# **Microfire LLC Mod-pH Arduino Library**

##

## **Release Information**

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## **Release History**

| **Release** | **Date** | **Description** |
| --- | --- | --- |
| 2.0.0 | 3/24/2023 | Changes for version 2 of hardware |
| 1.0.0 | 5/5/2021 | Initial |

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# Library Documentation

## Installation

Installation of this library can be done from within the Arduino IDE’s library manager. Search for `Microfire` and choose the library labeled `Microfire Mod-pH`.

The library is also installable through PlatformIO’s library manager.

## Member Variables

### const float pH

Result of the last pH measurement.

### const float mV

Raw milli-Volt value of the last pH measurement. No modification for temperature or calibration is done with this value.

### const float calibrationLowReading

Dual-point low reading of the probe. If there is no calibration data present, NaN (not a number) is returned.

### const float calibrationLowReference

Dual-point low reference of the probe. If there is no calibration data present, NaN (not a number) is returned.

### const float calibrationMidReading

Triple-point middle reading of the probe. If there is no calibration data present, NaN (not a number) is returned.

### const float calibrationMidReference

Triple-point middle reference of the probe. If there is no calibration data present, NaN (not a number) is returned.

### const float calibrationHighReading

Dual-point high reading of the probe. If there is no calibration data present, NaN (not a number) is returned.

### const float calibrationHighReference

Dual-point high reference of the probe. If there is no calibration data present, NaN (not a number) is returned.

### const float calibrationSingleOffset

Single offset calibration data. If there is no calibration data present, NaN (not a number) is returned.

### const float calibrationTemperature

Temperature at which the probe was calibrated.

### const int hwVersion

Hardware version of the module.

### const int fwVersion

Firmware version of the module.

### const int status

Status code of the last measurement or calibration.

## Member Methods

### begin()

Initializes the library and determines if the module is connected. Wire.begin() must be called prior.

#### Definition

| **bool** **begin**(TwoWire &wirePort = Wire, **uint8\_t** address = 0x0B); |
| --- |

#### Parameters

| **Parameter** | **Description** |
| --- | --- |
| **&wirePort** | TwoWire I2C interface |
| **address** | I2C address of the module |

#### Return

| **Type** | **Description** |
| --- | --- |
| **bool** | **True** if the module is connected.**False** if the module is disconnected. |

#### Example

| **#include <Microfire\_Mod-pH.h>**Microfire::Mod\_pH::i2c ph;**void** **setup**(){ Wire.begin();  ph.begin(); **if** (ph.begin() != true) { *// Error: the sensor isn't connected* }}**void** **loop** () {} |
| --- |

### connected()

Determines if the module is connected.

#### Definition

| **bool** **connected**(); |
| --- |

#### Parameters

| **Parameter** | **Description** |
| --- | --- |
| **None** |  |

#### Return

| **Type** | **Description** |
| --- | --- |
| **bool** | **True** if the module is connected.**False** if the module is disconnected. |

#### Example

| **#include <Microfire\_Mod-pH.h>**Microfire::Mod\_pH::i2c ph;**void** **setup**(){ Wire.begin();  ph.begin(); **if** (ph.connected() != true) { *// Error: the sensor isn't connected* }}**void** **loop** () {} |
| --- |

### **calibrateLow**

Performs a low-point calibration. [Status](#_tni6b2b8j9r), [calibrationLowReference](#_11to662k4e1w), and [calibrationLowReading](#_gbgu1rvzvfs6) are updated. It takes 750 ms to complete a measurement.

#### Definition

| **float** **calibrateLow**(**float** solution\_pH, **float** tempC = 25.0, **bool** blocking = true); |
| --- |

#### Parameters

| **Parameter** | **Description** |
| --- | --- |
| **solution\_pH** | The pH of the calibration solution. |
| **tempC** | The calibration solution’s temperature in Celsius |
| **blocking** | Return immediately or wait for the module to complete the calibration |

#### Return

| **Type** | **Description** |
| --- | --- |
| **uint8\_t** | An error code for the measurement. Can be one of the following:**0**: no error**1**: no probe detected or outside range**2**: system error**3**: config error |

#### Example

| **#include <Microfire\_Mod-pH.h>**Microfire::Mod\_pH::i2c ph;**void** **setup**(){ Wire.begin();  ph.begin(); ph.calibrateLow(4.0, 23.1);}**void** **loop** () {} |
| --- |

###

### **calibrateMid**

Performs a mid-point calibration. [Status](#_tni6b2b8j9r), [calibrationMidReference](#_yfaw0krtsf2v), and [calibrationMidReading](#_uiim96mptv90) are updated. It takes 750 ms to complete a measurement.

#### Definition

| **float** **calibrateMid**(**float** solution\_pH, **float** tempC = 25.0, **bool** blocking = true); |
| --- |

#### Parameters

| **Parameter** | **Description** |
| --- | --- |
| **solution\_pH** | The pH of the calibration solution. |
| **tempC** | The calibration solution’s temperature in Celsius |
| **blocking** | Return immediately or wait for the module to complete the calibration |

#### Return

| **Type** | **Description** |
| --- | --- |
| **uint8\_t** | An error code for the measurement. Can be one of the following:**0**: no error**1**: no probe detected or outside range**2**: system error**3**: config error |

#### Example

| **#include <Microfire\_Mod-pH.h>**Microfire::Mod\_pH::i2c ph;**void** **setup**(){ Wire.begin();  ph.begin(); ph.calibrateMid(7.0, 23.1)); **if** (ph.status) { *// Error* }}**void** **loop** () {} |
| --- |

###

### **calibrateHigh**

Performs a high-point calibration. [Status](#_tni6b2b8j9r), [calibrationHighReference](#_fqubx53yam2x), and [calibrationHighReading](#_y13r0t3077dl) are updated. It takes 750 ms to complete a measurement.

#### Definition

| **float** **calibrateHigh**(**float** solution\_pH, **float** tempC = 25.0, **bool** blocking = true); |
| --- |

#### Parameters

| **Parameter** | **Description** |
| --- | --- |
| **solution\_pH** | The pH of the calibration solution. |
| **tempC** | The calibration solution’s temperature in Celsius |
| **blocking** | Return immediately or wait for the module to complete the calibration |

#### Return

| **Type** | **Description** |
| --- | --- |
| **uint8\_t** | An error code for the measurement. Can be one of the following:**0**: no error**1**: no probe detected or outside range**2**: system error**3**: config error |

#### Example

| **#include <Microfire\_Mod-pH.h>**Microfire::Mod\_pH::i2c ph;**void** **setup**(){ Wire.begin();  ph.begin(); ph.calibrateHigh(10.0, 23.1); **if** (ph.status) { *// Error* }}**void** **loop** () {} |
| --- |

###

### **calibrateSingle**

Performs a single-point calibration. [status](#_tni6b2b8j9r) and [calibrationSingleOffset](#_z7izshvyhlto) are updated. It takes 750 ms to complete a measurement.

#### Definition

| **float** **calibrateSingle**(**float** solution\_pH, **float** tempC = 25.0, **bool** blocking = true); |
| --- |

#### Parameters

| **Parameter** | **Description** |
| --- | --- |
| **solution\_pH** | The pH of the calibration solution. |
| **tempC** | The calibration solution’s temperature in Celsius |
| **blocking** | Return immediately or wait for the module to complete the calibration |

#### Return

| **Type** | **Description** |
| --- | --- |
| **uint8\_t** | An error code for the measurement. Can be one of the following:**0**: no error**1**: no probe detected or outside range**2**: system error**3**: config error |

#### Example

| **#include <Microfire\_Mod-pH.h>**Microfire::Mod\_pH::i2c ph;**void** **setup**(){ Wire.begin();  ph.begin(); ph.calibrateSingle(4.0, 23.1); **if** (ph.status) { *// Error* }}**void** **loop** () {} |
| --- |

###

### **getDeviceInfo**

Updates all measurement, calibration, and system registers with the most recent information.

#### Definition

| **void** **getDeviceInfo**(); |
| --- |

#### Parameters

| **Parameter** | **Description** |
| --- | --- |
| **None** |  |

#### Return

| **Type** | **Description** |
| --- | --- |
| **None** |  |

#### Example

| **#include <Microfire\_Mod-pH.h>**Microfire::Mod\_pH::i2c ph;**void** **setup**(){ Wire.begin();  ph.begin(); ph.getDeviceInfo(); *// The following variables are updated:* *// ph.hwVersion, ph.fwVersion* *// ph.calibrationLowReference, ph.calibrationLowReading* *// ph.calibrationMidReference, ph.calibrationMidReading* *// ph.calibrationHighReference, ph.calibrationHighReading* *// ph.calibrationSingleOffset, ph.calibrationTemperature*}**void** **loop** () {} |
| --- |

### **measurepH**

Starts a pHmeasurement. It takes 750 ms to complete a measurement.

Member variables [pH](#_z0wh8812wca1), [mV](#_2m2bwy7nv9pn) and [status](#_tni6b2b8j9r) are updated. [tempC](https://docs.google.com/document/d/13rdFA7Kfsq4sykMppDxd-BCVynKoE-gv_IsZ4FOFS-M/edit#heading=h.r1dhx9kooeu2) is modified to either what was passed, or to the default of 25.0.

#### Definition

| **float** **measurepH**(**float** tempC = 25.0, **bool** blocking = true); |
| --- |

#### Parameters

| **Parameter** | **Description** |
| --- | --- |
| **tempC** | The solution-under-test’s temperature in Celsius. |
| **blocking** | Return immediately or wait for the module to complete the measurement |

#### Return

| **Type** | **Description** |
| --- | --- |
| **float** | The solution-under-test’s conductivity in mS/cm.  |

#### Example

| **#include <Microfire\_Mod-pH.h>**Microfire::Mod\_pH::i2c ph;**void** **setup**(){ Serial.begin(9600); Wire.begin(); ph.begin();}**void** **loop** (){ ph.measurepH(4.0, 23.1); **if** (!ph.status) { Serial.println(ph.pH); }} |
| --- |

### **reset**

Resets all calibration data to the empty value of NaN (not a number).

#### Definition

| **void** **reset**(); |
| --- |

#### Parameters

| **Parameter** | **Description** |
| --- | --- |
| **None** |  |

#### Return

| **Type** | **Description** |
| --- | --- |
| **None** |  |

#### Example

| **#include <Microfire\_Mod-pH.h>**Microfire::Mod\_pH::i2c ph;**void** **setup**(){ Wire.begin(); ph.begin(); ph.reset();}**void** **loop** () {} |
| --- |

###

### **setDeviceInfo**

Sets all the device calibration registers with a specified value.

#### Definition

| **void** **setDeviceInfo**(**float** calibrationLowReading, **float** calibrationLowReference, **float** calibrationMidReading, **float** calibrationMidReference, **float** calibrationHighReading, **float** calibrationHighReference, **float** calibrationSingleOffset, float calibrationTemperature); |
| --- |

#### Parameters

| **Parameter** | **Description** |
| --- | --- |
| **calibrationLowReading** | Read-low calibration data |
| **calibrationLowReference** | Reference-low calibration data |
| **calibrationMidReading** | Read-mid calibration data |
| **calibrationMidReference** | Reference-high calibration data |
| **calibrationHighReading** | Read-high calibration data |
| **calibrationHighReference** | Reference-high calibration data |
| **calibrationSingleOffset** | Single-offset calibration data |
| **calibrationTemperature** | Temperature at which the probe was calibrated |

#### Return

| **Type** | **Description** |
| --- | --- |
| **None** |  |

#### Example

| **#include <Microfire\_Mod-pH.h>**Microfire::Mod\_pH::i2c ph;**void** **setup**(){ Wire.begin(); ph.begin(); ph.setDeviceInfo(187.2, 177.480, 0.0, 0.0, -177.480, 168.1, NAN, 22.371);}**void** **loop** () {} |
| --- |

###

### **setI2CAddress**

Changes the I2C address of the module. The change is stored and used again after a power-cycle.

Note: The library will use the new I2C address after calling this method, but the address must be stored and [begin](#_xmaezoebo0jf) must be called with the new address on subsequent initialization.

#### Definition

| **void** **setI2CAddress**(**uint8\_t** i2cAddress); |
| --- |

#### Parameters

| **Parameter** | **Description** |
| --- | --- |
| **uint8\_t** | New I2C address |

#### Return

| **Type** | **Description** |
| --- | --- |
| **None** |  |

#### Example

| **#include <Microfire\_Mod-pH.h>**Microfire::Mod\_pH::i2c ph;**void** **setup**(){ Wire.begin();  ph.begin(); ph.setI2CAddress(0x30);}**void** **loop** () {} |
| --- |

###

### **update**

If blocking is set to false when [measurepH](#_5lgktot395dt) or [measureTemp](#_k7n09cu6u7rb) is called, this method will update [pH](#_z0wh8812wca1) and [mV](#_2m2bwy7nv9pn). This allows the controlling device to do other work rather than wait for the module to complete the measurement.

#### Definition

| **void** **update**(); |
| --- |

#### Parameters

| **Parameter** | **Description** |
| --- | --- |
| **None** |  |

#### Return

| **Type** | **Description** |
| --- | --- |
| **None** |  |

#### Example

| **#include <Microfire\_Mod-pH.h>**Microfire::Mod\_pH::i2c ph;**void** **setup**(){ Wire.begin();  ph.begin(); ph.measurepH(23.1, false); *// blocking = false above, do other work for at least 750 ms* ph.update(); *// Measurement results are in* *// ph.pH, ph.mV*}**void** **loop** () {} |
| --- |

##