LM75 Device Driver

1.0

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Chapter 1

Arduino Library for the LM75A Temperature Sensor

This library was written to enable remote sensing of the temperature of batteries and motor controllers used in remotely piloted aircraft, for the purpose of real time data logging and air to ground telemetry.

This sensor uses the I2C bus protocol to communicate allowing the Arduino standard Wire library to communicate with the device. 2 pins are required to interface the device to an Arduino - the SDA and SCL lines.

Installing

Download the distribution package and decompress it.
Rename the uncompressed folder ***/lm75***.
Check that the ***/lm75*** folder contains the following files;

LM75.cpp
LM75.h
LM75.chm
LM75.pdf
property.h
doxyfile

Place the ***/lm75*** library folder into your ***arduinosketchfolder/libraries/*** folder.
You may need to create the libraries subfolder if its your first library. Restart the IDE.

Documentation

LM75.chm and *LM75.pdf* contain the documentation for the classes.
A Doxygen script is included to enable generation of documentation. You will need the graph tool, the dot tool, and the help compiler, in addition to editing the paths to these tools in the script to suit your environment.

Author

John Fitter B.E., Eagle Air Australia Pty. Ltd.

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Chapter 2

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Version 3, 29 June 2007

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If the program does terminal interaction, make it output a short notice like this when it starts in an interactive mode:

> [program] Copyright (C) [year] [name of author]

This program comes with ABSOLUTELY NO WARRANTY; for details type ∗"show w"∗. This is free software, and you are welcome to redistribute it under certain conditions; Type ∗"show c"∗ for details.

The hypothetical commands ∗"show w"∗ and ∗"show c"∗ should show the appropriate parts of the General Public License. Of course, your program's commands might be different; for a GUI interface, you would use an "about box".

You should also get your employer (if you work as a programmer) or school, if any, to sign a "copyright disclaimer" for the program, if necessary. For more information on this, and how to apply and follow the GNU GPL, see https://www.gnu.org/licenses/.

The GNU General Public License does not permit incorporating your program into proprietary programs. If your program is a subroutine library, you may consider it more useful to permit linking proprietary applications with the library. If this is what you want to do, use the GNU Lesser General Public License instead of this License. But first, please read https://www.gnu.org/licenses/why-not-lgpl.html.

Chapter 3

Class Index

3.1 Class List

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

LM75 17

Chapter 4

File Index

4.1 File List

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

LM75.cpp
LM75 Family Device Driver Library - CPP Source file 37
LM75.h
LM75 Family Device Driver Library - CPP Header file 42

Chapter 5

Class Documentation

5.1 LM75 Class Reference

Public Types

- enum tempUnit_t { LM75_TK, LM75_TC, LM75_TF }
- enum setPointType { SPT_OVERTEMP, SPT_HYSTERESIS }
- enum outputPolarity { POL_LOW, POL_HIGH }
- enum outputMode { MODE_COMP, MODE_INT }
- enum opMode { OPM_NORMAL, OPM_SHDN }
- enum faultQueue { FQ_1 = 1, FQ_2 = 2, FQ_4 = 4, FQ_6 = 6 }

Public Member Functions

- LM75 (uint8_t=LM75_I2CDEFAULTADDR)

  LM75 Device class constructor.
- boolean begin ()

  Initialize the device and the i2c interface.
- boolean **isReady** (void)
- double readTemp (tempUnit_t=LM75_TC)

  Return the measured temperature in specified units.
- double readSetPoint (tempUnit_t=LM75_TC, setPointType=SPT_OVERTEMP)

  Return the specified setpoint in specified units.
- void writeSetPoint (double, tempUnit_t=LM75_TC, setPointType=SPT_OVERTEMP)

  Write the specified setpoint supplied in the specified units.
- void setOutputPolarity (outputPolarity=POL_LOW)

  Set the OS polarity.
- void setOutputMode (outputMode=MODE_COMP)

  Set the OS operation mode.
- void setOperationMode (opMode=OPM_NORMAL)

  Set the device operation mode.
- void setFaultQueue (faultQueue)

  Set the value of the OS fault queue.
- double convCtoK (double degC)

  Convert temperature in degrees C to degrees K.
- double convCtoF (double degC)

  Convert temperature in degrees C to degrees F.
- double convKtoC (double degK)

  Convert temperature in degrees K to degrees C.
- double convFtoC (double degF)

  Convert temperature in degrees F to degrees C.

Public Attributes

- Property< uint8_t, LM75 > busAddr

Private Member Functions

- uint8_t getAddr (void)

  Return the device I2C Bus address.
- uint8_t read8 (uint8_t)

  Return an 8 bit register value from the device.
- uint16_t read16 (uint8_t)

  Return a 16 bit register value from the device.
- void write8 (uint8_t, uint8_t)

  Write a value to an 8 bit register in the device.
- void write16 (uint8_t, uint16_t)

  Write a value to a 16 bit register in the device.

Private Attributes

- boolean **_ready**
- uint8_t _addr

5.1.1 Detailed Description

Definition at line 81 of file LM75.h.

5.1.2 Member Enumeration Documentation

5.1.2.1 faultQueue

`enum LM75::faultQueue`

Enumerations for fault queue length.

Enumerator

FQ↩ _1	fault queue value = 1
FQ↩ _2	fault queue value = 2
FQ↩ _4	fault queue value = 4
FQ↩ _6	fault queue value = 6

Definition at line 111 of file LM75.h.

```
00111                     {FQ_1 = 1,                          /**< fault queue value = 1 */
00112                      FQ_2 = 2,                          /**< fault queue value = 2 */
00113                      FQ_4 = 4,                          /**< fault queue value = 4 */
00114                      FQ_6 = 6                           /**< fault queue value = 6 */
00115     };
```

5.1.2.2 opMode

```
enum LM75::opMode
```

Enumerations for operating mode.

Enumerator

OPM_NORMAL	normal operation mode
OPM_SHDN	shutdown mode

Definition at line 107 of file LM75.h.

```
00107                 {OPM_NORMAL,                          /**< normal operation mode */
00108                  OPM_SHDN                             /**< shutdown mode */
00109     };
```

5.1.2.3 outputMode

```
enum LM75::outputMode
```

Enumerations for output mode.

Enumerator

MODE_COMP	OS comparator mode
MODE_INT	OS interrupt mode

Definition at line 103 of file LM75.h.

```
00103                     {MODE_COMP,                         /**< OS comparator mode */
00104                      MODE_INT                           /**< OS interrupt mode */
00105     };
```

5.1.2.4 outputPolarity

```
enum LM75::outputPolarity
```

Enumerations for output polarity.

Enumerator

POL_LOW	OS output active low
POL_HIGH	OS output active high

Definition at line 99 of file LM75.h.

```
00099                         {POL_LOW,                         /**< OS output active low */
00100                          POL_HIGH                         /**< OS output active high */
00101     };
```

5.1.2.5 setPointType

```
enum LM75::setPointType
```

Enumerations for setpoint registers.

Enumerator

SPT_OVERTEMP	overtemp shutdown register
SPT_HYSTERESIS	hysteresis register

Definition at line 95 of file LM75.h.

```
00095                       {SPT_OVERTEMP,                    /**< overtemp shutdown register */
00096                        SPT_HYSTERESIS                   /**< hysteresis register */
00097     };
```

5.1.2.6 tempUnit_t

```
enum LM75::tempUnit_t
```

Enumerations for temperature units.

Enumerator

LM75_TK	degrees Kelvin
LM75_TC	degrees Centigrade
LM75_TF	degrees Fahrenheit

Definition at line 90 of file LM75.h.

```
00090                     {LM75_TK,                                 /**< degrees Kelvin */
00091                      LM75_TC,                                 /**< degrees Centigrade */
00092                      LM75_TF                                  /**< degrees Fahrenheit */
00093     };
```

5.1.3 Constructor & Destructor Documentation

5.1.3.1 LM75()

```
LM75::LM75 (
             uint8_t i2caddr = LM75_I2CDEFAULTADDR )
```

LM75 Device class constructor.

constructor

Parameters

in	*i2caddr*	Device address (default: published value).

Definition at line 50 of file LM75.cpp.

References _addr, busAddr, and getAddr().

```
00050                           {
00051
00052     busAddr.Set_Class(this);
00053     busAddr.Set_Get(&LM75::getAddr);
00054
00055     _addr  = i2caddr;
00056     _ready = false;
00057 }
```

Here is the call graph for this function:

5.1.4 Member Function Documentation

5.1.4.1 convCtoF()

```
double LM75::convCtoF (
            double degC )
```

Convert temperature in degrees C to degrees F.

Parameters

in	*degC*	Temperature in degrees Centigrade.

Returns

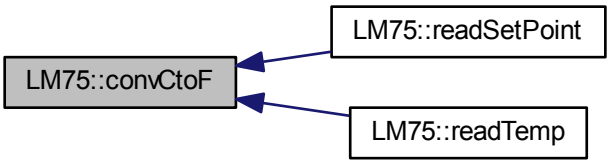
Temperature in degrees Fahrenheit.

Definition at line 265 of file LM75.cpp.

Referenced by readSetPoint(), and readTemp().

```
00265 {return (degC * 1.8) + 32.0;}
```

Here is the caller graph for this function:



5.1.4.2 convCtoK()

```
double LM75::convCtoK (
            double degC )
```

Convert temperature in degrees C to degrees K.

Parameters

in	*degC*	Temperature in degrees Centigrade.

Returns

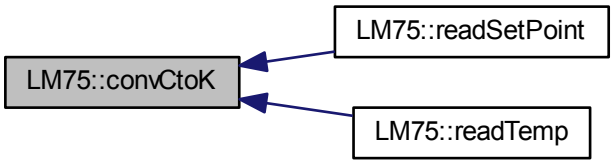
Temperature in degrees Kelvin.

Definition at line 258 of file LM75.cpp.

Referenced by readSetPoint(), and readTemp().

```
00258 {return degC + 273.15;}
```

Here is the caller graph for this function:



5.1.4.3 convFtoC()

```
double LM75::convFtoC (
            double degF )
```

Convert temperature in degrees F to degrees C.

Parameters

in	*degF*	Temperature in degrees Fahrenheit.

Returns

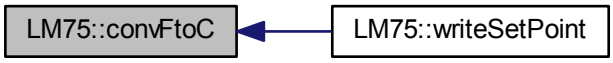
Temperature in degrees Centigrade.

Definition at line 279 of file LM75.cpp.

Referenced by writeSetPoint().

```
00279 {return (degF - 32.0) / 1.8;}
```

Here is the caller graph for this function:



5.1.4.4 convKtoC()

```
double LM75::convKtoC (
            double degK )
```

Convert temperature in degrees K to degrees C.

Parameters

in	*degK*	Temperature in degrees Kelvin.

Returns

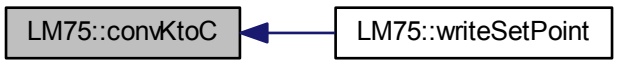
Temperature in degrees Centigrade.

Definition at line 272 of file LM75.cpp.

Referenced by writeSetPoint().

```
00272 {return degK - 273.15;}
```

Here is the caller graph for this function:



5.1.4.5 getAddr()

```
uint8_t LM75::getAddr (
            void  )  [private]
```

Return the device I2C Bus address.

Returns

Device address.

Definition at line 173 of file LM75.cpp.

References _addr.

Referenced by LM75().

```
00173 {return _addr;}
```

Here is the caller graph for this function:

5.1.4.6 read16()

```
uint16_t LM75::read16 (
            uint8_t reg )  [private]
```

Return a 16 bit register value from the device.

Parameters

in	*reg*	16b Register to read from.

Returns

Value read from register.

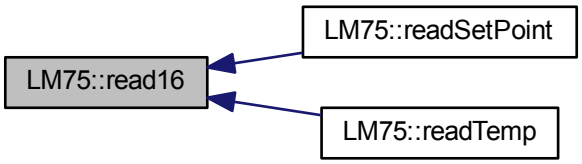
Definition at line 200 of file LM75.cpp.

References _addr.

Referenced by readSetPoint(), and readTemp().

```
00200                                   {
00201     uint16_t val;
00202
00203     // send the device address then the register pointer byte
00204     Wire.beginTransmission(_addr);
00205     Wire.write(reg);
00206 //    Wire.endTransmission(false);
00207     Wire.endTransmission();
00208
00209     // resend device address then get the 2 returned bytes
00210     Wire.requestFrom(_addr, (uint8_t)2);
00211
00212     // data is returned as 2 bytes big endian
00213     val = Wire.read() << 8;
00214     val |= Wire.read();
00215
00216     return val;
00217 }
```

Here is the caller graph for this function:



5.1.4.7 read8()

```
uint8_t LM75::read8 (
            uint8_t reg )  [private]
```

Return an 8 bit register value from the device.

Parameters

in	*reg*	8b Register to read from.

Returns

Value read from register.

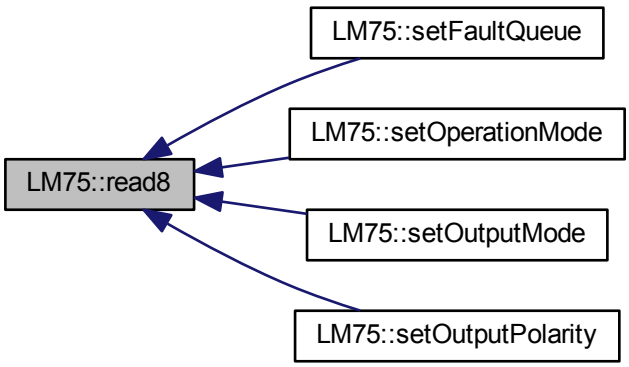
Definition at line 180 of file LM75.cpp.

References _addr.

Referenced by setFaultQueue(), setOperationMode(), setOutputMode(), and setOutputPolarity().

```
00180                                {
00181
00182     // send the device address then the register pointer byte
00183     Wire.beginTransmission(_addr);
00184     Wire.write(reg);
00185 //    Wire.endTransmission(false);
00186     Wire.endTransmission();
00187
00188     // resend device address then get the returned byte
00189     Wire.requestFrom(_addr, (uint8_t)1);
00190
00191     // data is returned as 1 byte
00192     return Wire.read();
00193 }
```

Here is the caller graph for this function:



5.1.4.8 readSetPoint()

```
double LM75::readSetPoint (
             tempUnit_t tunit = LM75_TC,
             setPointType spt = SPT_OVERTEMP )
```

Return the specified setpoint in specified units.

Remarks

Setpoint is returned as a 2's complement value in the most significant 9 bits of a 16 bit field expressed in degrees C to a resolution of 0.125C.

Parameters

in	*tunit*	Temperature units to convert raw data to.
in	*spt*	Setpoint type (overtemp or hysteresis)

Returns

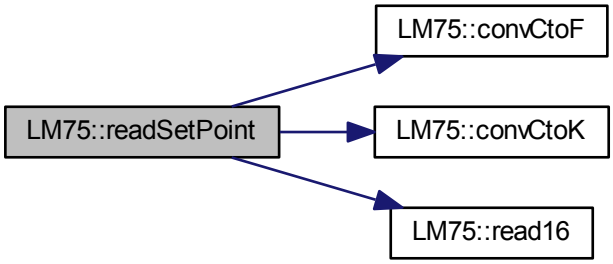
Temperature.

Definition at line 93 of file LM75.cpp.

References convCtoF(), convCtoK(), LM75_TF, LM75_THYST, LM75_TK, LM75_TOS, read16(), and SPT_OVERTEMP.

```
00093                                                                {
00094     double val;
00095
00096     val = read16(spt == SPT_OVERTEMP ? LM75_TOS :
      LM75_THYST) * 0.125/128.0;
00097     switch(tunit) {
00098         case    LM75_TK : return convCtoK(val);
00099         case    LM75_TF : return convCtoF(val);
00100         default : return val;
00101     }
00102 }
```

Here is the call graph for this function:



5.1.4.9 readTemp()

```
double LM75::readTemp (
              tempUnit_t tunit = LM75_TC )
```

Return the measured temperature in specified units.

Remarks

Temperature is returned as a 2's complement value in the most significant 11 bits of a 16 bit field expressed in degrees C to a resolution of 0.125C.

Parameters

in	*tunit*	Temperature units to convert raw data to.

Returns

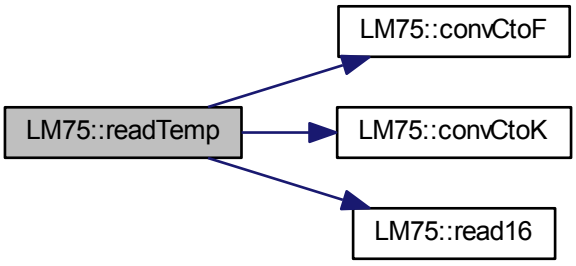
Temperature.

Definition at line 74 of file LM75.cpp.

References convCtoF(), convCtoK(), LM75_TEMP, LM75_TF, LM75_TK, and read16().

```
00074                                       {
00075     double temp;
00076
00077     temp = read16(LM75_TEMP) * 0.125/32.0;
00078     switch(tunit) {
00079         case LM75_TK : return convCtoK(temp);
00080         case LM75_TF : return convCtoF(temp);
00081     }
00082     return temp;
00083 }
```

Here is the call graph for this function:



5.1.4.10 setFaultQueue()

```
void LM75::setFaultQueue (
             faultQueue fqueue )
```

Set the value of the OS fault queue.

Parameters

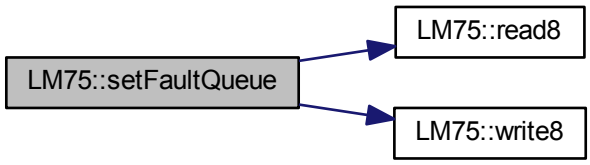
in	*fqueue*	Enumerated OS fault queue programming value.

Definition at line 157 of file LM75.cpp.

References FQ_1, FQ_2, FQ_4, FQ_6, LM75_CONF, LM75_CONF_OSFQUE_1, read8(), and write8().

```
00157                                           {
00158     uint8_t fq;
00159
00160     switch(fqueue) {
00161         case    FQ_1 : fq = LM75_CONF_OSFQUE_1; break;
00162         case    FQ_2 : fq = LM75_CONF_OSFQUE_1; break;
00163         case    FQ_4 : fq = LM75_CONF_OSFQUE_1; break;
00164         case    FQ_6 : fq = LM75_CONF_OSFQUE_1;
00165     }
00166     write8(LM75_CONF, read8(LM75_CONF) & fq);
00167 }
```

Here is the call graph for this function:



5.1.4.11 setOperationMode()

```
void LM75::setOperationMode (
              opMode mode = OPM_NORMAL )
```

Set the device operation mode.

Parameters

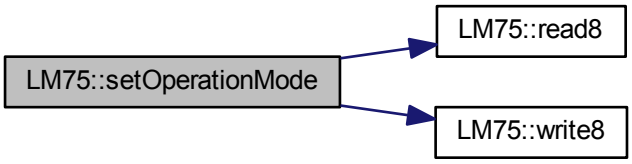
in	*mode*	Enumerated operation mode.

Definition at line 147 of file LM75.cpp.

References LM75_CONF, LM75_CONF_DOM_NORMAL, LM75_CONF_DOM_SHUTDOWN, OPM_NORMAL, read8(), and write8().

```
00147                                       {
00148
00149     write8(LM75_CONF, read8(LM75_CONF) &
00150         (mode == OPM_NORMAL ? LM75_CONF_DOM_NORMAL :
      LM75_CONF_DOM_SHUTDOWN));
00151 }
```

Here is the call graph for this function:



5.1.4.12 setOutputMode()

```
void LM75::setOutputMode (
            outputMode mode = MODE_COMP )
```

Set the OS operation mode.

Parameters

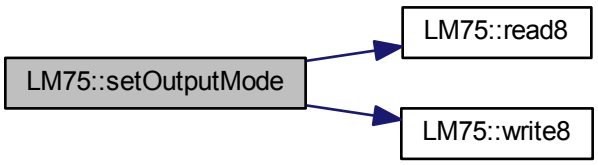
in	*mode*	Enumerated OS operation mode.

Definition at line 137 of file LM75.cpp.

References LM75_CONF, LM75_CONF_OSOM_COMP, LM75_CONF_OSOM_INT, MODE_COMP, read8(), and write8().

```
00137                                       {
00138
00139     write8(LM75_CONF, read8(LM75_CONF) &
00140         (mode == MODE_COMP ? LM75_CONF_OSOM_COMP :
      LM75_CONF_OSOM_INT));
00141 }
```

Here is the call graph for this function:



5.1.4.13 setOutputPolarity()

```
void LM75::setOutputPolarity (
            outputPolarity pol = POL_LOW )
```

Set the OS polarity.

Parameters

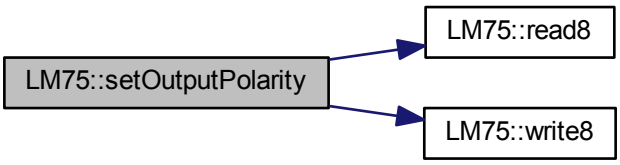
in	*pol*	Enumerated OS polarity selection.

Definition at line 127 of file LM75.cpp.

References LM75_CONF, LM75_CONF_OSPOL_AH, LM75_CONF_OSPOL_AL, POL_LOW, read8(), and write8().

```
00127                                                {
00128
00129     write8(LM75_CONF, read8(LM75_CONF) &
00130         (pol == POL_LOW ? LM75_CONF_OSPOL_AL :
      LM75_CONF_OSPOL_AH));
00131 }
```

Here is the call graph for this function:



5.1.4.14 write16()

```
void LM75::write16 (
            uint8_t reg,
            uint16_t data )  [private]
```

Write a value to a 16 bit register in the device.

Parameters

in	*reg*	Register to write to.
in	*data*	Value to write.

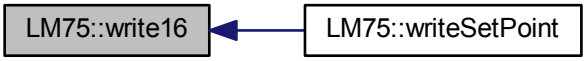
Definition at line 241 of file LM75.cpp.

References _addr.

Referenced by writeSetPoint().

```
00241                                           {
00242
00243     // send the device address then the register pointer byte
00244     Wire.beginTransmission(_addr);
00245     Wire.write(reg);
00246
00247     // write the data high byte first
00248     Wire.write(highByte(data));
00249     Wire.write(lowByte(data));
00250     Wire.endTransmission(true);
00251 }
```

Here is the caller graph for this function:



5.1.4.15 write8()

```
void LM75::write8 (
            uint8_t reg,
            uint8_t data )  [private]
```

Write a value to an 8 bit register in the device.

Parameters

in	*reg*	Register to write to.
in	*data*	Value to write.

Definition at line 224 of file LM75.cpp.

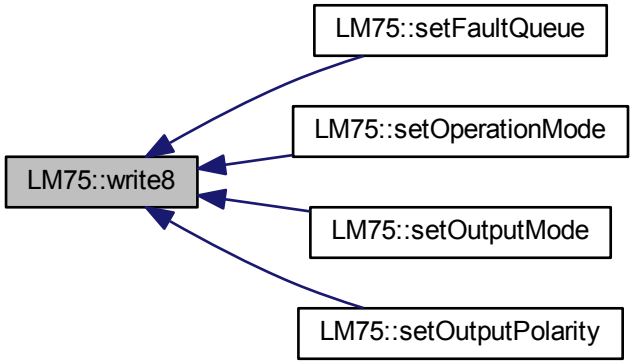
References _addr.

Referenced by setFaultQueue(), setOperationMode(), setOutputMode(), and setOutputPolarity().

```
00224                                           {
00225
00226     // send the device address then the register pointer byte
00227     Wire.beginTransmission(_addr);
00228     Wire.write(reg);
```

```
00229
00230     // write the data
00231     Wire.write(data);
00232 //    Wire.endTransmission(true);
00233     Wire.endTransmission();
00234 }
```

Here is the caller graph for this function:



5.1.4.16 writeSetPoint()

```
void LM75::writeSetPoint (
            double val,
            tempUnit_t tunit = LM75_TC,
            setPointType spt = SPT_OVERTEMP )
```

Write the specified setpoint supplied in the specified units.

Remarks

Setpoint is written as a 2's complement value in the most significant 9 bits of a 16 bit field expressed in degrees C to a resolution of 0.125C.

Parameters

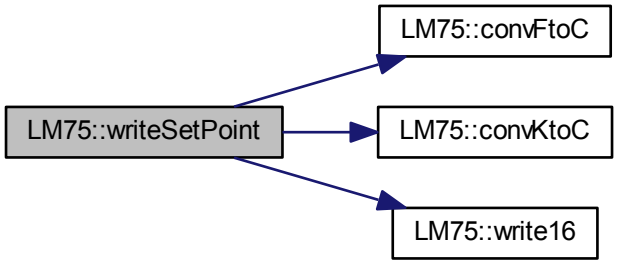
in	*val*	Setpoint temperature.
in	*tunit*	Temperature units of the setpoint.
in	*spt*	Setpoint type (overtemp or hysteresis)

Definition at line 112 of file LM75.cpp.

References convFtoC(), convKtoC(), LM75_TF, LM75_THYST, LM75_TK, LM75_TOS, SPT_OVERTEMP, and write16().

```
00112                                                                   {
00113     uint16_t data;
00114
00115     switch(tunit) {
00116         case    LM75_TK : val = convKtoC(val); break;
00117         case    LM75_TF : val = convFtoC(val);
00118     }
00119     data = (uint16_t)(val * 128.0/0.125 + 0.5);
00120     write16(spt == SPT_OVERTEMP ? LM75_TOS :
      LM75_THYST, data);
00121 }
```

Here is the call graph for this function:



5.1.5 Member Data Documentation

5.1.5.1 _addr

```
uint8_t LM75::_addr  [private]
```

Slave address

Definition at line 133 of file LM75.h.

Referenced by getAddr(), LM75(), read16(), read8(), write16(), and write8().

5.1.5.2 busAddr

```
Property<uint8_t, LM75> LM75::busAddr
```

I2C Bus address property

Definition at line 87 of file LM75.h.

Referenced by LM75().

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

- LM75.h
- LM75.cpp

Chapter 6

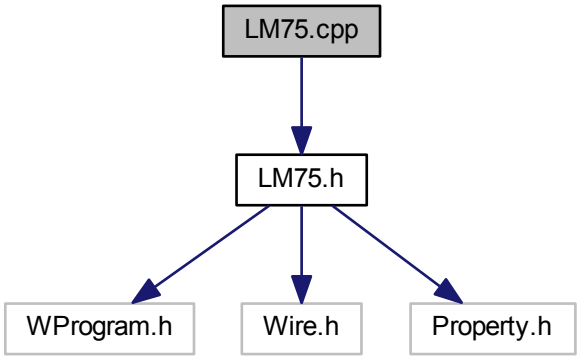
File Documentation

6.1 LM75.cpp File Reference

LM75 Family Device Driver Library - CPP Source file.

```
#include "LM75.h"
```

Include dependency graph for LM75.cpp:



6.1.1 Detailed Description

LM75 Family Device Driver Library - CPP Source file.

Details

Based on the LM75 Family Data Sheet 3901090614 Rev 004 09jun2008.

- The current implementation does not manage PWM (only digital data by I2C).
- Sleep mode is not implemented yet.

Note

THIS IS ONLY A PARTIAL RELEASE. THIS DEVICE CLASS IS CURRENTLY UNDERGOING ACTIVE D↩ EVELOPMENT AND IS STILL MISSING SOME IMPORTANT FEATURES. PLEASE KEEP THIS IN MIND IF YOU DECIDE TO USE THIS PARTICULAR CODE FOR ANYTHING.

Author

J. F. Fitter jfitter@eagleairaust.com.au

Version

1.0

Date

jan2016

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Definition in file LM75.cpp.

6.2 LM75.cpp

```
00001 /**************************************************************************************************//**
00002  *  \brief      LM75 Family Device Driver Library - CPP Source file
00003  *  \par
00004  *  \par        Details
00005  *              Based on the LM75 Family Data Sheet 3901090614 Rev 004 09jun2008.
00006  *  \li         The current implementation does not manage PWM (only digital data by I2C).
00007  *  \li         Sleep mode is not implemented yet.
00008  *
00009  *  \note       THIS IS ONLY A PARTIAL RELEASE. THIS DEVICE CLASS IS CURRENTLY UNDERGOING
00010  *              ACTIVE DEVELOPMENT AND IS STILL MISSING SOME IMPORTANT FEATURES. PLEASE KEEP
00011  *              THIS IN MIND IF YOU DECIDE TO USE THIS PARTICULAR CODE FOR ANYTHING.
00012  *
00013  *  \file       LM75.CPP
00014  *  \author     J. F. Fitter <jfitter@eagleairaust.com.au>
00015  *  \version    1.0
00016  *  \date       jan2016
00017  *  \copyright  Copyright (c) 2016-2017 John Fitter.  All right reserved.
00018  *
00019  *  \par License
00020  *              GNU Public License. Permission is hereby granted, free of charge, to any
00021  *              person obtaining a copy of this software and associated documentation files
00022  *              (the "Software"), to deal in the Software without restriction, including
00023  *              without limitation the rights to use, copy, modify, merge, publish, distribute,
00024  *              sublicense, and/or sell copies of the Software, and to permit persons to whom
00025  *              the Software is furnished to do so, subject to the following conditions:
00026  *  \par
00027  *              The above copyright notice and this permission notice shall be included in
00028  *              all copies or substantial portions of the Software.
00029  *  \par
00030  *              THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR
00031  *              IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY,
00032  *              FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE
00033  *              AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER
00034  *              LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM,
00035  *              OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN
00036  *              THE SOFTWARE.
00037  *
00038  **************************************************************************************************/
00039
00040 #include "LM75.h"
00041
00042 /**************************************************************************************************/
00043 /*  LM75 Device class functions.                                                                  */
00044 /**************************************************************************************************/
00045
00046 /**
00047  *  \brief              LM75 Device class constructor.
00048  *  \param [in] i2caddr  Device address (default: published value).
00049  */
00050 LM75::LM75(uint8_t i2caddr) {
00051
00052     busAddr.Set_Class(this);
00053     busAddr.Set_Get(&LM75::getAddr);
00054
00055     _addr  = i2caddr;
00056     _ready = false;
00057 }
00058
00059 /**
00060  *  \brief  Initialize the device and the i2c interface.
00061  */
00062 boolean LM75::begin(void) {
00063
00064     return _ready = true;
00065 }
00066
00067 /**
00068  *  \brief             Return the measured temperature in specified units.
00069  *  \remarks           Temperature is returned as a 2's complement value in the most significant
00070  *                     11 bits of a 16 bit field expressed in degrees C to a resolution of 0.125C.
00071  *  \param [in] tunit  Temperature units to convert raw data to.
00072  *  \return            Temperature.
00073  */
00074 double LM75::readTemp(tempUnit_t tunit) {
00075     double temp;
00076
00077     temp = read16(LM75_TEMP) * 0.125/32.0;
00078     switch(tunit) {
00079         case LM75_TK : return convCtoK(temp);
00080         case LM75_TF : return convCtoF(temp);
00081     }
00082     return temp;
00083 }
00084
```

```
00085 /**
00086  *  \brief              Return the specified setpoint in specified units.
00087  *  \remarks            Setpoint is returned as a 2's complement value in the most significant
00088  *                      9 bits of a 16 bit field expressed in degrees C to a resolution of 0.125C.
00089  *  \param [in] tunit   Temperature units to convert raw data to.
00090  *  \param [in] spt     Setpoint type (overtemp or hysteresis)
00091  *  \return             Temperature.
00092  */
00093 double LM75::readSetPoint(tempUnit_t tunit,
      setPointType spt) {
00094     double val;
00095
00096     val = read16(spt == SPT_OVERTEMP ? LM75_TOS :
      LM75_THYST) * 0.125/128.0;
00097     switch(tunit) {
00098         case    LM75_TK : return convCtoK(val);
00099         case    LM75_TF : return convCtoF(val);
00100         default : return val;
00101     }
00102 }
00103
00104 /**
00105  *  \brief              Write the specified setpoint supplied in the specified units.
00106  *  \remarks            Setpoint is written as a 2's complement value in the most significant
00107  *                      9 bits of a 16 bit field expressed in degrees C to a resolution of 0.125C.
00108  *  \param [in] val     Setpoint temperature.
00109  *  \param [in] tunit   Temperature units of the setpoint.
00110  *  \param [in] spt     Setpoint type (overtemp or hysteresis)
00111  */
00112 void LM75::writeSetPoint(double val, tempUnit_t tunit,
      setPointType spt) {
00113     uint16_t data;
00114
00115     switch(tunit) {
00116         case    LM75_TK : val = convKtoC(val); break;
00117         case    LM75_TF : val = convFtoC(val);
00118     }
00119     data = (uint16_t)(val * 128.0/0.125 + 0.5);
00120     write16(spt == SPT_OVERTEMP ? LM75_TOS :
      LM75_THYST, data);
00121 }
00122
00123 /**
00124  *  \brief              Set the OS polarity.
00125  *  \param [in] pol     Enumerated OS polarity selection.
00126  */
00127 void LM75::setOutputPolarity(outputPolarity pol) {
00128
00129     write8(LM75_CONF, read8(LM75_CONF) &
00130         (pol == POL_LOW ? LM75_CONF_OSPOL_AL :
      LM75_CONF_OSPOL_AH));
00131 }
00132
00133 /**
00134  *  \brief              Set the OS operation mode.
00135  *  \param [in] mode    Enumerated OS operation mode.
00136  */
00137 void LM75::setOutputMode(outputMode mode) {
00138
00139     write8(LM75_CONF, read8(LM75_CONF) &
00140         (mode == MODE_COMP ? LM75_CONF_OSOM_COMP :
      LM75_CONF_OSOM_INT));
00141 }
00142
00143 /**
00144  *  \brief              Set the device operation mode.
00145  *  \param [in] mode    Enumerated operation mode.
00146  */
00147 void LM75::setOperationMode(opMode mode) {
00148
00149     write8(LM75_CONF, read8(LM75_CONF) &
00150         (mode == OPM_NORMAL ? LM75_CONF_DOM_NORMAL :
      LM75_CONF_DOM_SHUTDOWN));
00151 }
00152
00153 /**
00154  *  \brief              Set the value of the OS fault queue.
00155  *  \param [in] fqueue  Enumerated OS fault queue programming value.
00156  */
00157 void LM75::setFaultQueue(faultQueue fqueue) {
00158     uint8_t fq;
00159
00160     switch(fqueue) {
00161         case    FQ_1 : fq = LM75_CONF_OSFQUE_1; break;
00162         case    FQ_2 : fq = LM75_CONF_OSFQUE_1; break;
00163         case    FQ_4 : fq = LM75_CONF_OSFQUE_1; break;
00164         case    FQ_6 : fq = LM75_CONF_OSFQUE_1;
```

```
00165     }
00166     write8(LM75_CONF, read8(LM75_CONF) & fq);
00167 }
00168
00169 /**
00170  *  \brief            Return the device I2C Bus address.
00171  *  \return           Device address.
00172  */
00173 uint8_t LM75::getAddr(void) {return _addr;}
00174
00175 /**
00176  *  \brief            Return an 8 bit register value from the device.
00177  *  \param [in] reg   8b Register to read from.
00178  *  \return           Value read from register.
00179  */
00180 uint8_t LM75::read8(uint8_t reg) {
00181
00182     // send the device address then the register pointer byte
00183     Wire.beginTransmission(_addr);
00184     Wire.write(reg);
00185 //    Wire.endTransmission(false);
00186     Wire.endTransmission();
00187
00188     // resend device address then get the returned byte
00189     Wire.requestFrom(_addr, (uint8_t)1);
00190
00191     // data is returned as 1 byte
00192     return Wire.read();
00193 }
00194
00195 /**
00196  *  \brief            Return a 16 bit register value from the device.
00197  *  \param [in] reg   16b Register to read from.
00198  *  \return           Value read from register.
00199  */
00200 uint16_t LM75::read16(uint8_t reg) {
00201     uint16_t val;
00202
00203     // send the device address then the register pointer byte
00204     Wire.beginTransmission(_addr);
00205     Wire.write(reg);
00206 //    Wire.endTransmission(false);
00207     Wire.endTransmission();
00208
00209     // resend device address then get the 2 returned bytes
00210     Wire.requestFrom(_addr, (uint8_t)2);
00211
00212     // data is returned as 2 bytes big endian
00213     val = Wire.read() << 8;
00214     val |= Wire.read();
00215
00216     return val;
00217 }
00218
00219 /**
00220  *  \brief            Write a value to an 8 bit register in the device.
00221  *  \param [in] reg   Register to write to.
00222  *  \param [in] data  Value to write.
00223  */
00224 void LM75::write8(uint8_t reg, uint8_t data) {
00225
00226     // send the device address then the register pointer byte
00227     Wire.beginTransmission(_addr);
00228     Wire.write(reg);
00229
00230     // write the data
00231     Wire.write(data);
00232 //    Wire.endTransmission(true);
00233     Wire.endTransmission();
00234 }
00235
00236 /**
00237  *  \brief            Write a value to a 16 bit register in the device.
00238  *  \param [in] reg   Register to write to.
00239  *  \param [in] data  Value to write.
00240  */
00241 void LM75::write16(uint8_t reg, uint16_t data) {
00242
00243     // send the device address then the register pointer byte
00244     Wire.beginTransmission(_addr);
00245     Wire.write(reg);
00246
00247     // write the data high byte first
00248     Wire.write(highByte(data));
00249     Wire.write(lowByte(data));
00250     Wire.endTransmission(true);
00251 }
```

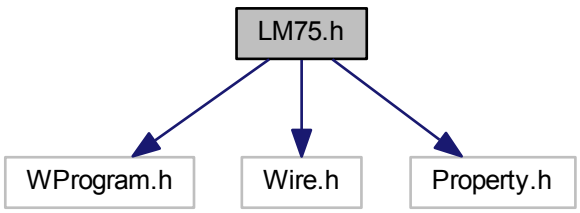
```
00252
00253 /**
00254  *  \brief            Convert temperature in degrees C to degrees K.
00255  *  \param [in] degC  Temperature in degrees Centigrade.
00256  *  \return           Temperature in degrees Kelvin.
00257  */
00258 double LM75::convCtoK(double degC) {return degC + 273.15;}
00259
00260 /**
00261  *  \brief            Convert temperature in degrees C to degrees F.
00262  *  \param [in] degC  Temperature in degrees Centigrade.
00263  *  \return           Temperature in degrees Fahrenheit.
00264  */
00265 double LM75::convCtoF(double degC) {return (degC * 1.8) + 32.0;}
00266
00267 /**
00268  *  \brief            Convert temperature in degrees K to degrees C.
00269  *  \param [in] degK  Temperature in degrees Kelvin.
00270  *  \return           Temperature in degrees Centigrade.
00271  */
00272 double LM75::convKtoC(double degK) {return degK - 273.15;}
00273
00274 /**
00275  *  \brief            Convert temperature in degrees F to degrees C.
00276  *  \param [in] degF  Temperature in degrees Fahrenheit.
00277  *  \return           Temperature in degrees Centigrade.
00278  */
00279 double LM75::convFtoC(double degF) {return (degF - 32.0) / 1.8;}
00280
00281
```

6.3 LM75.h File Reference

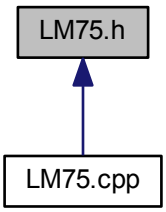
LM75 Family Device Driver Library - CPP Header file.

```
#include "WProgram.h"
#include <Wire.h>
#include "Property.h"
```

Include dependency graph for LM75.h:



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



Classes

- class LM75

Macros

- #define LM75_I2CDEFAULTADDR 0x48
- #define LM75_BROADCASTADDR 0
- #define LM75_CONF 0x01
- #define LM75_TEMP 0x00
- #define LM75_TOS 0x03
- #define LM75_THYST 0x02
- #define LM75_CONF_RES 0x00
- #define LM75_CONF_OSFQUE_1 0x00
- #define LM75_CONF_OSFQUE_2 0x08
- #define LM75_CONF_OSFQUE_4 0x10
- #define LM75_CONF_OSFQUE_6 0x18
- #define LM75_CONF_OSPOL_AL 0x00
- #define LM75_CONF_OSPOL_AH 0x04
- #define LM75_CONF_OSOM_COMP 0x00
- #define LM75_CONF_OSOM_INT 0x02
- #define LM75_CONF_DOM_NORMAL 0x00
- #define LM75_CONF_DOM_SHUTDOWN 0x01

6.3.1 Detailed Description

LM75 Family Device Driver Library - CPP Header file.

Details

Based on the Melexis LM75 Family Data Sheet 3901090614 Rev 004 09jun2008.

- The current implementation does not manage PWM (only digital data by I2C).
- Sleep mode is not implemented yet.

Note

THIS IS ONLY A PARTIAL RELEASE. THIS DEVICE CLASS IS CURRENTLY UNDERGOING ACTIVE D↩ EVELOPMENT AND IS STILL MISSING SOME IMPORTANT FEATURES. PLEASE KEEP THIS IN MIND IF YOU DECIDE TO USE THIS PARTICULAR CODE FOR ANYTHING.

Author

J. F. Fitter jfitter@eagleairaust.com.au

Version

1.0

Date

jan2016

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Definition in file LM75.h.

6.3.2 Macro Definition Documentation

6.3.2.1 LM75_BROADCASTADDR

```
#define LM75_BROADCASTADDR 0
```

Device broadcast slave address

Definition at line 56 of file LM75.h.

6.3.2.2 LM75_CONF

```
#define LM75_CONF 0x01
```

REGISTER addresses. RAM reg - Configuration

Definition at line 59 of file LM75.h.

Referenced by LM75::setFaultQueue(), LM75::setOperationMode(), LM75::setOutputMode(), and LM75::setOutputPolarity().

6.3.2.3 LM75_CONF_DOM_NORMAL

```
#define LM75_CONF_DOM_NORMAL 0x00
```

Device operation mode - normal

Definition at line 74 of file LM75.h.

Referenced by LM75::setOperationMode().

6.3.2.4 LM75_CONF_DOM_SHUTDOWN

```
#define LM75_CONF_DOM_SHUTDOWN 0x01
```

Device operation mode - shutdown

Definition at line 75 of file LM75.h.

Referenced by LM75::setOperationMode().

6.3.2.5 LM75_CONF_OSFQUE_1

```
#define LM75_CONF_OSFQUE_1 0x00
```

OS fault queue programming value = 1

Definition at line 66 of file LM75.h.

Referenced by LM75::setFaultQueue().

6.3.2.6 LM75_CONF_OSFQUE_2

```
#define LM75_CONF_OSFQUE_2 0x08
```

OS fault queue programming value = 2

Definition at line 67 of file LM75.h.

6.3.2.7 LM75_CONF_OSFQUE_4

```
#define LM75_CONF_OSFQUE_4 0x10
```

OS fault queue programming value = 4

Definition at line 68 of file LM75.h.

6.3.2.8 LM75_CONF_OSFQUE_6

```
#define LM75_CONF_OSFQUE_6 0x18
```

OS fault queue programming value = 6

Definition at line 69 of file LM75.h.

6.3.2.9 LM75_CONF_OSOM_COMP

```
#define LM75_CONF_OSOM_COMP 0x00
```

OS operation mode - comparator

Definition at line 72 of file LM75.h.

Referenced by LM75::setOutputMode().

6.3.2.10 LM75_CONF_OSOM_INT

```
#define LM75_CONF_OSOM_INT 0x02
```

OS operation mode - interrupt

Definition at line 73 of file LM75.h.

Referenced by LM75::setOutputMode().

6.3.2.11 LM75_CONF_OSPOL_AH

```
#define LM75_CONF_OSPOL_AH 0x04
```

OS polarity selection active HIGH

Definition at line 71 of file LM75.h.

Referenced by LM75::setOutputPolarity().

6.3.2.12 LM75_CONF_OSPOL_AL

```
#define LM75_CONF_OSPOL_AL 0x00
```

OS polarity selection active LOW

Definition at line 70 of file LM75.h.

Referenced by LM75::setOutputPolarity().

6.3.2.13 LM75_CONF_RES

```
#define LM75_CONF_RES 0x00
```

CONFIGURATION bits masks. Manufacturer reserved bits

Definition at line 65 of file LM75.h.

6.3.2.14 LM75_I2CDEFAULTADDR

```
#define LM75_I2CDEFAULTADDR 0x48
```

Device default slave address

Definition at line 55 of file LM75.h.

6.3.2.15 LM75_TEMP

```
#define LM75_TEMP 0x00
```

RAM reg - Temperature

Definition at line 60 of file LM75.h.

Referenced by LM75::readTemp().

6.3.2.16 LM75_THYST

```
#define LM75_THYST 0x02
```

RAM reg - Hysteresis

Definition at line 62 of file LM75.h.

Referenced by LM75::readSetPoint(), and LM75::writeSetPoint().

6.3.2.17 LM75_TOS

```
#define LM75_TOS 0x03
```

RAM reg - Overtemperature shutdown threshold

Definition at line 61 of file LM75.h.

Referenced by LM75::readSetPoint(), and LM75::writeSetPoint().

6.4 LM75.h

```
00001 #ifndef _LM75_H_
00002 #define _LM75_H_
00003
00004 /*****************************************************************************************************//**
00005  *  \brief      LM75 Family Device Driver Library - CPP Header file
00006  *  \par
00007  *  \par        Details
00008  *              Based on the Melexis LM75 Family Data Sheet 3901090614 Rev 004 09jun2008.
00009  *  \li         The current implementation does not manage PWM (only digital data by I2C).
00010  *  \li         Sleep mode is not implemented yet.
00011  *
00012  *  \note       THIS IS ONLY A PARTIAL RELEASE. THIS DEVICE CLASS IS CURRENTLY UNDERGOING
00013  *              ACTIVE DEVELOPMENT AND IS STILL MISSING SOME IMPORTANT FEATURES. PLEASE KEEP
00014  *              THIS IN MIND IF YOU DECIDE TO USE THIS PARTICULAR CODE FOR ANYTHING.
00015  *
00016  *  \file       LM75.H
00017  *  \author     J. F. Fitter <jfitter@eagleairaust.com.au>
00018  *  \version    1.0
00019  *  \date       jan2016
00020  *  \copyright  Copyright (c) 2016-2017 John Fitter.  All right reserved.
00021  *
00022  *  \par License
00023  *              GNU Public License. Permission is hereby granted, free of charge, to any
00024  *              person obtaining a copy of this software and associated documentation files
00025  *              (the "Software"), to deal in the Software without restriction, including
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00027  *              sublicense, and/or sell copies of the Software, and to permit persons to whom
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00037  *              LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM,
00038  *              OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN
00039  *              THE SOFTWARE.
00040  *
00041  *****************************************************************************************************/
00042
00043 #if (ARDUINO >= 100)
00044     #include "Arduino.h"
00045 #else
```

```
00046     #include "WProgram.h"
00047 #endif
00048 #include <Wire.h>
00049 #include "Property.h"
00050
00051 /**************************************************************************************************/
00052 /* Definitions                                                                                    */
00053 /**************************************************************************************************/
00054
00055 #define LM75_I2CDEFAULTADDR     0x48    /**< Device default slave address */
00056 #define LM75_BROADCASTADDR      0       /**< Device broadcast slave address */
00057
00058 /** REGISTER addresses. */
00059 #define LM75_CONF               0x01    /**< RAM reg - Configuration */
00060 #define LM75_TEMP               0x00    /**< RAM reg - Temperature */
00061 #define LM75_TOS                0x03    /**< RAM reg - Overtemperature shutdown threshold */
00062 #define LM75_THYST              0x02    /**< RAM reg - Hysteresis */
00063
00064 /** CONFIGURATION bits masks. */
00065 #define LM75_CONF_RES           0x00    /**< Manufacturer reserved bits */
00066 #define LM75_CONF_OSFQUE_1      0x00    /**< OS fault queue programming value = 1 */
00067 #define LM75_CONF_OSFQUE_2      0x08    /**< OS fault queue programming value = 2 */
00068 #define LM75_CONF_OSFQUE_4      0x10    /**< OS fault queue programming value = 4 */
00069 #define LM75_CONF_OSFQUE_6      0x18    /**< OS fault queue programming value = 6 */
00070 #define LM75_CONF_OSPOL_AL      0x00    /**< OS polarity selection active LOW */
00071 #define LM75_CONF_OSPOL_AH      0x04    /**< OS polarity selection active HIGH */
00072 #define LM75_CONF_OSOM_COMP     0x00    /**< OS operation mode - comparator */
00073 #define LM75_CONF_OSOM_INT      0x02    /**< OS operation mode - interrupt */
00074 #define LM75_CONF_DOM_NORMAL    0x00    /**< Device operation mode - normal */
00075 #define LM75_CONF_DOM_SHUTDOWN  0x01    /**< Device operation mode - shutdown */
00076
00077 /**************************************************************************************************/
00078 /* LM75 Device class.                                                                             */
00079 /**************************************************************************************************/
00080
00081 class LM75 {
00082 public:
00083     LM75(uint8_t = LM75_I2CDEFAULTADDR);                    /**< constructor */
00084
00085     boolean  begin();
00086
00087     Property<uint8_t, LM75> busAddr;                        /**< I2C Bus address property */
00088
00089     /** Enumerations for temperature units. */
00090     enum tempUnit_t {LM75_TK,                               /**< degrees Kelvin */
00091                      LM75_TC,                               /**< degrees Centigrade */
00092                      LM75_TF                                /**< degrees Fahrenheit */
00093     };
00094     /** Enumerations for setpoint registers. */
00095     enum setPointType {SPT_OVERTEMP,                        /**< overtemp shutdown
 register */
00096                        SPT_HYSTERESIS                       /**< hysteresis register */
00097     };
00098     /** Enumerations for output polarity. */
00099     enum outputPolarity {POL_LOW,                           /**< OS output active low
*/
00100                          POL_HIGH                           /**< OS output active high */
00101     };
00102     /** Enumerations for output mode. */
00103     enum outputMode {MODE_COMP,                             /**< OS comparator mode */
00104                      MODE_INT                               /**< OS interrupt mode */
00105     };
00106     /** Enumerations for operating mode. */
00107     enum opMode {OPM_NORMAL,                                /**< normal operation mode */
00108                  OPM_SHDN                                   /**< shutdown mode */
00109     };
00110     /** Enumerations for fault queue length. */
00111     enum faultQueue {FQ_1 = 1,                              /**< fault queue value = 1 */
00112                      FQ_2 = 2,                              /**< fault queue value = 2 */
00113                      FQ_4 = 4,                              /**< fault queue value = 4 */
00114                      FQ_6 = 6                               /**< fault queue value = 6 */
00115     };
00116
00117     boolean isReady(void) { return _ready; };
00118     double readTemp(tempUnit_t = LM75_TC);
00119     double readSetPoint(tempUnit_t = LM75_TC,
      setPointType = SPT_OVERTEMP);
00120     void writeSetPoint(double, tempUnit_t = LM75_TC,
      setPointType = SPT_OVERTEMP);
00121     void setOutputPolarity(outputPolarity =
      POL_LOW);
00122     void setOutputMode(outputMode = MODE_COMP);
00123     void setOperationMode(opMode = OPM_NORMAL);
00124     void setFaultQueue(faultQueue);
00125
00126     double convCtoK(double degC);
00127     double convCtoF(double degC);
```

```
00128     double convKtoC(double degK);
00129     double convFtoC(double degF);
00130
00131 private:
00132     boolean _ready;
00133     uint8_t _addr;                                          /**< Slave address */
00134     uint8_t getAddr(void);
00135
00136     uint8_t read8(uint8_t);
00137     uint16_t read16(uint8_t);
00138     void write8(uint8_t, uint8_t);
00139     void write16(uint8_t, uint16_t);
00140 };
00141
00142 #endif /* _LM75_H_ */
```

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