

# Arduino Toolkit 0.3.0

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a somewhat MATLAB compatible Arduino toolkit for GNU Octave.

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To download a copy of the GNU Octave arduino package, please visit <http://octave.sourceforge.net/arduino/>.

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# 1 Installing and loading

The Arduino toolkit must be installed and then loaded to be used.

It can be installed in GNU Octave directly from octave-forge, or can be installed in an off-line mode via a downloaded tarball.

The toolkit must be then be loaded once per each GNU Octave session in order to use its functionality.

## 1.1 Online Direct install

With an internet connection available, the Arduino package can be installed from octave-forge using the following command within GNU Octave:

```
pkg install -forge arduino
```

The latest released version of the toolkit will be downloaded and installed.

## 1.2 Off-line install

With the arduino toolkit package already downloaded, and in the current directory when running GNU Octave, the package can be installed using the following command within GNU Octave:

```
pkg install arduino-0.3.0.tar.gz
```

## 1.3 Loading

Regardless of the method of installing the Arduino toolkit, in order to use its functions, the toolkit must be loaded using the pkg load command:

```
pkg load arduino
```

The toolkit must be loaded on each GNU Octave session.

## 2 Hardware setup

In order to use the arduino hardware with the toolkit, it must be programmed with special firmware.

### 2.1 Programming the Arduino

To program the hardware, using a default configuration, run the `arduinsetup` command:

```
arduinsetup
```

A temporary Arduino project will be created, with the Arduino toolkit files copied to it and the Arduino IDE will open.

Set the board type and port correctly for the connected Arduino and press the upload button on the IDE.

The sources will be compiled and then uploaded to the connected arduino board.

After successful upload the Arduino IDE should be closed.

### 2.2 Known Arduino Board Types

The board type must be known in order to successfully detect and connect to the Arduino board after programming.

Currently, known boards are:

- Arduino UNO
- Arduino Mega 2560
- Arduino Nano
- Arduino Pro/Pro Mini
- Sparkfun SAMD21
- Arduino Lilypad

Additional boards can be added easily, however require minor code changes.

## 3 Connecting to an arduino

To control an arduino device, a connection must be made to it by creating an arduino object.

### 3.1 Connecting to a single arduino

Assuming a single arduino device is connected to the computer, creating an arduino object with no arguments will find the connected arduino and connect to it:

```
ar = arduino()
```

### 3.2 Connecting to a specific arduino

Where multiple arduinos may be connected to the computer, a specific board can be connected by specifying the name of the port it is connected to:

```
ar = arduino("/dev/ttyACM0")
```

The port name will be operating system dependent.

### 3.3 Querying available arduinos

To list the ports of all *programmed* available arduinos, the scanForArduinos function can be used:

```
scanForArduinos
```

It will provide a list of all available boards it can find with the port they are connected to.

## 4 Basic Input and Output Overview

Basic input and output can be performed on a connected arduino device using by calling the read and write functions for a specific named pin on the arduino.

A list of available pins can get found from the pins property of the connected arduino object and are also displayed as part of the default shown properties:

```
ar = arduino();
% get the pin names
pins = ar.availablepins
```

Pin generally follow a naming scheme of D<number> for digital pins and A<number> for analog pins.

Digital pins can be used to read and write digital data, but can not read analog voltages. Analog pins can perform digital I/O as well as reading voltages.

### 4.1 Performing Digital I/O

A pin's digital logic value can be true (1) or false (0) and can be set using the writeDigitalPin function.

The following example attempts to set the D2 pin of the connected arduino object "ar" to true, waits 5 seconds and then sets it to false:

```
writeDigitalPin (ar, "d2", true);
pause 5
writeDigitalPin (ar, "d2", false);
```

Using the readDigitalPin will read the current logic state of the pin.

```
value = readDigitalPin (ar, "d2");
```

### 4.2 Performing Analog Input

For analog pins, the voltage level can be read using a analog to digital conversion and will return a voltage level between 0 and the boards voltage (nominally 5V):

```
value = readVoltage (ar, "a0");
```

The raw digital value of the pin can also be read instead of a voltage, giving a value between 0 and  $2^x$  where x is the number of bits used by the analog to digital converter.

```
value = readAnalogPin (ar, "a0");
```

## 5 Protocol based I/O Overview

The arduino toolkit supports more complex I/O for SPI, I2C, Servo control and more.

### 5.1 SPI communication

SPI communication can be performed by creating a SPI dev object and then calling the writeRead function:

```
spi = spidev (ar, "d2");
```

The function call expects a connected arduino object as the first argument, followed by the chip select pin of the SPI device.

After a device is created, a write to device followed by read can be made using the writeRead function:

```
spi = spidev (ar, "d2");
data = writeRead (spi, 100);
```

### 5.2 I2C communication

I2C communication can be performed by creating an I2C dev object for a specific I2C address. The following example creates an I2C device that will communicate with a I2C device at address 100"

```
i2c = i2cdev (ar, 100);
```

After creating an I2C device, data can be read and written using read, write, readRegister and writeRegister. The data to send and receive will be device dependent.

### 5.3 Servo communication

Servo communication can be performed after creating a servo device object to operate on a PWM pin:

```
servoobj = servo(ar, "d9", "minpulseduration", 1.0e-3, ...
    "maxpulseduration", 2e-3);
```

The servo function expects the connected arduino object and the PWM pin that the servo is connected to. Optional properties can be specified to control the setup of device.

In the example, the min and max pulse width values are set.

Using the servo object the current position can be read or set with values ranging between 0 to 1, with 0 being the minimum pulse width and 1 being the maximum.

The following example sets the servo to its middle position.

```
servoobj = servo(ar, "d9", "minpulseduration", 1.0e-3, ...
    "maxpulseduration", 2e-3);

writePosition (servoobj, 0.5);
```

### 5.4 Shift Registers

A shift register can be controlled by creating a shiftRegister object:

```
registerobj = shiftRegister(ar, '74hc164', "d2", "d3");
```

The parameters required are dependent on the type of shift register created.

Once a register object has been created, it can be read and written to using the read and write functions.

## 5.5 Rotary Encoders

A rotary encoder can be created by creating a rotaryEncoder object.

```
encoder = rotaryEncoder(ar, "d2", "d3", 180);
```

Using the created object, the rotary encoder value and speed can be read.

## 6 Addons Overview

This chapter provides an overview of the arduino package addon functionality for adding additional addons to arduino.

### 6.1 Addon Introduction

Addons provide a way of adding additional functionality to the arduino toolkit that provides matlab access directly to the arduino hardware.

Addons are implemented in two parts.

1. code running on the arduino that implements the required functionality
2. a octave wrapper class that provided the matlab interface and communication to the code.

Both parts are required to create a plugin.

The arduino toolkit provides a number of pre-created addons. These can be seen using the following command:

```
listArduinoLibraries
```

The command will display all known arduino libraries (addons as well as core libraries), however addons typically use a "foldername/classname" for this naming.

**See also:** listArduinoLibraries.

### 6.2 Creating an addon

An addon requires at minimum 3 things:

1. A addon directory that will contain the addon files
2. A matlab file within that directory that is a subclass of `arduinoio.LibraryBase`
3. A arduino source/header file that contains the arduino code to load, subclassed for `LibraryBase`

So the addon directory structure at a minimum will be:

```
+arduinoioaddons (dir) [somewhere in the octave load path]
  MyAddons (dir)
    MyAddon1.m
    MyAddon1.h
```

#### 6.2.1 Addon package directory

The addon architechure looks for plugins in the octave load path in a package directory called `+arduinoioaddons`

So this directory must be created somewhere within the paths that octave will check for functions.

In addition, the addon architecture expects plugins to be contained in a sub directory within the `+arduinoioaddons`

Multiple plugin .m files can be within teh same sub directory.

#### 6.2.2 Addon package .m file

The matlab interface file within the addon directory provides the matlab interface for the arduino code as well as provides information about the addon.

## Class inheritance and required properties

The interface file must be a subclass of `arduinoio.LibraryBase` and must contain some constant properties values that provide the information.

A minimum example of required is below:

```
classdef MyAddon1 < arduinoio.LibraryBase
    properties(Access = protected, Constant = true)
        LibraryName = 'MyAddons/MyAddon1';
        CppHeaderFile = fullfile(arduinoio.FilePath(mfilename('fullpath')), 'MyAddon1.h');
        CppClassName = 'MyAddon1';
    endproperties
    .
    .
    .
endclassdef
```

The following constant properties can be set within the addon:

`LibraryName`

(Required) The name of the addon. My convention this is usually the directoryname / theclassname

`CppHeaderFile`

(Required) The header file for the arduino code

`CppSourceFile`

(Optional) The source file (if any) for the arduino code

`CppClassName`

(Required) The classname used within the cppheaderfile for the arduino library

`DependantLibraries`

(Optional) Any additional addons or cores that are needed for this library to be used

`ArduinoLibraryHeaderFiles`

(Optional) Any additional header files that need to be included

## Class constructor

The matlab class constructor will be called from the addon function when creating a instance of the addon and should initialize at least two properties in inherited from `arduinoio.LibraryBase`:

1. Parent should be set to the first input argument (the arduino class)
2. Pins should be set to a list of pins that are used for the plugin

```
classdef MyAddon1 < arduinoio.LibraryBase
    .
    .
    methods
        function obj = MyAddon1(parentObj, varargin)
            obj.Parent = parentObj;
            # no pins being used
            obj.Pins = [];
            # send any command to the arduino during setup ?
```

```

        endfunction
    .
    .
    endmethods
endclassdef

```

## Class functions

The class functions will usually communicate to the arduino and use the response for what is returned to the user.

By convention, the commands sent to the arduino are defined as constants in the class file but do not have to be.

```

classdef MyAddon1 < arduinoio.LibraryBase
    properties(Access = private, Constant = true)
        INIT_COMMAND = hex2dec('00');
        FUNC1_COMMAND = hex2dec('01');
    endproperties
    .
    .
    methods
        function obj = MyAddon1(parentObj, varargin)
            obj.Parent = parentObj;
            # no pins being used
            obj.Pins = [];
            # send any command to the arduino during setup ?
            sendCommand(obj.Parent, obj.LibraryName, obj.INIT_COMMAND, []);
        endfunction

        function retval = func1(obj)
            cmdID = obj.FUNC1_COMMAND;
            retval = sendCommand(obj.Parent, obj.LibraryName, cmdID, []);
        endfunction
    .
    .
    endmethods
endclassdef

```

Note the sendCommand uses the objects parent for the arduino, the objects library name and the command id.

**See also:** sendCommand.

### 6.2.3 Addon package header file

The header file should contain a class that matches the functionality and information of the matlab file and provides the ability to register the code on the arduino.

The following things should occur in the arduino class files:

1. The class name within the file must be the same as the one set in the .m file CppClassName property.
2. The libName variable must be the same as the LibraryName property.
3. The constructor should call registerLibrary

4. the `commandHandler` function to act on `cmdId` values that match the commands that will be sent from `.m` file and send data back using `sendResponseMsg`
5. on receiving unknown `cmdId` values, the `commandHandler` should use `sendUnknownCmdIDMsg`

An example, matching the previous `.m` file code is below:

```
#include "LibraryBase.h"

#define MYADDON1_INIT 0x00
#define MYADDON1_FUNC1 0x01

class MyAddon1 : public LibraryBase
{
    uint8_t cnt;
public:
    MyAddon1(OctaveArduinoClass& a)
    {
        libName = "MyAddons/MyAddon1";
        a.registerLibrary(this);
    }
    void commandHandler(uint8_t cmdID, uint8_t* data, uint8_t datasz)
    {
        switch (cmdID)
        {
            case MYADDON1_INIT:
            {
                cnt = 0;
                sendResponseMsg(cmdID, 0,0);
                break;
            }
            case MYADDON1_FUNC1:
            {
                // func 1 is just returning a uint8 count of number of times called
                cnt ++;
                sendResponseMsg(cmdID, &cnt, 1);
                break;
            }
            default:
            {
                // notify of invalid cmd
                sendUnknownCmdIDMsg();
            }
        }
    }
}
```

The body of functions can be in the `CppSourceFile` file if it is defined or within the header file as illustrated above.

### 6.2.4 Verify octave can see the addon

Use the `listArduinoLibraries` command to verify that the new addon appears in the list of known libraries.

If it does not, ensure that the `+arduinoioaddons` directory is within one of the octave class paths, and that the directory structure and inheritance requirements have been met.

## 6.3 Using addons

### 6.3.1 Programing the arduino with the addon

To use a addon, the code must be programmed onto the arduino.

Using the `libraries` command, when creating a arduino object, the arduino can be reprogrammed if the library does not already exist on the arduino.

```
ar = arduino([],[], 'libraries', 'MyAddons/MyAddon1', 'forcebuild', true)
```

The `libraries` property of the arduino object should list the libraries programmed on the arduino.

Alternatively, the library can be added using the `libraries` property and `arduinsetup`

**See also:** `arduino`, `arduinsetup`.

### 6.3.2 Creating a addon object

An object of the `addon` type can be created using the `addon` command.

```
ar = arduino([],[], 'libraries', 'MyAddons/MyAddon1', 'forcebuild', true)
obj = addon(ar, "MyAddons/MyAddon1");
```

## 7 Examples

### 7.1 Blinking an LED

This example shows blinking the inbuilt LED on the Arduino board. Code is available by running:

```
edit examples/example_blink
```

#### Hardware setup

This example uses in the builtin LEDS, so requires only a connection of the Arduino board to computer for communication.

#### Create an Arduino object

```
ar = arduino ();
```

If you have more than one Arduino board connected, you may need to specify the port in order to connect to the correct device.

#### Query Device for pins connected to builtin LEDS

The pin connected to the Arduino UNO built in led is D13.

```
led_pin = "d13";
```

The connected pins can be queried programatically if desired.

```
pins = getLEDTerminals (ar);
```

Connected to a Arduino UNO would return a list pins containing only one item '13'.

The terminal number can be converted to a pin using getPinsFromTerminals:

```
led_pin = getPinsFromTerminals (ar, pins{1});
```

#### Turn the LED off

Write a 0 value to the pin to turn it off.

```
writeDigitalPin (ar, led_pin, 0);
```

#### Turn the LED on

Write a 1 value to the pin to turn it on

```
writeDigitalPin (ar, led_pin, 1);
```

#### Making the LED blink

Add a while loop with a pause between the changes in the pin state to blink.

```
while true
  writeDigitalPin (ar, led_pin, 0);
  pause (0.5)
  writeDigitalPin (ar, led_pin, 1);
  pause (0.5)
endwhile
```

## 7.2 Using I2C to communicate with an EEPROM

This example shows using I2C to communicate with a EEPROM chip. Code is available by running:

```
edit examples/example_i2c_eeprom
```

### Hardware setup

Using an Arduino UNO, the board should be configured with the following connections between the board and a 24XX256 EEPROM chip:

A4	Connected to pin 5 of EEPROM
A5	Connected to pin 6 of EEPROM
5V	Connected to pin 8 of EEPROM
GND	Connected to pin 1,2,3,4 of EEPROM

### Create an Arduino object

```
ar = arduino ();
```

If you have more than one Arduino board connected, you may need to specify the port in order to connect to the correct device.

### Query I2C pins

Display the I2C terminals of the board:

```
getI2CTerminals(ar)
```

### Scan the arduino for the connected device

```
scanI2Cbus(ar)
```

The devices listed should contain 0x50, the address of the EEPROM chip.

### Create an I2C object to communicate to the EEPROM

```
eeeprom = i2cdev(ar, 0x50)
```

### Write data to the EEPROM

The EEPROM expects the first byte to be the page number, the second the offset, followed by data, so to write 1 2 3 4, starting address 0 (page 0, offset 0):

```
write(eeeprom, [0 0 1 2 3 4])
```

### Reading from the EEPROM

Reading from the EEPROM requires first writing the address to read from, in this case, if we want to read the 3, 4, this would be page 0, offset 2:

```
write(eeeprom, [0 2])
```

Next read the 2 bytes:

```
data = read(eeeprom, 2)
```

### 7.3 Using SPI to communicate with a mcp3002 10 bit ADC

This example shows using SPI to communicate with an mcp3002 10 bit ADC. Code is available by running:

```
edit examples/example_spi_mcp3002
```

#### Hardware setup

Using an Arduino UNO, the board should be configured with the following connections between the board and a mcp3002 chip:

D10	Connected to pin 1 (CS) of MCP3002
D11	Connected to pin 5 (DI) of MCP3002
D12	Connected to pin 6 (DO) of MCP3002
D13	Connected to pin 7 (CLK) MCP3002
VCC	Connected to pin 8 (VDD) MCP3002
GND	Connected to pin 4 (VSS) MCP3002

Analog input

Connected from pin 2 of the MCP3002 to a LOW (< 5V) voltage to measure

#### Create an Arduino object

```
ar = arduino ();
```

If you have more than one Arduino board connected, you may need to specify the port in order to connect to the correct device.

#### Create an SPI object to communicate to the MCP3002

```
adc = spidev(ar, "d10")
```

The d10 is the chip select pin connected from the Arduino to the MCP3002.

#### Read the ADC

The MCP3002 expects specific commands in order to read a channel.

For illustration for the command to read chan 0 in single ended mode:

```
command (bits) in MSB mode to device:
[START SGL ODN MSBF X X X X] [ X X X X X X X X ]
  1   1   0   1   1 1 1 1   1 1 1 1 1 1 1 1
  [chan 0 ] MSB
data back:
  X   X X   X   X 0 D D   D D D D D D D D
```

D is a output data bit

X is a don't care what value is input/output

The first byte contains the command and start of the data read back, the second bytes is written to clock out the rest of the ADC data.

In hex, this corresponds to 0xDF 0xFF,

```
data = writeRead(adc, [hex2dec("DF") hex2dec("FF")])
```

Of the data returned, the last 10 bits is the actual data, so convert data to a 16 bit value:

```
val = uint16(data(1))*256 + uint16(data(2))
```

Then bitand it to remove the non value parts, to get the ADC value:

```
val = bitand (val, hex2dec('3FF'))
```

To make the value correspond to a voltage it needs to be scaled as 0 will be 0 Volts, 1023 will be 5 Volts.

```
volts = double(val) * 5.0 / 1023.0;
```

## 8 Function Reference

The functions currently available in the Arduino toolkit are described below;

### 8.1 General Functions

#### 8.1.1 arduinosetup

```
retval = arduinosetup ()
retval = arduinosetup (propertyname, propertyvalue)
```

Open the arduino config / programming tool to program the arduino hardware for usage with the Octave arduino functions.

arduinsetup will create a temporary project using the arduino IDE and allow compiling and programming of the code to an arduino.

#### Inputs

*propertyname, propertyvalue* - A sequence of property name/value pairs can be given to set defaults while programming.

Currently the following properties can be set:

**libraries**      The value should be the name of a library, or string array of libraries to program on the arduino board.

**arduinobinary**  
The value should be the name/path of the arduino IDE binary for programming.  
If not specified, the function will attempt to find the binary itself.

#### Outputs

*retval* - return 1 if arduino IDE returned without an error

**See also:** arduino, --arduino\_binary--.

#### 8.1.2 isarduino

```
retval = isarduino (obj)
```

Check if input value is an arduino object  
Function is essentially just a call of `retval = asis(obj, "arduino");`

#### Inputs

*obj* - The object to check

#### Outputs

*retval* is true, if obj is an arduino object, false otherwise.

**See also:** arduino.

#### 8.1.3 listArduinoLibraries

```
retval = listArduinoLibraries ()
```

Retrieve list of all known arduino library modules that are available.

#### Inputs

None

## Outputs

*retval* is an cell array of string library names that are available for programming to the arduino.

**See also:** `arduino`, `arduinoseup`.

### 8.1.4 scanForArduinos

```
retval = scanForArduinos (maxCount)
retval = scanForArduinos (maxCount, type)
```

Scan system for programmed arduino boards.

`scanForArduinos` will scan the system for programmed arduino boards and return at most *maxCount* of them as a cell array in *retval*.

## Inputs

*maxCount* - max number of arduino boards to detect. if *maxCount* is not specified, or is a less than 1, the function will return as many arduino boards as it can detect.

*type* - optional board type to match. If specified, the board type must match for the arduino to be added to the return list.

## Outputs

*retval* structure cell array of matching detected arduino boards.

Each cell value of the cell array will contain a structure with values of:

<code>port</code>	the serial port the arduino is connected to
<code>board</code>	the board type of the arduino

**See also:** `arduino`.

## 8.2 Arduino Functions

### 8.2.1 @arduino/arduino

```
retval = arduino ()
retval = arduino (port)
retval = arduino (port, board)
retval = arduino (port, board[, [propname, propvalue]*])
```

Create a arduino object with a connection to an arduino board.

## Inputs

*port* - full path of serial port to connect to. For Linux, usually `/dev/ttySXXX`, for windows `COMXX`.

*board* - name of board to connect (default is 'uno').

*propname*, *propvalue* - property name and value pair for additional properties to pass to the creation of the arduino object. Currently properties are ignored.

if the `arduino` function is called without parameters, it will scan for the first available arduino it can find and connect to it.

## Outputs

*retval* - a successfully connected arduino object.

## Properties

The `arduino` object has the following public properties:

<code>name</code>	name assigned to the <code>arduino</code> object
<code>debug</code>	<code>true</code> / <code>false</code> flag for whether debug is turned on
<code>port</code> (read only)	the communications port the board is connected to.
<code>board</code> (read only)	The name of the board type that the arduino connected to
<code>libraries</code> (read only)	The libraries currently programmed onto the board
<code>availablepins</code>	The pins available for use on the board

**See also:** `scanForArduinos`, `arduinsetup`.

### 8.2.2 @arduino/configurePin

`currmode = configurePin (ar, pin)`

`configurePin (ar, pin, mode)`

Set/Get pin mode for a specified pin on arduino connection.

`configurePin (ar, pin)` will get the current mode of the specified pin.

`configurePin (ar, pin, mode)` will attempt set the pin to the specified mode if the mode is unset.

## Inputs

`ar` - the `arduino` object of the connection to an arduino board.

`pin` - string name of the pin to set/get the mode of.

`mode` - string mode to set the pin to.

## Outputs

`mode` - string current mode of the pin.

Valid modes can be:

- `AnalogInput` - Acquire analog signals from pin
- `DigitalInput` - Acquire digital signals from pin
- `DigitalOutput` - Generate digital signals from pin
- `I2C` - Specify a pin to use with I2C protocol
- `Pullup` - Specify pin to use a pullup switch
- `PWM` - Specify pin to use a pulse width modulator
- `Servo` - Specify pin to use a servo
- `SPI` - Specify a pin to use with SPI protocol
- `Unset` - Clears pin designation. The pin is no longer reserved and can be automatically set at the next operation.

**See also:** `arduino`.

### 8.2.3 @arduino/configurePinResource

```
currmode = configurePinResource (ar, pin)
configurePinResource (ar, pin, owner, mode)
configurePinResource (ar, pin, owner, mode, force)
```

Set/Get pin mode for a specified pin on arduino connection.

configurePinResource (*ar*, *pin*) will get the current mode of the specified pin.

configurePinResource (*ar*, *pin*, *owner*, *mode*) will attempt set the pin to the specified mode and owner.

If the pin is already owned by another owner, the configure will fail unless the force option is used. If the mode is already set, configure will fail unless force is used.

#### Inputs

*ar* - the arduino object of the connection to an arduino board.

*pin* - string name of the pin to set/get the mode of.

*mode* - string mode to set the pin to.

*owner* - string name to use as the pin owner.

*force* - boolean to force mode change. If not set, it will be false.

#### Outputs

*currmode* - current string mode of the pin.

Valid modes can be:

- AnalogInput - Acquire analog signals from pin
- DigitalInput - Acquire digital signals from pin
- DigitalOutput - Generate digital signals from pin
- I2C - Specify a pin to use with I2C protocol
- Pullup - Specify pin to use a pullup switch
- PWM - Specify pin to use a pulse width modulator
- Servo - Specify pin to use a servo
- SPI - Specify a pin to use with SPI protocol
- Reserved - Pin marked reserved, but not for of any particular mode
- Unset - Clears pin designation. The pin is no longer reserved and can be automatically set at the next operation.

**See also:** arduino, configurePin.

### 8.2.4 @arduino/decrementResourceCount

```
count = decrementResourceCount (ar, resource)
```

Decrement the count of a named resource by 1 and return the new count.

#### Inputs

*ar* - connected arduino object

*resource* - name of resource to decrement count.

#### Outputs

*count* = count of uses registered to resource.

**See also:** getResourceCount. incrementResourceCount.

### 8.2.5 @arduino/display

`display (ar)`

Display the arduino object in a verbose way, showing the board and available pins.

#### Inputs

*ar* - the arduino object.

If the arduino object has debug mode set, additional information will be displayed.

**See also:** arduino.

### 8.2.6 @arduino/getI2CTerminals

`pinlist = getI2CTerminals (ar)`

Get a cell list of pin Ids available are used for I2C mode.

#### Inputs

*ar* - the arduino object.

#### Outputs

*pinlist* - cell list of pin numbers available for I2C use.

**See also:** arduino.

### 8.2.7 @arduino/getLEDTerminals

`pinlist = getLEDTerminals (ar)`

Get a cell list of pin Ids available are connected natively to LEDs.

#### Inputs

*ar* - the arduino object.

#### Outputs

*pinlist* - cell list of pin numbers available for LED use.

**See also:** arduino.

### 8.2.8 @arduino/getMCU

`mcu = getMCU (ar)`

Get the MCU used by the connected arduino.

#### Inputs

*ar* - arduino object connected to a arduino board.

#### Outputs

*mcu* - string representing the mcu used by the arduino board.

**See also:** arduino.

### 8.2.9 @arduino/getPWMTerminals

`pinlist = getPWMTerminals (ar)`

Get a cell list of pin Ids available for PWM use.

## Inputs

*ar* - the arduino object.

## Outputs

*pinlist* - cell list of pin numbers available for PWM use.

**See also:** arduino.

### 8.2.10 @arduino/getPinInfo

*pininfo* = getPinInfo (*ar*, *pin*)

*pininfoarray* = getPinInfo (*ar*, *pinarray*)

Get the pin information from the input pins values.

getPinInfo (*ar*, *pin*) will get information for a single pin.

getPinInfo (*ar*, *pinarray*) will get a cell array of pin information

## Inputs

*ar* - the connected arduino object.

*pin* - a pin number or pin name.

*pinarray* - the array of pin numbers or names

The pininfo struct contains the following fields:

terminal	Terminal number of the pin
name	String name of the pin
owner	Current item owner of the pin
mode	Current configured mode for the pin

## Outputs

*pininfo* - struct on pin information.

*pininfolist* - cell array of pin info

**See also:** arduino, configurePinResource, getResourceOwner.

### 8.2.11 @arduino/getPinsFromTerminals

*pinnames* = getPinsFromTerminals (*ar*, *terminals*)

Get the pin names from the input terminal values.

## Inputs

*ar* - the connected arduino object.

*terminals* - the numeric pin number, or array of pin numbers to get pin names.

## Outputs

*pinnames* - the string names of each input pin. If terminals was a single value, the return will be a single string, otherwise it will return a cell array of each pin name.

**See also:** arduino, getTerminalsFromPins.

### 8.2.12 @arduino/getResourceCount

*count* = getResourceCount (*ar*, *resource*)

Get the count of uses of a given resource.

**Inputs**

*ar* - connected arduino object

*resource* - name of resource to get count for.

**Outputs**

*count* = count of uses registered to resource.

**See also:** `incrementResourceCount`, `decrementResourceCount`.

**8.2.13 @arduino/getResourceOwner**

*owner* = `getResourceOwner (ar, terminal)`

Get the owner of pin allocated previously by `configurePinResource`.

**Inputs**

*ar* - connected arduino object

*terminal* - terminal number to get owner of.

**Outputs**

*owner* = owner of the terminal pin, or "" if not owned.

**See also:** `configurePinResource`.

**8.2.14 @arduino/getSPITerminals**

*pinlist* = `getSPITerminals (ar)`

Get a cell list of pin Ids available for SPI mode.

**Inputs**

*ar* - the arduino object.

**Outputs**

*pinlist* - cell list of pin numbers available for SPI use.

**See also:** `arduino`.

**8.2.15 @arduino/getServoTerminals**

*pinlist* = `getServoTerminals (ar)`

Get a cell list of pin Ids available for servo use.

**Inputs**

*ar* - the arduino object.

**Outputs**

*pinlist* - cell list of pin numbers available for servo use.

**See also:** `arduino`, `getPWMTerminals`.

**8.2.16 @arduino/getSharedResourceProperty**

*count* = `getSharedResourceProperty (ar, resource, property)`

Get the value of a property from a given resource.

## Inputs

*ar* - connected arduino object

*resource* - name of resource to get property for.

*property* - name of property from the resource.

## Outputs

*propvalue* - value of the property

**See also:** `getResourceCount`, `setSharedResourceProperty`.

### 8.2.17 @arduino/getTerminalMode

*mode* = `getTerminalMode (ar, terminal)`

Get the mode of a pin allocated previously by `configurePinResource`.

## Inputs

*ar* - connected arduino object

*terminal* - terminal number to get owner of.

## Outputs

*mode* - mode of the terminal pin, or "not\_set" if not owned.

**See also:** `configurePinResource`, `getResourceOwner`.

### 8.2.18 @arduino/getTerminalsFromPins

*pinnums* = `getTerminalsFromPins (ar, pins)`

Get the terminal number for each pin.

## Inputs

*ar* - connected arduino object

*pins* - single pin name or cell or vector array of pin names.

## Outputs

*pinnums* - pin number of each named pin. If the input was a single string, returns a number. if the input pins was a vector or cell array, return a cell array of pin numbers corresponding to each input pin name.

**See also:** `arduino`, `getPinsFromTerminals`.

### 8.2.19 @arduino/incrementResourceCount

*count* = `incrementResourceCount (ar, resource)`

Increment the count value of a named resource by 1 and return the new count

## Inputs

*ar* - connected arduino object

*resource* - name of resource to increment count.

## Outputs

*count* = count of uses registered to resource.

**See also:** `getResourceCount`. `decrementResourceCount`.

### 8.2.20 @arduino/isTerminalAnalog

`ret = isTerminalAnalog (obj, terminal)`  
Return true if pin is capable of analog input

#### Inputs

*ar* - the connected arduino object  
*terminal* is a terminal number to check

#### Outputs

*ret* return 1 if terminal is a analog pin, 0 otherwise

### 8.2.21 @arduino/isTerminalDigital

`ret = isTerminalDigital(obj, terminal)`  
Return true if pin is capable of digital functions

#### Inputs

*ar* - the connected arduino object  
*terminal* is a terminal number to check

#### Outputs

*ret* return 1 if terminal is a digital pin, 0 otherwise

### 8.2.22 @arduino/playTone

`playTone (ar, pin, freq, duration)`  
Play a tone of a given frequency on a specified pin.

#### Inputs

*ar* - connected arduino object  
*pin* - digital pin to play tone on  
*freq* - frequency in hertz to play between 0 and 32767Hz.  
*duration* duration in seconds to play tone between 0 and 30 seconds  
If duration is 0 or not specified, tone will continue to play until next tone is commanded. If frequency is 0, tone will stop playing  
**NOTE:** use of playTone can interfere with PWM output.

### 8.2.23 @arduino/readAnalogPin

`value = readAnalogPin (ar, pin)`  
Read analog voltage of *pin*.

#### Inputs

*ar* - connected arduino object.  
*pin* - string name of the pin to read.

#### Outputs

*value* - analog value of the pin

## Example

```
ar = arduino ();
readAnalogPin(ar, "A4");
ans =
87
```

**See also:** `arduino`, `readVoltage`.

### 8.2.24 @arduino/readDigitalPin

`value = readDigitalPin (obj, pin)`  
Read digital value from a digital I/O pin.

#### Inputs

*ar* - connected arduino object.

*pin* - string name of the pin to read.

#### Outputs

*value* - the logical value (0, 1, true false) of the current pin state.

## Example

```
a = arduino ();
pinvalue = readDigitalPin (a, 'D5');
```

**See also:** `arduino`, `writeDigitalPin`.

### 8.2.25 @arduino/readVoltage

`voltage = readVoltage (ar, pin)`  
Read analog voltage of a pin.

#### Inputs

*ar* - connected arduino.

*pin* - pin name or number to query for voltage

#### Outputs

*voltage* - scaled pin value as a voltage

## Example

```
ar = arduino ();
readVoltage(ar, "A4");
ans =
1.401
```

**See also:** `arduino`, `readAnalogPin`.

### 8.2.26 @arduino/reset

`reset (ar)`

Send reset command to arduino hardware to force a hardware reset.

#### Inputs

*ar* - connected arduino object.

**See also:** `arduino`.

### 8.2.27 @arduino/sendCommand

`outdata, outsize = sendCommand (ar, libname, commandid)`

`outdata, outsize = sendCommand (ar, libname, commandid, data)`

`outdata, outsize = sendCommand (ar, libname, commandid, data, timeout)`

Send a command with option data to the connected arduino, waiting up to a specified number of seconds for a response.

#### Inputs

*ar* - connected arduino object.

*libname* - library sending the command. The name should match a programmed library of the arduino, or an error will be displayed.

*commandid* - integer value for the command being sent to the arduino.

*data* - optional data sent with the command.

*timeout* - optional timeout to wait for data

#### Outputs

*outdata* - data returned back from the arduino in response to command

*outsize* - size of data received

If the arduino fails to respond with a valid reply, `sendCommand` will error.

**See also:** `arduino`.

### 8.2.28 @arduino/setSharedResourceProperty

`setSharedResourceProperty (ar, resource, propname, propvalue)`

`setSharedResourceProperty (ar, resource, propname, propvalue, ...)`

Set property values for a given resource.

#### Inputs

*ar* - connected arduino object

*resource* - name of resource to get property for.

*propname* - name of property from the resource.

*propvalue* - value of property from the resource.

Multiple *propname*, *propvalue* pairs can be given.

#### Outputs

None

## Example

```
ar = arduino();
setSharedResourceProperty(ar, "myresource", "myproperty", [1 2 3])
```

**See also:** `getSharedResourceProperty`.

### 8.2.29 @arduino/uptime

```
sec = uptime (ar)
```

Get the number of seconds the arduino board has been running concurrently.

#### Inputs

*ar* - the arduino object of the connection to an arduino board.

#### Outputs

*sec* - the number seconds the board has been running. Note that the count will wrap around after approximately 50 days.

**See also:** `arduino`.

### 8.2.30 @arduino/validatePin

```
validatePin (ar, pin, type)
```

Validate that the mode is allowed for specified pin

If the mode is not valid, an error will be thrown.

#### Inputs

*ar* - connected arduino object

*pin* - name of pin to query mode validity of

*mode* - mode to query

Known modes are:

- 'I2C'
- 'SPI'
- 'PWM'
- 'Servo'
- 'analog'
- 'digital'

**See also:** `arduino`, `configurePin`.

### 8.2.31 @arduino/version

```
ver = version (ar)
```

Get version of library code installed on arduino board

#### Inputs

*ar* - the arduino object of the connection to an arduino board.

## Outputs

*ver* - version string in format of X.Y.Z.

**See also:** `arduino`.

### 8.2.32 @arduino/writeDigitalPin

`writeDigitalPin (ar, pin, value)`

Write digital value to a digital I/O pin.

## Inputs

*ar* - connected arduino object.

*pin* - string name of the pin to write to.

*value* - the logical value (0, 1, true false) to write to the pin.

If pin was unconfigured before using, pin is set into digital mode.

## Example

```
a = arduino();
writeDigitalPin(a,'D5',1);
```

**See also:** `arduino`, `readDigitalPin`.

### 8.2.33 @arduino/writePWMDutyCycle

`writePWMDutyCyle (ar, pin, value)`

Set pin to output a square wave with a specified duty cycle.

## Inputs

*ar* - connected arduino object

*pin* - pin to write to.

*value* - duty cycle value where 0 = off, 0.5 = 50% on, 1 = always on.

## Example

```
a = arduino();
writePWMDutyCycle(a,'D5',0.5);
```

**See also:** `arduino`, `writePWMPVoltage`.

### 8.2.34 @arduino/writePWMPVoltage

`writePWMPVoltage (ar, pin, voltage)`

Emulate an approximate voltage out of a pin using PWM.

## Inputs

*ar* - connected arduino object

*pin* - pin to write to.

*voltage* - voltage to emulate with PWM, between 0 - 5.0

## Example

```
a = arduino();
writePWMDutyCycle(a, 'D5', 1.0);
```

**See also:** `arduino`, `writePWMDutyCycle`.

## 8.3 Arduino I2C Functions

### 8.3.1 @i2cdev/display

`display (dev)`

Display i2cdev object.

#### Inputs

*dev* - i2cdev object

**See also:** `i2cdev`.

### 8.3.2 @i2cdev/i2cdev

`dev = i2cdev (ar, address)`

`dev = i2cdev (ar, address, propname, propvalue)`

Create an i2cdev object to communicate to the i2c port on a connected arduino.

#### Inputs

*ar* - connected arduino object

*address* - address to use for device on I2C bus.

*propname*, *propvalue* - property name/value pair for values to pass to devices.

Currently known properties:

*bus*                *bus* number (when arduino board supports multiple I2C buses) with value of 0 or 1.

#### Outputs

*dev* - new created i2cdev object.

#### Properties

The i2cdev object has the following public properties:

*parent*            The parent (arduino) for this device

*pins*              pins used by this object

*bus*                bus used for created object

*address*           I2C address set for object

**See also:** `arduino`.

### 8.3.3 @i2cdev/read

`data = read (dev, numbytes)`

`data = read (dev, numbytes, precision)`

Read a specified number of bytes from a i2cdev object using optional precision for bytesize.

**Inputs**

*dev* - connected i2c device opened using i2cdev

*numbytes* - number of bytes to read.

*precision* - Optional precision for the output data read data. Currently known precision values are uint8 (default), int8, uint16, int16

**Outputs**

*data* - data read from i2cdevice

**See also:** arduino, i2cdev.

**8.3.4 @i2cdev/readRegister**

```
data = readRegister (dev, reg, numbytes)
```

```
data = readRegister (dev, reg, numbytes, precision)
```

Read a specified number of bytes from a register of an i2cdev object using optional precision for bytesize.

**Inputs**

*dev* - connected i2c device opened using i2cdev

*reg* - registry value number

*numbytes* - number of bytes to read.

*precision* - Optional precision for the output data read data. Currently known precision values are uint8 (default), int8, uint16, int16

**Output**

*data* - data read from device.

**See also:** arduino, i2cdev.

**8.3.5 @i2cdev/subsref**

```
val = subsref (dev, sub)
```

subref for i2cdev

**See also:** i2cdev.

**8.3.6 @i2cdev/write**

```
write (dev, datain)
```

```
write (dev, datain, precision)
```

Write data to a i2cdev object using optional precision for the data byte used for the data.

**Inputs**

*dev* - connected i2c device opened using i2cdev

*datain* - data to write to device. Datasize should not exceed the constraints of the data type specified for the precision.

*precision* - Optional precision for the input write data. Currently known precision values are uint8 (default), int8, uint16, int16

**See also:** arduino, i2cdev, read.

### 8.3.7 @i2cdev/writeRegister

```
writeRegister (dev, reg, datain)
writeRegister (dev, dev, datain, precision)
```

Write data to i2cdev object at a given registry position using optional precision for the data byte used for the data.

#### Inputs

*dev* - connected i2c device opened using i2cdev

*reg* - registry position to write to.

*datain* - data to write to device. Datasize should not exceed the constraints of the data type specified for the precision.

*precision* - Optional precision for the input write data. Currently known precision values are uint8 (default), int8, uint16, int16

**See also:** arduino, i2cdev, read.

### 8.3.8 scanI2Cbus

```
retval = scanI2Cbus (ar)
retval = scanI2Cbus (ar, bus)
```

Scan arduino for devices on the I2C bus.

#### Inputs

*ar* - arduino object connected to a arduino board.

*bus* - bus number to scan I2C devices, when multiple buses are available. If the bus is not specified, it will default to 0.

#### Outputs

*retval* - cell array of addresses as strings in format of "0xXX".

#### Example

```
# create arduino connection.
ar = arduino();
# get the pins that will be used for I2C
scanI2Cbus (ar)
% output
ans =
{
    [1,1] = 0x50
}
```

**See also:** arduino, i2cdev.

## 8.4 Arduino Rotary Encoder Functions

### 8.4.1 @rotaryEncoder/display

```
retval = display (obj)
```

Display the rotary encoder object in a verbose way,

## Inputs

*obj* - the arduino rotary encoder object created with rotaryEncoder

**See also:** rotaryEncoder.

### 8.4.2 @rotaryEncoder/readCount

```
[count, time] = readCount (obj)
```

```
[count, time] = readCount (obj, name, value)
```

read count value from the rotary encoder.

subsubheading Inputs *obj* - rotary encoder object created with rotaryEncoder call.

*name, value* - optional name,value pairs

Valid option name pairs currently are:

reset           Reset the count after reading (if true)

## Outputs

*count* - returned count read from the encoder.

*time* - seconds since arduino started

**See also:** rotaryEncoder, resetCount.

### 8.4.3 @rotaryEncoder/readSpeed

```
speed = readSpeed (obj)
```

read rotational speed from the rotary encoder.

## Inputs

*obj* - rotary encoder object created with rotaryEncoder call.

## Outputs

*speed* - returned speed in revolutions per minute read from the encoder.

**See also:** rotaryEncoder, resetCount.

### 8.4.4 @rotaryEncoder/resetCount

```
reset (obj)
```

```
reset (obj, cnt)
```

reset the rotary encoder count values

## Inputs

*obj* - the rotaryEncoder object

*cnt* - optional count value to reset to

**See also:** rotaryEncoder, readCount.

### 8.4.5 @rotaryEncoder/rotaryEncoder

```
obj = rotaryEncoder (ar, chanApin, chanBpin)
```

```
obj = rotaryEncoder (ar, chanApin, chanBpin, ppr)
```

Create a rotaryEncoder object controlled by the input pins.

**Inputs**

*ar* - connected arduino object.

*chanApin* - pin used for channel A

*chanBpin* - pin used for channel B

*ppr* - count of encoder pulsed required for a full revolution of the encoder.

**Outputs**

*obj* - created rotary encoder object

**Example**

```
a = arduino ();
enc = rotaryEncoder(a, "d2", "d3", 180);
```

**Properties**

The rotaryEncoder object has the following public properties:

parent      The parent (arduino) for this device

pins        pins used by this object

ppr        Number of pulses used per rotation

**See also:** arduino.

**8.4.6 @rotaryEncoder/subsref**

```
val = subsref (dev, sub)
      subref for rotaryEncoder
```

**See also:** rotaryEncoder.

**8.5 Arduino Servo Functions****8.5.1 @servo/display**

```
display (dev)
      Display servo object.
```

**Inputs**

*dev* - device to display

**See also:** servo.

**8.5.2 @servo/readPosition**

```
position = readPosition (servo)
      Read the position of a servo
```

**Inputs**

*servo* - servo object created from arduino.servo.

**Outputs**

*position* - value between 0 .. 1 for the current servo position, where 0 is the servo min position, 1 is the servo maximum position.

**See also:** servo, writePosition.

### 8.5.3 @servo/servo

```
obj = servo (arduinoobj, pin)
obj = servo (arduinoobj, pin, propertyname, propertyvalue)
```

Create a servo object using a specified pin on a arduino board.

#### Inputs

*obj* - servo object

*arduinoobj* - connected arduino object

*propertyname*, *propertyvalue* - name value pairs for properties to pass to the created servo object.

Current properties are:

minpulseduration

min PWM pulse value in seconds.

maxpulseduration

max PWM pulse value in seconds.

#### Outputs

*obj* - created servo object.

#### Example

```
# create arduino connection
ar = arduino();
# create hobby servo (1 - 2 ms pulse range)
servo = servo(ar, "d9", "minpulseduration", 1.0e-3, "maxpulseduration", 2e-3);
# center the servo
writePosition(servo, 0.5);
```

#### Properties

The servo object has the following public properties:

parent      The parent (arduino) for this device

pins        pins used by this object

minpulseduration

minpusleduration set for object

maxpulseduration

maxpulseduration set for object

**See also:** arduino, readPosition, writePosition.

### 8.5.4 @servo/subsref

```
val = subsref (dev, sub)
```

subref for servo

**See also:** servo.

### 8.5.5 @servo/writePosition

```
writePosition (servo, position)
```

Write the position to a servo.

## Inputs

*servo* - servo object created from `arduino.servo`.

*position* - value between 0 .. 1 for the current servo position, where 0 is the servo min position, 1 is the servo maximum position.

**See also:** `servo`, `readPosition`.

## 8.6 Arduino Shiftregister Functions

### 8.6.1 @shiftRegister/display

```
retval = display (register)
```

Display the register object in a verbose way,

## Inputs

*register* - the arduino register object created with `shiftRegister`.

**See also:** `shiftRegister`.

### 8.6.2 @shiftRegister/read

```
retval = read (register)
```

```
retval = read (register, precision)
```

read a value from the shift register.

## Inputs

*register* - shift register created from `shiftRegister` call.

*precision* - optional precision of the data, where precision can be a number in a multiple of 8 (ie: 8,16,32) or can be a named integer type: 8 of `'uint8'`, `'uint16'`, `'uint32'`. The default precision is 8.

## Outputs

*retval* - returned data read from the register.

**See also:** `shiftRegister`, `write`.

### 8.6.3 @shiftRegister/reset

```
reset (register)
```

clear the shift register value.

## Inputs

*register* - shift register created from `shiftRegister` call.

**See also:** `shiftRegister`, `read`, `write`.

### 8.6.4 @shiftRegister/shiftRegister

```
register = shiftRegister (ar, shifttype, dataPin, clockPin ...)
```

```
register = shiftRegister (ar, '74hc164', dataPin, clockPin, resetPin)
```

```
register = shiftRegister (ar, '74hc165', dataPin, clockPin, loadPin,  
                        clockEnablePin)
```

```
register = shiftRegister(ar, '74hc595', dataPin, clockPin, latchPin ,  
                        resetPin)
```

Create shift register of a given type, controlled by the input pins.

## Inputs

Common function parameter definition:

*ar* - connected arduino object.

*shifttype* - string name of the shift register type.

*dataPin* - pin used for data in/out of the device.

*clockPin* - pin used for clocking data on the shiftRegister.

Other variables are dependent on the shift register type:

'74hc164' Additional inputs:

*resetPin* - optional pin for resetting the shift register.

'74hc165' Additional inputs:

*loadPin* - load pin to the shift register. *clockEnablePin* - clock enable pin.

'74hc595' Additional inputs:

*latchPin* - latching data to the shift register. *resetPin* - optional pin for resetting the shift register.

## Outputs

*register* - register object

## Properties

The shiftRegister object has the following public properties:

parent      The parent (arduino) for this device

pins        pins used by this object

model      model set for object

**See also:** arduino.

### 8.6.5 @shiftRegister/subsref

```
val = subsref (dev, sub)
```

subref for shiftRegister

**See also:** shiftRegister.

### 8.6.6 @shiftRegister/write

```
write (register, dataIn)
```

```
write (register, dataIn, precision)
```

Write a value to the shift register.

## Inputs

*register* - shift register created from shiftRegister call.

*dataIn* - data to clock into the shiftRegister.

*precision* - optional precision of the data, where precision can be a number in a multiple of 8 (ie: 8,16,32) or can be a named integer type of 'uint8', 'uint16', 'uint32'. The default precision is 8.

**See also:** shiftRegister, read.

## 8.7 Arduino SPI Functions

### 8.7.1 @spidev/display

`display (dev)`

Display spidev object.

#### Inputs

*dev* - spidev object to display

**See also:** spidev.

### 8.7.2 @spidev/spidev

`dev = spidev (ar, cspin)`

`dev = spidev (ar, cspin, propname, propvalue)`

Create an spidev object to communicate to the SPI port on a connected arduino.

#### Inputs

*ar* - connected arduino object

*cspin* - chip select pin for attached spi device.

*propname*, *propvalue* - property name/value pair for values to pass to devices.

Currently known properties:

bitrate      bit rate speed in Mbs

bitorder    'msbfirst' or 'lsbfirst'

mode        SPI mode 0 - 3.

#### Outputs

*dev* - created spidev object

#### Properties

The spidev object has the following public properties:

parent      The parent (arduino) for this device

pins        pins used by this object

mode        mode used for created object

bitrate     Bitrate set for object

bitorder    Bitorder set for object

chipselctpin

Pin used for chipselect

**See also:** arduino, readWrite.

### 8.7.3 @spidev/subsref

`val = subsref (dev, sub)`

subref for spidev

**See also:** spidev.

### 8.7.4 @spidev/writeRead

*dataOut* = readWrite (*spi*, *dataIn*)

Write uint8 data to spi device and return back clocked out response data of same size.

#### Inputs

*spi* - connected spi device on arduino

*dataIn* - uint8 sized data to send to spi device framed between SS frame.

#### Outputs

*dataOut* - uint8 data clocked out during send to *dataIn*.

**See also:** arduino, spidev.

## 8.8 Arduino Addons

### 8.8.1 addon

*retval* = addon (*ar*, *addonname*)

*retval* = addon (*ar*, *addonname*, *varargs*)

Create an addon object using the addon named class.

#### Inputs

*ar* - connected arduino object

*addonname* - the name of the addon to create. The addon name can be a user addon or an inbuilt addon, however must appear in the listArduinoLibraries output and have been programmed onto the arduino.

*varargs* - optional values that will be provided verbatim to the the addon class constructor.

#### Outputs

*retval* - cell array of string library names.

**See also:** arduino, arduinosetup, listArduinoLibraries.

### 8.8.2 arduinoioaddons.EEPROMAddon.EEPROM

arduinoioaddons.EEPROMAddon.EEPROM

EEPROM addon for arduino

Allows read and write of uint8 data to the onboard arduino EEPROM.

#### Example

Assuming eeprom addon has been programmed into the Arduino:

```
a = arduino ();
e = addon (a, "eepromaddon/eeprom");
write (e, 0, uint8("hello world"));
str = uint8( read(e, 0, 11) )
```

**See also:** addon.

#### Properties

*length* - Size of the EEPROM.

## Methods

`eeeprom = EEPROM ()`

Constructor to create eeprom device.

## Outputs

*eeeprom* - created EEPROM device.

`erase ()`

Erase all values in EEPROM (Effectively setting the 0xFF)

`write (address, uintdata)`

Write data to EEPROM at the provided address.

## Inputs

*address* - start address to write data to, should be a integer between 0 and the size of the EEPROM.

*uintdata* a value or array of uint8 data to write to EEROM.

`data = read (address)`

`data = read (address, count)`

Read data from starting address of EEPROM.

## Inputs

*address* - start address to read data from, should be a integer between 0 and the size of the EEPROM.

*count* - Number of uint8 values to read from the EEPROM (default is 1)

## Outputs

*data* a value or array of uint8 data read from the EEROM.

### 8.8.3 arduinoioaddons.ExampleAddon.Echo

`arduinoioaddons.ExampleAddon.Echo`

Basic Example matlab/octave code to illustrate creating a user addon.

**See also:** `addon`.

## Properties

*Parent* - the parent arduino object.

*Pins* - the pins allocated the addon.

## Methods

`obj = Echo(arObj)`

Constructor to create Echo addon

## Inputs

*arObj* - the arduino parent object

## Outputs

*obj* - created Echo object

`response = shout(text)`

Send text to arduino and receive back the echoed reply

**Inputs**

*text* - text to send to arduino

**Outputs**

*response* - response from the arduino, which should be the same as the input text.

**8.8.4 arduinoioaddons.ExampleLCD.LCD**

`arduinoioaddons.LCDAddon.LCD`

Basic Example octave addon for LCD

Allows basic manipulation of an LCD as a illustration of using the addon functionality.

**Example**

Assuming the arduino has been programmed with the lcd addon:

```
a = arduino();
lcd = addon(a, "examplelcd/lcd", "d8", "d9", "d4", "d5", "d6", "d7")
clearLCD(lcd);
printLCD(lcd, "Hello");
# go to next line
gotoLCD(lcd, 0, 1);
printLCD(lcd, "World");
```

**See also:** `addon`.

**Properties**

*Pins* - the pins allocated the LCD display.

**Methods**

`lcd = LCD(arObj, rs, enable, d0, d1, d2, d3)`

Constructor to create LCD device

**Inputs**

*arObj* - the arduino parent object

*rs* - the pin to use for the rs line.

*enable* - the pin to use for the enable line.

*d0* - the pin to use for the d0 line.

*d1* - the pin to use for the d1 line.

*d2* - the pin to use for the d2 line.

*d3* - the pin to use for the d3 line.

**Outputs**

*lcd* - created LCD object

`freeLCD()`

Free the LCD

Should be called before discarding the LCD

**Inputs**

None.

**Outputs**

None.

`clearLCD()`

Clear the LCD display and set the cursor position to the home position.

**Inputs**

None.

**Outputs**

None.

`printLCD(text)`

Display text on LCD starting at the current cursor position.

**Inputs**

*text* - text to display on LCD

**Outputs**

None.

`gotoLCD(col, row)`

Set the cursor position to row, col

**Inputs**

*col* - 0 indexed LCD column to position to.

*row* - 0 indexed LCD row to position to.

**Outputs**

None.

**8.8.5 arduinoioaddons.RTCAddon.DS1307**

`arduinoioaddons.RTCAddon.DS1307`

DS1307 addon

**See also:** `addon`.

**Properties**

*Parent* - the parent arduino object.

*Pins* - the pins allocated the addon.

**Methods**

`obj = DS1307(arObj)`

`obj = DS1307(arObj, propertyname, propertyvalue ....)`

Constructor to create DS1307 addon

**Inputs**

*arObj* - the arduino parent object

*propertyname, propertyvalue* - optional property name, value pairs. Current known properties are:

*address*      I2C address of the DS1307 (default 0x68)

## Outputs

*obj* - created DS1307 object

## Example

```
a = arduino()
rtc = addon(a, "rtcaddon/ds1307")
```

```
date = clock(dsObj)
clock(dsObj, date)
Get/set the DS1307 clock
```

## Inputs

*dsObj* - the ds1307 object

*date* - a date vector in same format as datevec and clock

## Outputs

*date* - a date vector in same format as datevec and clock

## Example

```
a = arduino()
rtc = addon(a, "rtcaddon/ds1307")
# get and display rtc time as a date string
datestr(rtc.clock)
```

**See also:** datevec.

```
ctrl = control(dsObj)
control(dsObj, ctrl)
Get/set the DS1307 clock
```

## Inputs

*dsObj* - the ds1307 object

*ctrl* - a structure containing the control bit fields.

## Outputs

*ctrl* - a structure containing the control bit fields.

Control structure fields are: Current properties are:

out	Out bit in the control register
sqwe	Square wave enable bit in control register
rs	The combined RS0, RS1 value

```
YN = isstarted(dsObj)
Get whether the RTC clock is currently counting time
```

## Inputs

*dsObj* - the ds1307 object

**Outputs**

*YN* - returns true if the RTC is counting

**See also:** *start*, *stop*.

***start(dsObj)***

Start the RTC counting

**Inputs**

*dsObj* - the ds1307 object

**Outputs**

None

**See also:** *datevec*.

***stop(dsObj)***

Stop the RTC counting

**Inputs**

*dsObj* - the ds1307 object

**Outputs**

None

**See also:** *datevec*.

## 8.9 Arduino I/O package

### 8.9.1 arduinoio.AddonBase

**arduinoio.AddonBase**

Base class used for arduino library sensors

**See also:** *arduinoio.LibraryBase*.

**Properties**

Base properties are expected to be inherited and overwritten in inherited classes. and are constant in order to query through the metaobject mechanism.

*Parent* - parent librarybase object

**Methods**

***ab = AddonBase ()***

Constructor of base class

**Outputs**

The return value *ab* is an object of the *arduinoio.AddonBase* class.

**See also:** *arduino*, *addon*.

***display ()***

Display the addon in a verbose way.

### 8.9.2 arduinoio.FilePath

`retval = arduinoio.FilePath (fullpathname)`

Get the directory component of a pathname.

#### Inputs

*fullpathname* filepath to get directory component of.

#### Outputs

*retval* the directory part of the filename.

### 8.9.3 arduinoio.LibFiles

`filelist = arduinoio.LibFiles ()`

Get the list of files used for the building arduino library

#### Outputs

*filelist* - string cell array of files for the arduino project

### 8.9.4 arduinoio.LibraryBase

`arduinoio.LibraryBase`

Base class used for arduino library plugins

**See also:** `arduino`, `listArduinoLibraries`, `addon`.

#### Properties

Base properties are expected to be inherited and overwritten in inherited classes. and are constant in order to query through the metaobject mechanism.

*LibraryName* - name of the addon library

*DependentLibraries* - array of dependant library names that must be included when installing this plugin.

*CppHeaderFile* - name (if any) of header file that will be included into the arduino project when adding this library.

*CppSourceFile* - name (if any) of source file that will be included into the arduino project when adding this library.

*CppClassName* - name of the cpp class for the addon library. project when adding this library.

*Pins* - pins allocated to the addon

*Parent* - parent arduino object.

#### Methods

`lb = LibraryBase ()`

Constructor of base class

The constructor is usually not called but called indirectly from the `addon` function.

#### Outputs

The return value *lb* is an object of the `arduinoio.LibraryBase` class.

**See also:** `arduino`, `listArduinoLibraries`, `addon`.

`display ()`

Display the addon in a verbose way.

### 8.9.5 `arduinoio.getBoardConfig`

`retval = arduinoio.getBoardConfig (boardname)`

Return the configuration for a known arduino board type

Function is used to get the expected pin/board configuration for a named board type which is used to verify and identify the functionality of the board.

#### **Inputs**

*boardname* - name of board to get configuration of ie: "uno"

#### **Outputs**

*retval* configuration struct.

# Appendix A GNU General Public License

Version 3, 29 June 2007

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