</th>
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<tr>
<td>**</td>
<td>6140813</td>
<td>04/25/2018</td>
<td>Initial release</td>
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<tr>
<td>*A</td>
<td>6354961</td>
<td>10/18/2018</td>
<td>Added slides 2, 4, 5, and note descriptions in all slides. Updated slides 3, 9, 10, and 11.</td>
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<tr>
<td>*B</td>
<td>6599849</td>
<td>06/13/2019</td>
<td>Updated slides 2, 3, 4, 9 and 10. Added slide 5.</td>
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<tr>
<td>*C</td>
<td>7062498</td>
<td>01/08/2021</td>
<td>Updated slides 2 to 13.</td>
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