

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

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# Chapter 1

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

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

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

<a href="#">main.c</a>	(Application example to demonstrate the usage of the usb as mouse (lib_usb) for HALIOS IC E909.05 or E909.06. Following 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 to build the mouse movement ) . . . . .	3
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# Chapter 2

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

### 2.1 main.c File Reference

Application example to demonstrate the usage of the usb as mouse (lib\_usb) for HALIOS IC E909.05 or E909.06. Following 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 to build the mouse movement.

```
#include "firmware.h"  
#include "main.h"  
#include "user_space.h"  
#include "haliostools.h"  
#include "c3d.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 usb as mouse (lib\_usb) for HALIOS IC E909.05 or E909.06. Following 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 to build the mouse movement.

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

**Id**

[main.c](#),v 1.3 2011/03/17 15:37:35 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 86 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 92 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 111 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];

#if (USB == USB_MOUSE)
int16_t Ari_posLast[3] = {Ari_c3dPos[0], Ari_c3dPos[1], Ari_c3dPos[2]};
int16_t Ari_posDif[2];
stateMouse_t t_stateMouse = Mouse_idle;
#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 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);
```

```

/** 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 occurred
* - 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 = 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);

/**
* 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, C3D_FLIP_Y);

    /** 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 */
P0DIR &= ~(BIT2 | BIT3 | BIT4 | BIT5);

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

/** 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 tines 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 */
PONEDGE_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 sensor
         * 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 * BLOCK_SIZE))
            }
            else
            {
                ui_quis_min = paramGetValue(RAM_QUIESCENT_LOOP0 + (ui_cnt * BLOCK_SIZE))
            }
        }

        /**
         * Force calibration when current value
         * is below saved quiescent value

```

```

*/
if ((ui_autocatch == 0) && ((ui_filtervalue < ui_quis_min) || (ui_c
    && (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 opti
 * 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_filtvalue > ui_quiescent)
{
    paramSetValue( RAM_AMPLITUDE_LOOP0 + (ui_cnt * BLOCK_SIZE)
    , (ui_filtvalue - ui_quiescent) );
}
else
{
    paramSetValue( RAM_AMPLITUDE_LOOP0 + (ui_cnt * BLOCK_SIZE) , 0);
}

    /* filter loops and check calibration */

    /** 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_MOUSE)
    switch (t_stateMouse)

```

```

    {
    case Mouse_idle:
        if (Ari_c3dPos[2] == 0)
        {
            // Moving over the surface
            t_stateMouse = Mouse_active;
            Ari_posLast[0] = Ari_c3dPos[0];
            Ari_posLast[1] = Ari_c3dPos[1];
        }
        break;

    case Mouse_active:
        for ( ui_cnt = 0; ui_cnt < 2; ui_cnt++)
        {
            // Compute the differents between old and new position
            Ari_posDif[ui_cnt] = Ari_c3dPos[ui_cnt] - Ari_posLast[ui_cnt];

// Scale up the differnts when to move quiker
            if (Ari_posDif[ui_cnt] > 10)
                Ari_posDif[ui_cnt] *= 4;
            else if (Ari_posDif[ui_cnt] > 5)
                Ari_posDif[ui_cnt] *= 2;

            paramSetValue( (RAM_MOUSE_DATA + ui_cnt + 1), paramGetValue(RAM_MOUSE_
            Ari_posLast[ui_cnt] = Ari_c3dPos[ui_cnt];
        }

            if (Ari_c3dPos[2] > 2)
                t_stateMouse = Mouse_idle;

            break;
        }
    #endif

    #if (USB != USB_OFF)

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

            gui_doUsb = 0;

            /** Do transmission */
        }
    #if (USB == USB_HACO)

```

```
        usbHacoHandleIrqs();
#elif (USB == USB_MOUSE)
        usbMouseHandleIrqs(RAM_MOUSE_DATA);
#elif (USB == USB_KEYB)
#warning see application note usb
#endif
    }
#endif

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

    /**
```

Definition at line 124 of file main.c.

References CAL\_AUTO\_CATCH, CAL\_START, CAL\_TIME, 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 58 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 64 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\_MOUSE
- #define [CAL\\_OFF](#) 0
- #define [CAL\\_START](#) BIT0
- #define [CAL\\_TIME](#) BIT1
- #define [CAL\\_AUTO\\_CATCH](#) BIT2

### Typedefs

- typedef enum [stateMouse\\_e](#) [stateMouse\\_t](#)

### Enumerations

- enum [stateMouse\\_e](#)

#### 2.2.1 Detailed Description

Header file for the example application.

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**Date:**

Created: 2007-03-13

**Author:**

Roland Muenzer, Media System Consulting

**Date:**

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

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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 added comments, removed obsolete include "firmware.h"

**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 E909.05A baseboard.

Definition at line 47 of file main.h.

### 2.2.2.4 `#define USB_USB_MOUSE`

Software switch to choose between standalone mode and USB support.

Definition at line 52 of file main.h.

### 2.2.2.5 `#define CAL_OFF 0`

Bit definitions for calibration

Definition at line 55 of file main.h.

## 2.2.3 Typedef Documentation

### 2.2.3.1 `typedef enum stateMouse_e stateMouse_t`

enum type for mouse positions

## 2.2.4 Enumeration Type Documentation

### 2.2.4.1 enum `stateMouse_e`

enum type for mouse positions

Definition at line 63 of file main.h.

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