

MLX90614 Device Driver

1.0.0

Generated by Doxygen 1.8.16

Thu Feb 13 2020 18:49:47

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1 MLX90614 Device Driver

This library was written to enable remote sensing of the temperature of the rotors of outrunner style brushless DC motors used in remotely piloted aircraft, for the purpose of real time data logging and air to ground telemetry.

These sensors use the SMB bus protocol to communicate. This is similar, though not identical, to the I2C bus. There is enough similarity to enable the Arduino standard Wire library to communicate with the device, however not all features can be implemented, for example it is not possible to read the flags register with standard Wire functions. 2 pins are required to interface the device to an Arduino - the SDA and SCL lines.

Installing

Download the distribution package **MLX90614.rar** and decompress it.

Rename the uncompressed folder **/mlx90614**.

Check that the **/mlx90614** folder contains the following files;

```
src/MLX90614.cpp
src/MLX90614.h
src/Crc8.cpp
src/Crc8.h
src/property.h
doc/MLX90614.chm
doc/MLX90614.pdf
Doxyfile
keywords.txt
library.properties
LICENSE.md
README.md
```

Place the **/mlx90614** library folder into your **arduinofolder/libraries/** folder.

You may need to create the libraries subfolder if its your first library.

Restart the IDE.

You can also optionally install this library using the Arduino IDE built-in installer.

Documentation

MLX90614.chm and **MLX90614.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.
This library was inspired by a library written by Adafruit Industries.

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Version 3, 29 June 2007

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3 Class Index

3.1 Class List

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

CRC8	10
MLX90614	14
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4 File Index

4.1 File List

Here is a list of all files with brief descriptions:

Crc8.cpp	
8 bit CRC helper/utility class - CPP Source file	40
Crc8.h	
8 bit CRC helper/utility class - CPP Header file	42
MLX90614.cpp	
Melexis MLX90614 Family Device Driver Library - CPP Source file	45
MLX90614.h	52
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5 Class Documentation

5.1 CRC8 Class Reference

```
#include <Crc8.h>
```

Public Member Functions

- [CRC8](#) (uint8_t polynomial=[CRC8_DEFAULTPOLY](#))
[CRC8](#) class constructor.
- uint8_t [crc8](#) (void)
Return the current value of the CRC.
- uint8_t [crc8](#) (uint8_t data)
Update the current value of the CRC.
- void [crc8Start](#) (uint8_t poly)
Initialize the [CRC8](#) object.

Private Attributes

- uint8_t [_crc](#)
- uint8_t [_poly](#)

5.1.1 Detailed Description

Definition at line 37 of file [Crc8.h](#).

5.1.2 Constructor & Destructor Documentation

5.1.2.1 CRC8() `CRC8::CRC8 (uint8_t poly = CRC8_DEFAULTPOLY)`

[CRC8](#) class constructor.

Parameters

in	<i>poly</i>	8 bit CRC polynomial to use.
----	-------------	------------------------------

Definition at line 36 of file [Crc8.cpp](#).
00036 {[crc8Start](#)(poly);}

References [crc8Start\(\)](#).

Here is the call graph for this function:



5.1.3 Member Function Documentation

5.1.3.1 `crc8()` [1/2] `uint8_t CRC8::crc8 (`
`uint8_t data)`

Update the current value of the CRC.

Parameters

<code>in</code>	<code>data</code>	New 8 bit data to be added to the CRC.
-----------------	-------------------	--

Returns

8 bit CRC current value.

Definition at line 49 of file [Crc8.cpp](#).

```
00049                                     {
00050     uint8_t i = 8;
00051
00052     _crc ^= data;
00053     while(i--) _crc = _crc & 0x80 ? (_crc << 1) ^ _poly : _crc << 1;
00054     return _crc;
00055 }
```

References [_crc](#), and [_poly](#).

5.1.3.2 `crc8()` [2/2] `uint8_t CRC8::crc8 (`
`void)`

Return the current value of the CRC.

Returns

8 bit CRC current value.

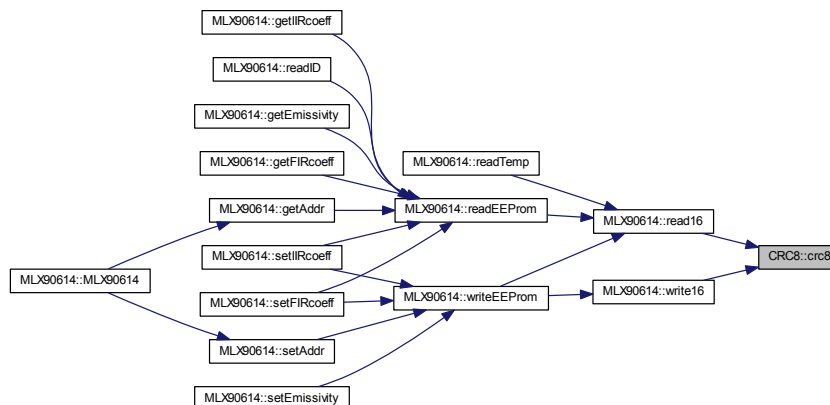
Definition at line 42 of file [Crc8.cpp](#).

```
00042 {return _crc;}
```

References [_crc](#).

Referenced by [MLX90614::read16\(\)](#), and [MLX90614::write16\(\)](#).

Here is the caller graph for this function:



5.1.3.3 crc8Start() void CRC8::crc8Start (
 uint8_t poly)

Initialize the [CRC8](#) object.

Parameters

in	poly	8 bit CRC polynomial to use.
----	------	------------------------------

Definition at line 61 of file [Crc8.cpp](#).

```

00061 {
00062     _poly = poly;
00063     _crc = 0;
00064 }
```

References [_crc](#), and [_poly](#).

Referenced by [CRC8\(\)](#).

Here is the caller graph for this function:



5.1.4 Member Data Documentation

5.1.4.1 `_crc` `uint8_t CRC8::_crc` [private]

Definition at line 44 of file [Crc8.h](#).

Referenced by [crc8\(\)](#), and [crc8Start\(\)](#).

5.1.4.2 `_poly` `uint8_t CRC8::_poly` [private]

Definition at line 45 of file [Crc8.h](#).

Referenced by [crc8\(\)](#), and [crc8Start\(\)](#).

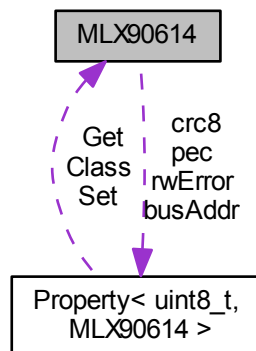
The documentation for this class was generated from the following files:

- [Crc8.h](#)
- [Crc8.cpp](#)

5.2 MLX90614 Class Reference

```
#include <MLX90614.h>
```

Collaboration diagram for MLX90614:



Public Types

- enum `tempUnit_t` { `MLX90614_TK`, `MLX90614_TC`, `MLX90614_TF` }
- enum `tempSrc_t` { `MLX90614_SRC_A`, `MLX90614_SRC01`, `MLX90614_SRC02` }

Public Member Functions

- [MLX90614](#) (uint8_t i2caddr=[MLX90614_I2CDEFAULTADDR](#))
MLX90614 Device class constructor.
- boolean [begin](#) ()
Initialize the device and the i2c interface.
- boolean [isReady](#) (void)
- uint64_t [readID](#) (void)
Retrieve the chip ID bytes.
- uint8_t [getIIRcoeff](#) (void)
Get the coefficients of the IIR digital filter.
- uint8_t [getFIRcoeff](#) (void)
Get the coefficients of the FIR digital filter.
- float [getEmissivity](#) (void)
Get the emissivity (ϵ) of the object.
- void [setIIRcoeff](#) (uint8_t csb=4)
Set the coefficients of the IIR digital filter.
- void [setFIRcoeff](#) (uint8_t csb=7)
Set the coefficients of the FIR digital filter.
- void [setEmissivity](#) (float emiss=1.0)
Set the emissivity (ϵ) of the object.
- uint16_t [readEEProm](#) (uint8_t)
Return a 16 bit value read from EEPROM.
- void [writeEEProm](#) (uint8_t, uint16_t)
Write a 16 bit value to EEPROM after first clearing the memory.
- double [readTemp](#) (tempSrc_t=[MLX90614_SRC01](#), tempUnit_t=[MLX90614_TC](#))
Return a temperature from the specified source in specified units.
- double [convKtoC](#) (double)
Convert temperature in $^{\circ}\text{K}$ to $^{\circ}\text{C}$.
- double [convCtoF](#) (double)
Convert temperature in $^{\circ}\text{C}$ to $^{\circ}\text{F}$.

Public Attributes

- [Property](#)< uint8_t, [MLX90614](#) > [busAddr](#)
- [Property](#)< uint8_t, [MLX90614](#) > [rwError](#)
- [Property](#)< uint8_t, [MLX90614](#) > [crc8](#)
- [Property](#)< uint8_t, [MLX90614](#) > [pec](#)

Private Member Functions

- uint16_t [read16](#) (uint8_t)
Return a 16 bit value read from RAM or EEPROM.
- void [write16](#) (uint8_t, uint16_t)
Write a 16 bit value to memory.
- uint8_t [getRwError](#) (void)
- uint8_t [getCRC8](#) (void)
- uint8_t [getPEC](#) (void)
- uint8_t [getAddr](#) (void)
Return the device SMBus address.
- void [setAddr](#) (uint8_t)
Set device SMBus address.

Private Attributes

- `boolean _ready`
- `uint8_t _addr`
- `uint8_t _rwError`
- `uint8_t _crc8`
- `uint8_t _pec`

5.2.1 Detailed Description

Examples

`MelexisTest.ino`.

Definition at line 104 of file `MLX90614.h`.

5.2.2 Member Enumeration Documentation

5.2.2.1 `tempSrc_t` `enum MLX90614::tempSrc_t`

Enumerations for temperature measurement source.

Enumerator

<code>MLX90614_SRC_A</code>	Chip (ambient) sensor
<code>MLX90614_SRC_01</code>	IR source #1
<code>MLX90614_SRC_02</code>	IR source #2

Definition at line 134 of file `MLX90614.h`.

```
00140 :  
00141     boolean _ready;
```

5.2.2.2 `tempUnit_t` `enum MLX90614::tempUnit_t`

Enumerations for temperature units.

Enumerator

<code>MLX90614_TK</code>	degrees Kelvin
<code>MLX90614_TC</code>	degrees Centigrade
<code>MLX90614_TF</code>	degrees Fahrenheit

Definition at line 129 of file `MLX90614.h`.

```
00131     {MLX90614_SRC_A,                               /**< Chip (ambient) sensor */  
00132     MLX90614_SRC_01,                               /**< IR source #1 */
```

5.2.3 Constructor & Destructor Documentation

5.2.3.1 MLX90614() MLX90614::MLX90614 (
 uint8_t i2caddr = [MLX90614_I2CDEFAULTADDR](#))

[MLX90614](#) Device class constructor.

Parameters

in	<i>i2caddr</i>	Device address (default: published value).
----	----------------	--

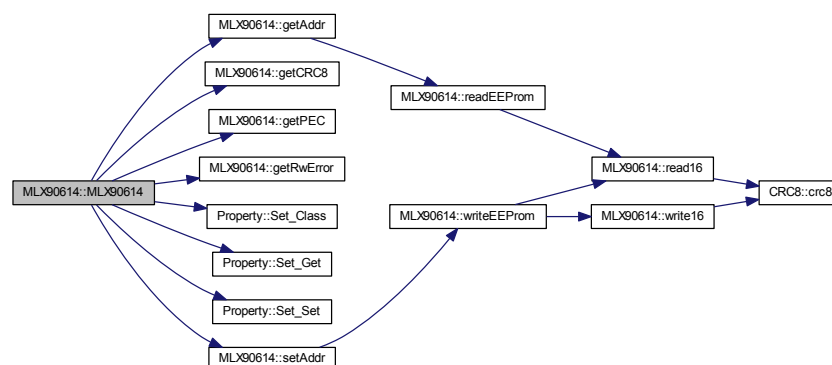
Definition at line 50 of file [MLX90614.cpp](#).

```

00050 {
00051
00052     busAddr.Set_Class(this);
00053     busAddr.Set_Get(&MLX90614::getAddr);
00054     busAddr.Set_Set(&MLX90614::setAddr);
00055
00056     rwError.Set_Class(this);
00057     rwError.Set_Get(&MLX90614::getRwError);
00058
00059     pec.Set_Class(this);
00060     pec.Set_Get(&MLX90614::getPEC);
00061
00062     crc8.Set_Class(this);
00063     crc8.Set_Get(&MLX90614::getCRC8);
00064
00065     _addr = i2caddr;
00066     _ready = false;
00067 }
```

References [_addr](#), [_ready](#), [busAddr](#), [crc8](#), [getAddr\(\)](#), [getCRC8\(\)](#), [getPEC\(\)](#), [getRwError\(\)](#), [pec](#), [rwError](#), [Property< Type, ClassHolder >::Set_Class\(\)](#), [Property< Type, ClassHolder >::Set_Get\(\)](#), [Property< Type, ClassHolder >::Set_Set](#) and [setAddr\(\)](#).

Here is the call graph for this function:



5.2.4 Member Function Documentation

5.2.4.1 begin() `boolean MLX90614::begin (`
`void)`

Initialize the device and the i2c interface.

Examples

[MelexisTest.ino](#).

Definition at line 72 of file [MLX90614.cpp](#).

```
00072 {  
00073  
00074     _rError = _pec = _crc8 = 0;  
00075     return _ready = true;  
00076 }
```

References [_crc8](#), [_pec](#), [_ready](#), and [_rError](#).

5.2.4.2 convCtoF() `double MLX90614::convCtoF (`
`double degC)`

Convert temperature in °C to °F.

Parameters

<code>in</code>	<code>degC</code>	Temperature in °C.
-----------------	-------------------	--------------------

Returns

Temperature in °F.

Examples

[MelexisTest.ino](#).

Definition at line 395 of file [MLX90614.cpp](#).

```
00395 {return (degC * 1.8) + 32.0;}
```

Referenced by [readTemp\(\)](#).

Here is the caller graph for this function:



5.2.4.3 convKtoC() `double MLX90614::convKtoC (`
`double degK)`

Convert temperature in °K to °C.

Parameters

<code>in</code>	<code>degK</code>	Temperature in °K.
-----------------	-------------------	--------------------

Returns

Temperature in °C.

Examples

[MelexisTest.ino](#).

Definition at line 388 of file [MLX90614.cpp](#).

```
00388 {return degK - 273.15;}
```

Referenced by [readTemp\(\)](#).

Here is the caller graph for this function:



5.2.4.4 getAddr() `uint8_t MLX90614::getAddr (`
`void) [private]`

Return the device SMBus address.

SMB bus address getter

Remarks

- Must be only device on the bus.
- Sets the library to use the new found address.

Returns

Device address.

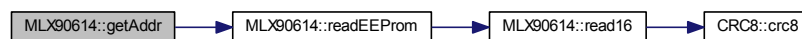
Definition at line 256 of file [MLX90614.cpp](#).

```
00256 {  
00257     uint8_t tempAddr = _addr;  
00258  
00259     _rError = 0;  
00260  
00261     // It is assumed we do not know the existing slave address so the broadcast address is used.  
00262     // This will throw a r/w error so errors will be ignored.  
00263     _addr = MLX90614_BROADCASTADDR;  
00264  
00265     // Reload program copy with the existing slave address.  
00266     _addr = lowByte(readEEProm(MLX90614_ADDR));  
00267  
00268     return _addr;  
00269 }
```

References [_addr](#), [_rError](#), [MLX90614_ADDR](#), [MLX90614_BROADCASTADDR](#), and [readEEProm\(\)](#).

Referenced by [MLX90614\(\)](#).

Here is the call graph for this function:



Here is the caller graph for this function:



5.2.4.5 getCRC8() `uint8_t MLX90614::getCRC8 (`
`void) [inline], [private]`

8 bit CRC getter

Definition at line 154 of file [MLX90614.h](#).

Referenced by [MLX90614\(\)](#).

Here is the caller graph for this function:



5.2.4.6 getEmissivity() `float MLX90614::getEmissivity (`
`void)`

Get the emissivity (ε) of the object.

Emissivity getter

Remarks

The emissivity is stored as a 16 bit integer defined by the following:
 $\varepsilon = \text{dec2hex}[\text{round}(65535 \times \text{emiss})]$

Returns

Physical emissivity value in range 0.1 ...1.0

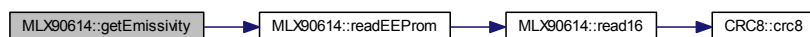
Definition at line 126 of file [MLX90614.cpp](#).

```

00126     {
00127
00128         _rwError = 0;
00129         uint16_t emiss = readEEProm(MLX90614_EMISS);    // fix 13feb2020
00130         if(_rwError) return (float)1.0;
00131         return (float)emiss / 65535.0;
00132     }
  
```

References [_rwError](#), [MLX90614_EMISS](#), and [readEEProm\(\)](#).

Here is the call graph for this function:



5.2.4.7 getFIRcoeff() uint8_t MLX90614::getFIRcoeff (
 void)

Get the coefficients of the FIR digital filter.

FIR coefficient getter

Remarks

The FIR digital filter coefficient N is bits 10:8 of ConfigRegister1
 The value of N is set as follows: $N = 2^{(csb + 3)}$
 The manufacturer does not recommend $N < 128$

Definition at line 214 of file MLX90614.cpp.

```
00214 {
00215
00216     _rwError = 0;
00217
00218     // Get the current value of ConfigRegister1 bits 10:8
00219     uint8_t fir = (readEEProm(MLX90614_CONFIG) >> 8) & 7;
00220
00221     if(_rwError) return 7;
00222     return fir;
00223 }
```

References [_rwError](#), [MLX90614_CONFIG](#), and [readEEProm\(\)](#).

Here is the call graph for this function:



5.2.4.8 getIIRcoeff() uint8_t MLX90614::getIIRcoeff (
 void)

Get the coefficients of the IIR digital filter.

IIR coefficient getter

Remarks

The IIR digital filter coefficients are set by the LS 3 bits of ConfigRegister1

Returns

Filter coefficient table index. Range 0...7

Definition at line 172 of file [MLX90614.cpp](#).

```
00172     {  
00173  
00174         _rwError = 0;  
00175  
00176         // Get the current value of ConfigRegister1 bits 2:0  
00177         uint8_t iir = readEEProm(MLX90614_CONFIG) & 7;  
00178  
00179         if(_rwError) return 4;  
00180         return iir;  
00181     }
```

References [_rwError](#), [MLX90614_CONFIG](#), and [readEEProm\(\)](#).

Here is the call graph for this function:



5.2.4.9 getPEC() `uint8_t MLX90614::getPEC (`
`void) [inline], [private]`

PEC getter

Definition at line 155 of file [MLX90614.h](#).

Referenced by [MLX90614\(\)](#).

Here is the caller graph for this function:



5.2.4.10 getRwError() `uint8_t MLX90614::getRwError (`
`void) [inline], [private]`

R/W error flags getter

Definition at line 153 of file [MLX90614.h](#).

Referenced by [MLX90614\(\)](#).

Here is the caller graph for this function:



5.2.4.11 isReady() `boolean MLX90614::isReady (`
`void) [inline]`

Definition at line 109 of file [MLX90614.h](#).

00126 {[MLX90614_TK](#), /**< degrees Kelvin */

5.2.4.12 read16() `uint16_t MLX90614::read16 (`
`uint8_t cmd) [private]`

Return a 16 bit value read from RAM or EEPROM.

Parameters

<code>in</code>	<code>cmd</code>	Command to send (register to read from).
-----------------	------------------	--

Returns

Value read from memory.

Definition at line 276 of file [MLX90614.cpp](#).

```

00276 {
00277     uint16_t val;
00278     CRC8 crc(MLX90614\_CRC8POLY);
00279
00280     // Send the slave address then the command and set any error status bits returned by the write.
00281     Wire.beginTransaction(_addr);
00282     Wire.write(cmd);
00283     _rwError |= (1 « Wire.endTransmission(false)) » 1;
00284
00285     // Experimentally determined delay to prevent read errors (manufacturer's data sheet has
00286     // left something out).
  
```

```

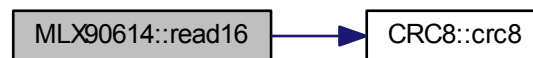
00287     delayMicroseconds(MLX90614_XDLY);
00288
00289     // Resend slave address then get the 3 returned bytes.
00290     Wire.requestFrom(_addr, (uint8_t)3);
00291
00292     // Data is returned as 2 bytes little endian.
00293     val = Wire.read();
00294     val |= Wire.read() << 8;
00295
00296     // Rread the PEC (CRC-8 of all bytes).
00297     _pec = Wire.read();
00298
00299     // Clear r/w errors if using broadcast address.
00300     if(_addr == MLX90614_BROADCASTADDR) _rwError &= MLX90614_NORWERROR;
00301
00302     // Build our own CRC-8 of all received bytes.
00303     crc.crc8(_addr << 1);
00304     crc.crc8(cmd);
00305     crc.crc8((_addr << 1) + 1);
00306     crc.crc8(lowByte(val));
00307     _crc8 = crc.crc8(highByte(val));
00308
00309     // Set error status bit if CRC mismatch.
00310     if(_crc8 != _pec) _rwError |= MLX90614_RXCRC;
00311
00312     return val;
00313 }

```

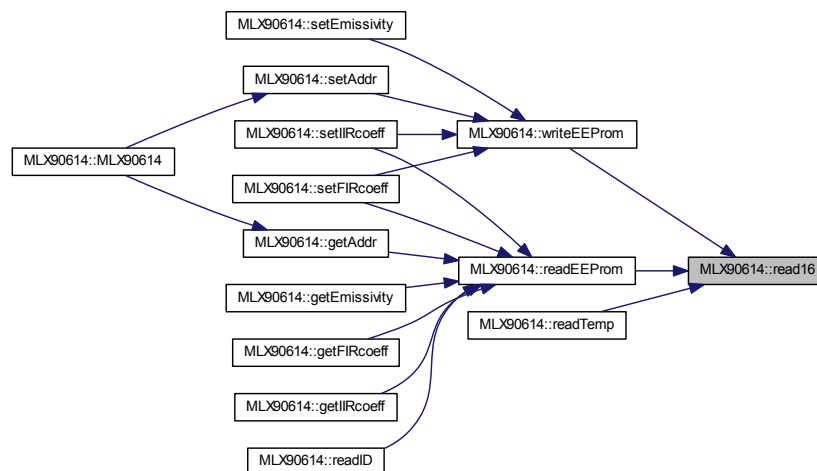
References [_addr](#), [_crc8](#), [_pec](#), [_rwError](#), [CRC8::crc8\(\)](#), [MLX90614_BROADCASTADDR](#), [MLX90614_CRC8POLY](#), [MLX90614_NORWERROR](#), [MLX90614_RXCRC](#), and [MLX90614_XDLY](#).

Referenced by [readEEProm\(\)](#), [readTemp\(\)](#), and [writeEEProm\(\)](#).

Here is the call graph for this function:



Here is the caller graph for this function:



5.2.4.13 readEEProm() `uint16_t MLX90614::readEEProm (`
`uint8_t addr)`

Return a 16 bit value read from EEPROM.

Parameters

in	addr	Register address to read from.
----	------	--------------------------------

Returns

Value read from EEPROM.

Examples

[MelexisTest.ino](#).

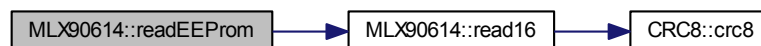
Definition at line 350 of file [MLX90614.cpp](#).

```
00350 {return read16(addr | 0x20);}
```

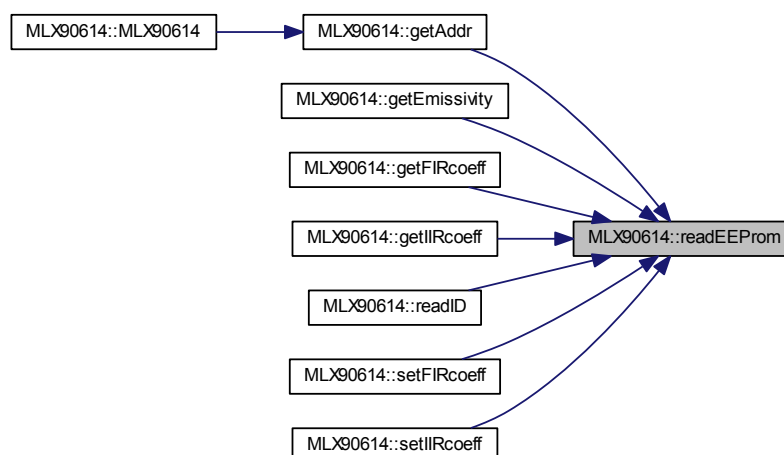
References [read16\(\)](#).

Referenced by [getAddr\(\)](#), [getEmissivity\(\)](#), [getFIRcoeff\(\)](#), [getIIRcoeff\(\)](#), [readID\(\)](#), [setFIRcoeff\(\)](#), and [setIIRcoeff\(\)](#).

Here is the call graph for this function:



Here is the caller graph for this function:



5.2.4.14 readID() `uint64_t MLX90614::readID (`
`void)`

Retrieve the chip ID bytes.

Chip ID getter

Returns

Chip ID as a 64 bit word.

Examples

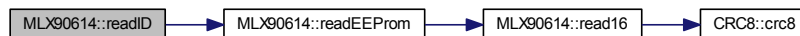
[MelexisTest.ino](#).

Definition at line 401 of file [MLX90614.cpp](#).

```
00401     {
00402         uint64_t ID = 0;
00403
00404         // If we are lucky the compiler will optimise this.
00405         for(uint8_t i = 0; i < 4; i++) ID = (ID << 16) | readEEProm(MLX90614_ID1 + i);
00406         return ID;
00407     }
```

References [MLX90614_ID1](#), and [readEEProm\(\)](#).

Here is the call graph for this function:



5.2.4.15 readTemp() `double MLX90614::readTemp (`
`tempSrc_t tsrc = MLX90614_SRC01,`
`tempUnit_t tunit = MLX90614_TC)`

Return a temperature from the specified source in specified units.

Remarks

- Temperature is stored in ram as a 16 bit absolute value to a resolution of 0.02°K
- Linearized sensor die temperature is available as Ta (ambient).
- One or two object temperatures are linearized to the range -38.2°C...125°C

Parameters

in	<i>tsrc</i>	Internal temperature source to read, default #1.
in	<i>tunit</i>	Temperature units to convert raw data to, default °C.

Returns

Temperature.

Examples

[MelexisTest.ino](#).

Definition at line 90 of file [MLX90614.cpp](#).

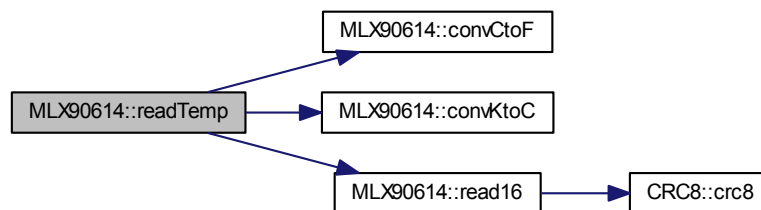
```

00090                                     {
00091     double temp;
00092
00093     _rwError = 0;
00094     switch (tsrc) {
00095         case MLX90614_SRC01 : temp = read16(MLX90614_TOBJ1); break;
00096         case MLX90614_SRC02 : temp = read16(MLX90614_TOBJ2); break;
00097         default : temp = read16(MLX90614_TA);
00098     }
00099     temp *= 0.02;
00100     switch (tunit) {
00101         case MLX90614_TC : return convKtoC(temp);
00102         case MLX90614_TF : return convCtoF(convKtoC(temp)); // fix 13feb2020
00103     }
00104     return temp;
00105 }

```

References [_rwError](#), [convCtoF\(\)](#), [convKtoC\(\)](#), [MLX90614_SRC01](#), [MLX90614_SRC02](#), [MLX90614_TA](#), [MLX90614_TC](#), [MLX90614_TF](#), [MLX90614_TOBJ1](#), [MLX90614_TOBJ2](#), and [read16\(\)](#).

Here is the call graph for this function:



5.2.4.16 setAddr() void MLX90614::setAddr (
 uint8_t addr) [private]

Set device SMBus address.

SMB bus address setter

Remarks

- Must be only device on the bus.
- Must power cycle the device after changing address.

Parameters

in	<i>addr</i>	New device address. Range 1...127
----	-------------	-----------------------------------

Definition at line 232 of file [MLX90614.cpp](#).

```

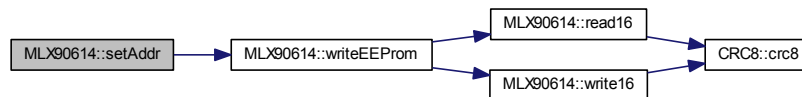
00232     {
00233
00234         _rwError = 0;
00235
00236         // It is assumed we do not know the existing slave address so the broadcast address is used.
00237         // First ensure the new address is in the legal range (1..127)
00238         if(addr &= 0x7F) {
00239             _addr = MLX90614_BROADCASTADDR;
00240             writeEEProm(MLX90614_ADDR, addr);
00241
00242             // There will always be a r/w error using the broadcast address so we cannot respond
00243             // to r/w errors. We must just assume this worked.
00244             _addr = addr;
00245
00246         } else _rwError |= MLX90614_INVALIDDATA;
00247     }

```

References [_addr](#), [_rwError](#), [MLX90614_ADDR](#), [MLX90614_BROADCASTADDR](#), [MLX90614_INVALIDDATA](#), and [writeEEProm\(\)](#).

Referenced by [MLX90614\(\)](#).

Here is the call graph for this function:



Here is the caller graph for this function:



5.2.4.17 setEmissivity() void MLX90614::setEmissivity (float *emiss* = 1.0)

Set the emissivity (ε) of the object.

Emissivity setter

Remarks

The emissivity is stored as a 16 bit integer defined by the following:

$\varepsilon = \text{dec2hex}[\text{round}(65535 \times \text{emiss})]$

Parameters

in	<i>emiss</i>	Physical emissivity value in range 0.1 ...1.0, default 1.0
----	--------------	--

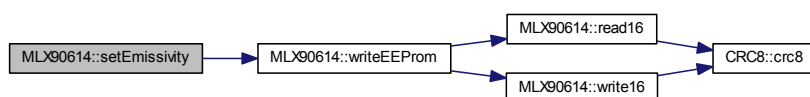
Definition at line 113 of file [MLX90614.cpp](#).

```

00113                                     {
00114
00115     _rwError = 0;
00116     uint16_t e = emiss * 65535. + 0.5;
00117     if((emiss > 1.0) || (e < 6553)) _rwError |= MLX90614_INVALIDDATA;
00118     else writeEEProm(MLX90614_EMISS, e);
00119 }
```

References [_rwError](#), [MLX90614_EMISS](#), [MLX90614_INVALIDDATA](#), and [writeEEProm\(\)](#).

Here is the call graph for this function:



5.2.4.18 setFIRcoeff() void MLX90614::setFIRcoeff (
uint8_t csb = 7)

Set the coefficients of the FIR digital filter.

FIR coefficient setter

Remarks

The FIR digital filter coefficient N is bits 10:8 of ConfigRegister1
The value of N is set as follows: $N = 2^{(csb + 3)}$
The manufacturer does not recommend $N < 128$

Parameters

in	<i>csb</i>	See page 12 of datasheet. Range 0...7, default = 7 (N = 1024)
----	------------	---

Definition at line 190 of file [MLX90614.cpp](#).

```

00190                                     {
00191
00192     _rwError = 0;
00193
00194     // Ensure legal range by clearing all but the LS 3 bits.
00195     csb &= 7;
00196
00197     // Get the current value of ConfigRegister1
00198     uint16_t reg = readEEProm(MLX90614_CONFIG);
00199
00200     // Clear bits 10:8, mask in the new value, then write it back.
00201     if(!_rwError) {
00202         reg &= 0xf8ff;
```



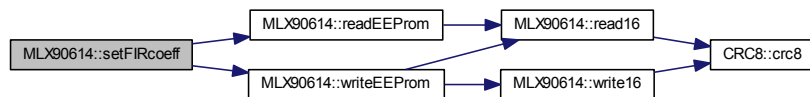
```

00203         reg |= (uint16_t)csb << 8;
00204         writeEEProm(MLX90614_CONFIG, reg);
00205     }
00206 }

```

References [_rwError](#), [MLX90614_CONFIG](#), [readEEProm\(\)](#), and [writeEEProm\(\)](#).

Here is the call graph for this function:



5.2.4.19 setIIRcoeff() void MLX90614::setIIRcoeff (uint8_t csb = 4)

Set the coefficients of the IIR digital filter.

IIR coefficient setter

Remarks

The IIR digital filter coefficients are set by the LS 3 bits of ConfigRegister1
The value of the coefficients is set as follows:

csb = 0	a1 = 0.5	a2 = 0.5
1	0.25	0.75
2	0.167	0.833
3	0.125	0.875
4	1	0 (IIR bypassed)
5	0.8	0.2
6	0.67	0.33
7	0.57	0.43

Parameters

in	csb	See page 12 of datasheet. Range 0...7, default = 4 (IIR bypassed)
----	-----	---

Definition at line 149 of file [MLX90614.cpp](#).

```

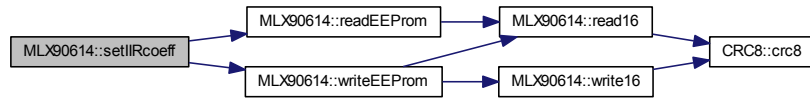
00149     {
00150
00151         _rwError = 0;
00152
00153         // Ensure legal range by clearing all but the LS 3 bits.
00154         csb &= 7;
00155
00156         // Get the current value of ConfigRegister1
00157         uint16_t reg = readEEProm(MLX90614_CONFIG);
00158
00159         // Clear bits 2:0, mask in the new value, then write it back.
00160         if(!_rwError) {
00161             reg &= 0xff8;
00162             reg |= (uint16_t)csb;
00163             writeEEProm(MLX90614_CONFIG, reg);

```

```
00164     }
00165 }
```

References [_rwError](#), [MLX90614_CONFIG](#), [readEEProm\(\)](#), and [writeEEProm\(\)](#).

Here is the call graph for this function:



5.2.4.20 write16() void MLX90614::write16 (
 uint8_t cmd,
 uint16_t data) [private]

Write a 16 bit value to memory.

Parameters

in	<i>cmd</i>	Command to send (register to write to).
in	<i>data</i>	Value to write.

Definition at line 320 of file [MLX90614.cpp](#).

```

00320                                     {
00321     CRC8 crc(MLX90614_CRC8POLY);
00322
00323     // Build the CRC-8 of all bytes to be sent.
00324     crc.crc8(_addr << 1);
00325     crc.crc8(cmd);
00326     crc.crc8(lowByte(data));
00327     _crc8 = crc.crc8(highByte(data));
00328
00329     // Send the slave address then the command.
00330     Wire.beginTransmission(_addr);
00331     Wire.write(cmd);
00332
00333     // Write the data low byte first.
00334     Wire.write(lowByte(data));
00335     Wire.write(highByte(data));
00336
00337     // Then write the crc and set the r/w error status bits.
00338     Wire.write(_pec = _crc8);
00339     _rwError |= (1 << Wire.endTransmission(true)) >> 1;
00340
00341     // Clear r/w errors if using broadcast address.
00342     if(_addr == MLX90614_BROADCASTADDR) _rwError &= MLX90614_NORWERROR;
00343 }
```

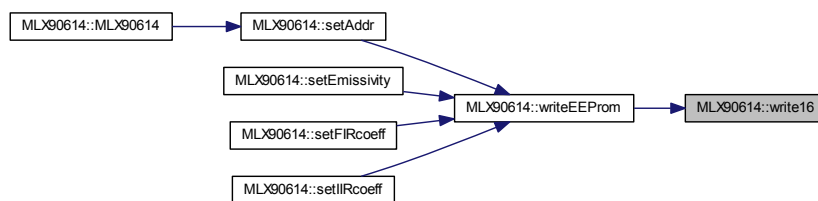
References [_addr](#), [_crc8](#), [_pec](#), [_rwError](#), [CRC8::crc8\(\)](#), [MLX90614_BROADCASTADDR](#), [MLX90614_CRC8POLY](#), and [MLX90614_NORWERROR](#).

Referenced by [writeEEProm\(\)](#).

Here is the call graph for this function:



Here is the caller graph for this function:



5.2.4.21 writeEEProm() void MLX90614::writeEEProm (
 uint8_t reg,
 uint16_t data)

Write a 16 bit value to EEPROM after first clearing the memory.

Remarks

- Erase and write time 5ms per manufacturer specification
- Manufacturer does not specify max or min erase/write times

Parameters

in	<i>reg</i>	Address to write to.
in	<i>data</i>	Value to write.

Examples

[MelexisTest.ino](#).

Definition at line 360 of file [MLX90614.cpp](#).

```

00360                                     {
00361     uint16_t val;
00362     reg |= 0x20;
  
```

```

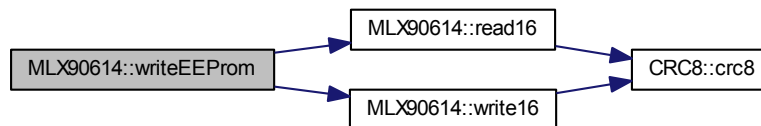
00363
00364 // Read current value, compare to the new value, and do nothing on a match or if there are
00365 // read errors set the error status flag only.
00366 val = read16(reg);
00367 if((val != data) && !_rwError) {
00368
00369     // On any R/W errors it is assumed the memory is corrupted.
00370     // Clear the memory and wait Teras (per manufacturer's documentation).
00371     write16(reg, 0);
00372     delay(5);
00373     if(_rwError) _rwError |= MLX90614_EECORRUPT;
00374
00375     // Write the data and wait Twrite (per manufacturer's documentation)
00376     // and set the r/w error status bits.
00377     write16(reg, data);
00378     delay(5);
00379     if(_rwError) _rwError |= MLX90614_EECORRUPT;
00380 }
00381 }

```

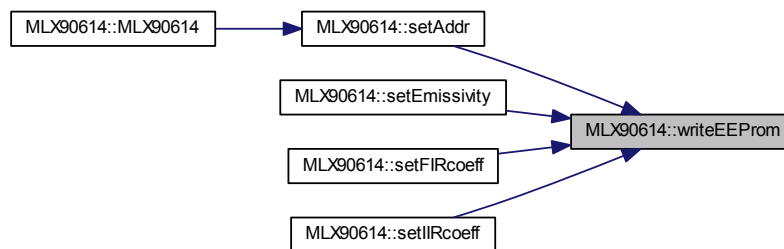
References [_rwError](#), [MLX90614_EECORRUPT](#), [read16\(\)](#), and [write16\(\)](#).

Referenced by [setAddr\(\)](#), [setEmissivity\(\)](#), [setFIRcoeff\(\)](#), and [setIIRcoeff\(\)](#).

Here is the call graph for this function:



Here is the caller graph for this function:



5.2.5 Member Data Documentation

5.2.5.1 `_addr` `uint8_t MLX90614::_addr` [private]

Slave address

Definition at line 145 of file [MLX90614.h](#).

Referenced by [getAddr\(\)](#), [MLX90614\(\)](#), [read16\(\)](#), [setAddr\(\)](#), and [write16\(\)](#).

5.2.5.2 `_crc8` `uint8_t MLX90614::_crc8` [private]

8 bit CRC

Definition at line 147 of file [MLX90614.h](#).

Referenced by [begin\(\)](#), [read16\(\)](#), and [write16\(\)](#).

5.2.5.3 `_pec` `uint8_t MLX90614::_pec` [private]

PEC

Definition at line 148 of file [MLX90614.h](#).

Referenced by [begin\(\)](#), [read16\(\)](#), and [write16\(\)](#).

5.2.5.4 `_ready` `boolean MLX90614::_ready` [private]

Definition at line 144 of file [MLX90614.h](#).

Referenced by [begin\(\)](#), and [MLX90614\(\)](#).

5.2.5.5 `_rwError` `uint8_t MLX90614::_rwError` [private]

R/W error flags

Definition at line 146 of file [MLX90614.h](#).

Referenced by [begin\(\)](#), [getAddr\(\)](#), [getEmissivity\(\)](#), [getFIRcoeff\(\)](#), [getIIRcoeff\(\)](#), [read16\(\)](#), [readTemp\(\)](#), [setAddr\(\)](#), [setEmissivity\(\)](#), [setFIRcoeff\(\)](#), [setIIRcoeff\(\)](#), [write16\(\)](#), and [writeEEProm\(\)](#).

5.2.5.6 `busAddr` `Property<uint8_t, MLX90614> MLX90614::busAddr`

SMBus address property

Definition at line 123 of file [MLX90614.h](#).

Referenced by [MLX90614\(\)](#).

5.2.5.7 **crc8** `Property<uint8_t, MLX90614> MLX90614::crc8`

8 bit CRC property

Examples

[MelexisTest.ino](#).

Definition at line 125 of file [MLX90614.h](#).

Referenced by [MLX90614\(\)](#).

5.2.5.8 **pec** `Property<uint8_t, MLX90614> MLX90614::pec`

PEC property

Examples

[MelexisTest.ino](#).

Definition at line 126 of file [MLX90614.h](#).

Referenced by [MLX90614\(\)](#).

5.2.5.9 **rwError** `Property<uint8_t, MLX90614> MLX90614::rwError`

R/W error flags property

Examples

[MelexisTest.ino](#).

Definition at line 124 of file [MLX90614.h](#).

Referenced by [MLX90614\(\)](#).

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

- [MLX90614.h](#)
- [MLX90614.cpp](#)

5.3 **Property< Type, ClassHolder > Class Template Reference**

```
#include <Property.h>
```

Public Member Functions

- [Property](#) ()
- [Property](#) (ClassHolder *ClassA, Type(ClassHolder::*GetA)(), void(ClassHolder::*SetA)(Type Val))
- void [Set_Property_Control](#) (ClassHolder *ClassA, Type(ClassHolder::*GetA)(), void(ClassHolder::*SetA)(Type Val))
- void [Set_Get](#) (Type(ClassHolder::*GetA)())
- void [Set_Set](#) (void(ClassHolder::*SetA)(Type Val))
- void [Set_Class](#) (ClassHolder *Holder)
- Type [operator=](#) (const Type &In)
- Type [operator=](#) ([Property](#) &In)
- [operator Type](#) ()

Private Attributes

- Type(ClassHolder::* [Get](#))()
- void(ClassHolder::* [Set](#))(Type Val)
- ClassHolder * [Class](#)

5.3.1 Detailed Description

```
template<typename Type, typename ClassHolder>
class Property< Type, ClassHolder >
```

Definition at line 8 of file [Property.h](#).

5.3.2 Constructor & Destructor Documentation

5.3.2.1 Property() [1/2] `template<typename Type, typename ClassHolder>`
[Property](#)< Type, ClassHolder >::[Property](#) () [inline]

Definition at line 15 of file [Property.h](#).

```
00015 : Get(NULL), Set(NULL), Class(NULL) {}
```

5.3.2.2 Property() [2/2] `template<typename Type, typename ClassHolder>`
[Property](#)< Type, ClassHolder >::[Property](#) (
 ClassHolder * [ClassA](#),
 Type(ClassHolder::*)() [GetA](#),
 void(ClassHolder::*)(Type Val) [SetA](#)) [inline]

Definition at line 16 of file [Property.h](#).

```
00016 : Class(ClassA), Get(GetA), Set(SetA) {}
```

5.3.3 Member Function Documentation

5.3.3.1 operator Type() `template<typename Type, typename ClassHolder>`
`Property< Type, ClassHolder >::operator Type () [inline]`

Definition at line 49 of file [Property.h](#).

```
00049      {
00050          return Get ? (Class->*Get)() : 0;
00051      }
```

5.3.3.2 operator=() [1/2] `template<typename Type, typename ClassHolder>`
`Type Property< Type, ClassHolder >::operator= (`
 `const Type & In) [inline]`

Definition at line 37 of file [Property.h](#).

```
00037      {
00038          if ( Set ) (Class->*Set)(In);
00039          return In;
00040      }
```

5.3.3.3 operator=() [2/2] `template<typename Type, typename ClassHolder>`
`Type Property< Type, ClassHolder >::operator= (`
 `Property< Type, ClassHolder > & In) [inline]`

Definition at line 43 of file [Property.h](#).

```
00043      {
00044          if ( Set ) (Class->*Set)(In);
00045          return In;
00046      }
```

5.3.3.4 Set_Class() `template<typename Type, typename ClassHolder>`
`void Property< Type, ClassHolder >::Set_Class (`
 `ClassHolder * Holder) [inline]`

Definition at line 32 of file [Property.h](#).

```
00032      {
00033          Class = Holder;
00034      }
```

Referenced by [MLX90614::MLX90614\(\)](#).

Here is the caller graph for this function:



5.3.3.5 Set_Get() `template<typename Type, typename ClassHolder>`
`void Property< Type, ClassHolder >::Set_Get (`
`Type(ClassHolder::*) () GetA) [inline]`

Definition at line 24 of file [Property.h](#).

```
00024      {
00025          Get = GetA;
00026      }
```

Referenced by [MLX90614::MLX90614\(\)](#).

Here is the caller graph for this function:



5.3.3.6 Set_Property_Control() `template<typename Type, typename ClassHolder>`
`void Property< Type, ClassHolder >::Set_Property_Control (`
`ClassHolder * ClassA,`
`Type(ClassHolder::*) () GetA,`
`void(ClassHolder::*) (Type Val) SetA) [inline]`

Definition at line 18 of file [Property.h](#).

```
00018      {
00019          Class = ClassA;
00020          Get = GetA;
00021          Set = SetA;
00022      }
```

5.3.3.7 Set_Set() `template<typename Type, typename ClassHolder>`
`void Property< Type, ClassHolder >::Set_Set (`
`void(ClassHolder::*) (Type Val) SetA) [inline]`

Definition at line 28 of file [Property.h](#).

```
00028      {
00029          Set = SetA;
00030      }
```

Referenced by [MLX90614::MLX90614\(\)](#).

Here is the caller graph for this function:



5.3.4 Member Data Documentation

5.3.4.1 Class `template<typename Type, typename ClassHolder>`
`ClassHolder* Property< Type, ClassHolder >::Class [private]`

Definition at line 12 of file [Property.h](#).

Referenced by [Property< uint8_t, MLX90614 >::operator uint8_t\(\)](#), [Property< uint8_t, MLX90614 >::operator=\(\)](#), [Property< uint8_t, MLX90614 >::Set_Class\(\)](#), and [Property< uint8_t, MLX90614 >::Set_Property_Control\(\)](#).

5.3.4.2 Get `template<typename Type, typename ClassHolder>`
`Type(ClassHolder::* Property< Type, ClassHolder >::Get) () [private]`

Definition at line 10 of file [Property.h](#).

Referenced by [Property< uint8_t, MLX90614 >::operator uint8_t\(\)](#), [Property< uint8_t, MLX90614 >::Set_Get\(\)](#), and [Property< uint8_t, MLX90614 >::Set_Property_Control\(\)](#).

5.3.4.3 Set `template<typename Type, typename ClassHolder>`
`void(ClassHolder::* Property< Type, ClassHolder >::Set) (Type Val) [private]`

Definition at line 11 of file [Property.h](#).

Referenced by [Property< uint8_t, MLX90614 >::operator=\(\)](#), [Property< uint8_t, MLX90614 >::Set_Property_Control\(\)](#), and [Property< uint8_t, MLX90614 >::Set_Set\(\)](#).

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

- [Property.h](#)

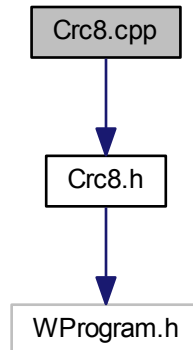
6 File Documentation

6.1 Crc8.cpp File Reference

8 bit CRC helper/utility class - CPP Source file.

```
#include "Crc8.h"
```

Include dependency graph for Crc8.cpp:



6.1.1 Detailed Description

8 bit CRC helper/utility class - CPP Source file.

Author

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

Version

1.0

Date

2014-2017

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Definition in file [Crc8.cpp](#).

6.2 Crc8.cpp

```

00001 /*****
00002  * \brief      8 bit CRC helper/utility class - CPP Source file.
00003  * \file       CRC8.CPP
00004  * \author     J. F. Fitter <jfitter@eagleairaustr.com.au>
00005  * \version    1.0
00006  * \date       2014-2017
00007  * \copyright  Copyright &copy; 2017 John Fitter. All right reserved.
00008  *
00009  * \par        License
00010  *            This program is free software; you can redistribute it and/or modify it under
00011  *            the terms of the GNU Lesser General Public License as published by the Free
00012  *            Software Foundation; either version 2.1 of the License, or (at your option)
00013  *            any later version.
00014  * \par
00015  *            This Program is distributed in the hope that it will be useful, but WITHOUT ANY
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00017  *            PARTICULAR PURPOSE. See the GNU Lesser General Public License for more details
00018  *            at http://www.gnu.org/copyleft/gpl.html
00019  * \par
00020  *            You should have received a copy of the GNU Lesser General Public License along
00021  *            with this library; if not, write to the Free Software Foundation, Inc.,
00022  *            51 Franklin St, Fifth Floor, Boston, MA 02110-1301 USA
00023  */
00024 /*****
00025
00026 #include "Crc8.h"
00027
00028 /*****
00029  * CRC8 helper class functions.
00030  */
00031
00032 /**
00033  * \brief      CRC8 class constructor.
00034  * \param [in] poly 8 bit CRC polynomial to use.
00035  */
00036 CRC8::CRC8(uint8_t poly) {crc8Start(poly);}
00037
00038 /**
00039  * \brief      Return the current value of the CRC.
00040  * \return     8 bit CRC current value.
00041  */
00042 uint8_t CRC8::crc8(void) {return _crc;}
00043
00044 /**
00045  * \brief      Update the current value of the CRC.
00046  * \param [in] data New 8 bit data to be added to the CRC.
00047  * \return     8 bit CRC current value.
00048  */
00049 uint8_t CRC8::crc8(uint8_t data) {
00050     uint8_t i = 8;
00051
00052     _crc ^= data;
00053     while(i--) _crc = _crc & 0x80 ? (_crc << 1) ^ _poly : _crc << 1;
00054     return _crc;
00055 }
00056
00057 /**
00058  * \brief      Initialize the CRC8 object.
00059  * \param [in] poly 8 bit CRC polynomial to use.
00060  */
00061 void CRC8::crc8Start(uint8_t poly) {
00062     _poly = poly;
00063     _crc = 0;
00064 }
00065

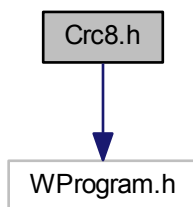
```

6.3 Crc8.h File Reference

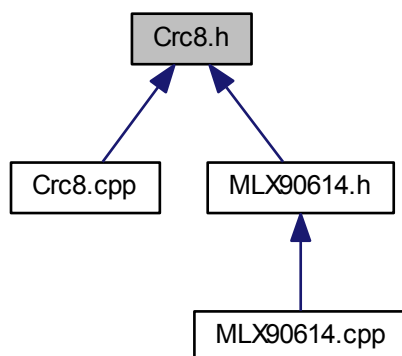
8 bit CRC helper/utility class - CPP Header file.

```
#include "WProgram.h"
```

Include dependency graph for Crc8.h:



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



Classes

- class [CRC8](#)

Macros

- #define [CRC8_DEFAULTPOLY](#) 7

6.3.1 Detailed Description

8 bit CRC helper/utility class - CPP Header file.

Author

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

Version

1.0

Date

2014-2017

Copyright

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Definition in file [Crc8.h](#).

6.3.2 Macro Definition Documentation

6.3.2.1 CRC8_DEFAULTPOLY `#define CRC8_DEFAULTPOLY 7`

Default CRC polynomial = X^8+X^2+X+1

Definition at line 35 of file [Crc8.h](#).

6.4 Crc8.h

```

00001 #ifndef _CRC8_H_
00002 #define _CRC8_H_
00003
00004 /*****
00005  * \brief      8 bit CRC helper/utility class - CPP Header file.
00006  * \file       CRC8.H
00007  * \author     J. F. Fitter <jfitter@eagleairaut.com.au>
00008  * \version    1.0
00009  * \date       2014-2017
00010  * \copyright  Copyright &copy; 2017 John Fitter. All right reserved.
00011  *
00012  * \par        License
00013  *             This program is free software; you can redistribute it and/or modify it under
00014  *             the terms of the GNU Lesser General Public License as published by the Free
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00017  * \par
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00020  *             PARTICULAR PURPOSE. See the GNU Lesser General Public License for more details
00021  *             at http://www.gnu.org/copyleft/gpl.html
00022  * \par
00023  *             You should have received a copy of the GNU Lesser General Public License along
00024  *             with this library; if not, write to the Free Software Foundation, Inc.,
00025  *             51 Franklin St, Fifth Floor, Boston, MA 02110-1301 USA
00026  *
00027  */
00028
00029 #if (ARDUINO >= 100)
00030     #include "Arduino.h"
00031 #else
00032     #include "WProgram.h"
00033 #endif
00034
00035 #define CRC8_DEFAULTPOLY 7 /**< Default CRC polynomial = X8+X2+X1+1 */
00036
00037 class CRC8 {
00038 public:
00039     CRC8(uint8_t polynomial = CRC8_DEFAULTPOLY);
00040     uint8_t crc8(void);
00041     uint8_t crc8(uint8_t data);
00042     void crc8Start(uint8_t poly);
00043 private:
00044     uint8_t _crc;
00045     uint8_t _poly;
00046 };
00047
00048 #endif /* _CRC8_H_ */

```

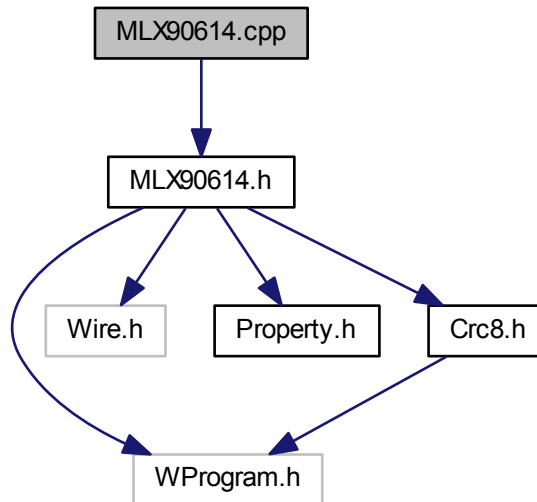
6.5 LICENSE.md File Reference

6.6 MLX90614.cpp File Reference

Melexis [MLX90614](#) Family Device Driver Library - CPP Source file.

```
#include "MLX90614.h"
```

Include dependency graph for MLX90614.cpp:



6.6.1 Detailed Description

Melexis [MLX90614](#) Family Device Driver Library - CPP Source file.

Details

Based on the Melexis [MLX90614](#) 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 DEVELOPMENT AND IS STILL MISSING SOME IMPORTANT FEATURES. PLEASE KEEP THIS IN MIND IF YOU DECIDE TO USE THIS PARTICULAR CODE FOR ANYTHING.

Author

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Version

1.0

Date

2014-2017

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Definition in file [MLX90614.cpp](#).

6.7 MLX90614.cpp

```

00001 /*****
00002  *  \brief      Melexis MLX90614 Family Device Driver Library - CPP Source file
00003  *  \par
00004  *  \par      Details
00005  *  Based on the Melexis MLX90614 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      MLX90614.CPP
00014  *  \author    J. F. Fitter <jfitter@eagleairaustr.com.au>
00015  *  \version   1.0
00016  *  \date      2014-2017
00017  *  \copyright Copyright &copy; 2017 John Fitter. All right reserved.
00018  *
00019  *  \par      License
00020  *  This program is free software; you can redistribute it and/or modify it under
00021  *  the terms of the GNU Lesser General Public License as published by the Free
00022  *  Software Foundation; either version 2.1 of the License, or (at your option)
00023  *  any later version.
00024  *  \par
00025  *  This Program is distributed in the hope that it will be useful, but WITHOUT ANY
00026  *  WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A
00027  *  PARTICULAR PURPOSE. See the GNU Lesser General Public License for more details
00028  *  at http://www.gnu.org/copyleft/gpl.html
00029  *  \par
00030  *  You should have received a copy of the GNU Lesser General Public License along
00031  *  with this library; if not, write to the Free Software Foundation, Inc.,
00032  *  51 Franklin St, Fifth Floor, Boston, MA 02110-1301 USA
00033  *

```

```

00034  *//*****
00035
00036 #include "MLX90614.h"
00037
00038 *//*****
00039 /* MLX90614 Device class functions. */
00040 *//*****
00041 /**
00042  * \example{lineno} MelexisTest.ino
00043  * An example of how to use the MLX90614 class.
00044  */
00045
00046 /**
00047  * \brief MLX90614 Device class constructor.
00048  * \param [in] i2caddr Device address (default: published value).
00049  */
00050 MLX90614::MLX90614(uint8_t i2caddr) {
00051
00052     busAddr.Set_Class(this);
00053     busAddr.Set_Get(&MLX90614::getAddr);
00054     busAddr.Set_Set(&MLX90614::setAddr);
00055
00056     rwError.Set_Class(this);
00057     rwError.Set_Get(&MLX90614::getRwError);
00058
00059     pec.Set_Class(this);
00060     pec.Set_Get(&MLX90614::getPEC);
00061
00062     crc8.Set_Class(this);
00063     crc8.Set_Get(&MLX90614::getCRC8);
00064
00065     _addr = i2caddr;
00066     _ready = false;
00067 }
00068
00069 /**
00070  * \brief Initialize the device and the i2c interface.
00071  */
00072 boolean MLX90614::begin(void) {
00073
00074     _rwError = _pec = _crc8 = 0;
00075     return _ready = true;
00076 }
00077
00078 /**
00079  * \brief Return a temperature from the specified source in specified units.
00080  * \remarks
00081  * \li Temperature is stored in ram as a 16 bit absolute value to a
00082  * resolution of 0.02&deg;K
00083  * \li Linearized sensor die temperature is available as Ta (ambient).
00084  * \li One or two object temperatures are linearized to the
00085  * range -38.2&deg;C...125&deg;C
00086  * \param [in] tsrc Internal temperature source to read, default #1.
00087  * \param [in] tunit Temperature units to convert raw data to, default &deg;C.
00088  * \return Temperature.
00089  */
00090 double MLX90614::readTemp(tempSrc_t tsrc, tempUnit_t tunit) {
00091     double temp;
00092
00093     _rwError = 0;
00094     switch(tsrc) {
00095         case MLX90614_SRC01 : temp = read16(MLX90614_TOBJ1); break;
00096         case MLX90614_SRC02 : temp = read16(MLX90614_TOBJ2); break;
00097         default : temp = read16(MLX90614_TA);
00098     }
00099     temp *= 0.02;
00100     switch(tunit) {
00101         case MLX90614_TC : return convKtoC(temp);
00102         case MLX90614_TF : return convCtoF(convKtoC(temp)); // fix 13feb2020
00103     }
00104     return temp;
00105 }
00106
00107 /**
00108  * \brief Set the emissivity (&epsilon;) of the object.
00109  * \remarks The emissivity is stored as a 16 bit integer defined by the following:
00110  * \n <tt>&epsilon; = dec2hex[round(65535 x emiss)]</tt>
00111  * \param [in] emiss Physical emissivity value in range 0.1 ...1.0, default 1.0
00112  */
00113 void MLX90614::setEmissivity(float emiss) {
00114
00115     _rwError = 0;
00116     uint16_t e = emiss * 65535. + 0.5;
00117     if((emiss > 1.0) || (e < 6553)) _rwError |= MLX90614_INVALIDDATA;
00118     else writeEEProm(MLX90614_EMISS, e);
00119 }
00120 /**

```

```

00121 * \brief          Get the emissivity (&epsilon;) of the object.
00122 * \remarks        The emissivity is stored as a 16 bit integer defined by the following:
00123 * \n              <tt>&epsilon; = dec2hex[round(65535 x emiss)]</tt>
00124 * \return         Physical emissivity value in range 0.1 ...1.0
00125 */
00126 float MLX90614::getEmissivity(void) {
00127
00128     _rwError = 0;
00129     uint16_t emiss = readEeprom(MLX90614_EMISS);    // fix 13feb2020
00130     if(_rwError) return (float)1.0;
00131     return (float)emiss / 65535.0;
00132 }
00133
00134 /**
00135 * \brief          Set the coefficients of the IIR digital filter.
00136 * \remarks        The IIR digital filter coefficients are set by the LS 3 bits of ConfigRegister1
00137 * \n              The value of the coefficients is set as follows:
00138 * \n <tt> \verbatim
00139 csb = 0    a1 = 0.5    a2 = 0.5
00140          1    0.25     0.75
00141          2    0.167    0.833
00142          3    0.125    0.875
00143          4    1        0 (IIR bypassed)
00144          5    0.8      0.2
00145          6    0.67     0.33
00146          7    0.57     0.43 \endverbatim </tt>
00147 * \param [in] csb See page 12 of datasheet. Range 0...7, default = 4 (IIR bypassed)
00148 */
00149 void MLX90614::setIIRcoeff(uint8_t csb) {
00150
00151     _rwError = 0;
00152
00153     // Ensure legal range by clearing all but the LS 3 bits.
00154     csb &= 7;
00155
00156     // Get the current value of ConfigRegister1
00157     uint16_t reg = readEeprom(MLX90614_CONFIG);
00158
00159     // Clear bits 2:0, mask in the new value, then write it back.
00160     if(!_rwError) {
00161         reg &= 0xfff8;
00162         reg |= (uint16_t)csb;
00163         writeEeprom(MLX90614_CONFIG, reg);
00164     }
00165 }
00166
00167 /**
00168 * \brief          Get the coefficients of the IIR digital filter.
00169 * \remarks        The IIR digital filter coefficients are set by the LS 3 bits of ConfigRegister1
00170 * \return         Filter coefficient table index. Range 0...7
00171 */
00172 uint8_t MLX90614::getIIRcoeff(void) {
00173
00174     _rwError = 0;
00175
00176     // Get the current value of ConfigRegister1 bits 2:0
00177     uint8_t iir = readEeprom(MLX90614_CONFIG) & 7;
00178
00179     if(_rwError) return 4;
00180     return iir;
00181 }
00182
00183 /**
00184 * \brief          Set the coefficients of the FIR digital filter.
00185 * \remarks        The FIR digital filter coefficient N is bits 10:8 of ConfigRegister1
00186 * \n              The value of N is set as follows:  &nbsp;<tt> N = 2 ^ (csb + 3)</tt>
00187 * \n              The manufacturer does not recommend &nbsp;<tt>N < 128</tt>
00188 * \param [in] csb See page 12 of datasheet. Range 0...7, default = 7 (N = 1024)
00189 */
00190 void MLX90614::setFIRcoeff(uint8_t csb) {
00191
00192     _rwError = 0;
00193
00194     // Ensure legal range by clearing all but the LS 3 bits.
00195     csb &= 7;
00196
00197     // Get the current value of ConfigRegister1
00198     uint16_t reg = readEeprom(MLX90614_CONFIG);
00199
00200     // Clear bits 10:8, mask in the new value, then write it back.
00201     if(!_rwError) {
00202         reg &= 0xf8ff;
00203         reg |= (uint16_t)csb << 8;
00204         writeEeprom(MLX90614_CONFIG, reg);
00205     }
00206 }
00207

```

```

00208 /**
00209  * \brief          Get the coefficients of the FIR digital filter.
00210  * \remarks        The FIR digital filter coefficient N is bits 10:8 of ConfigRegister1
00211  * \n              The value of N is set as follows: <tt>N = 2 ^ (csb + 3)</tt>
00212  * \n              The manufacturer does not recommend <tt>N < 128</tt>
00213  */
00214 uint8_t MLX90614::getFIRcoeff(void) {
00215
00216     _rwError = 0;
00217
00218     // Get the current value of ConfigRegister1 bits 10:8
00219     uint8_t fir = (readEEProm(MLX90614_CONFIG) >> 8) & 7;
00220
00221     if(_rwError) return 7;
00222     return fir;
00223 }
00224
00225 /**
00226  * \brief          Set device SMBus address.
00227  * \remarks        Must be only device on the bus.
00228  * \li             Must power cycle the device after changing address.
00229  * \li             New device address. Range 1...127
00230  * \param [in] addr
00231  */
00232 void MLX90614::setAddr(uint8_t addr) {
00233
00234     _rwError = 0;
00235
00236     // It is assumed we do not know the existing slave address so the broadcast address is used.
00237     // First ensure the new address is in the legal range (1..127)
00238     if(addr &= 0x7f) {
00239         _addr = MLX90614_BROADCASTADDR;
00240         writeEEProm(MLX90614_ADDR, addr);
00241
00242         // There will always be a r/w error using the broadcast address so we cannot respond
00243         // to r/w errors. We must just assume this worked.
00244         _addr = addr;
00245
00246     } else _rwError |= MLX90614_INVALIDDATA;
00247 }
00248
00249 /**
00250  * \brief          Return the device SMBus address.
00251  * \remarks        Must be only device on the bus.
00252  * \li             Sets the library to use the new found address.
00253  * \li             Device address.
00254  * \return         Device address.
00255  */
00256 uint8_t MLX90614::getAddr(void) {
00257     uint8_t tempAddr = _addr;
00258
00259     _rwError = 0;
00260
00261     // It is assumed we do not know the existing slave address so the broadcast address is used.
00262     // This will throw a r/w error so errors will be ignored.
00263     _addr = MLX90614_BROADCASTADDR;
00264
00265     // Reload program copy with the existing slave address.
00266     _addr = lowByte(readEEProm(MLX90614_ADDR));
00267
00268     return _addr;
00269 }
00270
00271 /**
00272  * \brief          Return a 16 bit value read from RAM or EEPROM.
00273  * \param [in] cmd  Command to send (register to read from).
00274  * \return         Value read from memory.
00275  */
00276 uint16_t MLX90614::read16(uint8_t cmd) {
00277     uint16_t val;
00278     CRC8 crc(MLX90614_CRC8POLY);
00279
00280     // Send the slave address then the command and set any error status bits returned by the write.
00281     Wire.beginTransmission(_addr);
00282     Wire.write(cmd);
00283     _rwError |= (1 << Wire.endTransmission(false)) >> 1;
00284
00285     // Experimentally determined delay to prevent read errors (manufacturer's data sheet has
00286     // left something out).
00287     delayMicroseconds(MLX90614_XDLY);
00288
00289     // Resend slave address then get the 3 returned bytes.
00290     Wire.requestFrom(_addr, (uint8_t)3);
00291
00292     // Data is returned as 2 bytes little endian.
00293     val = Wire.read();
00294     val |= Wire.read() << 8;

```

```

00295
00296 // Read the PEC (CRC-8 of all bytes).
00297 _pec = Wire.read();
00298
00299 // Clear r/w errors if using broadcast address.
00300 if(_addr == MLX90614_BROADCASTADDR) _rError &= MLX90614_NORWERROR;
00301
00302 // Build our own CRC-8 of all received bytes.
00303 crc.crc8(_addr << 1);
00304 crc.crc8(cmd);
00305 crc.crc8((_addr << 1) + 1);
00306 crc.crc8(lowByte(val));
00307 _crc8 = crc.crc8(highByte(val));
00308
00309 // Set error status bit if CRC mismatch.
00310 if(_crc8 != _pec) _rError |= MLX90614_RXCRC;
00311
00312 return val;
00313 }
00314
00315 /**
00316 * \brief Write a 16 bit value to memory.
00317 * \param [in] cmd Command to send (register to write to).
00318 * \param [in] data Value to write.
00319 */
00320 void MLX90614::write16(uint8_t cmd, uint16_t data) {
00321     CRC8 crc(MLX90614_CRC8POLY);
00322
00323     // Build the CRC-8 of all bytes to be sent.
00324     crc.crc8(_addr << 1);
00325     crc.crc8(cmd);
00326     crc.crc8(lowByte(data));
00327     _crc8 = crc.crc8(highByte(data));
00328
00329     // Send the slave address then the command.
00330     Wire.beginTransmission(_addr);
00331     Wire.write(cmd);
00332
00333     // Write the data low byte first.
00334     Wire.write(lowByte(data));
00335     Wire.write(highByte(data));
00336
00337     // Then write the crc and set the r/w error status bits.
00338     Wire.write(_pec = _crc8);
00339     _rError |= (1 << Wire.endTransmission(true)) > 1;
00340
00341     // Clear r/w errors if using broadcast address.
00342     if(_addr == MLX90614_BROADCASTADDR) _rError &= MLX90614_NORWERROR;
00343 }
00344
00345 /**
00346 * \brief Return a 16 bit value read from EEPROM.
00347 * \param [in] addr Register address to read from.
00348 * \return Value read from EEPROM.
00349 */
00350 uint16_t MLX90614::readEEProm(uint8_t addr) {return read16(addr | 0x20);}
00351
00352 /**
00353 * \brief Write a 16 bit value to EEPROM after first clearing the memory.
00354 * \remarks
00355 * \li Erase and write time 5ms per manufacturer specification
00356 * \li Manufacturer does not specify max or min erase/write times
00357 * \param [in] reg Address to write to.
00358 * \param [in] data Value to write.
00359 */
00360 void MLX90614::writeEEProm(uint8_t reg, uint16_t data) {
00361     uint16_t val;
00362     reg |= 0x20;
00363
00364     // Read current value, compare to the new value, and do nothing on a match or if there are
00365     // read errors set the error status flag only.
00366     val = read16(reg);
00367     if((val != data) && !_rError) {
00368
00369         // On any R/W errors it is assumed the memory is corrupted.
00370         // Clear the memory and wait Teras (per manufacturer's documentation).
00371         write16(reg, 0);
00372         delay(5);
00373         if(_rError) _rError |= MLX90614_EECORRUPT;
00374
00375         // Write the data and wait Twrite (per manufacturer's documentation)
00376         // and set the r/w error status bits.
00377         write16(reg, data);
00378         delay(5);
00379         if(_rError) _rError |= MLX90614_EECORRUPT;
00380     }
00381 }

```

```

00382
00383 /**
00384  * \brief          Convert temperature in &deg;K to &deg;C.
00385  * \param [in] degK Temperature in &deg;K.
00386  * \return         Temperature in &deg;C.
00387  */
00388 double MLX90614::convKtoC(double degK) {return degK - 273.15;}
00389
00390 /**
00391  * \brief          Convert temperature in &deg;C to &deg;F.
00392  * \param [in] degC Temperature in &deg;C.
00393  * \return         Temperature in &deg;F.
00394  */
00395 double MLX90614::convCtoF(double degC) {return (degC * 1.8) + 32.0;}
00396
00397 /**
00398  * \brief          Retrieve the chip ID bytes.
00399  * \return         Chip ID as a 64 bit word.
00400  */
00401 uint64_t MLX90614::readID(void) {
00402     uint64_t ID = 0;
00403
00404     // If we are lucky the compiler will optimise this.
00405     for(uint8_t i = 0; i < 4; i++) ID = (ID <= 16) | readEEProm(MLX90614_ID1 + i);
00406     return ID;
00407 }
00408

```

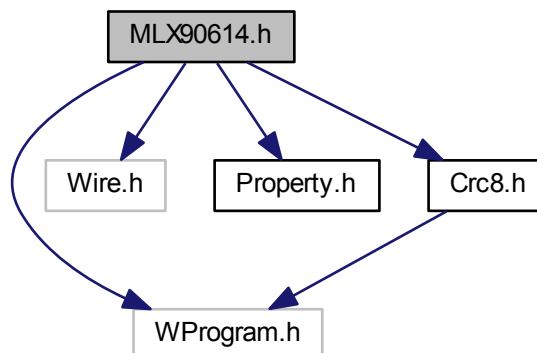
6.8 MLX90614.h File Reference

```

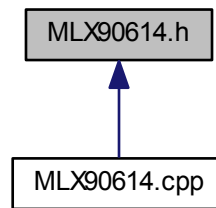
#include "WProgram.h"
#include <Wire.h>
#include "Property.h"
#include "Crc8.h"

```

Include dependency graph for MLX90614.h:



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



Classes

- class [MLX90614](#)

Macros

- #define [MLX90614_I2CDEFAULTADDR](#) 0x5A
- #define [MLX90614_BROADCASTADDR](#) 0
- #define [MLX90614_CRC8POLY](#) 7
- #define [MLX90614_XDLY](#) 25
- #define [MLX90614_RAWIR1](#) 0x04
- #define [MLX90614_RAWIR2](#) 0x05
- #define [MLX90614_TA](#) 0x06
- #define [MLX90614_TOBJ1](#) 0x07
- #define [MLX90614_TOBJ2](#) 0x08
- #define [MLX90614_TOMAX](#) 0x00
- #define [MLX90614_TOMIN](#) 0x01
- #define [MLX90614_PWMCTRL](#) 0x02
- #define [MLX90614_TARANGE](#) 0x03
- #define [MLX90614_EMISS](#) 0x04
- #define [MLX90614_CONFIG](#) 0x05
- #define [MLX90614_ADDR](#) 0x0E
- #define [MLX90614_ID1](#) 0x1C
- #define [MLX90614_ID2](#) 0x1D
- #define [MLX90614_ID3](#) 0x1E
- #define [MLX90614_ID4](#) 0x1F
- #define [MLX90614_RFLAGCMD](#) 0xF0
- #define [MLX90614_EEBUSY](#) 0x80
- #define [MLX90614_EE_DEAD](#) 0x20
- #define [MLX90614_INIT](#) 0x10
- #define [MLX90614_NORWERROR](#) 0
- #define [MLX90614_DATATOOLONG](#) 1
- #define [MLX90614_TXADDRNACK](#) 2
- #define [MLX90614_TXDATANACK](#) 4
- #define [MLX90614_TXOTHER](#) 8
- #define [MLX90614_RXCRC](#) 0x10
- #define [MLX90614_INVALIDDATA](#) 0x20
- #define [MLX90614_EECORRUPT](#) 0x40
- #define [MLX90614_RFLGERR](#) 0x80

6.8.1 Macro Definition Documentation

6.8.1.1 MLX90614_ADDR `#define MLX90614_ADDR 0x0E`

EEPROM reg - SMBus address

Examples

[MelexisTest.ino](#).

Definition at line 76 of file [MLX90614.h](#).

6.8.1.2 MLX90614_BROADCASTADDR `#define MLX90614_BROADCASTADDR 0`

Device broadcast slave address

Examples

[MelexisTest.ino](#).

Definition at line 53 of file [MLX90614.h](#).

6.8.1.3 MLX90614_CONFIG `#define MLX90614_CONFIG 0x05`

EEPROM reg - Configuration register

Definition at line 75 of file [MLX90614.h](#).

6.8.1.4 MLX90614_CRC8POLY `#define MLX90614_CRC8POLY 7`

CRC polynomial = $X^8+X^2+X^1+1$

Definition at line 54 of file [MLX90614.h](#).

6.8.1.5 MLX90614_DATATOOLONG `#define MLX90614_DATATOOLONG 1`

R/W error bitmask - Data is too long

Examples

[MelexisTest.ino](#).

Definition at line 91 of file [MLX90614.h](#).

6.8.1.6 MLX90614_EE_DEAD `#define MLX90614_EE_DEAD 0x20`

R/W flag bitmask - EEPROM double error has occurred

Definition at line 86 of file [MLX90614.h](#).

6.8.1.7 MLX90614_EEBUSY `#define MLX90614_EEBUSY 0x80`

Read flags - bitmask. R/W flag bitmask - EEPROM is busy (writing/erasing)

Definition at line 85 of file [MLX90614.h](#).

6.8.1.8 MLX90614_EECORRUPT `#define MLX90614_EECORRUPT 0x40`

R/W error bitmask - The EEPROM is likely to be corrupted

Examples

[MelexisTest.ino](#).

Definition at line 97 of file [MLX90614.h](#).

6.8.1.9 MLX90614_EMISS `#define MLX90614_EMISS 0x04`

EEPROM reg - Object emissivity register

Definition at line 74 of file [MLX90614.h](#).

6.8.1.10 MLX90614_I2CDEFAULTADDR `#define MLX90614_I2CDEFAULTADDR 0x5A`

Device default slave address

Definition at line 52 of file [MLX90614.h](#).

6.8.1.11 MLX90614_ID1 `#define MLX90614_ID1 0x1C`

EEPROM reg - ID numer (w1)

Definition at line 77 of file [MLX90614.h](#).

6.8.1.12 MLX90614_ID2 `#define MLX90614_ID2 0x1D`

EEPROM reg - ID numer (w2)

Definition at line 78 of file [MLX90614.h](#).

6.8.1.13 MLX90614_ID3 `#define MLX90614_ID3 0x1E`

EEPROM reg - ID numer (w3)

Definition at line 79 of file [MLX90614.h](#).

6.8.1.14 MLX90614_ID4 `#define MLX90614_ID4 0x1F`

EEPROM reg - ID numer (w4)

Definition at line 80 of file [MLX90614.h](#).

6.8.1.15 MLX90614_INIT `#define MLX90614_INIT 0x10`

R/W flag bitmask - POR initialization is still ongoing

Definition at line 87 of file [MLX90614.h](#).

6.8.1.16 MLX90614_INVALIDDATA `#define MLX90614_INVALIDDATA 0x20`

R/W error bitmask - RX/TX Data fails selection criteria

Examples

[MelexisTest.ino](#).

Definition at line 96 of file [MLX90614.h](#).

6.8.1.17 MLX90614_NORWERROR `#define MLX90614_NORWERROR 0`

R/W Error flags - bitmask. R/W error bitmask - No Errors

Examples

[MelexisTest.ino](#).

Definition at line 90 of file [MLX90614.h](#).

6.8.1.18 MLX90614_PWMCTRL `#define MLX90614_PWMCTRL 0x02`

EEPROM reg - Pulse width modulation output control register

Definition at line 72 of file [MLX90614.h](#).

6.8.1.19 MLX90614_RAWIR1 `#define MLX90614_RAWIR1 0x04`

RAM addresses. RAM reg - Raw temperature, source #1

Definition at line 63 of file [MLX90614.h](#).

6.8.1.20 MLX90614_RAWIR2 `#define MLX90614_RAWIR2 0x05`

RAM reg - Raw temperature, source #2

Definition at line 64 of file [MLX90614.h](#).

6.8.1.21 MLX90614_RFLAGCMD `#define MLX90614_RFLAGCMD 0xF0`

Read R/W Flags register command

Definition at line 82 of file [MLX90614.h](#).

6.8.1.22 MLX90614_RFLGERR `#define MLX90614_RFLGERR 0x80`

R/W error bitmask - R/W flags register access error

Examples

[MelexisTest.ino](#).

Definition at line 98 of file [MLX90614.h](#).

6.8.1.23 MLX90614_RXCRC `#define MLX90614_RXCRC 0x10`

R/W error bitmask - Receiver CRC mismatch

Examples

[MelexisTest.ino](#).

Definition at line 95 of file [MLX90614.h](#).

6.8.1.24 MLX90614_TA `#define MLX90614_TA 0x06`

RAM reg - Linearized temperature, ambient

Definition at line 65 of file [MLX90614.h](#).

6.8.1.25 MLX90614_TARANGE `#define MLX90614_TARANGE 0x03`

EEPROM reg - Customer dependent ambient temperature range

Definition at line 73 of file [MLX90614.h](#).

6.8.1.26 MLX90614_TOBJ1 `#define MLX90614_TOBJ1 0x07`

RAM reg - Linearized temperature, source #1

Definition at line 66 of file [MLX90614.h](#).

6.8.1.27 MLX90614_TOBJ2 `#define MLX90614_TOBJ2 0x08`

RAM reg - Linearized temperature, source #2

Definition at line 67 of file [MLX90614.h](#).

6.8.1.28 MLX90614_TOMAX `#define MLX90614_TOMAX 0x00`

EEPROM addresses. EEPROM reg - Customer dependent object temperature range maximum

Definition at line 70 of file [MLX90614.h](#).

6.8.1.29 MLX90614_TOMIN `#define MLX90614_TOMIN 0x01`

EEPROM reg - Customer dependent object temperature range minimum

Definition at line 71 of file [MLX90614.h](#).

6.8.1.30 MLX90614_TXADDRNACK `#define MLX90614_TXADDRNACK 2`

R/W error bitmask - TX address not acknowledged

Examples

[MelexisTest.ino](#).

Definition at line 92 of file [MLX90614.h](#).

6.8.1.31 MLX90614_TXDATANACK `#define MLX90614_TXDATANACK 4`

R/W error bitmask - TX data not acknowledged

Examples

[MelexisTest.ino](#).

Definition at line 93 of file [MLX90614.h](#).

6.8.1.32 MLX90614_TXOTHER `#define MLX90614_TXOTHER 8`

R/W error bitmask - Unknown error

Examples

[MelexisTest.ino](#).

Definition at line 94 of file [MLX90614.h](#).

6.8.1.33 MLX90614_XDLY `#define MLX90614_XDLY 25`

Experimentally determined delay to prevent read errors after calling `Wire.endTransmission()` (*possibly due to incompatibility between Wire library and SMBus protocol*).

Definition at line 55 of file [MLX90614.h](#).

6.9 MLX90614.h

```

00001 #ifndef _MLX90614_H_
00002 #define _MLX90614_H_
00003
00004 /*****
00005  * \brief      Melexis MLX90614 Family Device Driver Library - CPP Source file
00006  * \par
00007  * \par      Details
00008  *           Based on the Melexis MLX90614 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      MLX90614.CPP
00017  * \author    J. F. Fitter <jfitter@eagleairaustr.com.au>
00018  * \version   1.0
00019  * \date      2014-2017
00020  * \copyright Copyright &copy; 2017 John Fitter. All right reserved.
00021  *
00022  * \par      License
00023  *           This program is free software; you can redistribute it and/or modify it under
00024  *           the terms of the GNU Lesser General Public License as published by the Free
00025  *           Software Foundation; either version 2.1 of the License, or (at your option)
00026  *           any later version.
00027  * \par
00028  *           This Program is distributed in the hope that it will be useful, but WITHOUT ANY
00029  *           WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A
00030  *           PARTICULAR PURPOSE. See the GNU Lesser General Public License for more details
00031  *           at http://www.gnu.org/copyleft/gpl.html
00032  * \par
00033  *           You should have received a copy of the GNU Lesser General Public License along
00034  *           with this library; if not, write to the Free Software Foundation, Inc.,
00035  *           51 Franklin St, Fifth Floor, Boston, MA 02110-1301 USA
00036  *
00037  */*****/
00038
00039 #if (ARDUINO >= 100)
00040 #include "Arduino.h"
00041 #else
00042 #include "WProgram.h"
00043 #endif
00044 #include <Wire.h>
00045 #include "Property.h"
00046 #include "Crc8.h"
00047
00048 /*****
00049  * Definitions
00050  */*****/
00051
00052 #define MLX90614_I2CDEFAULTADDR 0x5A /**< Device default slave address */
00053 #define MLX90614_BROADCASTADDR 0 /**< Device broadcast slave address */
00054 #define MLX90614_CRC8POLY 7 /**< CRC polynomial = X8+X2+X1+1 */
00055 #define MLX90614_XDLY 25 /**< Experimentally determined delay to prevent read
00056 errors after calling Wire.endTransmission()
00057 <em>(possibly due to incompatibility between Wire
00058 library and SMBus protocol)</em>. */
00059 /** RAM addresses. */
00060 #define MLX90614_RAWIR1 0x04 /**< RAM reg - Raw temperature, source #1 */
00061 #define MLX90614_RAWIR2 0x05 /**< RAM reg - Raw temperature, source #2 */
00062 #define MLX90614_TA 0x06 /**< RAM reg - Linearized temperature, ambient */
00063 #define MLX90614_TOBJ1 0x07 /**< RAM reg - Linearized temperature, source #1 */
00064 #define MLX90614_TOBJ2 0x08 /**< RAM reg - Linearized temperature, source #2 */
00065
00066 /** EEPROM addresses. */
00067 #define MLX90614_TOMAX 0x00 /**< EEPROM reg - Customer dependent object temperature range
maximum */
00068 #define MLX90614_TOMIN 0x01 /**< EEPROM reg - Customer dependent object temperature range
minimum */
00069 #define MLX90614_PWMCTRL 0x02 /**< EEPROM reg - Pulse width modulation output control
register */
00070 #define MLX90614_TARANGE 0x03 /**< EEPROM reg - Customer dependent ambient temperature range
*/
00071 #define MLX90614_EMISS 0x04 /**< EEPROM reg - Object emissivity register */
00072 #define MLX90614_CONFIG 0x05 /**< EEPROM reg - Configuration register */
00073 #define MLX90614_ADDR 0x0E /**< EEPROM reg - SMBus address */
00074 #define MLX90614_ID1 0x1C /**< EEPROM reg - ID numer (w1) */
00075 #define MLX90614_ID2 0x1D /**< EEPROM reg - ID numer (w2) */
00076 #define MLX90614_ID3 0x1E /**< EEPROM reg - ID numer (w3) */
00077 #define MLX90614_ID4 0x1F /**< EEPROM reg - ID numer (w4) */
00078
00079 #define MLX90614_RFLAGCMD 0xF0 /**< Read R/W Flags register command */
00080
00081 /** Read flags - bitmask. */

```

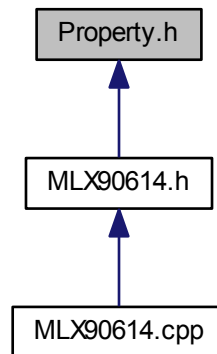
```

00082 #define MLX90614_EEBUSY          0x80    /**< R/W flag bitmask - EEPROM is busy (writing/erasing) */
00083 #define MLX90614_EE_DEAD          0x20    /**< R/W flag bitmask - EEPROM double error has occurred */
00084 #define MLX90614_INIT              0x10    /**< R/W flag bitmask - POR initialization is still ongoing */
00085
00086 /** R/W Error flags - bitmask. */
00087 #define MLX90614_NORWERROR          0        /**< R/W error bitmask - No Errors */
00088 #define MLX90614_DATATOOLONG        1        /**< R/W error bitmask - Data is too long */
00089 #define MLX90614_TXADDRNACK          2        /**< R/W error bitmask - TX address not acknowledged */
00090 #define MLX90614_TXDATANACK          4        /**< R/W error bitmask - TX data not acknowledged */
00091 #define MLX90614_TXOTHER              8        /**< R/W error bitmask - Unknown error */
00092 #define MLX90614_RXCRC              0x10    /**< R/W error bitmask - Receiver CRC mismatch */
00093 #define MLX90614_INVALIDDATA          0x20    /**< R/W error bitmask - RX/TX Data fails selection criteria
*/
00094 #define MLX90614_EECORRUPT          0x40    /**< R/W error bitmask - The EEPROM is likely to be corrupted
*/
00095 #define MLX90614_RFLGERR            0x80    /**< R/W error bitmask - R/W flags register access error */
00096
00097 /*****
00098 /* MLX90614 Device class.
00099 /*****
00100
00101 class MLX90614 {
00102 public:
00103     MLX90614(uint8_t i2caddr = MLX90614_I2CDEFAULTADDR);
00104
00105     boolean    begin();
00106     boolean    isReady(void) { return _ready; };
00107     uint64_t   readID(void);                                /**< Chip ID getter */
00108
00109     uint8_t    getIIRcoeff(void);                            /**< IIR coefficient getter */
00110     uint8_t    getFIRcoeff(void);                            /**< FIR coefficient getter */
00111     float      getEmissivity(void);                          /**< Emissivity getter */
00112
00113     void       setIIRcoeff(uint8_t csb = 4);                 /**< IIR coefficient setter */
00114     void       setFIRcoeff(uint8_t csb = 7);                 /**< FIR coefficient setter */
00115     void       setEmissivity(float emiss = 1.0);             /**< Emissivity setter */
00116
00117     uint16_t   readEEProm(uint8_t);
00118     void       writeEEProm(uint8_t, uint16_t);
00119
00120     Property<uint8_t, MLX90614> busAddr;                      /**< SMBus address property */
00121     Property<uint8_t, MLX90614> rwError;                      /**< R/W error flags property */
00122     Property<uint8_t, MLX90614> crc8;                         /**< 8 bit CRC property */
00123     Property<uint8_t, MLX90614> pec;                          /**< PEC property */
00124
00125     /** Enumerations for temperature units. */
00126     enum tempUnit_t {MLX90614_TK,                            /**< degrees Kelvin */
00127                     MLX90614_TC,                            /**< degrees Centigrade */
00128                     MLX90614_TF                             /**< degrees Fahrenheit */
00129     };
00130     /** Enumerations for temperature measurement source. */
00131     enum tempSrc_t {MLX90614_SRC_A,                          /**< Chip (ambient) sensor */
00132                    MLX90614_SRC01,                          /**< IR source #1 */
00133                    MLX90614_SRC02                          /**< IR source #2 */
00134     };
00135
00136     double     readTemp(tempSrc_t = MLX90614_SRC01, tempUnit_t = MLX90614_TC);
00137     double     convKtoC(double);
00138     double     convCtoF(double);
00139 private:
00140     boolean    _ready;
00141     uint8_t    _addr;                                /**< Slave address */
00142     uint8_t    _rwError;                            /**< R/W error flags */
00143     uint8_t    _crc8;                                /**< 8 bit CRC */
00144     uint8_t    _pec;                                /**< PEC */
00145
00146     uint16_t   read16(uint8_t);
00147     void       write16(uint8_t, uint16_t);
00148
00149     uint8_t    getRwError(void) {return _rwError;};         /**< R/W error flags getter */
00150     uint8_t    getCRC8(void) {return _crc8;};               /**< 8 bit CRC getter */
00151     uint8_t    getPEC(void) {return _pec;};                 /**< PEC getter */
00152
00153     uint8_t    getAddr(void);                            /**< SMB bus address getter */
00154     void       setAddr(uint8_t);                         /**< SMB bus address setter */
00155
00156
00157 };
00158
00159 #endif /* _MLX90614_H_ */

```

6.10 Property.h File Reference

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



Classes

- class [Property](#)< [Type](#), [ClassHolder](#) >

6.11 Property.h

```

00001 #ifndef _Property_H_
00002 #define _Property_H_
00003
00004 // Thankyou Joeman for this code - http://forums.codeguru.com/showthread.php?459696-GET-SET-in-C
00005
00006 template<typename Type, typename ClassHolder>
00007
00008 class Property {
00009 private:
00010     Type (ClassHolder::*Get)();
00011     void (ClassHolder::*Set)(Type Val);
00012     ClassHolder * Class;
00013
00014 public:
00015     Property() : Get(NULL), Set(NULL), Class(NULL) {}
00016     Property(ClassHolder * ClassA, Type (ClassHolder::*GetA)(), void (ClassHolder::*SetA)(Type Val)) :
00017         Class(ClassA), Get(GetA), Set(SetA) {}
00018
00019     void Set_Property_Control(ClassHolder * ClassA, Type (ClassHolder::*GetA)(), void
00020 (ClassHolder::*SetA)(Type Val)) {
00021         Class = ClassA;
00022         Get = GetA;
00023         Set = SetA;
00024     }
00025
00026     void Set_Get(Type (ClassHolder::*GetA)()) {
00027         Get = GetA;
00028     }
00029
00030     void Set_Set(void (ClassHolder::*SetA)(Type Val)) {
00031         Set = SetA;
00032     }
00033
00034     void Set_Class(ClassHolder * Holder) {
00035         Class = Holder;
00036     }
00037
00038     // set
00039     Type operator = (const Type& In) {

```



```

00038         if ( Set ) (Class->*Set) (In);
00039         return In;
00040     }
00041
00042     // set
00043     Type operator = (Property& In) {
00044         if ( Set ) (Class->*Set) (In);
00045         return In;
00046     }
00047
00048     // get
00049     operator Type() {
00050         return Get ? (Class->*Get) () : 0;
00051     }
00052 };
00053
00054 #endif /* _Property_H_ */

```

6.12 README.md File Reference

7 Example Documentation

7.1 MelexisTest.ino

An example of how to use the [MLX90614](#) class.

```

00001 /*****
00002  * \brief      Melexis MCX90614BAA Test Program - Sensor test implementation.
00003  * \details    Arduino test implementation of Melexis MCX90614 PIR temperature sensor driver.
00004  *
00005  * \note       THIS IS ONLY A PARTIAL RELEASE. THIS DEVICE CLASS IS CURRENTLY UNDERGOING
00006  *             ACTIVE DEVELOPMENT AND IS STILL MISSING SOME IMPORTANT FEATURES. PLEASE KEEP
00007  *             THIS IN MIND IF YOU DECIDE TO USE THIS PARTICULAR CODE FOR ANYTHING.
00008  *
00009  * \file       MelexisTest.ino
00010  * \author     J. F. Fitter <jfitter@eagleairaustr.com.au>
00011  * \version    1.0
00012  * \date       2014-2017
00013  * \copyright  Copyright (c) 2017 John Fitter. All right reserved.
00014  *
00015  * \par        License
00016  *             This program is free software; you can redistribute it and/or modify it under
00017  *             the terms of the GNU Lesser General Public License as published by the Free
00018  *             Software Foundation; either version 2.1 of the License, or (at your option)
00019  *             any later version.
00020  * \par
00021  *             This Program is distributed in the hope that it will be useful, but WITHOUT ANY
00022  *             WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A
00023  *             PARTICULAR PURPOSE. See the GNU Lesser General Public License for more details
00024  *             at http://www.gnu.org/copyleft/gpl.html
00025  * \par
00026  *             You should have received a copy of the GNU Lesser General Public License along
00027  *             with this library; if not, write to the Free Software Foundation, Inc.,
00028  *             51 Franklin St, Fifth Floor, Boston, MA 02110-1301 USA
00029  *
00030  */**
00031
00032 #define MELEXISTEST_C
00033 #define __STDC_LIMIT_MACROS
00034 #define __STDC_CONSTANT_MACROS
00035
00036 #include <Arduino.h>
00037 #include <Wire.h>
00038 #include <MLX90614.h>
00039 #include "printf.h"
00040
00041 MLX90614 mlx = MLX90614(MLX90614_BROADCASTADDR); // *** must be only one device on bus ***
00042
00043 /**
00044  * \brief      Program setup.
00045  */
00046 void setup(void) {
00047
00048     Wire.begin(); // library does not do this by default
00049     Serial.begin(115200);
00050     printf_begin();
00051     mlx.begin();
00052

```

```

00053     Serial.println(F("\nMelexis MLX90614 Temperature Sensor Test Program"));
00054     Serial.print(F("SMBus address ="));
00055     printf(" %02Xh", (uint8_t)mlx.readEEProm(MLX90614_ADDR));
00056     Serial.print(F("  Chip ID ="));
00057
00058     uint64_t id = mlx.readID();
00059     printf(" %04X-%04X-%04X-%04X\n\n", (uint16_t)(id >> 48), (uint16_t)(id >> 32),
00060         (uint16_t)(id >> 16), (uint16_t)id);
00061     dumpEEProm();
00062     Serial.println("");
00063 }
00064
00065 /**
00066  * \brief Main processing loop.
00067  */
00068 void loop(void) {
00069     static uint16_t smpcount = 0, errcount = 0;
00070
00071     // read ambient temperature from chip and print out
00072     printlnTemp(mlx.readTemp(MLX90614::MLX90614_SRC_A, MLX90614::MLX90614_TK), 'A');
00073     if(mlx.rwError) ++errcount;
00074
00075     // read object temperature from source #1 and print out
00076     printlnTemp(mlx.readTemp(MLX90614::MLX90614_SRC_O1, MLX90614::MLX90614_TK), 'O');
00077     if(mlx.rwError) ++errcount;
00078
00079     // print running total of samples and errors
00080     Serial.print(F("      Samples:Errors "));
00081     printf("%u:%u\n", smpcount += 2, errcount);
00082
00083     // slow down to human speed
00084     delay(250);
00085 }
00086
00087 /**
00088  * \brief          Print a line of temperature, crc, pec, and error string.
00089  * \param [in] temp Temperature
00090  * \param [in] src  Temperature source
00091  */
00092 void printlnTemp(double temp, char src) {
00093     char str[20];
00094
00095     if(mlx.rwError) Serial.print(F("No valid temperatures          "));
00096     else {
00097         if(src == 'A') Serial.print(F("Ambient temperature"));
00098         else Serial.print(F("Object  temperature"));
00099         printf(" = %sK ", floatToStr(str, temp));
00100         printf("%sC ", floatToStr(str, mlx.convKtoC(temp)));
00101         printf("%sF   ", floatToStr(str, mlx.convCtoF(mlx.convKtoC(temp))));
00102     }
00103     printCRC(mlx.crc8, mlx.pec);
00104     printErrStr(mlx.rwError);
00105     Serial.println("");
00106 }
00107
00108 /**
00109  * \brief Print a complete memory dump of the EEPROM.
00110  */
00111 void dumpEEProm() {
00112     Serial.println(F("EEProm Dump"));
00113     for(uint8_t j=0; j<8; j++) {
00114         for(uint8_t i=0; i<4; i++) printf("%02Xh-%04Xh      ", j*4+i, mlx.readEEProm(j*4+i));
00115         printCRC(mlx.crc8, mlx.pec);
00116         printErrStr(mlx.rwError);
00117         Serial.println("");
00118     }
00119 }
00120
00121
00122 /**
00123  * \brief          Utility to stringify a float.
00124  * \param [in] str String to receive converted result
00125  * \param [in] val Float value
00126  * \return         Float as string
00127  */
00128 char* floatToStr(char *str, double val) {
00129     sprintf(str, "%4d.%02u", int(val), int(val * 100) % 100);
00130     return str;
00131 }
00132
00133
00134 /**
00135  * \brief          Just print the crc and pec.
00136  * \param [in] crc CRC
00137  * \param [in] pec PEC
00138  */
00139 void printCRC(uint8_t crc, uint8_t pec) {printf("crc=%02Xh pec=%02Xh", crc, pec);}

```

```

00140
00141 /**
00142  * \brief          Convert error flags to diagnostic strings and print.
00143  * \param [in] err Error flags
00144  */
00145 void printErrStr(uint8_t err) {
00146     Serial.print(F(" *** "));
00147     if(err == MLX90614_NORWERROR) Serial.print(F("RW Success"));
00148     else {
00149         Serial.print(F("Errors: "));
00150         if(err & MLX90614_DATATOOLONG) Serial.print(F("Data too long / "));
00151         if(err & MLX90614_TXADDRNACK) Serial.print(F("TX addr NACK / "));
00152         if(err & MLX90614_TXDATANACK) Serial.print(F("TX data NACK / "));
00153         if(err & MLX90614_TXOTHER) Serial.print(F("Unknown / "));
00154         if(err & MLX90614_RXCRC) Serial.print(F("RX CRC / "));
00155         if(err & MLX90614_INVALIDDATA) Serial.print(F("Invalid data / "));
00156         if(err & MLX90614_EECORRUPT) Serial.print(F("EEPROM / "));
00157         if(err & MLX90614_RFLGERR) Serial.print(F("RFlags / "));
00158     }
00159 }
00160 }
00161
00162 /**
00163  * \brief          EEPROM memory contents factory default values.
00164  */
00165 const struct defaultEEPromData {
00166     uint8_t address;
00167     uint16_t data;
00168 } eDat[] = {{0x20, 0x9993}, {0x21, 0x62E3}, {0x22, 0x0201},
00169             {0x23, 0xF71C}, {0x24, 0xFFFF}, {0x25, 0x9FB4},
00170             {0x2E, 0xBE5A}, {0x2F, 0x0000}, {0x39, 0x0000}};
00171
00172 /**
00173  * \brief          Set EEPROM memory contents to factory default values.
00174  * \remarks        A device with default address must not be on the bus.
00175  * \n<tt>Only user allowed memory locations are written.</tt>
00176  */
00177 void setEEPromDefaults(void) {
00178     for(uint8_t i = 0; i < sizeof(eDat)/sizeof(defaultEEPromData),
00179         !mlx.rwError; i++) {
00180         mlx.writeEEProm(eDat[i].address, eDat[i].data);
00181     }
00182 }
00183 }
00184

```


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