SAE Auto Shifter

Version
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Author:

Rocky Gray Jr.

Introduction

Todo:

Write an introduction This will be the text for the introduction... continued... continued... Second paragraph for intro if needed... cont... cont...

Files used for this project:

- **SAE_AutoShifter.h**
- **delay_rg.h**
- **main.c**

Todo List

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Write an introduction This will be the text for the introduction... continued... continued... Second paragraph for intro if needed... cont... cont...

File Index

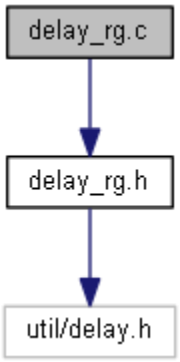
File List

Here is a list of all files with brief descriptions:

File Documentation

delay_rg.c File Reference

This file defines delay functions that extend the usefullness of the avr-gcc delay functions.
`#include "delay_rg.h"`
Include dependency graph for delay_rg.c:



Functions

- void **delay_ms** (uint16_t ms)
  Delays for `ms` *milliseconds.*
- void **delay_us** (uint16_t us)
  Delays for `us` *microseconds.*

Detailed Description

This file defines delay functions that extend the usefullness of the avr-gcc delay functions.

Author:
Rocky Gray Jr.

Date:
2/6/2012

Function Documentation

void delay_ms (uint16_t *ms*)

Delays for `ms` milliseconds.

Allows for longer delays. The longest delay that _delay_ms() can provide is 262.14ms / **F_CPU(in MHz)**.

Parameters:

ms	length of delay in miliseconds

Returns:

none

Here is the caller graph for this function:

void delay_us (uint16_t *us*)

Delays for `us` microseconds.

Allows for longer delays. The longest delay that _delay_us() can provide is 768us / **F_CPU(in MHz)**.

Parameters:

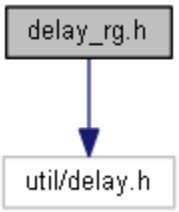
us	length of delay in microseconds

Returns:

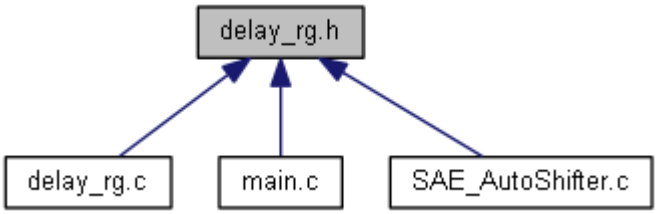
none

delay_rg.h File Reference

This file defines delay functions that extend the usefullness of the avr-gcc delay functions.
`#include <util/delay.h>`
Include dependency graph for delay_rg.h:



This graph shows which files directly or indirectly include this file:



Defines

- #define **DLAY_MAX_MS** (262.14/**F_CPU**)-1
- #define **DLAY_MAX_US** (768/**F_CPU**)-1

Functions

- void **delay_ms** (uint16_t ms)
  Delays for `ms` *milliseconds.*
- void **delay_us** (uint16_t us)
  Delays for `us` *microseconds.*

Detailed Description

This file defines delay functions that extend the usefullness of the avr-gcc delay functions.

Author:
Rocky Gray Jr.

Date:
2/6/2012

Define Documentation

#define DLAY_MAX_MS (262.14/F_CPU)-1

#define DLAY_MAX_US (768/F_CPU)-1

Function Documentation

void delay_ms (uint16_t *ms*)

Delays for `ms` milliseconds.

Allows for longer delays. The longest delay that _delay_ms() can provide is 262.14ms / **F_CPU(in MHz)**.

Parameters:

ms	length of delay in miliseconds

Returns:

none

Here is the caller graph for this function:

void delay_us (uint16_t *us*)

Delays for `us` microseconds.

Allows for longer delays. The longest delay that _delay_us() can provide is 768us / **F_CPU(in MHz)**.

Parameters:

us	length of delay in microseconds

Returns:

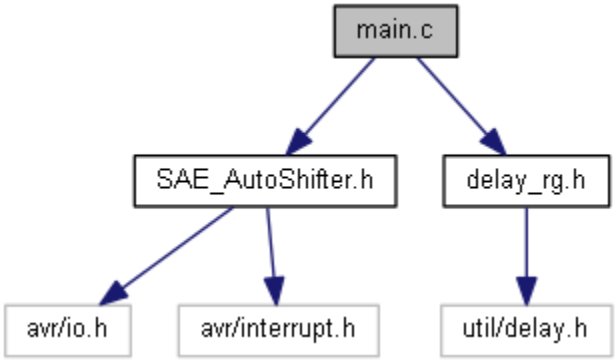
none

main.c File Reference

This file defines the main task.

```
#include "SAE_AutoShifter.h"
#include "delay_rg.h"
```

Include dependency graph for main.c:



Defines

- #define **F_CPU** 16000000UL

Functions

- int **main** (void)
  The main task for the autoshifter.

Detailed Description

This file defines the main task.

Author:
Rocky Gray Jr.

Date:
3/11/2012

Define Documentation

#define F_CPU 16000000UL

Function Documentation

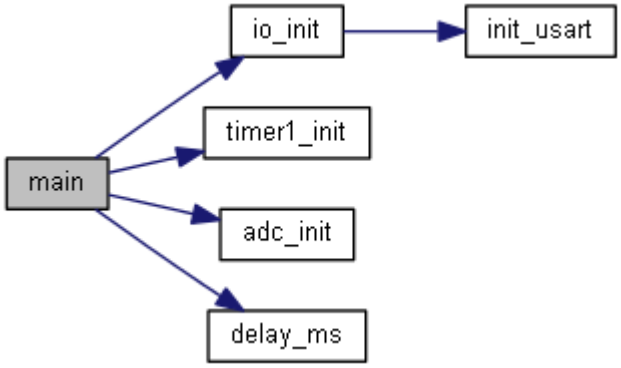
int main (void)

The main task for the autoshifter.

Returns:

This task never returns

Here is the call graph for this function:



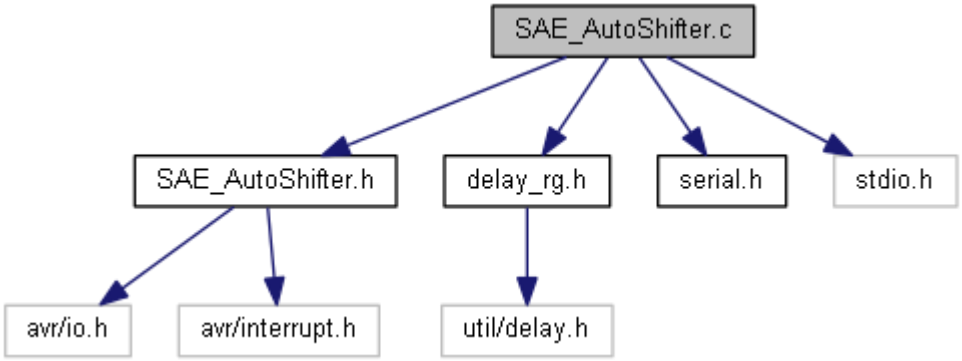
mainpage.h File Reference

SAE_AutoShifter.c File Reference

This file defines the main task and ISRs.

```
#include "SAE_AutoShifter.h"
#include "delay_rg.h"
#include "serial.h"
#include <stdio.h>
```

Include dependency graph for SAE_AutoShifter.c:



Functions

- void **io_init** (void)
  Initialize i/o ports and timer.
- void **timer1_init** (void)
  Initialize Timer 1.
- void **adc_init** (void)
  Initialize the ADC.
- **ISR** (TIMER1_COMPA_vect)
  *Toggle the LED if **USHIFT_PIN** is pressed.*
- **ISR** (ADC_vect)
  ADC Interrupt Service Routine.

Detailed Description

This file defines the main task and ISRs.

Author:

Rocky Gray Jr.

Date:

2/6/2012

Function Documentation

void adc_init (void)

Initialize the ADC.

ADC 0:

- Prescaler set to 128 (16MHz/128 = 125kHz)
- ADC result is left adjusted (Just read ADCH)
- Free-Running mode enabled
- Interrupt enabled

Returns:

none

Here is the caller graph for this function:

void io_init (void)

Initialize i/o ports and timer.

Inputs:

- User Buttons
  - **BTN_IP_DDR** => set **USHIFT_PIN** and **DSHIFT_PIN** as input
  - **BTN_IP_PORT** => set pullups for **USHIFT_PIN** and **DSHIFT_PIN**
- Tachometer Input
  - **TACH_IP_DDR** => set **TACH_PIN** as input
  - **TACH_IP_PORT** => set pullups for **TACH_PIN**
-

Outputs:

- Solenoid Output
  - **SOLEN_OP_DDR** => set **SOLEN_DN** and **SOLEN_UP** as input
  - **SOLEN_OP_PORT** => initialize **SOLEN_DN** and **SOLEN_UP** to 0
-

Returns:

none

Here is the call graph for this function:

Here is the caller graph for this function:

ISR (TIMER1_COMPA_vect)

Toggle the LED if **USHIFT_PIN** is pressed.

Fires at **PIN_CHECK_FREQ** Hz. (1ms)

Returns:

reti

ISR (ADC_vect)

ADC Interrupt Service Routine.

Fires at 16MHz/128 = 125kHz

Returns:

reti

void timer1_init (void)

Initialize Timer 1.

Timer 1:

- Configure Timer 1 for CTC (Clear Timer on Compare)
- Prescaler set to 1 (16MHz/1)
- Fires every **PIN_CHECK_FREQ** Hz (1kHz = 1ms)

Returns:

none

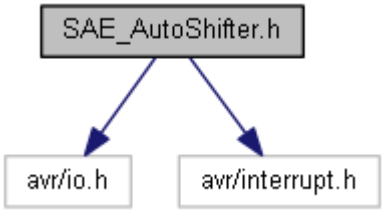
Here is the caller graph for this function:

SAE_AutoShifter.h File Reference

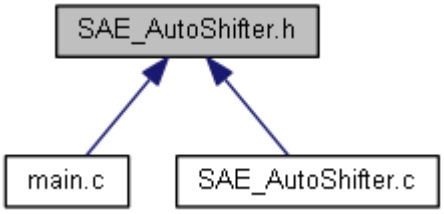
This header file contains constant definitions and function prototypes.

```
#include <avr/io.h>
#include <avr/interrupt.h>
```

Include dependency graph for SAE_AutoShifter.h:



This graph shows which files directly or indirectly include this file:



Defines

Port Definitions*Mappings for I/O ports*

- #define **BTN_IP_DDR** DDRD
- #define **BTN_IP_PORT** PORTD
- #define **BTN_IP_PIN** PIND
- #define **USHIFT_PIN** PD2
- #define **DSHIFT_PIN** PD3
- #define **TACH_IP_DDR** DDRC
- #define **TACH_IP_PIN** PINC
- #define **TACH_IP_PORT** PORTC
- #define **TACH_PIN** PC0
- #define **SOLEN_OP_DDR** DDRB
- #define **SOLEN_OP_PORT** PORTB
- #define **SOLEN_OP_PIN** PINB
- #define **SOLEN_DN** PB1
- #define **SOLEN_UP** PB2

Timer Definitions*Definitions to make setting up the timer easier*

- #define **PIN_CHECK_FREQ** 1000
- #define **PRESCALER** 1
- #define **TIMER1_COUNT** ((**F_CPU**/(**PIN_CHECK_FREQ***PRESCALER**))-1)

Button States*Defines for the states of the buttons*

- #define **RELEASED** 0
- #define **PRESSED** 1

Functions

- void **io_init** (void)
  Initialize i/o ports and timer.
- void **timer1_init** (void)
  Initialize Timer 1.
- void **adc_init** (void)
  Initialize the ADC.
- **ISR** (TIMER1_COMPA_vect)
  *Toggle the LED if **USHIFT_PIN** is pressed.*
- **ISR** (ADC_vect)
  ADC Interrupt Service Routine.

Variables

Port Values*Used to get the values from the I/O ports*

- uint8_t **btn_pins**
  *Only the **USHIFT_PIN** and **DSHIFT_PIN** pins are active.*
- uint8_t **tach_pin**
  *Only the **TACH_PIN** pin is active.*
- uint8_t **solen_port**
  *Only the **SOLEN_DN** and **SOLEN_UP** pins are active.*

Button Variables*The states of the buttons and debouncer values.*

- uint8_t **up_shift_btn**
  The state of the Up Shift Button.
- uint8_t **dn_shift_btn**
  The state of the Down Shift Button.
- uint16_t **uPressCount**
  Up button debouncer value.
- uint16_t **dPressCount**
  Down button debouncer value.

Detailed Description

This header file contains constant definitions and function prototypes.

This project uses the Arduino Uno board. It uses the ATMEGA 328P microcontroller with a 16MHz crystal oscillator. Pin mappings described below should only be used for this board or ones with the same pin mappings

Author:

Rocky Gray Jr.

Date:

3/7/2012

Define Documentation

#define BTN_IP_DDR DDRD

Maps to DDRD

#define BTN_IP_PIN PIND

Maps to PIND

#define BTN_IP_PORT PORTD

Maps to PORTD

#define DSHIFT_PIN PD3

Downshift

- Connect to Digital Pin 3 (PIND3)

#define PIN_CHECK_FREQ 1000

Button pin check frequency in Hz

#define PRESCALER 1

Prescaler needed for longer timer.

Valid values:

- 1 (no prescaling)
- 8
- 64
- 256
- 1024

#define PRESSED 1

Button is pressed (1)

#define RELEASED 0

Button is released (0)

#define SOLEN_DN PB1

Solenoid Down

- Connect to Digital Pin 9(PWM) (PINB1)
  - Shifts down, pushes solenoid out
-

#define SOLEN_OP_DDR DDRB

Maps to DDRB

#define SOLEN_OP_PIN PINB

Maps to PINB

#define SOLEN_OP_PORT PORTB

Maps to PORTB

#define SOLEN_UP PB2

Solenoid Up

- Connect to Digital Pin 10(PWM) (PINB2)
  - Shifts up, pulls solenoid in
-

#define TACH_IP_DDR DDRC

Maps to DDRC

#define TACH_IP_PIN PINC

Maps to PINC

#define TACH_IP_PORT PORTC

Maps to PORTC

#define TACH_PIN PC0

Tachometer

- Connect to Analog Input 0 (PINC0)

#define TIMER1_COUNT ((F_CPU/(PIN_CHECK_FREQ*PRESCALER))-1)

Computes the value the timer should count to.

#define USHIFT_PIN PD2

Upshift

- Connect to Digital Pin 2 (PIND2)

Function Documentation

void adc_init (void)

Initialize the ADC.

ADC 0:

- Prescaler set to 128 (16MHz/128 = 125kHz)
- ADC result is left adjusted (Just read ADCH)
- Free-Running mode enabled
- Interrupt enabled

Returns:

none

Here is the caller graph for this function:

void io_init (void)

Initialize i/o ports and timer.

Inputs:

- User Buttons
  - **BTN_IP_DDR** => set **USHIFT_PIN** and **DSHIFT_PIN** as input
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- Tachometer Input
  - **TACH_IP_DDR** => set **TACH_PIN** as input
  - **TACH_IP_PORT** => set pullups for **TACH_PIN**
-

Outputs:

- Solenoid Output
  - **SOLEN_OP_DDR** => set **SOLEN_DN** and **SOLEN_UP** as input
  - **SOLEN_OP_PORT** => initialize **SOLEN_DN** and **SOLEN_UP** to 0
-

Returns:

none

Here is the call graph for this function:

Here is the caller graph for this function:

ISR (TIMER1_COMPA_vect)

Toggle the LED if **USHIFT_PIN** is pressed.

Fires at **PIN_CHECK_FREQ** Hz. (1ms)

Returns:

reti

ISR (ADC_vect)

ADC Interrupt Service Routine.

Fires at 16MHz/128 = 125kHz

Returns:

reti

void timer1_init (void)

Initialize Timer 1.

Timer 1:

- Configure Timer 1 for CTC (Clear Timer on Compare)
- Prescaler set to 1 (16MHz/1)
- Fires every **PIN_CHECK_FREQ** Hz (1kHz = 1ms)

Returns:

none

Here is the caller graph for this function:

Variable Documentation

uint8_t btn_pins

Only the **USHIFT_PIN** and **DSHIFT_PIN** pins are active.

uint8_t dn_shift_btn

The state of the Down Shift Button.

uint16_t dPressCount

Down button debouncer value.

uint8_t solen_port

Only the **SOLEN_DN** and **SOLEN_UP** pins are active.

uint8_t tach_pin

Only the **TACH_PIN** pin is active.

uint8_t up_shift_btn

The state of the Up Shift Button.

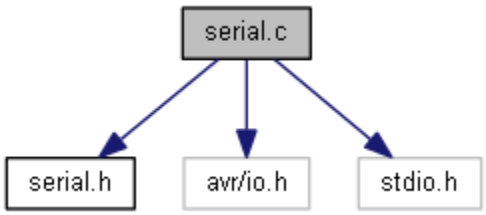
uint16_t uPressCount

Up button debouncer value.

serial.c File Reference

```
#include "serial.h"
#include "avr/io.h"
#include <stdio.h>
```

Include dependency graph for serial.c:



Functions

- void **init_usart** (unsigned int baudrate)

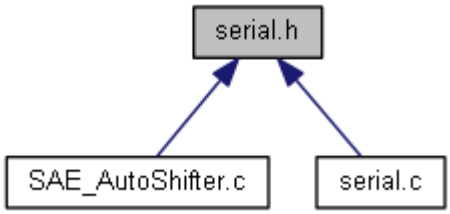
Function Documentation

void init_usart (unsigned int *baudrate*)

Here is the caller graph for this function:

serial.h File Reference

This graph shows which files directly or indirectly include this file:



Defines

- #define **LF** '\n' /* line feed */
- #define **CR** '\r' /* carriage return */
- #define **UBRR_V**(Baud) ((**F_CPU**/16/Baud) - 1)
- #define **Baud115200** (**UBRR_V**(115200))
- #define **Baud57600** (**UBRR_V**(57600))
- #define **Baud38400** (**UBRR_V**(38400))
- #define **Baud19200** (**UBRR_V**(19200))
- #define **Baud9600** (**UBRR_V**(9600))

Functions

- void **init_usart** (unsigned int baudrate)

Define Documentation

#define Baud115200 (UBRR_V(115200))

#define Baud19200 (UBRR_V(19200))

#define Baud38400 (UBRR_V(38400))

#define Baud57600 (UBRR_V(57600))

#define Baud9600 (UBRR_V(9600))

#define CR '\r' /* carriage return */

#define LF '\n' /* line feed */

#define UBRR_V(Baud) ((F_CPU/16/Baud) - 1)

Function Documentation

void init_usart (unsigned int *baudrate*)

Here is the caller graph for this function:

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