

Epson RX-8035 I2C Linux Driver - February 3, 2014 _ K3.8-v1.0

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Added second interrupt

Epson RX-8035 I2C Linux Driver - January 22, 2014 _ K3.8-v1.0_beta3

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Added register read/write and voltage low detection read/clear via iocctl.

Epson RX-8035 I2C Linux Driver - January 10, 2014

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The RX-8035 I2C Linux device driver provides the means for an application running in user space to access the Epson RX-8035 RTC.

The I2C driver can be easily modified according to the user's requirements and rebuilt. The driver was tested using Linux kernel 3.8.x and was developed using the ARMhf Ubuntu 12.04LTS distribution on a BeagleBone Black. It is expected that changes and additions will be required for driver implementation on other platforms/interfaces based on the specific requirements of those platforms.

Installing the Driver

To install the driver source:

1. Copy the file rtc-rx8035.c into the directory ./linux-3.8.x/drivers/rtc. "linux-3.8.x" refers to the base of the linux kernel source tree.

2. Add the following lines into the drivers/rtc/Kconfig file:

config RTC_DRV_RX8035

 tristate "Epson RX-8035SA/LC"

 help

 If you say yes here you get support for the Epson
 RX-8035SA/LC RTC chips.

 This driver can also be built as a module. If so, the module
 will be called rtc-rx8035.

3. Add the following line to the drivers/rtc/Makefile:

 obj-\$(CONFIG_RTC_DRV_RX8035)+= rtc-rx8035.o

4. During the rebuild, make sure to include the 'Epson RX-8035SA/LC' option in the Kernel Configuration window under 'Device Drivers' -> 'Real Time Clock'.

Hardware Considerations

The testing of the driver was done using an Epson RX-8035 part mounted on a breadboard connected to the BeagleBone Black P9 header. The connections are as follows:

RX-8035 pin	BeagleBone Black P9	Notes
-----	-----	-----
GND	P9_01	
VDD	P9_03	
SCL	P9_19	/* i2c2 scl: gpio0_13 */
SDA	P9_20	/* i2c2 sda: gpio0_12 */
INTRA	P9_23	/* gpio1_17: used for IRQ A */
INTRB	P9_27	/* gpio3_19: used for IRQ B */

See Note and pull-up resistor recommended (see RX-8350 spec)

Note: Both INTRA and INTRB need pull-up resistor.

Testing Environment

The following assumes that the RX-8035 driver has been modified as required, rebuilt, and included in the linux build as either a built-in driver or a module.

To test the driver, the "RTC breadboard" was setup as a cape on the BeagleBone Black header P9. This requires adding the RX-8035 RTC into the device tree using a device tree overlay (.dtbo). A sample device tree source file (.dts) and the compiled .dtbo file are included in the driver package. These files must be copied to the /lib/firmware directory on the BeagleBone Black system.

Before loading the cape you have to enable GPIO modules otherwise you will get "Unhandled fault: external abort on non-linefetch (0x1028)". Please see note (at the end of this document) to create the bbb_enable_gpio.sh script to work around this problem.

Once the system has booted and bbb_enable_gpio.sh created, type the following (you may need root access depending on your setup/configuration):

```
./bbb_enable_gpio.sh
echo BBB-RX8035 > /sys/devices/bone_capemgr.* /slots
cat /sys/devices/bone_capemgr.* /slots
```

The RX-8035 cape should now be listed in one of the slots and the driver should be loaded at /dev/rtc1 (again depending on your configuration). To confirm that the driver has loaded, type:

```
dmesg | grep rx8035
```

To test the read/write capabilities of the RX-8035, we can now use the hwclock command. To get the current time, type:

```
hwclock -r -f /dev/rtc1
```

If the time has not been set yet, the rtc should return with Jan 1, 1970. Next, we can set the system date with the following example:

```
date -s "Thurs Nov 07 11:33:00 PDT 2013"
```

Write the new date to the clock:

```
hwclock -w -f /dev/rtc1
```

And read it back:

```
hwclock -r -f /dev/rtc1
```

The RX-8035 is now set with the new time.

The driver package also includes small sample applications, rtctest.c and iocctl.c.

The rtctest demonstrates how to read and write the time from/to the RX-8035 using the ioctls RTC_RD_TIME and RTC_SET_TIME.

The iocctl demonstrates how to read and write to the registers of RX-8035.

For instance, to read register (0h):

```
./iocctl read 0  
REG[00h]=>29h
```

to write a value (20h) to register (0h):

```
./iocctl write 0 20  
REG[00h]<=20h
```

to read Voltage Low Flag bit status:

```
./iocctl vlr  
0
```

to clear Voltage Low Flag bit status:

```
./iocctl vlc
```

Note:

1. Since the RX-8035 is an I2C device, the I2C Tools package may be useful for debugging purposes. If your system does not already include the i2cdetect, i2cget, i2cset, etc., install the I2C tools package ("apt-get install i2c-tools" for Ubuntu distros).
2. To create bbb_enable_gpio.sh script copy and paste to your BeagleBone Black terminal the following lines and then: chmod +x bbb_enable_gpio.sh

```
echo '#!/bin/bash
```

```
#https://github.com/piranha32/IOoo/blob/master/examples/bbb_enable_gpio.sh
```

```
#workaround for a bug in bone-pinmux-helper to enable GPIO modules.
```

```
#based on the code from Luigi Rinaldi:
```

```
#https://groups.google.com/forum/!msg/beagleboard/OYFp4EXawiI/Mq6s3sg14HoJ
```

```
EXPORT=/sys/class/gpio/export
```

```
echo 5 > /sys/class/gpio/export
```

```
echo 65 > /sys/class/gpio/export
```

```
echo 105 > /sys/class/gpio/export' >> bbb_enable_gpio.sh
```