

Application Note for E909.05 and E909.6 evaluation board 4.0

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Chapter 1

Application Note for E909.05 and E909.6 evaluation board File Index

1.1 Application Note for E909.05 and E909.6 evaluation board File List

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

main.c (Application example to demonstrate the usage of the E909.05 and the E909.06 HALIOS IC firmware. This is the basic software delivered with the HALIOS baseboard. It shows the usage of measurements and the sample timing. Additionally all released libraries are used: lib_firmware - firmware API functions for HALIOS IC lib_callback - callback functions for interrupt routines lib_haliostools - functions for filtering and calibrating the loop values lib_usb - SPI-USB communication lib_c3d - 3 dimensional coordinates for the HMI head)	3
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Chapter 2

Application Note for E909.05 and E909.6 evaluation board File Documentation

2.1 main.c File Reference

Application example to demonstrate the usage of the E909.05 and the E909.06 HALIOS IC firmware. This is the basic software delivered with the HALIOS baseboard. It shows the usage of measurements and the sample timing. Additionally all released libraries are used: lib_firmware - firmware API functions for HALIOS IC lib_callback - callback functions for interrupt routines lib_haliostools - functions for filtering and calibrating the loop values lib_usb - SPI-USB communication lib_c3d - 3 dimensional coordinates for the HMI head.

```
#include "firmware.h"  
#include "main.h"  
#include "user_space.h"  
#include "haliostools.h"  
#include "c3d.h"  
#include "lin.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 the E909.05 and the E909.06 HALIOS IC firmware. This is the basic software delivered with the HALIOS baseboard. It shows the usage of measurements and the sample timing. Additionally all released libraries are used: lib_firmware - firmware API functions for HALIOS IC lib_callback - callback functions for interrupt routines lib_haliostools - functions for filtering and calibrating the loop values lib_usb - SPI-USB communication lib_c3d - 3 dimensional coordinates for the HMI head.

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

Id

[main.c](#),v 1.3 2011/03/17 15:38:15 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 89 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;

  }

  P0NEDGE_CLR = 0x3F;
/**

```

Definition at line 95 of file main.c.

References gui_doUsb, and USB_PIN.

2.1.3.3 void isr_wakeup (void)

Interrupt function Wakeup occurred - Set wuakeupEnd and do a measurement

Definition at line 114 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

```

**/
uint16_t ui_cnt;
loopConf_t t_loopConf;

/* variables for filter and calibration functions */
uint16_t ui_filtervalue, ui_quiescent;
uint16_t ui_autocatch = 0;
uint16_t ui_quis_min;
Calib_Result_t t_calib_result = Calib_Nothing_Done;
uint16_t ui_lastCalibTimestamp[LOOPMAXCOUNT];
uint16_t ui_oldCalTime = 0;

```

```
/* variables for c3d */
int16_t Ari_c3dPos[3] = { 0, 0, 16 };
uint16_t Arui_loop[4];
uint16_t Arui_quisLoop[4];

/**
 * 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 trimmvalues 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);

/**
 * Default setting for LIN is LIN_OFF
 */
#if (LIN == LIN_ON)
    initializeLin();
#else
```

```

POCFG = 0;
#endif

/**
 * 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 | DEVCOM_SPI);

/**
 * 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 occurred
*     - HALIOS_PARAM: Wrong parameter for count passed.
*/
haliosSetLoopCount(8);

/**
* 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 = 0;
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);
haliosLoopInitialize(4, 21077, 0, 3, 1023, 127, 0);
haliosLoopInitialize(5, 20993, 0, 287, 31, 127, 0);
haliosLoopInitialize(6, 21077, 0, 259, 1023, 127, 0);
haliosLoopInitialize(7, 20993, 0, 127, 31, 127, 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);

/** Settings for filter and calibration in the user space */
paramSetValue(RAM_FILT_BORDER, HALIOS_FILT_8); /* filter depth */
paramSetValue(RAM_FILT_BREAK, 10);           /* filter break */
paramSetValue(RAM_CAL_TUBE, 32);             /* tube around target value */
paramSetValue(RAM_CAL_TIME, 300);           /* time for calibration */
paramSetValue(RAM_CAL_DCNT, 8);             /* value for movement detection with l
paramSetValue(RAM_CAL_TARGET_VALUE, 100);   /* target value for calibration */

/** Set quiescent-value for the loops */
for (ui_cnt = 0; ui_cnt < haliosGetLoopCount(); ui_cnt++)
    paramSetValue(RAM_QUIESCENT_LOOP0 + (ui_cnt * BLOCK_SIZE), paramGetValue(RAM_C

/** Switch Calibration
* Application options are:
* CAL_START - calibration on start up
* CAL_TIME - calibration for time
* CAL_AUTO_CATCH - enable autocatch function
*/

```

```
paramSetValue(RAM_CAL_SETUP, ( CAL_START | CAL_TIME ));

/** Settings for c3d, constants are defined in c3d.h */
paramSetValue(RAM_C3D_X_SCALE, XSCALE);
paramSetValue(RAM_C3D_Y_SCALE, YSCALE);
paramSetValue(RAM_C3D_Z_SCALE, ZSCALE);
paramSetValue(RAM_C3D_X_OFFSET, XOFFS);
paramSetValue(RAM_C3D_Y_OFFSET, YOFFS);
paramSetValue(RAM_C3D_X_FACT, XFACT);
paramSetValue(RAM_C3D_Y_FACT, YFACT);
paramSetValue(RAM_C3D_Z_FACT, ZFACT);
paramSetValue(RAM_C3D_ROT, 0);
paramSetValue(RAM_C3D_FLIP, 0);

/** Set the time (maximum time, some USB controller call more
than this value!) the PC requests for new values. */
paramSetValue(RAM_USB_CALL_TIME, 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();

/** Set GPIO 2..5 as output pins */
PDIR &= ~(BIT2 | BIT3 | BIT4 | BIT5);

/**
 * @brief Function o init the HALIOS tools
 *
 * Initialize the structures for filtering and calibration.
 */
init_haliostools();

/**
 * Initialize the LevelSwitch with standard values
 */
deviceLevelSwitchInit(RAM_LEVEL_SWITCH);
```

```

/** Initialize module coordinates 3D */
c3dInitialize( paramGetValue(RAM_C3D_X_SCALE)
, paramGetValue(RAM_C3D_Y_SCALE)
, paramGetValue(RAM_C3D_Z_SCALE) );

/**
 * @brief Warmup the HALIOS loops.
 *
 * Function from HALIOS Tools. Do some measurements for each loop to ensure
 * that the measuerment counter has reached its actual value.
 *
 * @param[in] times How many times to start an empty measurement to warm up the
 * loops:
 * - HALIOS_WARMUP_FULL: 6 times for a full range of 1024 steps
 * - HALIOS_WARMUP_HALF: 3 times for a half range of 512 steps
 */
haliosWarmup(HALIOS_WARMUP_FULL);

/**
 * Force a calibration for each active loop.
 */
if (paramGetValue(RAM_CAL_SETUP) & CAL_START)
{
    for (ui_cnt = 0; ui_cnt < paramGetSFR(LOOPCOUNT); ++ui_cnt)
    {
        t_calib_result = haliosCompCalib(ui_cnt, haliosGetResult(ui_cnt), \
            paramGetValue(RAM_CAL_TARGET_VALUE),
            paramGetValue(RAM_CAL_TUBE), 0, 1023);
        paramSetValue( ((ui_cnt * BLOCK_SIZE) + RAM_QUIESCENT_LOOP0), g_calib[ui_cnt].
    }
}

for(ui_cnt = 0; ui_cnt < LOOPMAXCOUNT; ui_cnt++)
{
    /* Initialize the last calibration-time-stamp variable for calibration */
    ui_lastCalibTimestamp[ui_cnt] = 0;
}

#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(RAM_USB_CALL_TIME));

/* 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);

/**
* Filter the loops and check the calibration.
*/
ui_autocatch = 0;
for (ui_cnt = 0; ui_cnt < paramGetSFR(LOOPCOUNT); ++ui_cnt)
{
    /**
    * @brief Filter the loop with a low pass filter.
    *
    * @param[in] loopNr      Number of the loop (0 .. LOOPCOUNT).
    * @param[in] border3db  The 3dB border of the low pass filter.
    * @param[in] filterBreak If the derivation of the raw loop value is higher
    *                        than filterBreak the filtered value is omitted
    *                        the raw loop value will be written to loopFilter
    *                        negative value for filterBreak disables the filter
    *                        break mechanism.
    *
    * @return      filter_value the software filtered value
    */
    ui_filtervalue = haliosFilterLoop(ui_cnt, \
        (HALIOS_FILT)paramGetValue(RAM_FILT_BORDER), \
        paramGetValue(RAM_FILT_BREAK));

    /** Set filtervalue to user space */
    paramSetValue( (RAM_FILT_LOOP0 + (ui_cnt * BLOCK_SIZE)) , ui_filtervalue);

    if (paramGetValue(RAM_CAL_SETUP) & CAL_TIME)
    {
        /**
        * When the autocatch function cause a calibration it sets the time for
        * So this forces a calibration immediately.
        * The variable ui_lastCalibTimestamp prevents that autocatch enforces
        * That's necessary because if no sensor is connected or the optical c
        * value is below quiescent value and probably around zero.
        */
        if (paramGetValue(RAM_CAL_SETUP) & CAL_AUTO_CATCH)
        {
            if ( paramGetValue(RAM_QUIESCENT_LOOP0 + (ui_cnt * BLOCK_SIZE)) <=
            {
                ui_quis_min = paramGetValue(RAM_QUIESCENT_LOOP0 + (ui_cnt * BL

```

```

    }
    else
    {
        ui_quis_min = paramGetValue(RAM_QUIESCENT_LOOP0 + (ui_cnt * BL
    }

/**
 * Force calibration when current value
 * is below saved quiescent value
 */
if ((ui_autocatch == 0) && ((ui_filtervalue < ui_quis_min) || (ui_
    && (ui_lastCalibTimestamp[ui_cnt] > 50))
{
    ui_autocatch = 1;
    ui_oldCalTime = paramGetValue(RAM_CAL_TIME);
    paramSetValue(RAM_CAL_TIME, 0);
    ui_lastCalibTimestamp[ui_cnt] = 0;
}
else if ((ui_lastCalibTimestamp[ui_cnt] <= 50) \
    && ((ui_filtervalue < ui_quis_min) || (ui_quis_min == 0)))
{
    ui_lastCalibTimestamp[ui_cnt]++;
}
else if ((ui_lastCalibTimestamp[ui_cnt] != 0) && (ui_filtervalue >
{
    ui_lastCalibTimestamp[ui_cnt] = 0;
}
}

/**
 * @brief
 * Calibrate the passed loop. This function counts the calls for each l
 * The function checks if a movement can be detected. In case of a mov
 * counter will reset. If no movement for countEnd has been detected th
 * checks if the loop is in the tube around the target value (target va
 * If the loop is outside the tube the compensator offset will be chang
 * to reach the target value again. In case of a balanced loop the
 * offset from both sender will be influenced.
 * This is important when a static object has been detected or the opt
 * of the sensor has changed.
 *
 * @param[in] nr          number of the loop (0 .. LOOPCOUNT)
 * @param[in] loopValue   actual value of the signal
 * @param[in] target      target value for the idle loop
 * @param[in] tube        If the loop is within the tube borders (tar
 *                        < loopValue < target+tube) then the actual
 *                        value is fetched as the new reference value
 *                        derivation is smaller than maxDCnt. If the
 *                        value is outside the calibration tube the
 *                        compensator offset current is calibrated.
 * @param[in] countEnd    If the loop value is count times between th

```

```

*                                     calibTube then a new reference value is det
*                                     If count is zero the function immediatly st
*                                     calibration.
* @param[in] maxDCnt                 If the derivation is greater than maxDCnt t
*                                     calibration is aborted and counter gets a r
*/
t_calib_result = haliosCompCalib(ui_cnt, ui_filtervalue, \
    paramGetValue(RAM_CAL_TARGET_VALUE), \
    paramGetValue(RAM_CAL_TUBE), \
    ((uint32_t)(paramGetValue(RAM_CAL_TIME)) * 100), \
    paramGetValue(RAM_CAL_DCNT));

/** Save the new quiescent value to user space */
if (t_calib_result != Calib_Nothing_Done)
{
    paramSetValue(RAM QUIESCENT_LOOP0 + (ui_cnt * BLOCK_SIZE), g_calib
}

/** Set calibTime to old value */
if (ui_oldCalTime != 0)
{
    paramSetValue(RAM_CAL_TIME, ui_oldCalTime);
    ui_oldCalTime = 0;
}
} /* calibration time */

/** Compute amplitude for the loop */
ui_quiescent = paramGetValue(RAM QUIESCENT_LOOP0 + (ui_cnt * BLOCK_SIZE));
if (ui_filtervalue > ui_quiescent)
{
    paramSetValue( RAM_AMPLITUDE_LOOP0 + (ui_cnt * BLOCK_SIZE)
, (ui_filtervalue - ui_quiescent) );
}
else
{
    paramSetValue( RAM_AMPLITUDE_LOOP0 + (ui_cnt * BLOCK_SIZE) , 0);
}

} /* filter loops and check calibration */

/**
* This function switches an output pin on or off in dependence of
* the loop value of the assigned loop. There are four LevelSwitch
* modules. Each of these modules could be configured separately:
* - Assign a loop to the module
* - Define a high and a low treshhold
*
* @note startAddress Start for parameter in User_space
*

```

```

* @note return Error code:
* - 0: No error
* - 1: Border is not set
* - 2: Border is out of range
*/
    paramSetValue(RAM_LEVEL_SWITCH_RETURN, \
deviceLevelSwitch(RAM_LEVEL_SWITCH));

    /**
    * If USB is switched on the output pins from MAX3420 are used.
    * Otherwise the GPIO from HALIOS IC are used.
    */
#if (USB != USB_OFF)
    /* output pins from max3420 are used */
    wreg(rGPIO, paramGetValue(RAM_LEVEL_SWITCH_RESULT));
#else
    /* IO2..5 are used */
    P0OUT = (P0OUT & 0xffc3) | paramGetValue(RAM_LEVEL_SWITCH_RESULT) << 2;
#endif

    /** Set loop- and quiescent-array for C3D */
    for (ui_cnt = 0; ui_cnt < 4; ui_cnt++)
    {
    /** Set filtered values to an array of for loops */
    Arui_loop[ui_cnt] = paramGetValue(RAM_FILT_LOOP0 + (ui_cnt * BLOCK_SIZE));

    /** Set the quiescent values to an array */
    Arui_quisLoop[ui_cnt] = paramGetValue(RAM_QUIESCENT_LOOP0 + (ui_cnt * BLOCK_SIZE));
    }

    /*
    * This function calculates three dimensional
    * coordinates { x, y, z }.
    *
    * @pre - loop 0 and loop 1 are used to calculate the x coordinate.
    *       - loop 2 and loop 3 are used to calculate the y coordinate.
    *       - loop 0 .. loop3 are used to calculate the z coordinate.
    *       - Loop 0 .. loop 3 should be configured in a way, that
    *         one LED in phase B adjusts against the compensator in
    *         phase A.
    *
    * @param[in] loop      pointer to an array of loop values
    *
    * @param[in] quis_loop pointer to an array of quiescent values
    *                for the corresponding loop values
    *
    * @param[in] xFact     multiply the found x position (-1 .. 1)
    *                       with xFact.
    * @param[in] yFact     multiply the found y position (-1 .. 1)
    *                       with yFact.
    * @param[in] zFact     multiply the found z position (0 .. 1)

```

```

*                                     with zFact.
*
* @param[in]  xOffs      add xOffs to the computed
*                    x position value.
* @param[in]  yOffs      add yOffs to the computed
*                    y position value.
*
* @param[out] *pos       pointer to an array where the three
*                    computed coordinates { x, y, z } are
*                    saved.
*/
    c3d(Arui_loop, Arui_quisLoop, Ari_c3dPos, paramGetValue(RAM_C3D_X_OFFSET), \
paramGetValue(RAM_C3D_Y_OFFSET), paramGetValue(RAM_C3D_X_FACT), \
    paramGetValue(RAM_C3D_Y_FACT), paramGetValue(RAM_C3D_Z_FACT));

/*
* Rotate the position and mirror it on the determined axis.
*
* @note      *pos       The position to rotate, the rotated value is also
*                    stored there.
* @note      rot        The angle to rotate the position counter clock
*                    wise. Only the following angle values are
*                    supported:
*                    0, 45, 90, 135, 180, 225, 270, 315.
* @note      flip       Determine how to mirror the position on the axis.
*                    Only the following values are supported:
*                    M3D_FLIP_OFF, M3D_FLIP_X, M3D_FLIP_Y
*/
    c3dRotFlip(Ari_c3dPos, paramGetValue(RAM_C3D_ROT), paramGetValue(RAM_C3D_FLIP)

    /** Store the data in the user space */
    paramSetValue(RAM_C3D_X, Ari_c3dPos[0]);
    paramSetValue(RAM_C3D_Y, Ari_c3dPos[1]);
    paramSetValue(RAM_C3D_Z, Ari_c3dPos[2]);

} /* if measuerment */

#if (USB != USB_OFF)

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

```

```
        gui_doUsb = 0;

        /** Do transmission */
        usbHacoHandleIrqs();
    }
#endif

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

    /**
```

Definition at line 127 of file main.c.

References CAL_AUTO_CATCH, CAL_START, CAL_TIME, gArc_project_number, gui_doUsb, gui_meurment, 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 61 of file main.c.

2.1.4.2 volatile uint16_t [gui_meurment](#) = 0

Global variable for synchronize the measueremt with configured sample time

Definition at line 67 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
- #define LIN_OFF 0
- #define LIN_ON 1
- #define LIN LIN_OFF
- #define CAL_OFF 0
- #define CAL_START BIT0
- #define CAL_TIME BIT1
- #define CAL_AUTO_CATCH BIT2

2.2.1 Detailed Description

Header file for the example application.

Author:

Miroslav Ostric, Mechaless Systems GmbH

Date:

Created: 2007-03-13

Author:

Roland Muenzer, Media System Consulting

Date:

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

Author:

Florian Degler, Mechaless Systems GmbH

Date:

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

Author:

Markus Kilian, Mechaless Systems GmbH

Date:

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

Author:

Markus Kilian, Mechaless Systems GmbH

Date:

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

Author:

Markus Kilian, Mechaless Systems GmbH

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:

Markus Kilian, Mechaless Systems GmbH

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 baseboard for E909.05 or E909.06.

Definition at line 47 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 52 of file main.h.

2.2.2.5 #define LIN_OFF 0

Definitions for LIN module

Keep in mind: LIN can only be used with E909.06

Definition at line 60 of file main.h.

2.2.2.6 #define CAL_OFF 0

Definitions for Calibration

Definition at line 68 of file main.h.

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