aWXIron

1.2

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Contents

Chapter 1

SMD Soldering Station for Weller RT Series Tips

Based on a project from **Martin Kumm** `http://www.martin-kumm.de/wiki/doku.php?id=Projects:SMD_Solderstation`.

The hardware has been redesigned (two channels, 16x2 LCD instead of 7 segments display, etc), and the software rewrote from scratch.

I want to especially thank my friend **Olivier**, ***F5LGJ***, for his great help and support in this project.

Chapter 2

User Interface overview

- The Soldering Station control is done using a simple rotary encoder, which integrates a push button.
- The temperature range goes from 100℃, up to 450℃.
- Depending of the hardware assembly, it can control one or two soldering irons:
  1. In Single mode, the temperature reading and setting is displayed using double height font.
  2. In dual channels version, both soldering irons can be controled separately, or can be joined:
     - when separate channels mode is used, each channel is independent. Simple click on the encoder push button will set the focus to the next channel. The focused channel temperature will be surrounded by the symbols **[** and **]**
     - when joined mode is used, the temperature is displayed like in Single channel mode (double height font), both channels share the same settings (target temperature and standby mode).
- LED status decoding:

LED Status	**Meaning**
ON	the tip is heating
OFF	the tip is cooling
Blinking	the tip has reached his target temperature
Three times blinking	the soldering station is in Standby mode (see Standby)

- The target temperature is stored, for each channel, inside the microcontroller's EEPROM. The values will be restored on the next startup. After a timeout of 60 seconds, a new defined target temperature will be stored into the EEPROM. If in the meantime the user defines a new target temperature, the timeout is resetted
- When the station is in temperature reading mode, the displayed value(s) is left aligned. When the station is in settings mode, the displayed value is right aligned.

2.1 Encoder usage

- In any mode (settings or temperature reading), the rotary encoder is used to define the target temperature. Turn the encoder clockwise to increase the target temperature, and anti-clockwise to decrease it.
- When the soldering station is not in settings mode, it displays the soldering tip temperature. A single encoder detents rotation will switch the soldering station into settings mode, and display the target temperature without any change to the target temperature setting.

- When the soldering station is in settings mode, if not action is done using the encoder's rotation within 3 seconds, it will switch back to temperature reading.

- Encoder's push button:
  - Single soldering tip version:

Button	Action
Single Click	*no effect*
Double Click	toggles standby mode (see Standby)
Held	*no effect*

  - Dual soldering tip version:

Button	Action
Single click	change the focus to the next channel (if not in joined mode)
Double click	switch to standby mode (see Standby)
Held	toggles joined mode (see Joined mode)

2.2 Joined mode

- With dual channel enabled hardware, it's possible to share the same temperature preset for both soldering tips.

See Encoder usage

2.3 Standby

- A double-click on the encoder brings the soldering station in the standby mode.

- When standby mode is enabled, the target temperature will go down to 150℃ if the temperature setting is set above this point, otherwise it will go down to 100℃.

- Any encoder action will exit the standby mode.

- When Standby mode is activated, the LEDs blink three times cyclically.

Chapter 3

Calibration Process

- **Prerequisites**:
  - **Hardware**:
    - Digital Thermometer (e.g: you multimeter with a K probe)
  - **Software**:
    - A serial terminal emulator (e.g. “*HyperTerminal*” or “*Tera Term*” on Windows, “*minicom*” or “*cute-com*” on Linux).
    - The calibration spreadsheet file **aWXIronsCalibration.ods**
    - A software able to open the calibration spreadsheet, like “*LibreOffice*“, “*OpenOffice*“ and so on.

  The serial communication settings are: **57600**, **8**, **N**, **1**

- **Why a calibration**:

  You have to connect the soldering station to the PC, using a USB cable. The calibration process is necessary get accurate temperature control. To turn the soldering station in calibration, you have to keep the encoder push button pressed while turning the station ON. Once the station is ready to use, the '***CAL***' string is displayed on the top left side of the LCD display. In calibration mode, the readed temperature isn't displayed. Instead, the ADC value is shown. It's really important to start from the lowest temperature setting (100℃), and wait for till the temperature stabilize.

- **Process Description**:
  - Blah

Todo write me

Chapter 4

Todo List

Page Calibration Process

write me

Chapter 5

Class Index

5.1 Class List

Here are the classes, structs, unions and interfaces with brief descriptions:

Chapter 6

File Index

6.1 File List

Here is a list of all files with brief descriptions:

Chapter 7

Class Documentation

7.1 aDSChannels::_eepromCalibrationValue_t Union Reference

Union to manipulate float/uint8_t [] calibration values.

```
#include <aDSEngine.h>
```

Public Attributes

- float v
- uint8_t c [sizeof(float)]

7.1.1 Detailed Description

Union to manipulate float/uint8_t [] calibration values.

7.1.2 Member Data Documentation

7.1.2.1 uint8_t aDSChannels::_eepromCalibrationValue_t::c[sizeof(float)]

7.1.2.2 float aDSChannels::_eepromCalibrationValue_t::v

The documentation for this union was generated from the following file:

- aDSEngine.h

7.2 aDSChannel Class Reference

aDSChannel class

```
#include <aDSEngine.h>
```

Classes

- struct aPin_t

  Our pin structure.
- struct CalibrationData_t

  Calibration values.

Public Types

- enum HeatingState_t { HEATING_STATE_HEATING, HEATING_STATE_COOLING, HEATING_STATE_REACHED, HEATING_STATE_STANDBY }

  Heating State enumeration.

Public Member Functions

- aDSChannel ()

  aDSChannel class constructor
- virtual ∼aDSChannel ()

  aDSChannel destructor
- void setup (uint8_t, uint8_t, uint8_t)

  Setup member function, should be called before any other member.
- void setFocus (bool)

  Set the focus, as display point of view.
- bool hasFocus ()

  Get the focus state.
- uint16_t getTemperature (OperationMode_t)

  Get current temperature accordingly from the given mode (SET/READ)
- bool setTemperature (OperationMode_t, int16_t)

  Set current temperature accordingly from the given mode (SET/READ)
- bool service (unsigned long)

  This member should be called often, it manage heating/cooling of the Channel.
- void setStandbyMode (bool)

  Enable or disable channel's standby.
- bool getStandbyMode ()

  Get channel's standby enability.
- bool isTempHasChanged ()

  Is target temperature has changed (use for EEPROM storage)
- void syncTempChange ()

  Reset temperature change flag (use for EEPROM storage)
- uint8_t updateLEDState (unsigned long)

  Change LED state according for Heating/Cooling/Standby status.
- uint8_t getLEDState ()

  Get state LED status.
- HeatingState_t getHeatState ()

  Get channel heating state.
- void setCalibration (float, float)
- const CalibrationData_t getCalibration () const

  Get calibration data values.
- int16_t getADCValue ()

  Get latest ADC value.

Static Public Attributes

- static const int16_t TEMPERATURE_MIN = 10
- static const int16_t TEMPERATURE_MAX = 450

  Maximum temperature.
- static const int16_t TEMPERATURE_STANDBY = 150

  Standby temperature.
- static const float ADC_TO_TEMP_GAIN = 0.39
- static const float ADC_TO_TEMP_OFFSET = 23.9
- static const uint8_t CNTRL_GAIN = 10
- static const unsigned long BLINK_UPDATE_RATE = 400

  Update rate for LED blinking, in ms.
- static const int16_t TEMPERATURE_TOLERANCE = 3

  Temperature tolerance for REACHED state, +/- 2 ℃.
- static const float DEFAULT_TEMPERATURE_SLOPE = 0.3947387545
- static const float DEFAULT_TEMPERATURE_OFFSET = 43.8279285472
- static const uint8_t PWM_MAX_VALUE = 150

  Maximum PWM value.

Protected Member Functions

- void _turnOffPWM (aPin_t)

  Turns PWM off for the given pin.
- int8_t _digitalRead (aPin_t)

  Get state of the given pin.
- void _digitalWrite (aPin_t, uint8_t)

  Set state of the given pin.
- uint16_t _analogRead (aPin_t)

  Get analog value of the given pin.
- void _analogWrite (aPin_t, uint8_t)

  Set analog value for the given pin.

Private Attributes

- aPin_t m_pwmPin
- aPin_t m_sensorPin
- aPin_t m_ledPin
- bool m_hasFocus
- int16_t m_targetTemp
- int16_t m_currentTemp
- int8_t m_pwmValue
- int16_t m_adcValue
- bool m_inStandby
- HeatingState_t m_heatState
- uint8_t m_ledState
- unsigned long m_nextPass
- bool m_tempHasChanged
- unsigned long m_nextBlink
- uint8_t m_blinkStandby
- uint8_t m_ref
- CalibrationData_t m_cal
- uint8_t m_channel
- unsigned long m_nextTempStep
- unsigned long m_nextLowering

7.2.1 Detailed Description

aDSChannel class

7.2.2 Member Enumeration Documentation

7.2.2.1 enum **aDSChannel::HeatingState_t**

Heating State enumeration.

Enumerator

HEATING_STATE_HEATING	Heating.
HEATING_STATE_COOLING	Cooling.
HEATING_STATE_REACHED	Target temperature reached.
HEATING_STATE_STANDBY	In standby mode.

7.2.3 Constructor & Destructor Documentation

7.2.3.1 aDSChannel::aDSChannel ( )

aDSChannel class constructor

7.2.3.2 aDSChannel::∼aDSChannel ( ) [virtual]

aDSChannel destructor

7.2.4 Member Function Documentation

7.2.4.1 uint16_t aDSChannel::_analogRead (**aPin_t** *pin*) [protected]

Get analog value of the given pin.

Took and Hacked from Arduino wiring_analog.c

Parameters

pin	aPin_t : pin

Returns

uint8_t : analog value (0..255)

7.2.4.2 void aDSChannel::_analogWrite (**aPin_t** *pin,* uint8_t *val*) [protected]

Set analog value for the given pin.

Took and Hacked from Arduino wiring_analog.c

Parameters

pin	aPin_t : pin
val	uint8_t : analog value (0..255)

Returns

void

7.2.4.3 int8_t aDSChannel::_digitalRead (aPin_t *pin*) [protected]

Get state of the given pin.

Took and Hacked from Arduino wiring_digital.c

Parameters

pin	aPin_t : pin

Returns

int8_t : HIGH or LOW

7.2.4.4 void aDSChannel::_digitalWrite (aPin_t *pin*, uint8_t *val*) [protected]

Set state of the given pin.

Took and Hacked from Arduino wiring_digital.c

Parameters

pin	aPin_t : pin
val	uint8_t : state (HIGH or LOW)

Returns

void

7.2.4.5 void aDSChannel::_turnOffPWM (aPin_t *pin*) [protected]

Turns PWM off for the given pin.

Took and Hacked from Arduino wiring_digital.c

Parameters

pin	aPin_t : pin

Returns

void

7.2.4.6 int16_t aDSChannel::getADCValue ( )

Get latest ADC value.

Returns

int16_t : ADC value

7.2.4.7 const aDSChannel::CalibrationData_t aDSChannel::getCalibration ( ) const

Get calibration data values.

Returns

const CalibrationData_t : Calibration data

7.2.4.8 aDSChannel::HeatingState_t aDSChannel::getHeatState ( )

Get channel heating state.

Returns

aDSChannel::HeatingState_t : heating state

7.2.4.9 uint8_t aDSChannel::getLEDState ( )

Get state LED status.

Returns

uint8_t : HIGH or LOW (LED on or off, accordingly)

7.2.4.10 bool aDSChannel::getStandbyMode ( )

Get channel's standby enability.

Returns

bool

7.2.4.11 uint16_t aDSChannel::getTemperature (OperationMode_t *mode*)

Get current temperature accordingly from the given mode (SET/READ)

Parameters

mode	OperationMode_t : operation mode

Returns

uint16_t : temperature, in Celcius

7.2.4.12 bool aDSChannel::hasFocus ( )

Get the focus state.

Returns

bool : focus state

7.2.4.13 bool aDSChannel::isTempHasChanged ( )

Is target temperature has changed (use for EEPROM storage)

Returns

bool : return true if target temperature has changed, otherwise false

7.2.4.14 bool aDSChannel::service (unsigned long *m*)

This member should be called often, it manage heating/cooling of the Channel.

Parameters

m	unsigned long : current timestamp

Returns

bool : return true if readed temperature has changed since last call, otherwise false

7.2.4.15 void aDSChannel::setCalibration (float *slope,* float *offset*)

7.2.4.16 void aDSChannel::setFocus (bool *v*)

Set the focus, as display point of view.

Parameters

v	bool : focus state

Returns

void

7.2.4.17 void aDSChannel::setStandbyMode (bool *enable*)

Enable or disable channel's standby.

Parameters

enable	bool : enability

Returns

void

7.2.4.18 bool aDSChannel::setTemperature (OperationMode_t *mode,* int16_t *temp*)

Set current temperature accordingly from the given mode (SET/READ)

Parameters

mode	OperationMode_t : operation mode
temp	int16_t : temperature, in Celcius

Returns

bool : true if temperature has been changed, otherwise false

7.2.4.19 void aDSChannel::setup (uint8_t *pwmPin,* uint8_t *sensorPin,* uint8_t *ledPin*)

Setup member function, should be called before any other member.

Pins will be embedded into aPin_t object, timer, mask, port and output register will be set also here, preventing using Arduino analog/digital{Read/Write}() calls, which are quite slow.

Parameters

pwmPin	uint8_t : PWM pin, used to drive the output MosFET
sensorPin	uint8_t : Sensor pin, used to get analog temperature value.
ledPin	uint8_t : LED pin, used to reflect Heating/Cooling state

Returns

void

7.2.4.20 void aDSChannel::syncTempChange ( )

Reset temperature change flag (use for EEPROM storage)

Returns

void

7.2.4.21 uint8_t aDSChannel::updateLEDState (unsigned long *m*)

Change LED state according for Heating/Cooling/Standby status.

Parameters

m	unsigned long : timestamp

Returns

uint8_t : HIGH or LOW (LED on or off, accordingly)

7.2.5 Member Data Documentation

7.2.5.1 const float aDSChannel::ADC_TO_TEMP_GAIN = 0.39 `[static]`

7.2.5.2 const float aDSChannel::ADC_TO_TEMP_OFFSET = 23.9 `[static]`

7.2.5.3 const unsigned long aDSChannel::BLINK_UPDATE_RATE = 400 `[static]`

Update rate for LED blinking, in ms.

7.2.5.4 const uint8_t aDSChannel::CNTRL_GAIN = 10 [static]

7.2.5.5 const float aDSChannel::DEFAULT_TEMPERATURE_OFFSET = 43.8279285472 [static]

7.2.5.6 const float aDSChannel::DEFAULT_TEMPERATURE_SLOPE = 0.3947387545 [static]

7.2.5.7 int16_t aDSChannel::m_adcValue [private]

7.2.5.8 uint8_t aDSChannel::m_blinkStandby [private]

7.2.5.9 CalibrationData_t aDSChannel::m_cal [private]

7.2.5.10 uint8_t aDSChannel::m_channel [private]

7.2.5.11 int16_t aDSChannel::m_currentTemp [private]

7.2.5.12 bool aDSChannel::m_hasFocus [private]

7.2.5.13 HeatingState_t aDSChannel::m_heatState [private]

7.2.5.14 bool aDSChannel::m_inStandby [private]

7.2.5.15 aPin_t aDSChannel::m_ledPin [private]

7.2.5.16 uint8_t aDSChannel::m_ledState [private]

7.2.5.17 unsigned long aDSChannel::m_nextBlink [private]

7.2.5.18 unsigned long aDSChannel::m_nextLowering [private]

7.2.5.19 unsigned long aDSChannel::m_nextPass [private]

7.2.5.20 unsigned long aDSChannel::m_nextTempStep [private]

7.2.5.21 aPin_t aDSChannel::m_pwmPin [private]

7.2.5.22 int8_t aDSChannel::m_pwmValue [private]

7.2.5.23 uint8_t aDSChannel::m_ref [private]

7.2.5.24 aPin_t aDSChannel::m_sensorPin [private]

7.2.5.25 int16_t aDSChannel::m_targetTemp [private]

7.2.5.26 bool aDSChannel::m_tempHasChanged [private]

7.2.5.27 const uint8_t aDSChannel::PWM_MAX_VALUE = 150 [static]

Maximum PWM value.

7.2.5.28 const int16_t aDSChannel::TEMPERATURE_MAX = 450 [static]

Maximum temperature.

7.2.5.29 const int16_t aDSChannel::TEMPERATURE_MIN = 10 [static]

7.2.5.30 const int16_t aDSChannel::TEMPERATURE_STANDBY = 150 `[static]`

Standby temperature.

7.2.5.31 const int16_t aDSChannel::TEMPERATURE_TOLERANCE = 3 `[static]`

Temperature tolerance for REACHED state, +/- 2 ℃.

The documentation for this class was generated from the following files:

- aDSEngine.h
- aDSEngine.cpp

7.3 aDSChannels Class Reference

```
#include <aDSEngine.h>
```

Classes

- union _eepromCalibrationValue_t

  Union to manipulate float/uint8_t [] calibration values.

Public Types

- enum Channel_t { CHANNEL_ONE, CHANNEL_TWO, CHANNEL_MAX }

  Channels enumeration.

Public Member Functions

- aDSChannels (uint8_t, uint8_t, uint8_t, uint8_t, uint8_t, uint8_t)

  aDSChannels constructor
- virtual ∼aDSChannels ()

  aDSChannels destructor
- void setup (uint8_t, uint8_t, uint8_t, uint8_t, uint8_t, uint8_t, uint8_t, uint8_t, uint8_t)

  Setup member function, should be called before any other member.
- void setOperationMode (OperationMode_t)

  Set operation mode (SET/READ)
- OperationMode_t getOperationMode ()

  Get current operation mode.
- void updateOperationMode ()

  Update operation mode.
- void pingOperationMode ()

  Reset timeout for OPERATION_MODE_SET mode.
- void syncData (uint16_t)

  Reset given bit inside bitfield, regarless of its state.
- void incEncoderPosition (uint16_t)

  Increment or decrement encoder position.
- void service ()

  This member should be called often, it manage channels, LCD and EEPROM.
- void toggleJoined ()

Toggle channels joining.
- bool isJoinded ()

  Get channel joining state.
- void setFocusToNextChannel ()

  Set the focus to the next channel, if any.
- void toggleStandbyMode ()

  Toggle standby mode.
- bool isInStandby ()

  Get standby mode.
- void setCalibrationValues (Channel_t, aDSChannel::CalibrationData_t)

  Set calibration values for given channel.
- aDSChannel::CalibrationData_t getCalibrationValues (Channel_t)

  Get calibration value for given channel.
- void restoreCalibationValues ()

  Restore calibration values from EEPOM.
- void saveCalibrationValues (Channel_t)

  Save calibation value of given into EEPROM.
- bool isInCalibration ()

  Get calibration mode enability.
- void setCalibrationMode (bool)

  Set calibration mode.

Static Public Attributes

- static const uint8_t OFFSET_VALUE = 2

  Value column LCD offset.
- static const uint8_t OFFSET_MARKER_LEFT = 0

  Column LCD offset for left marker '['.
- static const uint8_t OFFSET_MARKER_RIGHT = 10

  Column LCD offset for right marker ']'.
- static const unsigned long OPERATION_SET_TIMEOUT = 3000

  Automatic toggle settings->reading timeout (3 seconds), in ms.
- static const unsigned long DISPLAY_UPDATE_RATE = 200

  Display update rate, in ms.
- static const unsigned long MEASURE_UPDATE_RATE = 200

  Measurement (for aDSChannel) rate, in ms.
- static const unsigned long TEMP_SETTING_INACTIVITY = 60000

  Timeout in ms, after which the new target temperature will be stored in the EEPROM.
- static const uint16_t DATA_CHANNEL2_ENABLED = 1

  Bitfield: Channel 2 is enabled.
- static const uint16_t DATA_CHANNELS_JOINDED = 1 << 1

  Bitfield: Channel 1 & 2 are joinded.
- static const uint16_t DATA_OPERATION = 1 << 2

  Bitfield: Operation mode has changed.
- static const uint16_t DATA_CHANNEL1_TEMP_SET = 1 << 3

  Bitfield: Target temperature of channel 1 has changed.
- static const uint16_t DATA_CHANNEL1_TEMP_READ = 1 << 4

  Bitfield: Readed temperature of channel 1 has changed.
- static const uint16_t DATA_CHANNEL1_LED_STATE = 1 << 5

  Bitfield: LED state of channel 1 has changed.

- static const uint16_t DATA_CHANNEL2_TEMP_SET = 1 << 6

  Bitfield: Target temperature of channel 1 has changed.
- static const uint16_t DATA_CHANNEL2_TEMP_READ = 1 << 7

  Bitfield: Readed temperature of channel 1 has changed.
- static const uint16_t DATA_CHANNEL2_LED_STATE = 1 << 8

  Bitfield: LED state of channel 1 has changed.
- static const uint16_t DATA_DISPLAY = 1 << 9

  Bitfield: Display should be refreshed.
- static const uint16_t DATA_STANDBY = 1 << 10

  Bitfield: Standby state.
- static const uint16_t DATA_DISPLAY_STANDBY = 1 << 11

  Bitfield: Standby state has changed.
- static const uint16_t DATA_FOCUS = 1 << 12

  Bitfield: Focus has changed.
- static const uint16_t DATA_IN_CALIBRATION = 1 << 13

  Bitfield: in Calibration.

Protected Member Functions

- void _enableData (uint16_t, bool)

  Enable a bit, regardless of its state, inside bitfield m_datas.
- void _enableDataCheck (uint16_t, bool)

  Enable a bit, if it's not already set, inside bitfield m_datas.
- void _updateDisplay ()

  Update LCD display, if needed.
- void _displayBigDigit (uint8_t, uint8_t, uint8_t=0)

  Display a big digit to given position.
- void _displayBigDigits (uint16_t, uint8_t, uint8_t=0)

  Display a big digits number to given position.
- void _clearValue (uint8_t, int=0)

  Clear numerical value field (in non big digit mode) on LCD.
- void _updateField (OperationMode_t, int16_t, uint8_t)

  Update value on LCD from given mode and row.
- void _wakeupFromStandby ()

  Wake up from standby mode.
- void _showBanner ()

  Display a banner on the LCD.
- bool _checkForMagicNumbers ()

  Check for the magic number in the EEPROM.
- void _writeMagicNumbers ()

  Write magic numbers into EEPROM.
- uint8_t _crc8 (const uint8_t ∗, uint8_t)

  CRC8 computation.
- template<typename T >
  bool _write (T const, int16_t &)

  Template to write a value into EEPROM, at given address.
- template<typename T >
  bool _read (T &, int16_t &)

  Template to read a value from the EEPROM, at given address.
- template<typename T >
  void _scissor (T v, uint8_t ∗, size_t &)

Template to decompose the value into an array of uint8_t (used for CRC8 computation)

- bool _getTempFromEEPROM (int16_t, uint16_t &)

  Helper to read the stored temperature inside EEPROM at given address.
- void _setTempToEEPROM (int16_t, uint16_t)

  Helper to write a temperature inside EEPROM at given address.
- void _restoreCalibrationFromEEPROM (int16_t, aDSChannel &)

  Restore calibation value for given channel.
- void _backupCalibrationFromEEPROM (int16_t, aDSChannel &)

  Backup calibration value for given channel.

Static Protected Attributes

- static const int16_t EEPROM_ADDR_MAGIC = 0

  EEPROM offset storage start for magic numbers (0xDEAD)
- static const int16_t EEPROM_STORAGE_STARTING = 5

  EEPROM starting address for program datas.
- static const int16_t EEPROM_TEMP_SIZE = sizeof(uint16_t) + sizeof(uint8_t)

  EEPROM temperature size (temperature + crc)
- static const int16_t EEPROM_ADDR_CHANNEL_JOINED = EEPROM_STORAGE_STARTING + 1

  Channels are joinded.
- static const int16_t EEPROM_ADDR_TEMP_CHANNEL_ONE = EEPROM_ADDR_CHANNEL_JOINED + EEPROM_TEMP_SIZE

  Target temp for Channel 1.
- static const int16_t EEPROM_ADDR_TEMP_CHANNEL_TWO = EEPROM_ADDR_TEMP_CHANNEL_ONE + EEPROM_TEMP_SIZE

  Target temp for Channel 2.
- static const int16_t EEPROM_CALIBRATION_SIZE = (sizeof(float) ∗ 2) + sizeof(uint8_t)

  EEPROM calibration size: 2 float (slope & offset), and one uint8_t for crc.
- static const int16_t EEPROM_ADDR_CALIBRATION_CHAN_1 = EEPROM_ADDR_TEMP_CHANNEL_TW-O + EEPROM_TEMP_SIZE

  EEPROM start offset for Channel 1 calibration values.
- static const int16_t EEPROM_ADDR_CALIBRATION_CHAN_2 = EEPROM_ADDR_CALIBRATION_CHAN-_1 + EEPROM_CALIBRATION_SIZE

  EEPROM start offset for Channel 2 calibration values.

Private Attributes

- LiquidCrystal m_lcd
- aDSChannel m_channels [CHANNEL_MAX]
- OperationMode_t m_operationMode
- unsigned long m_operationTick
- uint16_t m_datas
- uint8_t m_lcdCols
- uint8_t m_lcdRows
- unsigned long m_nextDisplayUpdate
- unsigned long m_nextMeasureUpdate
- unsigned long m_lastTempChange
- bool m_isValidEEPROM
- bool m_storedToEEPROM

7.3.1 Member Enumeration Documentation

7.3.1.1 enum aDSChannels::Channel_t

Channels enumeration.

Enumerator

CHANNEL_ONE

CHANNEL_TWO

CHANNEL_MAX

7.3.2 Constructor & Destructor Documentation

7.3.2.1 aDSChannels::aDSChannels (uint8_t *rs*, uint8_t *e*, uint8_t *d4*, uint8_t *d5*, uint8_t *d6*, uint8_t *d7*)

aDSChannels constructor

Parameters

rs	uint8_t : LCD RS pin
e	uint8_t : LCD Enable pin
d4	uint8_t : LCD D4 pin
d5	uint8_t : LCD D5 pin
d6	uint8_t : LCD D6 pin
d7	uint8_t : LCD D7 pin

7.3.2.2 aDSChannels::∼aDSChannels ( ) [virtual]

aDSChannels destructor

7.3.3 Member Function Documentation

7.3.3.1 void aDSChannels::_backupCalibrationFromEEPROM (int16_t *startAddr*, aDSChannel & *channel*) [protected]

Backup calibration value for given channel.

Parameters

startAddr	int16_t : EEPROM start address
channel	aDSChannel& : channel

Returns

void

7.3.3.2 bool aDSChannels::_checkForMagicNumbers ( ) [protected]

Check for the magic number in the EEPROM.

Returns

bool : true if magic numbers has been found, otherwise false

7.3.3.3 void aDSChannels::_clearValue (uint8_t *row*, int *destMinus* = `0`) `[protected]`

Clear numerical value field (in non big digit mode) on LCD.

Parameters

row	uint8_t : LCD row position
destMinus	int : right offset sub

Returns

void

7.3.3.4 uint8_t aDSChannels::_crc8 (const uint8_t ∗ *addr*, uint8_t *len*) `[protected]`

CRC8 computation.

Code took from `http://www.pjrc.com/teensy/td_libs_OneWire.html`

Parameters

addr	const uint8_t∗ : **Data source**
len	uint8_t : **Data source length**

Returns

uint8_t : **CRC**

7.3.3.5 void aDSChannels::_displayBigDigit (uint8_t *digit*, uint8_t *position*, uint8_t *offset* = 0) `[protected]`

Display a big digit to given position.

Parameters

digit	uint8_t : offset in _bigDigit{Top/Bottom} array
position	uint8_t : LCD position
offset	uint8_t : LCD offset position

Returns

void

7.3.3.6 void aDSChannels::_displayBigDigits (uint16_t *value*, uint8_t *position*, uint8_t *offset* = 0) `[protected]`

Display a big digits number to given position.

Parameters

value	uint16_t : value to display, DIGIT_WIDTH max length
position	uint8_t : LCD position
offset	uint8_t : LCD offset position

Returns

void

7.3.3.7 void aDSChannels::_enableData (uint16_t *bit*, bool *enable*) `[protected]`

Enable a bit, regardless of its state, inside bitfield m_datas.

Parameters

bit	uint16_t : bit to enable/disable
enable	bool : bit enability

Returns

void

7.3.3.8 void aDSChannels::_enableDataCheck (uint16_t *bit,* bool *enable*) [protected]

Enable a bit, if it's not already set, inside bitfield m_datas.

Parameters

bit	uint16_t : bit to enable/disable
enable	bool : bit enability

Returns

void

7.3.3.9 bool aDSChannels::_getTempFromEEPROM (int16_t *startAddr,* uint16_t & *temp*) [protected]

Helper to read the stored temperature inside EEPROM at given address.

Parameters

startAddr	int16_t : start address
temp	uint16_t& : temperature

Returns

bool : true if the CRCs matches

7.3.3.10 template<typename T > bool aDSChannels::_read (T & *v,* int16_t & *addr*) [protected]

Template to read a value from the EEPROM, at given address.

Parameters

v	T& : readed value
addr	int16_t& : start address

Returns

template <typename T> bool : true on read success, otherwise false

7.3.3.11 void aDSChannels::_restoreCalibrationFromEEPROM (int16_t *startAddr,* aDSChannel & *channel*) [protected]

Restore calibation value for given channel.

Parameters

startAddr	int16_t : EEPROM start address
channel	aDSChannel& : channel

Returns

void

7.3.3.12 template<typename T > void aDSChannels::_scissor (T *v*, uint8_t ∗ *dest*, size_t & *offset*) [protected]

Template to decompose the value into an array of uint8_t (used for CRC8 computation)

Parameters

v	T : value
dest	uint8_t∗ : pointer to the destination array
offset	size_t& : start offset of the array

Returns

template <typename T> void

7.3.3.13 void aDSChannels::_setTempToEEPROM (int16_t *startAddr*, uint16_t *temp*) [protected]

Helper to write a temperature inside EEPROM at given address.

Parameters

startAddr	int16_t : start address
temp	uint16_t : temperature

Returns

void

7.3.3.14 void aDSChannels::_showBanner ( ) [protected]

Display a banner on the LCD.

Returns

void

7.3.3.15 void aDSChannels::_updateDisplay ( ) [protected]

Update LCD display, if needed.

Returns

void

7.3.3.16 void aDSChannels::_updateField (OperationMode_t *mode*, int16_t *value*, uint8_t *row*) [protected]

Update value on LCD from given mode and row.

Parameters

mode	OperationMode_t : operation mode (SET/READ)
value	int16_t : value to display
row	uint8_t : LCD row

Returns

void

7.3.3.17 void aDSChannels::_wakeupFromStandby ( ) [protected]

Wake up from standby mode.

Returns

void

7.3.3.18 template<typename T > bool aDSChannels::_write (T const *v*, int16_t & *addr*) [protected]

Template to write a value into EEPROM, at given address.

Parameters

v	T const : value
addr	int16_t& : start address

Returns

template <typename T> bool : true on write success, otherwise false

7.3.3.19 void aDSChannels::_writeMagicNumbers ( ) [protected]

Write magic numbers into EEPROM.

Returns

void

7.3.3.20 aDSChannel::CalibrationData_t aDSChannels::getCalibrationValues (Channel_t *chan*)

Get calibration value for given channel.

Parameters

chan	Channel_t : channel

Returns

aDSChannel::CalibrationData_t : calibration values

7.3.3.21 OperationMode_t aDSChannels::getOperationMode ( )

Get current operation mode.

Returns

OperationMode_t : operation mode

7.3.3.22 void aDSChannels::incEncoderPosition (uint16_t *v*)

Increment or decrement encoder position.

Parameters

v	uint16_t : increment value (signed)

Returns

void

7.3.3.23 bool aDSChannels::isInCalibration ( )

Get calibration mode enability.

Returns

bool : true if in calibration mode, otherwise false

7.3.3.24 bool aDSChannels::isInStandby ( )

Get standby mode.

Returns

bool : true if in standby mode, otherwise false

7.3.3.25 bool aDSChannels::isJoinded ( )

Get channel joining state.

Returns

bool : true if joinded, otherwise false

7.3.3.26 void aDSChannels::pingOperationMode ( )

Reset timeout for OPERATION_MODE_SET mode.

Returns

void

7.3.3.27 void aDSChannels::restoreCalibationValues ( )

Restore calibration values from EEPOM.

Returns

void

7.3.3.28 void aDSChannels::saveCalibrationValues (Channel_t *chan*)

Save calibation value of given into EEPROM.

Parameters

chan	Channel_t : channel

Returns

void

7.3.3.29 void aDSChannels::service ( )

This member should be called often, it manage channels, LCD and EEPROM.

Returns

void

7.3.3.30 void aDSChannels::setCalibrationMode (bool *enable*)

Set calibration mode.

Parameters

enable	bool : enability

Returns

void

7.3.3.31 void aDSChannels::setCalibrationValues (Channel_t *chan,* aDSChannel::CalibrationData_t *cal*)

Set calibration values for given channel.

Parameters

chan	Channel_t : channel
cal	aDSChannel::CalibrationData_t : calibration values

Returns

void

7.3.3.32 void aDSChannels::setFocusToNextChannel ( )

Set the focus to the next channel, if any.

Returns

void

7.3.3.33 void aDSChannels::setOperationMode (OperationMode_t *m*)

Set operation mode (SET/READ)

Parameters

m	OperationMode_t : new operation mode

Returns

void

7.3.3.34 void aDSChannels::setup (uint8_t *cols,* uint8_t *rows,* uint8_t *pwmChan1,* uint8_t *sensChan1,* uint8_t *ledChan1,* uint8_t *chkChan2,* uint8_t *pwmChan2,* uint8_t *sensChan2,* uint8_t *ledChan2*)

Setup member function, should be called before any other member.

Parameters

cols	uint8_t : LCD number of columns
rows	uint8_t : LCD number of rows
pwmChan1	uint8_t : Channel 1 PWM pin
sensChan1	uint8_t : Channel 1 Temperature Sensor pin
ledChan1	uint8_t : Channel 1 LED pin
chkChan2	uint8_t : Channel 2 enability pin
pwmChan2	uint8_t : Channel 2 PWM pin
sensChan2	uint8_t : Channel 2 Temperature Sensor pin
ledChan2	uint8_t : Channel 2 LED pin

Returns

void

7.3.3.35 void aDSChannels::syncData (uint16_t *bit*)

Reset given bit inside bitfield, regarless of its state.

Parameters

bit	uint16_t : bit to reset

Returns

void

7.3.3.36 void aDSChannels::toggleJoined ( )

Toggle channels joining.

Returns

void

7.3.3.37 void aDSChannels::toggleStandbyMode ( )

Toggle standby mode.

Returns

void

7.3.3.38 void aDSChannels::updateOperationMode ( )

Update operation mode.

If operation mode is currently set to OPERATION_MODE_SET, and OPERATION_SET_TIMEOUT timeout is triggered, operation mode will be switched to OPERATION_MODE_READ

Returns

void

7.3.4 Member Data Documentation

7.3.4.1 const uint16_t aDSChannels::DATA_CHANNEL1_LED_STATE = 1 << 5 `[static]`

Bitfield: LED state of channel 1 has changed.

7.3.4.2 const uint16_t aDSChannels::DATA_CHANNEL1_TEMP_READ = 1 << 4 `[static]`

Bitfield: Readed temperature of channel 1 has changed.

7.3.4.3 const uint16_t aDSChannels::DATA_CHANNEL1_TEMP_SET = 1 << 3 `[static]`

Bitfield: Target temperature of channel 1 has changed.

7.3.4.4 const uint16_t aDSChannels::DATA_CHANNEL2_ENABLED = 1 `[static]`

Bitfield: Channel 2 is enabled.

7.3.4.5 const uint16_t aDSChannels::DATA_CHANNEL2_LED_STATE = 1 << 8 `[static]`

Bitfield: LED state of channel 1 has changed.

7.3.4.6 const uint16_t aDSChannels::DATA_CHANNEL2_TEMP_READ = 1 << 7 `[static]`

Bitfield: Readed temperature of channel 1 has changed.

7.3.4.7 const uint16_t aDSChannels::DATA_CHANNEL2_TEMP_SET = 1 << 6 [static]

Bitfield: Target temperature of channel 1 has changed.

7.3.4.8 const uint16_t aDSChannels::DATA_CHANNELS_JOINDED = 1 << 1 [static]

Bitfield: Channel 1 & 2 are joinded.

7.3.4.9 const uint16_t aDSChannels::DATA_DISPLAY = 1 << 9 [static]

Bitfield: Display should be refreshed.

7.3.4.10 const uint16_t aDSChannels::DATA_DISPLAY_STANDBY = 1 << 11 [static]

Bitfield: Standby state has changed.

7.3.4.11 const uint16_t aDSChannels::DATA_FOCUS = 1 << 12 [static]

Bitfield: Focus has changed.

7.3.4.12 const uint16_t aDSChannels::DATA_IN_CALIBRATION = 1 << 13 [static]

Bitfield: in Calibration.

7.3.4.13 const uint16_t aDSChannels::DATA_OPERATION = 1 << 2 [static]

Bitfield: Operation mode has changed.

7.3.4.14 const uint16_t aDSChannels::DATA_STANDBY = 1 << 10 [static]

Bitfield: Standby state.

7.3.4.15 const unsigned long aDSChannels::DISPLAY_UPDATE_RATE = 200 [static]

Display update rate, in ms.

7.3.4.16 const int16_t aDSChannels::EEPROM_ADDR_CALIBRATION_CHAN_1 = EEPROM_ADDR_TEMP_CHANNEL_T-WO + EEPROM_TEMP_SIZE [static], [protected]

EEPROM start offset for Channel 1 calibration values.

7.3.4.17 const int16_t aDSChannels::EEPROM_ADDR_CALIBRATION_CHAN_2 = EEPROM_AD-DR_CALIBRATION_CHAN_1 + EEPROM_CALIBRATION_SIZE [static], [protected]

EEPROM start offset for Channel 2 calibration values.

7.3.4.18 const int16_t aDSChannels::EEPROM_ADDR_CHANNEL_JOINED = EEPROM_STORAGE_STARTING + 1 [static], [protected]

Channels are joinded.

7.3.4.19 const int16_t aDSChannels::EEPROM_ADDR_MAGIC = 0 [static], [protected]

EEPROM offset storage start for magic numbers (0xDEAD)

7.3.4.20 const int16_t aDSChannels::EEPROM_ADDR_TEMP_CHANNEL_ONE = EEPROM_ADDR_CHANNEL_JOINED + EEPROM_TEMP_SIZE [static], [protected]

Target temp for Channel 1.

7.3.4.21 const int16_t aDSChannels::EEPROM_ADDR_TEMP_CHANNEL_TWO = EEPROM_ADDR_TEMP_CHANNEL_O-NE + EEPROM_TEMP_SIZE [static], [protected]

Target temp for Channel 2.

7.3.4.22 const int16_t aDSChannels::EEPROM_CALIBRATION_SIZE = (sizeof(float) $*$ 2) + sizeof(uint8_t) [static], [protected]

EEPROM calibration size: 2 float (slope & offset), and one uint8_t for crc.

7.3.4.23 const int16_t aDSChannels::EEPROM_STORAGE_STARTING = 5 [static], [protected]

EEPROM starting address for program datas.

7.3.4.24 const int16_t aDSChannels::EEPROM_TEMP_SIZE = sizeof(uint16_t) + sizeof(uint8_t) [static], [protected]

EEPROM temperature size (temperature + crc)

7.3.4.25 aDSChannel aDSChannels::m_channels[CHANNEL_MAX] [private]

7.3.4.26 uint16_t aDSChannels::m_datas [private]

7.3.4.27 bool aDSChannels::m_isValidEEPROM [private]

7.3.4.28 unsigned long aDSChannels::m_lastTempChange [private]

7.3.4.29 LiquidCrystal aDSChannels::m_lcd [private]

7.3.4.30 uint8_t aDSChannels::m_lcdCols [private]

7.3.4.31 uint8_t aDSChannels::m_lcdRows [private]

7.3.4.32 unsigned long aDSChannels::m_nextDisplayUpdate [private]

7.3.4.33 unsigned long aDSChannels::m_nextMeasureUpdate [private]

7.3.4.34 OperationMode_t aDSChannels::m_operationMode [private]

7.3.4.35 unsigned long aDSChannels::m_operationTick [private]

7.3.4.36 bool aDSChannels::m_storedToEEPROM [private]

7.3.4.37 const unsigned long aDSChannels::MEASURE_UPDATE_RATE = 200 [static]

Measurement (for aDSChannel) rate, in ms.

7.3.4.38 const uint8_t aDSChannels::OFFSET_MARKER_LEFT = 0 [static]

Column LCD offset for left marker '['.

7.3.4.39 const uint8_t aDSChannels::OFFSET_MARKER_RIGHT = 10 [static]

Column LCD offset for right marker ']'.

7.3.4.40 const uint8_t aDSChannels::OFFSET_VALUE = 2 [static]

Value column LCD offset.

7.3.4.41 const unsigned long aDSChannels::OPERATION_SET_TIMEOUT = 3000 [static]

Automatic toggle settings->reading timeout (3 seconds), in ms.

7.3.4.42 const unsigned long aDSChannels::TEMP_SETTING_INACTIVITY = 60000 [static]

Timeout in ms, after which the new target temperature will be stored in the EEPROM.

The documentation for this class was generated from the following files:

- aDSEngine.h
- aDSEngine.cpp

7.4 aDSEngine Class Reference

`#include <aDSEngine.h>`

Public Member Functions

- aDSEngine ()

  aDSEngine constructor
- virtual ~aDSEngine ()

  aDSEngine destructor
- void setup ()

  Setup member function, should be called before any other member.
- void run ()

  Main loop.

Protected Member Functions

- void _handleSerialInput ()

    Handle serial input, in calibation mode only.

Private Attributes

- aDSChannels m_channels
- ClickEncoder m_encoder
- uint16_t m_datas
- uint8_t m_RXbuffer [RXBUFFER_MAXLEN]

    USB rx buffer.
- uint8_t m_RXoffset

    USB rx buffer offset counter.
- unsigned long m_serialInputTick

Static Private Attributes

- static const uint8_t RXBUFFER_MAXLEN = 64

7.4.1 Constructor & Destructor Documentation

7.4.1.1 aDSEngine::aDSEngine ( )

aDSEngine constructor

7.4.1.2 aDSEngine::∼aDSEngine ( ) [virtual]

aDSEngine destructor

7.4.2 Member Function Documentation

7.4.2.1 void aDSEngine::_handleSerialInput ( ) [protected]

Handle serial input, in calibation mode only.

Returns

void

7.4.2.2 void aDSEngine::run ( )

Main loop.

Returns

void

7.4.2.3 void aDSEngine::setup ( )

Setup member function, should be called before any other member.

Returns

void

7.4.3 Member Data Documentation

7.4.3.1 aDSChannels aDSEngine::m_channels `[private]`

7.4.3.2 uint16_t aDSEngine::m_datas `[private]`

7.4.3.3 ClickEncoder aDSEngine::m_encoder `[private]`

7.4.3.4 uint8_t aDSEngine::m_RXbuffer[RXBUFFER_MAXLEN] `[private]`

USB rx buffer.

7.4.3.5 uint8_t aDSEngine::m_RXoffset `[private]`

USB rx buffer offset counter.

7.4.3.6 unsigned long aDSEngine::m_serialInputTick `[private]`

7.4.3.7 const uint8_t aDSEngine::RXBUFFER_MAXLEN = 64 `[static]`, `[private]`

The documentation for this class was generated from the following files:

- aDSEngine.h
- aDSEngine.cpp

7.5 aDSChannel::aPin_t Struct Reference

Our pin structure.

```
#include <aDSEngine.h>
```

Public Attributes

- uint8_t pin

  "Arduino" pin
- uint8_t timer

  Timer of the pin.
- uint8_t mask

  Bit mask of the pin.
- uint8_t port

  Port of the pin.
- volatile uint8_t ∗ outputRegister

  Output register of the pin.

7.5.1 Detailed Description

Our pin structure.

7.5.2 Member Data Documentation

7.5.2.1 uint8_t aDSChannel::aPin_t::mask

Bit mask of the pin.

7.5.2.2 volatile uint8_t* aDSChannel::aPin_t::outputRegister

Output register of the pin.

7.5.2.3 uint8_t aDSChannel::aPin_t::pin

"Arduino" pin

7.5.2.4 uint8_t aDSChannel::aPin_t::port

Port of the pin.

7.5.2.5 uint8_t aDSChannel::aPin_t::timer

Timer of the pin.

The documentation for this struct was generated from the following file:

- aDSEngine.h

7.6 aDSChannel::CalibrationData_t Struct Reference

Calibration values.

```
#include <aDSEngine.h>
```

Public Attributes

- float slope

  Slope value.
- float offset

  Offset value.

7.6.1 Detailed Description

Calibration values.

Contains Slope and Offset float values

7.6.2 Member Data Documentation

7.6.2.1 float aDSChannel::CalibrationData_t::offset

Offset value.

7.6.2.2 float aDSChannel::CalibrationData_t::slope

Slope value.

The documentation for this struct was generated from the following file:

- aDSEngine.h

Chapter 8

File Documentation

8.1 aDSEngine.cpp File Reference

```
#include "aDSEngine.h"
#include <wiring_private.h>
```

Functions

- static int8_t getNumericalLength (int16_t n)

  Return numerical character length of argument.
- void timer1ISR (void)

  Timer1 class ISR function.

Variables

- static const uint8_t DIGIT_WIDTH = 3

  Max numerical length of temperature (used with big digits)
- static const uint8_t _glyphs[ ][8] PROGMEM

  LCD glyphs (for big digits and LED)
- static const uint8_t _bigDigitsTop [11][DIGIT_WIDTH]

  _glyphs[] offsets
- static const uint8_t _bigDigitsBottom [11][DIGIT_WIDTH]

  _glyphs[] offsets
- ClickEncoder ∗ pEncoder = NULL

  Global pointer to ClickEncoder object, used inside timer1ISR() function.

8.1.1 Detailed Description

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Author

F1RMB, Daniel Caujolle-Bert `f1rmb.daniel@gmail.com`

8.1.2 Function Documentation

8.1.2.1 static int8_t getNumericalLength (int16_t *n*) [static]

Return numerical character length of argument.

Parameters

n	int16_t : value to get length from

Returns

int8_t : length

8.1.2.2 void timer1ISR (void)

Timer1 class ISR function.

This function is periodically called from Timer1 class, which handles encoder events

Returns

void

8.1.3 Variable Documentation

8.1.3.1 const uint8_t _bigDigitsBottom[11][DIGIT_WIDTH] [static]

Initial value:

```
=
{
    {  3,  1,  3 },
    {  1,  3,  1 },
    {  3,  1,  1 },
    {  1,  1,  3 },
    { 32, 32,  3 },
    {  1,  1,  3 },
    {  3,  1,  3 },
    { 32, 32,  3 },
    {  3,  1,  3 },
    {  1,  1,  3 },
    { 32, 32, 32 }
}
```

_glyphs[] offsets

0..9 + ' ' bottom characters matrix

8.1.3.2 const uint8_t _bigDigitsTop[11][DIGIT_WIDTH] [static]

Initial value:

```
=
{
    {  3,  0,  3 },
    {  0,  3, 32 },
    {  2,  2,  3 },
    {  0,  2,  3 },
    {  3,  1,  3 },
    {  3,  2,  2 },
    {  3,  2,  2 },
    {  0,  0,  3 },
    {  3,  2,  3 },
    {  3,  2,  3 },
    { 32, 32, 32 }
}
```

_glyphs[] offsets

0..9 + ' ' top characters matrix

8.1.3.3 const uint8_t DIGIT_WIDTH = 3 [static]

Max numerical length of temperature (used with big digits)

8.1.3.4 ClickEncoder* pEncoder = NULL

Global pointer to ClickEncoder object, used inside timer1ISR() function.

8.1.3.5 const uint8_t _glyphs [ ][8] PROGMEM [static]

LCD glyphs (for big digits and LED)

8.2 aDSEngine.h File Reference

```
#include <Arduino.h>
#include <LiquidCrystal.h>
#include <EEPROM.h>
#include "TimerOne.h"
#include "ClickEncoder.h"
```

Classes

- class aDSChannel

  aDSChannel class
- struct aDSChannel::CalibrationData_t

  Calibration values.
- struct aDSChannel::aPin_t

  Our pin structure.
- class aDSChannels
- union aDSChannels::_eepromCalibrationValue_t

  Union to manipulate float/uint8_t [] calibration values.
- class aDSEngine

Macros

- #define SIMU 1
- #define IS_DATA_ENABLED(bit) ((m_datas & bit))

Enumerations

- enum OperationMode_t { OPERATION_MODE_READ, OPERATION_MODE_SET, OPERATION_MODE_-UNKNOWN }

  Operation Mode enumeration.

Variables

- static const uint8_t CHANNEL2_ENABLE_PIN = 13

  Pin to check from if channel 2 is wired.
- static const uint8_t LCD_RS_PIN = 7

  LCD RS pin.
- static const uint8_t LCD_ENABLE_PIN = 8

  LCD Enable pin.
- static const uint8_t LCD_D4_PIN = 9

  LCD D4 pin.
- static const uint8_t LCD_D5_PIN = 10

  LCD D5 pin.
- static const uint8_t LCD_D6_PIN = 11

  LCD D6 pin.
- static const uint8_t LCD_D7_PIN = 12

  LCD D7 pin.
- static const uint8_t LCD_COLS = 16

  LCD columns.
- static const uint8_t LCD_ROWS = 2

  LCD rows.
- static const uint8_t ENCODER_A_PIN = 2

  Encoder A pin.
- static const uint8_t ENCODER_B_PIN = 3

  Encoder B pin.
- static const uint8_t ENCODER_PB_PIN = 4

  Encoder push button pin.
- static const uint8_t ENCODER_STEPS_PER_NOTCH = 4

  Number of steps per notch (indent)
- static const uint8_t PWM_CHANNEL1_PIN = 5

  PWM pin of channel 1.
- static const uint8_t PWM_CHANNEL2_PIN = 6

  PWM pin of channel 2.
- static const uint8_t TEMP_SENSOR_CHANNEL1_PIN = A1

  Temp sensor pin of channel 1.
- static const uint8_t TEMP_SENSOR_CHANNEL2_PIN = A0

  Temp sensor pin of channel 2.
- static const uint8_t LED_CHANNEL1_PIN = A2

  LED pin of channel 1.
- static const uint8_t LED_CHANNEL2_PIN = A3

  LED pin of channel 2.

- static const uint8_t PROGRAM_VERSION_MAJOR = 1

  Major program version.
- static const uint8_t PROGRAM_VERSION_MINOR = 2

  Minor program version.

8.2.1 Detailed Description

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Author

F1RMB, Daniel Caujolle-Bert `f1rmb.daniel@gmail.com`

8.2.2 Macro Definition Documentation

8.2.2.1 #define IS_DATA_ENABLED(*bit*) ((m_datas & bit))

8.2.2.2 #define SIMU 1

8.2.3 Enumeration Type Documentation

8.2.3.1 enum OperationMode_t

Operation Mode enumeration.

Enumerator

OPERATION_MODE_READ Reading values.

OPERATION_MODE_SET Settings values.

OPERATION_MODE_UNKNOWN Unset (internal)

8.2.4 Variable Documentation

8.2.4.1 const uint8_t CHANNEL2_ENABLE_PIN = 13 `[static]`

Pin to check from if channel 2 is wired.

8.2.4.2 const uint8_t ENCODER_A_PIN = 2 `[static]`

Encoder A pin.

8.2.4.3 const uint8_t ENCODER_B_PIN = 3 `[static]`

Encoder B pin.

8.2.4.4 const uint8_t ENCODER_PB_PIN = 4 `[static]`

Encoder push button pin.

8.2.4.5 const uint8_t ENCODER_STEPS_PER_NOTCH = 4 `[static]`

Number of steps per notch (indent)

8.2.4.6 const uint8_t LCD_COLS = 16 `[static]`

LCD columns.

8.2.4.7 const uint8_t LCD_D4_PIN = 9 `[static]`

LCD D4 pin.

8.2.4.8 const uint8_t LCD_D5_PIN = 10 `[static]`

LCD D5 pin.

8.2.4.9 const uint8_t LCD_D6_PIN = 11 `[static]`

LCD D6 pin.

8.2.4.10 const uint8_t LCD_D7_PIN = 12 `[static]`

LCD D7 pin.

8.2.4.11 const uint8_t LCD_ENABLE_PIN = 8 `[static]`

LCD Enable pin.

8.2.4.12 const uint8_t LCD_ROWS = 2 `[static]`

LCD rows.

8.2.4.13 const uint8_t LCD_RS_PIN = 7 `[static]`

LCD RS pin.

8.2.4.14 const uint8_t LED_CHANNEL1_PIN = A2 `[static]`

LED pin of channel 1.

8.2.4.15 const uint8_t LED_CHANNEL2_PIN = A3 [static]

LED pin of channel 2.

8.2.4.16 const uint8_t PROGRAM_VERSION_MAJOR = 1 [static]

Major program version.

8.2.4.17 const uint8_t PROGRAM_VERSION_MINOR = 2 [static]

Minor program version.

8.2.4.18 const uint8_t PWM_CHANNEL1_PIN = 5 [static]

PWM pin of channel 1.

8.2.4.19 const uint8_t PWM_CHANNEL2_PIN = 6 [static]

PWM pin of channel 2.

8.2.4.20 const uint8_t TEMP_SENSOR_CHANNEL1_PIN = A1 [static]

Temp sensor pin of channel 1.

8.2.4.21 const uint8_t TEMP_SENSOR_CHANNEL2_PIN = A0 [static]

Temp sensor pin of channel 2.

8.3 CDC.cpp File Reference

```
#include <CDC.cpp>
```

8.4 HardwareSerial.cpp File Reference

```
#include <HardwareSerial.cpp>
```

8.5 HID.cpp File Reference

```
#include <HID.cpp>
```

8.6 IPAddress.cpp File Reference

```
#include <IPAddress.cpp>
```

8.7 libraries.cpp File Reference

```
#include <Arduino.h>
#include "ClickEncoder.cpp"
#include "TimerOne.cpp"
```

8.8 main.cpp File Reference

```
#include <main.cpp>
```

8.9 new.cpp File Reference

```
#include <new.cpp>
```

8.10 Print.cpp File Reference

```
#include <Print.cpp>
```

8.11 sketch.cpp File Reference

```
#include <Arduino.h>
#include <LiquidCrystal.h>
#include "aDSEngine.h"
```

Functions

- void setup ()
- void loop ()

Variables

- aDSEngine ∗ engine

8.11.1 Function Documentation

8.11.1.1 void loop ( )

8.11.1.2 void setup ( )

8.11.2 Variable Documentation

8.11.2.1 aDSEngine∗ engine

8.12 Stream.cpp File Reference

```
#include <Stream.cpp>
```

8.13 Tone.cpp File Reference

```
#include <Tone.cpp>
```

8.14 USBCore.cpp File Reference

```
#include <USBCore.cpp>
```

8.15 WInterrupts.c File Reference

```
#include <WInterrupts.c>
```

8.16 wiring.c File Reference

```
#include "wiring_private.h"
```

Macros

- #define MICROSECONDS_PER_TIMER0_OVERFLOW (clockCyclesToMicroseconds(PRESCALE_FACTOR ∗ 256))
- #define MILLIS_INC (MICROSECONDS_PER_TIMER0_OVERFLOW / 1000)
- #define FRACT_INC ((MICROSECONDS_PER_TIMER0_OVERFLOW % 1000) >> 3)
- #define FRACT_MAX (1000 >> 3)

Functions

- if (f >=FRACT_MAX)
- unsigned long millis ()
- unsigned long micros ()
- void delay (unsigned long ms)
- void delayMicroseconds (unsigned int us)
- void init ()

Variables

- volatile unsigned long timer0_overflow_count = 0
- volatile unsigned long timer0_millis = 0
- static unsigned char timer0_fract = 0
- unsigned char f = timer0_fract
- m = MILLIS_INC

8.16.1 Macro Definition Documentation

8.16.1.1 #define FRACT_INC ((MICROSECONDS_PER_TIMER0_OVERFLOW % 1000) >> 3)

8.16.1.2 #define FRACT_MAX (1000 >> 3)

8.16.1.3 #define MICROSECONDS_PER_TIMER0_OVERFLOW (clockCyclesToMicroseconds(PRESCALE_FACTOR ∗ 256))

8.16.1.4 #define MILLIS_INC (MICROSECONDS_PER_TIMER0_OVERFLOW / 1000)

8.16.2 Function Documentation

8.16.2.1 void delay (unsigned long *ms*)

8.16.2.2 void delayMicroseconds (unsigned int *us*)

8.16.2.3 if (f >= *FRACT_MAX*)

8.16.2.4 void init ( )

8.16.2.5 unsigned long micros ( )

8.16.2.6 unsigned long millis ( )

8.16.3 Variable Documentation

8.16.3.1 f = timer0_fract

8.16.3.2 m = MILLIS_INC

8.16.3.3 timer0_fract = 0 `[static]`

8.16.3.4 timer0_millis = 0

8.16.3.5 timer0_overflow_count = 0

8.17 wiring_analog.c File Reference

```
#include <wiring_analog.c>
```

8.18 wiring_digital.c File Reference

```
#include <wiring_digital.c>
```

8.19 wiring_pulse.c File Reference

```
#include <wiring_pulse.c>
```

8.20 wiring_shift.c File Reference

```
#include <wiring_shift.c>
```

8.21 WMath.cpp File Reference

```
#include <WMath.cpp>
```

8.22 WString.cpp File Reference

```
#include <WString.cpp>
```

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