

Application Note for E909.05 and E909.6 for USB 4.0

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Chapter 1

Application Note for E909.05 and E909.6 for USB File Index

1.1 Application Note for E909.05 and E909.6 for USB File List

Here is a list of all documented files with brief descriptions:

main.c	(Application example to demonstrate the usage of of the USB library (lib_usb) for HALIOS IC E909.05 end E909.06. Following libraries are used: lib_firmware - firmware API functions for HALIOS IC lib_callback - callback functions for interrupt routines lib_usb - SPI-USB communication)	3
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Chapter 2

Application Note for E909.05 and E909.6 for USB File Documentation

2.1 main.c File Reference

Application example to demonstrate the usage of of the USB library (lib_usb) for HALIOS IC E909.05 end E909.06. Following libraries are used: lib_firmware - firmware API functions for HALIOS IC lib_callback - callback functions for interrupt routines lib_usb - SPI-USB communication.

```
#include "firmware.h"  
#include "main.h"  
#include "usb.h"
```

Defines

- #define [USB_PIN](#) BIT1

Functions

- const uint16_t gui_applicationVersion [__attribute__](#) ((section(".application_version")))
- void [isr_gpio_falling](#) (void)
- void [isr_wakeup](#) (void)
- int [main](#) (int argc, char *argv[])

Variables

- volatile uint16_t `gui_doUsb` = 1
- volatile uint16_t `gui_measurement` = 0
- const char `gArc_project_number` [] = "0908503"

2.1.1 Detailed Description

Application example to demonstrate the usage of of the USB library (`lib_usb`) for HALIOS IC E909.05 end E909.06. Following libraries are used: `lib_firmware` - firmware API functions for HALIOS IC `lib_callback` - callback functions for interrupt routines `lib_usb` - SPI-USB communication.

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Created: 2008-11-18

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Date:

Changed: 2008-12-03 Reworked documentation

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Changed: 2010-05-28 Reworked for firmware V4.0

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Date:

Changed: 2010-05-31 Reworked for firmware V4.0

Author:

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Date:

Changed: 2010-09-14 Makro request for __cpluplus added. Firmware now runs with c++.

Id

[main.c](#),v 1.3 2011/03/17 15:37:36 mki Exp

Definition in file [main.c](#).

2.1.2 Define Documentation

2.1.2.1 #define USB_PIN BIT1

Define the hardware input pin which is connected to IC Max3420 for USB-request. For base-board its always GPIO_1

Definition at line 80 of file main.c.

2.1.3 Function Documentation

2.1.3.1 const uint16_t gui_applicationVersion __attribute__((section(".application_version")))

Set a project application version number. Set to a fix area at FLASH to make possible read out in output file and verify the flashed code.

2.1.3.2 void isr_gpio_falling (void)

Interrupt function Falling edge at Pin 1 is a USB-request from Master

```
**/  
if (P0NEDGE_STAT & USB_PIN)  
{
```

```

    gui_doUsb = 1;
    g_status0.wakeupEnd = 1;

}

PONEDGE_CLR = 0x3F;
/**

```

Definition at line 86 of file main.c.

References `gui_doUsb`, and `USB_PIN`.

2.1.3.3 void isr_wakeup (void)

Interrupt function Wakeup occurred - Set wakeupEnd and do a measurement

Definition at line 105 of file main.c.

References `gui_measurment`.

2.1.3.4 int main (int argc, char * argv[])

main

Parameters:

← *argc* dummy parameter

← *argv* dummy parameter

```

**/
    loopConf_t t_loopConf;

#if (USB == USB_KEYB)
    uint16_t ui_cnt = 0;
    uint16_t ui_stateUsbKeybOut = 0;
#elif (USB == USB_MOUSE)

#endif

/**
 * Initializes the HALIOS SFRs and set up the basic functions of hardware.
 * @n It is recommend to call this function as first call.
 *
 * @post The system is configured:
 * - The trimvalues are read from InfoBlock and set to
 *   mclk and wkclk (only at (E909.05)
 * - Following interrupts are enabled:
 *   - HALIOS measurement ready

```

```
*      - wakeup timer
* - Following GPIO settings are used:
*      - The RDY_PIN will set as output,
*          if no readypin is needed set RDY_PIN as 0
* - Wakup timer enabled and set to 10 ms, used for sample time
* - One HALIOS loop enabled and set up (one LED against compensator).
*
* @param [in] BIT0 Set a GPIO as trigger pin for measurement, use only one bit.
*          If not needed set to 0.
*/
haliosInitialize(BIT0);

/**
* Set the projectnumber (eight characters) to g_sfr.project_number to make
* readable about the constant reading mechanism @ref paramCheckSfr.
*
* @param[in]   gArc_project_number Pointer to a string. The maximum numbers of eight ch
*/
paramSetProjectNr((uint8_t*)(gArc_project_number));

/** Setup the register of the watchdog timer0.
*
* Configure the watchdog in milliseconds (ms).
*
* @param[in] 500 Watchdogtime in ms.
* @n Must be smaller than 500 seconds (s)!
* @n Higher Values will ignore and set to 500 s
*/
deviceSetWatchdogTime (500UL);

/** set IO port function to GPIO for all pins */
POCFG = 0;

/**
* Define which communication device will be used and enable or disable the
* related interrupts.
* @n This function is optional. If this function is not called, communication
* devices set all to off.
*
* @param[in] DEVCOM_I2C set communication to I2C
* - For no communication device use (@ref DEVCOM_NO_COMM)
* - For I2C (@ref DEVCOM_I2C)
* - For SPI (@ref DEVCOM_SPI).
* - For SPI and I2C (@ref DEVCOM_I2C | @ref DEVCOM_SPI)
*/
deviceSetCommDevice(DEVCOM_I2C);

/**
* Call this function to show the last reset reason at a pin
* by a significant bit pattern.
* @n This function is optional. Use only if you don't want to
```

```

* do your own fail state.
* @n
* @n Count the blink sequence of the output pin:
* - 4 times blinking: watchdog reset
* - 5 times blinking: CPU register parity error
* - 6 times blinking: FLASH uncorrectable bit error
* - 7 times blinking: RAM perity error
* - 8 times blinking: Trap
* @n @n
* @param[in] outputPin Define the pin which should do the failState show
* @param[in] inputPin Define the pin which break the failState show.
*                               Set to 0 if now break is required
*/
failState(BIT2, BIT3);

/**
* Compute the checksum over all words in "Parameter FLASH Area".
* If the Checksum proofs "Valid Data", data is copied from the
* "Parameter FLASH Area" into RAM.
*
* @return
*   - -1: No valid data found.
*   - else: Number of copied words.
*/
if (deviceRestore() == -1)
{
    /**
    * Set the sample time in milli seconds. The wakeup timer
    * of the Analog Control Module is used for the timing.
    * Depending on the communication device the micro-controller
    * switches to STANDBY or STOP mode.
    *
    * @note time in milli seconds, must be between 2 and 32, only even
    * values are accepted. (See also description of the Analog Control Module).
    */
    paramSetSampleTime(8);

    /**
    * Set the amount of active loops.
    *
    * @param[in] count Amount of active loops. @a count must be less or equal to
    * @ref LOOPMAXCOUNT.
    * @return An element of the @a HaliosCode enumeration:
    *   - HALIOS_OK: No error occured
    *   - HALIOS_PARAM: Wrong parameter for count passed.
    */
    haliosSetLoopCount(4);

    /**
    * Configuration of the 1st loop.
    * This is an example how to use type loopConf_t for loop configuration.

```

```
* The values are indices for the LED current of the ASIC.
*/
t_loopConf.loopNr = 0;
t_loopConf.ledConf = H_LED3B | H_LED5A | H_AON | H_ACCON;
t_loopConf.phaseA.range = 10;
t_loopConf.phaseA.offset = 22;
t_loopConf.phaseB.range = 15;
t_loopConf.phaseB.offset = 15;
t_loopConf.iConfC = 15;
t_loopConf.DC_offset = 0;
t_loopConf.PreAmp = 0;
t_loopConf.ClockConf = 0;

/**
 * Store the configuration data into the virtuel loops at SFR by using
 * a struct @ref LoopConf.
 *
 * @param[in] t_LoopConfig The LED and current configuration.
 *
 * @return An element of the @ref HaliosCode enumeration:
 * - HALIOS_OK: No error occurred
 * - HALIOS_PARAM: Wrong parameter in @a t_LoopConfig passed.
 */
haliosLoopInit(t_loopConf);

/**
 * Store the configuration data into the virtuel loops at SFR by direct access.
 *
 * @note No validation check will done. It is recommand to use
 * the function @ref haliosLoopInit.
 *
 * @param[in] loopNr 0 .. @ref LOOPMAXCOUNT
 * @param[in] ledConf LED and measurement configuration.
 * @param[in] iClockConf Measurement Configuration HALIOS Clock
 * @param[in] iConfA Current configuration for phase A.
 * @param[in] iConfB Current configuration for phase B.
 * @param[in] iConfC Current configuration for the compensator offset.
 * @param[in] iPreAmp Preamplifier Configuration
 */
haliosLoopInitialize(1, 20993, 0, 875, 495, 27, 0);
haliosLoopInitialize(2, 20996, 0, 810, 495, 25, 0);
haliosLoopInitialize(3, 21056, 0, 908, 495, 29, 0);

/**
 * Set System Status to be used for @ref deviceWaitForTimer during wait
 * until timer has elapsed or a interrupt wakes up the system.
 * @n This function is optional. If not called system status is STANDBY.
 * @n
 * @param[in] SystemStatus Selects system mode for deviceWaitForTimer
 * - DEVSET_RUN: Keep System in RUN Mode in deviceWaitForTimer
 * - DEVSET_STANDBY: Switch to STANDBY Mode in deviceWaitForTimer
```

```

* - DEVSET_STOP:          Switch to STOP Mode in deviceWaitForTimer
* - DEVSET_OFF:           Switch to OFF Mode in deviceWaitForTimer
*
* Keep in mind that spi-usb communication only works in RUN and in STANDBY mode.
*/
deviceSetSystemStatus(DEVSET_STANDBY);

/**
 * Write USB call time to user space.
 * Set the time (maximum time, some USB controller call more
 * than this value!) the PC requests for new values.
 *
 * Write values to user space are readable using I2C Protocol or
 * USB (and HACo).
 *
 * The size of user space is 255 words
 */
paramSetValue(0, 8);
}

/**
 * Check the contents of SFR and does any special functions.
 * If the content of a SFR register has changed the new values will be copied
 * into the corresponding firmware functions or corresponding hardware registers.
 * - Set size of SFR and user space to address @ref BUFFSIZE at SFR
 * - Set constant reading values to SFR controled by @ref READ_CONST_CMD
 * - Set systemStatus
 * - Set Communication device
 * - Set sampletime
 * - Use spezial functions (use careful)
 * - Set main clock (ANALOG_MCLK) (Only E909.05)
 * - Set wakeup clock (ANALOG_WKCLK) (Only E909.05)
 * - Set HALIOS frequency (Only E909.06)
 * - Set number of Loops to g_sfr.loopCount
 */
paramCheckSfr();

#if (USB != USB_OFF)
/**
 * Initialize the SPI module and the MAX3420E SPI-USB bridge.
 *
 * @post GPIO 2..5 configured for SPI
 */
usbInitialize(USB_PART_ON, USB_PIN, paramGetValue(0));

/* set interrupt for falling signal on the interrupt request pin */
P0NEDGE_EN |= USB_PIN;
/* set interrupt mask for falling signal on a GPIO */
IRQ_MASK_H |= VBH_GPIO_FALLING;
#endif

```

```
/** Set application bit and Version */
g_sfr.inst_libs |= BIT15;
deviceCheckVersion(BIT15, gui_applicationVersion);

/**
 *
 * Do the measurement in an endless loop
 *
 */
while (1)
{
    /**
     * Start and retrigger the watchdog timer. This is an inline function.
     *
     * @note At E909.06: After first call of watchdog it is not possible
     * to disable the watchdog or change the watchdog time.
     *
     */
    KICKDOG();

    /**
     * Check the contents of SFR and does any special functions.
     * If the content of a SFR register has changed the new values will be copied
     * into the corresponding firmware functions or corresponding hardware registers.
     * - Set size of SFR and user space to address @ref BUFFSIZE at SFR
     * - Set constant reading values to SFR controled by @ref READ_CONST_CMD
     * - Set systemStatus
     * - Set Communication device
     * - Set sampletime
     * - Use spezial functions (use careful)
     * - Set main clock (ANALOG_MCLK) (Only E909.05)
     * - Set wakeup clock (ANALOG_WKCLK) (Only E909.05)
     * - Set HALIOS frequency (Only E909.06)
     * - Set number of Loops to g_sfr.loopCount
     */
    paramCheckSfr();

    if (gui_measurment == 1)
    {
        gui_measurment = 0;

        /**
         * Do the HALIOS measurement of all configured loops.
         * - Enable the analog part
         * - Start one Warmup to engage the analog part
         * - Start the configured measurements
         * - disable the analog part
         * - count up the @ref TIME_STAMP
         *
         * When haliosMeasure() is called with parameter HALIOS_RDYON,
```

```
* the configured PIN in haliosInitialize() will be switched on
* when entering the haliosMeasure() function,
* and will be switched off when haliosMeasure() is left.
*
* @param[in] readyPin @ref HaliosCode
*             - @ref HALIOS_RDYON GPIO is used as ready pin.
*             - @ref HALIOS_RDYOFF GPIO is not used as ready pin.
*/
haliosMeasure(HALIOS_RDYON);

} /* if measuerment */

#if (USB == USB_KEYB)
switch (ui_stateUsbKeybOut)
{
case 0:
    if (haliosGetResult(0) > 600)
    {
        ui_stateUsbKeybOut = 1;
    }
    break;

case 1:
    ui_cnt = setKey(KEY_LEFT_SHIFT, KEY_H);
    if (ui_cnt == 1)
        ui_stateUsbKeybOut = 2;
    break;

case 2:
    ui_cnt = setKey(0, KEY_E);
    if (ui_cnt == 1)
        ui_stateUsbKeybOut = 3;
    break;

case 3:
    ui_cnt = setKey(0, KEY_L);
    if (ui_cnt == 1)
        ui_stateUsbKeybOut = 4;
    break;

case 4:
    ui_cnt = setKey(0, KEY_L);
    if (ui_cnt == 1)
        ui_stateUsbKeybOut = 5;
    break;

case 5:
    ui_cnt = setKey(0, KEY_O);
    if (ui_cnt == 1)
        ui_stateUsbKeybOut = 6;
    break;
}
```

```
case 6:
    ui_cnt = setKey(0, KEY_SPACE);
    if (ui_cnt == 1)
        ui_stateUsbKeybOut = 7;
    break;

case 7:
    ui_cnt = setKey(KEY_LEFT_SHIFT, KEY_W);
    if (ui_cnt == 1)
        ui_stateUsbKeybOut = 8;
    break;

case 8:
    ui_cnt = setKey(0, KEY_O);
    if (ui_cnt == 1)
        ui_stateUsbKeybOut = 9;
    break;

case 9:
    ui_cnt = setKey(0, KEY_R);
    if (ui_cnt == 1)
        ui_stateUsbKeybOut = 10;
    break;

case 10:
    ui_cnt = setKey(0, KEY_L);
    if (ui_cnt == 1)
        ui_stateUsbKeybOut = 11;
    break;

case 11:
    ui_cnt = setKey(0, KEY_D);
    if (ui_cnt == 1)
        ui_stateUsbKeybOut = 12;
    break;

case 12:
    ui_cnt = setKey(0, KEY_ENTER);
    if (ui_cnt == 1)
        ui_stateUsbKeybOut = 13;
    break;

case 13:
    if (haliosGetResult(0) < 390)
    {
        ui_stateUsbKeybOut = 0;
    }
    break;

default:
```

```

        ui_stateUsbKeybOut = 0;
        break;
    }

#elif (USB == USB_MOUSE)

#endif /* (USB == USB_KEYB) */

#if (USB != USB_OFF)

    /**
     * If Interrupt falling edge was caused by USB Pin, do an USB transfer
     */
    if (gui_doUsb == 1)
    {
        /**
         * If USB-request occurred during a measurement
         * clear the wakeupEnd flag
         */
        g_status0.wakeupEnd = 0;

        gui_doUsb = 0;

        /** Do transmission */
#if (USB == USB_HACO)
        usbHacoHandleIrqs();
#elif (USB == USB_KEYB)
        usbKeybHandleIrqs();
#elif (USB == USB_MOUSE)
#warning see application note usb_mousedemo
#endif /* (USB == USB_HACO) */

    }

#endif /* (USB != USB_OFF) */

    /**
     * Wait until the timer has elapsed.
     */
    deviceWaitForTimer();

    /**

```

Definition at line 118 of file main.c.

References gArc_project_number, gui_doUsb, gui_measurment, and USB_PIN.

2.1.4 Variable Documentation

2.1.4.1 `volatile uint16_t gui_doUsb = 1`

Global variable for communication between Interrupt and USB-Part in main

Definition at line 52 of file main.c.

2.1.4.2 `volatile uint16_t gui_measurment = 0`

Global variable for synchronize the measueremt with configured sample time

Definition at line 58 of file main.c.

2.2 main.h File Reference

Defines

- #define `APPLICATION_VERSION` 103UL
- #define `USB_OFF` 1
- #define `USB_HACO` 2
- #define `USB_MOUSE` 3
- #define `USB_KEYB` 4
- #define `USB` `USB_HACO`

2.2.1 Detailed Description

Header file for the example application.

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Date:

Created: 2007-03-13

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Date:

Changed: 2008-11-26 added comments, added missing include "firmware.h"

Author:

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Date:

Changed: 2010-05-28 Reworked for firmware V4.0

Author:

Markus Kilian, Mechaless Systems GmbH

Date:

Changed: 2010-05-31 Reworked for firmware V4.0 added comments, removed obsolete include "firmware.h"

Author:

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Date:

Changed: 2010-07-13 Due to compatibility for GCC firmware library 4.01 available. Application version set to 1.01.

Author:

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Date:

Changed: 2010-08-12 Application version set to 1.02 Firmware library updated to 4.03 HALIOS tools library updated to 4.01

Author:

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Date:

Changed: 2011-03-17 Application version set to 1.03 Firmware library updated to 4.05 HALIOS tools library updated to 4.04 USB library updated to 4.01

Definition in file [main.h](#).

2.2.2 Define Documentation

2.2.2.1 #define APPLICATION_VERSION 103UL

Version number for the application.

Definition at line 38 of file main.h.

2.2.2.2 #define USB_OFF 1

Standalone application, no USB support.

Definition at line 41 of file main.h.

2.2.2.3 #define USB_HACO 2

USB support for the MAX3420E USB-SPI bridge, e.g. like on the E909.05A baseboard.

Definition at line 46 of file main.h.

2.2.2.4 #define USB USB_HACO

Software switch to choose between standalone mode and USB support.

Definition at line 51 of file main.h.

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