# AYABInterface Documentation

***Release 9***

**AllYarnsAreBeautiful**
**FOSSASIA**

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CHAPTER 1

# AYABInterface Installation Instructions

## 1.1 Package installation from Pypi

The AYABInterface library requires Python 3. It can be installed form the Python Package Index.

### 1.1.1 Windows

Install it with a specific python version under windows:

```
py -3 -m pip --no-cache-dir install --upgrade AYABInterface
```

Test the installed version:

```
py -3 -m pytest --pyargs AYABInterface
```

### 1.1.2 Linux

To install the version from the python package index, you can use your terminal and execute this under Linux:

```
sudo python3 -m pip --no-cache-dir install --upgrade AYABInterface
```

test the installed version:

```
python3 -m pytest --pyargs AYABInterface
```

## 1.2 Installation from Repository

You can setup the development version under Windows and Linux.

### 1.2.1 Linux

If you wish to get latest source version running, you can check out the repository and install it manually.

```
git clone https://github.com/fossasia/AYABInterface.git
cd AYABInterface
sudo python3 -m pip install --upgrade pip
sudo python3 -m pip install -r requirements.txt
sudo python3 -m pip install -r test-requirements.txt
py.test
```

To also make it importable for other libraries, you can link it into the site-packages folder this way:

```
sudo python3 setup.py link
```

### 1.2.2 Windows

Same as under *Linux* but you need to replace `sudo python3` with `py -3`. This also counts for the following documentation.

CHAPTER 2

# Development Setup

Make sure that you have the *repository installed*.

## 2.1 Install Requirements

To install all requirements for the development setup, execute

```
pip install --upgrade -r requirements.txt -r test-requirements.txt -r dev-
↪requirements.txt
```

## 2.2 Sphinx Documentation Setup

Sphinx was setup using the tutorial from readthedocs. It should be already setup if you completed *the previous step*.

Further reading:

- domains

With Notepad++ under Windows, you can run the make_html.bat file in the `docs` directory to create the documentation and show undocumented code.

## 2.3 Code Climate

To install the code climate command line interface (cli), read about it in their github repository You need docker to be installed. Under Linux you can execute this in the Terminal to install docker:

```
wget -qO- https://get.docker.com/ | sh
sudo usermod -aG docker $USER
```

Then, log in and out. Then, you can install the command line interface:

```
wget -qO- https://github.com/codeclimate/codeclimate/archive/master.tar.gz | tar xvz
cd codeclimate-* && sudo make install
```

Then, go to the AYABInterface repository and analyze it.

```
codeclimate analyze
```

## 2.4 Version Pinning

We use version pinning, described in this blog post (outdated). Also read the current version for how to set up.

After installation you can run

```
pip install -r requirements.in -r test-requirements.in -r dev-requirements.in
pip-compile --output-file requirements.txt requirements.in
pip-compile --output-file test-requirements.txt test-requirements.in
pip-compile --output-file dev-requirements.txt dev-requirements.in
pip-sync requirements.txt dev-requirements.txt test-requirements.txt
pip install --upgrade -r requirements.txt -r test-requirements.txt -r dev-
↪requirements.txt
```

`pip-sync` uninstalls every package you do not need and writes the fix package versions to the requirements files.

## 2.5 Continuous Integration to Pypi

Before you put something on Pypi, ensure the following:

1. The version is in the master branch on github.
2. The tests run by travis-ci run successfully.

Pypi is automatically deployed by travis. See here. To upload new versions, tag them with git and push them.

```
setup.py tag_and_deploy
```

The tag shows up as a travis build. If the build succeeds, it is automatically deployed to Pypi.

## 2.6 Manual Upload to the Python Package Index

However, here you can see how to upload this package manually.

### 2.6.1 Version

Throughout this chapter, `<new_version>` refers to a a string of the form `[0-9]+\.[0-9]+\.[0-9]+[ab]?` or `<MAYOR>.<MINOR>.<STEP>[<MATURITY>]` where `<MAYOR>`, `<MINOR>` and, `<STEP>` represent numbers and `<MATURITY>` can be a letter to indicate how mature the release is.

1. Create a new branch for the version.

```
git checkout -b <new_version>
```

2. Increase the `__version__` in __init__.py
   - no letter at the end means release
   - `b` in the end means Beta
   - `a` in the end means Alpha
3. Commit and upload this version.

```
git add AYABInterface/__init__.py
git commit -m "version <new_version>"
git push origin <new_version>
```

4. Create a pull-request.
5. Wait for travis-ci to pass the tests.
6. Merge the pull-request.
7. Checkout the master branch and pull the changes from the *commit*.

```
git checkout master
git pull
```

8. Tag the version at the master branch with a `v` in the beginning and push it to github.

```
git tag v<new_version>
git push origin v<new_version>
```

9. *Upload* the code to Pypi.

### 2.6.2 Upload

First ensure all tests are running:

```
setup.py pep8
```

From docs.python.org:

```
setup.py sdist bdist_wininst upload register
```

## 2.7 Classifiers

You can find all Pypi classifiers here.

CHAPTER 3

# Reference

## 3.1 The AYABInterface Module Reference

### 3.1.1 AYABInterface Module

AYABInterface - a module to control the AYAB shield.

**See also:**

http://ayab-knitting.com/

AYABInterface. **NeedlePositions** ( **args*, ***kw*)
Create a new NeedlePositions object.

**Returns** an *AYABInterface.needle_positions.NeedlePositions*

**See also:**

*AYABInterface.needle_positions.NeedlePositions*

AYABInterface. **get_machines** ( )
Return a list of all machines that can be used.

**Return type** list

**Returns** a list of Machines

AYABInterface. **get_connections** ( )
Return a list of all available serial connections.

**Return type** list

**Returns** a list of AYABInterface.SerialPort . All of the returned objects have a connect() method and a name attribute.

### 3.1.2 actions Module

These are the actions that can be executed by the users.

**class** AYABInterface.actions. **ActionMetaClass** ( *name*, *bases*, *attributes*)
Bases: type

Metaclass for the actions.

This class makes sure each *Action* has tests.

If a class is named `MyAction` , each *`Action`* gets the method `is_my_action()` which returns `False` for all *`Actions`* expcept for `MyAction` it returns `True` .

**`__init__`** ( *name*, *bases*, *attributes*)
Create a new *`Action`* subclass.

**class** `AYABInterface.actions.` **`Action`** ( **arguments*)
Bases: `object`

A base class for actions.

**`__eq__`** ( *other*)
Whether this object is equal to the other.

**Return type** bool

**`__hash__`** ( )
The hash of the object.

**Return type** int

**Returns** the `hash()` of the object

**`__init__`** ( **arguments*)
Create a new *`Action`* .

**Parameters** **`arguments`** (*`tuple`*) – The arguments passed to the action. These are also used to determine *`equality`* and the *`hash`* .

**`__repr__`** ( )
Return this object as string.

**Return type** str

**`__weakref__`**
list of weak references to the object (if defined)

**`is_action`** ( )
Test whether this is a Action.

**Return type** bool

**Returns** `True`

**`is_move_carriage_over_left_hall_sensor`** ( )
Test whether this is a MoveCarriageOverLeftHallSensor.

**Return type** bool

**Returns** `False`

**`is_move_carriage_to_the_left`** ( )
Test whether this is a MoveCarriageToTheLeft.

**Return type** bool

**Returns** `False`

**`is_move_carriage_to_the_right`** ( )
Test whether this is a MoveCarriageToTheRight.

**Return type** bool

**Returns** `False`

**`is_move_needles_into_position`** ( )
Test whether this is a MoveNeedlesIntoPosition.

**Return type** bool

**Returns** False

**is_put_color_in_nut_a** ( )
Test whether this is a PutColorInNutA.

**Return type** bool

**Returns** False

**is_put_color_in_nut_b** ( )
Test whether this is a PutColorInNutB.

**Return type** bool

**Returns** False

**is_switch_carriage_to_mode_kc** ( )
Test whether this is a SwitchCarriageToModeKc.

**Return type** bool

**Returns** False

**is_switch_carriage_to_mode_nl** ( )
Test whether this is a SwitchCarriageToModeNl.

**Return type** bool

**Returns** False

**is_switch_off_machine** ( )
Test whether this is a SwitchOffMachine.

**Return type** bool

**Returns** False

**is_switch_on_machine** ( )
Test whether this is a SwitchOnMachine.

**Return type** bool

**Returns** False

**class** AYABInterface.actions. **SwitchCarriageToModeKc** ( **arguments*)
Bases: *AYABInterface.actions.Action*

The user switches the mode of the carriage to KC.

**is_switch_carriage_to_mode_kc** ( )
Test whether this is a SwitchCarriageToModeKc.

**Return type** bool

**Returns** True

**class** AYABInterface.actions. **SwitchCarriageToModeNl** ( **arguments*)
Bases: *AYABInterface.actions.Action*

The user switches the mode of the carriage to NL.

**is_switch_carriage_to_mode_nl** ( )
Test whether this is a SwitchCarriageToModeNl.

**Return type** bool

**Returns** True

**class** AYABInterface.actions. **MoveCarriageOverLeftHallSensor** ( **arguments*)
Bases: *AYABInterface.actions.Action*

The user moves the carriage over the left hall sensor.

**is_move_carriage_over_left_hall_sensor** ( )
Test whether this is a MoveCarriageOverLeftHallSensor.

**Return type** bool

**Returns** True

**class** AYABInterface.actions. **MoveCarriageToTheLeft** ( **arguments*)
Bases: *AYABInterface.actions.Action*

The user moves the carriage to the left.

**is_move_carriage_to_the_left** ( )
Test whether this is a MoveCarriageToTheLeft.

**Return type** bool

**Returns** True

**class** AYABInterface.actions. **MoveCarriageToTheRight** ( **arguments*)
Bases: *AYABInterface.actions.Action*

The user moves the carriage to the right.

**is_move_carriage_to_the_right** ( )
Test whether this is a MoveCarriageToTheRight.

**Return type** bool

**Returns** True

**class** AYABInterface.actions. **PutColorInNutA** ( **arguments*)
Bases: *AYABInterface.actions.Action*

The user puts a color into nut A.

**is_put_color_in_nut_a** ( )
Test whether this is a PutColorInNutA.

**Return type** bool

**Returns** True

**class** AYABInterface.actions. **PutColorInNutB** ( **arguments*)
Bases: *AYABInterface.actions.Action*

The user puts a color into nut B.

**is_put_color_in_nut_b** ( )
Test whether this is a PutColorInNutB.

**Return type** bool

**Returns** True

**class** AYABInterface.actions. **MoveNeedlesIntoPosition** ( **arguments*)
Bases: *AYABInterface.actions.Action*

The user moves needles into position.

**is_move_needles_into_position** ( )
Test whether this is a MoveNeedlesIntoPosition.

**Return type** bool

**Returns** True

**class** AYABInterface.actions. **SwitchOffMachine** ( **arguments*)
Bases: *AYABInterface.actions.Action*

The user switches off the machine.

**is_switch_off_machine** ( )
Test whether this is a SwitchOffMachine.

**Return type** bool

**Returns** True

**class** AYABInterface.actions. **SwitchOnMachine** ( **arguments*)
Bases: *AYABInterface.actions.Action*

The user switches on the machine.

**is_switch_on_machine** ( )
Test whether this is a SwitchOnMachine.

**Return type** bool

**Returns** True

### 3.1.3 carriages Module

This module contains all the supported carriages.

**class** AYABInterface.carriages. **Carriage**
Bases: object

A base class for carriages.

**__eq__** ( *other*)
Equivalent to `self == other`.

**__hash__** ( )
Make this object hashable.

**__repr__** ( )
This object as string.

**__weakref__**
list of weak references to the object (if defined)

**class** AYABInterface.carriages. **KnitCarriage**
Bases: *AYABInterface.carriages.Carriage*

The carriage used for knitting.

### 3.1.4 interaction Module

This module can be used to interact with the AYAB Interface.

**class** AYABInterface.interaction. **Interaction** ( *knitting_pattern*, *machine*)
Bases: object

Interaction with the knitting pattern.

**__init__** ( *knitting_pattern*, *machine*)
Create a new interaction object.

**Parameters**

- **knitting_pattern** – a KnittingPattern
- **machine** (AYABInterface.machines.Machine) – the machine to knit on

**__weakref__**
list of weak references to the object (if defined)

**actions**
A list of actions to perform.

**Returns** a list of *AYABInterface.actions.Action*

**communicate_through** ( *file*)
Setup communication through a file.

**Return type** *AYABInterface.communication.Communication*

**communication**
The communication with the controller.

:rtype:AYABInterface.communication.Communication

### 3.1.5 machines Module

This module contains the information about the different types of machines.

Every machine specific knowledge should be put in this file. Machine specific knowledge is, for example:

- the number of needles a machine supports
- whether it is single or double bed
- how many colors are supported
- the name of the machine

**class** AYABInterface.machines. **Machine**
Bases: object

The type of the machine.

This is an abstract base class and some methods need to be overwritten.

**NAME = None**
the name of the machine

**__eq__** ( *other*)
Equavalent of `self == other`.

**Return type** bool

**Returns** whether this object is equal to the other object

**__hash__** ( )
Return the hash of this object.

**See also:**

`hash()`

**__repr__** ( )
Return this object as a string.

**__weakref__**
list of weak references to the object (if defined)

**is_ck35** ( )
Whether this machine is a Brother CK-35.

**Return type** bool

**is_kh270** ( )
Whether this machine is a Brother KH-270.

**Return type** bool

**is_kh900** ( )
Whether this machine is a Brother KH-910.

**Return type** bool

**is_kh910** ( )
Whether this machine is a Brother KH-900.

**Return type** bool

**is_kh930** ( )
Whether this machine is a Brother KH-930.

**Return type** bool

**is_kh950** ( )
Whether this machine is a Brother KH-950.

**Return type** bool

**is_kh965** ( )
Whether this machine is a Brother KH-965.

**Return type** bool

**left_end_needle**
The index of the leftmost needle.

**Return type** int

**Returns** `0`

**name**
The identifier of the machine.

**needle_positions**
The different needle positions.

**Return type** tuple

**needle_positions_to_bytes** ( *needle_positions*)
Convert the needle positions to the wire format.

This conversion is used for *The cnfLine Message*.

**Parameters** **needle_positions** – an iterable over *needle_positions* of length *number_of_needles*

**Return type** *bytes*

**number_of_needles**
The number of needles of this machine.

**Return type** int

**right_end_needle**
The index of the rightmost needle.

**Return type** int

**Returns** *left_end_needle* + *number_of_needles* - 1

**class** AYABInterface.machines. **KH9XXSeries**
Bases: *AYABInterface.machines.Machine*

The base class for the KH9XX series.

**needle_positions**
The different needle positions.

**Return type** tuple

**Returns** the needle positions are “B” and “D”

**number_of_needles**
The number of needles on this machine.

**Return type** int

**Returns** 200 . The KH9XX series has 200 needles.

**class** AYABInterface.machines. **CK35**
Bases: *AYABInterface.machines.Machine*

The machine type for the Brother CK-35.

**needle_positions**
The different needle positions.

**Return type** tuple

**Returns** the needle positions are “B” and “D”

**number_of_needles**
The number of needles on this machine.

**Return type** int

**Returns** 200 . The KH9XX series has 200 needles.

**class** AYABInterface.machines. **KH900**
Bases: *AYABInterface.machines.KH9XXSeries*

The machine type for the Brother KH-900.

**class** AYABInterface.machines. **KH910**
Bases: *AYABInterface.machines.KH9XXSeries*

The machine type for the Brother KH-910.

**class** AYABInterface.machines. **KH930**
Bases: *AYABInterface.machines.KH9XXSeries*

The machine type for the Brother KH-930.

**class** AYABInterface.machines. **KH950**
Bases: *AYABInterface.machines.KH9XXSeries*

The machine type for the Brother KH-950.

**class** AYABInterface.machines. **KH965**
Bases: *AYABInterface.machines.KH9XXSeries*

The machine type for the Brother KH-965.

**class** AYABInterface.machines. **KH270**
Bases: *AYABInterface.machines.Machine*

The machine type for the Brother KH-270.

**needle_positions**
The different needle positions.

**Return type** tuple

**Returns** the needle positions are "B" and "D"

**number_of_needles**
The number of needles on this machine.

**Return type** int

**Returns** `200` . The KH9XX series has 200 needles.

AYABInterface.machines. **get_machines** ( )
Return a list of all machines.

**Return type** list

**Returns** a list of `Machines`

### 3.1.6 needle_positions Module

This module provides the interface to the AYAB shield.

**class** AYABInterface.needle_positions. **NeedlePositions** ( *rows*, *machine* )
Bases: `object`

An interface that just focusses on the needle positions.

**__init__** ( *rows*, *machine* )
Create a needle interface.

**Parameters**

- **rows** (*list*) – a list of lists of *needle positions*
- **Machine** – the machine type to use

**Raises** **ValueError** – if the arguments are not valid, see *check()*

**__weakref__**
list of weak references to the object (if defined)

**check** ( )
Check for validity.

**Raises** **ValueError** –

- if not all lines are as long as the *number of needles*
- if the contents of the rows are not *needle positions*

**completed_row_indices**
The indices of the completed rows.

**Return type** list

When a *row was completed*, the index of the row turns up here. The order is preserved, entries may occur duplicated.

**get_row** ( *index*, *default=None* )
Return the row at the given index or the default value.

**machine**
The machine these positions are on.

**on_row_completed** ( *callable* )
Add an observer for completed rows.

**Parameters** **callable** – a callable that is called with the row index as first argument

When *row_completed()* was called, this `callable` is called with the row index as first argument. Call this method several times to register more observers.

**row_completed** ( *index* )
Mark the row at index as completed.

**See also:**

*completed_row_indices()*

This method notifies the obsevrers from *on_row_completed()*.

### 3.1.7 serial Module

The serial interface.

Execute this module to print all serial ports currently available.

AYABInterface.serial. **list_serial_port_strings** ( )
Lists serial port names.

**Raises** **EnvironmentError** – On unsupported or unknown platforms

**Returns** A list of the serial ports available on the system

**See also:**

The Stack Overflow answer

AYABInterface.serial. **list_serial_ports** ( )
Return a list of all available serial ports.

**Return type** list

**Returns** a list of *serial ports*

**class** AYABInterface.serial. **SerialPort** ( *port* )
Bases: object

A class abstracting the port behavior.

**__init__** ( *port*)
Create a new serial port instance.

**Parameters** **port** (*str*) – the port to connect to

**Note:** The baud rate is specified in *Serial Communication*

**__repr__** ( )
Return this object as string.

**Return type** str

**__weakref__**
list of weak references to the object (if defined)

**connect** ( )
Return a connection to this port.

**Return type** serial.Serial

**name**
The name of the port for displaying.

**Return type** str

### 3.1.8 utils Module

Utility methods.

AYABInterface.utils. **sum_all** ( *iterable*, *start*)
Sum up an iterable starting with a start value.

In contrast to `sum()` , this also works on other types like `lists` and `sets` .

AYABInterface.utils. **number_of_colors** ( *rows*)
Determine the numer of colors in the rows.

**Return type** int

AYABInterface.utils. **next_line** ( *last_line*, *next_line_8bit*)
Compute the next line based on the last line and a 8bit next line.

The behaviour of the function is specified in *The reqLine Message*.

**Parameters**

- **last_line** (*int*) – the last line that was processed
- **next_line_8bit** (*int*) – the lower 8 bits of the next line

**Returns** the next line closest to `last_line`

**See also:**

*The reqLine Message*

AYABInterface.utils. **camel_case_to_under_score** ( *camel_case_name*)
Return the underscore name of a camel case name.

**Parameters** **camel_case_name** (*str*) – a name in camel case such as `"ACamelCaseName"`

**Returns** the name using underscores, e.g. `"a_camel_case_name"`

**Return type** str

## 3.2 The AYABInterface.convert Module Reference

### 3.2.1 convert Module

Conversion of colors to needle positions.

AYABInterface.convert. **colors_to_needle_positions** ( *rows* )
Convert rows to needle positions.

**Returns**

**Return type** list

**class** AYABInterface.convert. **NeedlePositions** ( *needle_coloring*, *colors*, *two_colors* )
Bases: tuple

**__getnewargs__** ( )
Return self as a plain tuple. Used by copy and pickle.

**__getstate__** ( )
Exclude the OrderedDict from pickling

**static __new__** ( *_cls*, *needle_coloring*, *colors*, *two_colors* )
Create new instance of NeedlePositions(needle_coloring, colors, two_colors)

**__repr__** ( )
Return a nicely formatted representation string

**colors**
Alias for field number 1

**needle_coloring**
Alias for field number 0

**two_colors**
Alias for field number 2

## 3.3 The AYABInterface.communication Module Reference

### 3.3.1 communication Module

This module is used to communicate with the shield.

Requirement: Make objects from binary stuff.

**class** AYABInterface.communication. **Communication** ( *file*, *get_needle_positions*, *machine*, *on_message_received=()*, *left_end_needle=None*, *right_end_needle=None* )
Bases: object

This class comunicates with the AYAB shield.

**__init__** ( *file*, *get_needle_positions*, *machine*, *on_message_received=()*, *left_end_needle=None*, *right_end_needle=None* )
Create a new Communication object.

**Parameters**

- **file** – a file-like object with read and write methods for the communication with the Arduino. This could be a `serial.Serial` or a `socket.socket.makefile()` .
- **get_needle_positions** – a callable that takes an `index` and returns `None` or an iterable over needle positions.
- **machine** (`AYABInterface.machines.Machine`) – the machine to use for knitting
- **on_message_received** (*list*) – an iterable over callables that takes a received *message* whenever it comes in. Since *state* changes only take place when a message is received, this can be used as an state observer.
- **left_end_needle** – A needle number on the machine. Other needles that are on the left side of this needle are not used for knitting. Their needle positions are not be set.
- **right_end_needle** – A needle number on the machine. Other needles that are on the right side of this needle are not used for knitting. Their needle positions are not be set.

**__weakref__**
list of weak references to the object (if defined)

**api_version_is_supported** ( *api_version*)
Return whether an api version is supported by this class.

**Return type** bool

**Returns** if the `api version` is supported

**Parameters** **api_version** (*int*) – the api version

Currently supported api versions: `4`

**can_receive_messages** ( )
Whether tihs communication is ready to receive messages.]

**Return type** bool

```
assert not communication.can_receive_messages()
communication.start()
assert communication.can_receive_messages()
communication.stop()
assert not communication.can_receive_messages()
```

**controller**
Information about the controller.

If no information about the controller is received, the return value is `None` .

If information about the controller is known after *The cnfInfo Message* was received, you can access these values:

```
>>> communication.controller.firmware_version
(5, 2)
>>> communication.controller.firmware_version.major
5
>>> communication.controller.firmware_version.minor
2
>>> communication.controller.api_version
4
```

**last_requested_line_number**
The number of the last line that was requested.

**Return type** int

**Returns** the last requested line number or `0`

**left_end_needle**
The left end needle of the needle positions.

**Return type** int

**Returns** the `left end needle of the machine`

**lock**
The lock of the communication.

In case you *parallelize()* the communication, you may want to use this `lock` to make shure the parallelization does not break your code.

**needle_positions**
A cache for the needle positions.

**Return type** *AYABInterface.communication.cache.NeedlePositionCache*

**on_message** ( *callable* )
Add an observer to received messages.

**Parameters** **callable** – a callable that is called every time a *AYABInterface.communication.host_messages.Message* is sent or a `AYABInterface.communication.controller_messages.Message` is received

**parallelize** ( *seconds_to_wait=2* )
Start a parallel thread for receiving messages.

If *start()* was no called before, start will be called in the thread. The thread calls *receive_message()* until the *state is_connection_closed()* .

**Parameters** **seconds_to_wait** (*float*) – A time in seconds to wait with the parallel execution. This is useful to allow the controller time to initialize.

**See also:**

*lock* , *runs_in_parallel()*

**receive_message** ( )
Receive a message from the file.

**right_end_needle**
The left end needle of the needle positions.

**Return type** int

**Returns** the `right end needle of the machine`

**runs_in_parallel** ( )
Whether the communication runs in parallel.

**Return type** bool

**Returns** whether *parallelize()* was called and the communication still receives messages and is not stopped

**send** ( *host_message_class*, **args* )
Send a host message.

**Parameters**

- **host_message_class** (*type*) – a subclass of AYABImterface.communication.host_messages.Message
- **args** – additional arguments that shall be passed to the host_message_class as arguments

**start** ( )
Start the communication about a content.

**Parameters** **content** (*Content*) – the content of the communication.

**state**
The state this object is in.

**Returns** the state this communication object is in.

**Return type** *AYABInterface.communication.states.State*

**Note:** When calling *parallelize()* the state can change while you check it.

**stop** ( )
Stop the communication with the shield.

### 3.3.2 cache Module

Convert and cache needle positions.

**class** AYABInterface.communication.cache. **NeedlePositionCache** ( *get_needle_positions*, *machine* )

Bases: object

Convert and cache needle positions.

**__init__** ( *get_needle_positions*, *machine* )
Create a new NeedlePositions object.

**__weakref__**
list of weak references to the object (if defined)

**get** ( *line_number* )
Return the needle positions or None.

**Parameters** **line_number** (*int*) – the number of the line

**Return type** list

**Returns** the needle positions for a specific line specified by line_number or None if no were given

**get_bytes** ( *line_number* )
Get the bytes representing needle positions or None.

**Parameters** **line_number** (*int*) – the line number to take the bytes from

**Return type** *bytes*

**Returns** the bytes that represent the message or None if no data is there for the line.

Depending on the machine , the length and result may vary.

**get_line_configuration_message** ( *line_number* )
Return the cnfLine content without id for the line.

**Parameters** **line_number** (*int*) – the number of the line

**Return type** *bytes*

**Returns** a cnfLine message without id as defined in *The cnfLine Message*

**is_last** ( *line_number*)
Whether the line number is has no further lines.

**Return type** bool

**Returns** is the next line above the line number are not specified

### 3.3.3 carriages Module

This module contains the carriages which are communicated by the firmware.

**class** AYABInterface.communication.carriages. **NullCarriage** ( *needle_position*)
Bases: *AYABInterface.communication.carriages.Carriage*

This is an empty carriage.

**class** AYABInterface.communication.carriages. **KnitCarriage** ( *needle_position*)
Bases: *AYABInterface.communication.carriages.Carriage*

The carriage for knitting.

**is_knit_carriage** ( )
This is a knit carriage.

**Return type** bool

**Returns** True

**class** AYABInterface.communication.carriages. **HoleCarriage** ( *needle_position*)
Bases: *AYABInterface.communication.carriages.Carriage*

The carriage for creating holes.

**is_hole_carriage** ( )
This is a knit carriage.

**Return type** bool

**Returns** True

**class** AYABInterface.communication.carriages. **UnknownCarriage** ( *needle_position*)
Bases: *AYABInterface.communication.carriages.Carriage*

The carriage type if the type is not known.

**is_unknown_carriage** ( )
The type of this carriage is unknown.

**Return type** bool

**Returns** True

AYABInterface.communication.carriages. **id_to_carriage_type** ( *carriage_id*)
Return the carriage type for an id.

**Return type** type

**Returns** a subclass of *Carriage*

**class** AYABInterface.communication.carriages. **Carriage** ( *needle_position*)
Bases: object

A base class for carriages.

**__init__** ( *needle_position*)
Create a new carriage.

**Parameters** **needle_position** (*int*) – the position of the carriage

**__weakref__**
list of weak references to the object (if defined)

**is_hole_carriage** ( )
Whether this is a hole carriage.

**Return type** bool

**Returns** False

**is_knit_carriage** ( )
Whether this is a knit carriage.

**Return type** bool

**Returns** False

**is_unknown_carriage** ( )
Whether the type of this carriage is unkown.

**Return type** bool

**Returns** False

**needle_position**
The needle position of the carriages.

**Returns** the needle position of the carriage counted from the left, starting with 0

**Return type** int

### 3.3.4 hardware_messages Module

This modue contains all the messages taht are received.

AYABInterface.communication.hardware_messages. **read_message_type** ( *file*)
Read the message type from a file.

**class** AYABInterface.communication.hardware_messages. **StateIndication** ( *file*, *communication*)
Bases: *AYABInterface.communication.hardware_messages.FixedSizeMessage*

This message shows the state of the controller.

**See also:**

*The indState Message*

**MESSAGE_ID = 132**
The first byte that indicates this message

**carriage**
The carriage which is reported.

**Return type** *AYABInterface.communication.carriages.Carriage*

**Returns** the carriage with information about its position

**current_needle**
The current needle position.

**Return type** int

**is_ready_to_knit** ( )
Whether this message indicates that the controller can knit now.

**is_state_indication** ( )
Whether this is a InformationConfirmation message.

**Return type** bool

**Returns** `True`

**is_valid** ( )
Whether this messages matches the specification.

**left_hall_sensor_value**
The value of the left hall sensor.

**Return type** int

**received_by** ( *visitor*)
Call visitor.receive_state_indication.

**right_hall_sensor_value**
The value of the left hall sensor.

**Return type** int

**class** AYABInterface.communication.hardware_messages. **LineRequest** ( *file*, *communication*)
Bases: *AYABInterface.communication.hardware_messages.FixedSizeMessage*

The controller requests a line.

**See also:**

*The reqLine Message*

**MESSAGE_ID = 130**
The first byte that indicates this message

**is_line_request** ( )
Whether this is a LineRequest message.

**Return type** bool

**Returns** `True`

**line_number**
The line number that was requested.

**received_by** ( *visitor*)
Call visitor.receive_line_request.

**class** AYABInterface.communication.hardware_messages. **TestConfirmation** ( *file*, *communication*)
Bases: *AYABInterface.communication.hardware_messages.SuccessConfirmation*

This message is sent at/when

**MESSAGE_ID = 196**
The first byte that indicates this message

**is_test_confirmation** ( )
Whether this is a TestConfirmation message.

**Return type** bool

**Returns** `True`

**received_by** ( *visitor*)
Call visitor.test_information_confirmation.

**class** AYABInterface.communication.hardware_messages. **InformationConfirmation** ( *file*, *communication*)
Bases: *AYABInterface.communication.hardware_messages.FixedSizeMessage*

This message is the answer in the initial handshake.

A *InformationRequest* requests this message from the controller to start the initial handshake.

**See also:**

*The cnfInfo Message* `InformationRequest`

**MESSAGE_ID = 195**
The first byte that indicates this message

**api_version**
The API version of the controller.

**Return type** int

**api_version_is_supported** ( )
Whether the communication object supports this API version.

**Return type** bool

**See also:**

*Communication.api_version_is_supported*

**firmware_version**
The firmware version of the controller.

**Return type** *FirmwareVersion*

```
minor_version = int()
mayor_version = int()

assert message.firmware_version == (mayor_version, minor_version)
assert message.firmware_version.major == mayor_version
assert message.firmware_version.minor == minor_version
```

**is_information_confirmation** ( )
Whether this is a InformationConfirmation message.

**Return type** bool

**Returns** `True`

**received_by** ( *visitor*)
Call visitor.receive_information_confirmation.

**class** AYABInterface.communication.hardware_messages. **Debug** ( *file*, *communication*)
Bases: *AYABInterface.communication.hardware_messages.Message*

This message contains debug output from the controller.

**See also:**

*The debug Message*

**bytes**
The debug message as bytes.

**Return type** *bytes*

**Returns** the debug message as bytes without the `b'\r\n'` at the end

**is_debug** ( )
Whether this is a Debug message.

**Return type** bool

**Returns** `False`

**received_by** ( *visitor*)
Call visitor.receive_debug.

**class** AYABInterface.communication.hardware_messages. **StartConfirmation** ( *file*, *communication*)
Bases: *AYABInterface.communication.hardware_messages.SuccessConfirmation*

This marks the success or failure of a reqStart message.

**See also:**

*The cnfStart Message*

**MESSAGE_ID = 193**
The first byte that indicates this message

**is_start_confirmation** ( )
Whether this is a StartConfirmation message.

**Return type** bool

**Returns** `True`

**received_by** ( *visitor*)
Call visitor.receive_state_confirmation.

**class** AYABInterface.communication.hardware_messages. **SuccessConfirmation** ( *file*, *communication*)
Bases: *AYABInterface.communication.hardware_messages.FixedSizeMessage*

Base class for massages of success and failure.

**is_success** ( )
Whether the configuration was successful.

**Return type** bool

**is_valid** ( )
Whether this message is valid.

**class** AYABInterface.communication.hardware_messages. **UnknownMessage** ( *file*, *communication* )
Bases: *AYABInterface.communication.hardware_messages.FixedSizeMessage*

This is a special message for unknown message types.

**is_unknown** ( )
Whether this is a StateIndication message.

**Return type** bool

**Returns** True

**is_valid** ( )
Whether the message is valid.

**Return type** bool

**Returns** False

**received_by** ( *visitor* )
Call visitor.receive_unkown.

**class** AYABInterface.communication.hardware_messages. **Message** ( *file*, *communication* )
Bases: object

This is the base class for messages that are received.

**__init__** ( *file*, *communication* )
Create a new Message.

**__repr__** ( )
This object as string.

**Return type** str

**__weakref__**
list of weak references to the object (if defined)

**is_connection_closed** ( )
Whether this is a ConnectionClosed message.

**Return type** bool

**Returns** False

**is_debug** ( )
Whether this is a Debug message.

**Return type** bool

**Returns** False

**is_from_controller** ( )
Whether this message is sent by the controller.

**Return type** bool

**Returns** True

**is_from_host** ( )
Whether this message is sent by the host.

**Return type** bool

**Returns** False

**is_information_confirmation** ( )
Whether this is a InformationConfirmation message.

**Return type** bool

**Returns** False

**is_line_request** ( )
Whether this is a LineRequest message.

**Return type** bool

**Returns** False

**is_start_confirmation** ( )
Whether this is a StartConfirmation message.

**Return type** bool

**Returns** False

**is_state_indication** ( )
Whether this is a StateIndication message.

**Return type** bool

**Returns** False

**is_test_confirmation** ( )
Whether this is a TestConfirmation message.

**Return type** bool

**Returns** False

**is_unknown** ( )
Whether this is a StateIndication message.

**Return type** bool

**Returns** False

**is_valid** ( )
Whether the message is valid.

**Return type** bool

**Returns** True

**wants_to_answer** ( )
Whether this message produces and answer message.

**Return type** bool

**Returns** False

**class** AYABInterface.communication.hardware_messages. **ConnectionClosed** ( *file*, *communication* )

Bases: *AYABInterface.communication.hardware_messages.Message*

This message is notified about when the connection is closed.

**is_connection_closed** ( )
Whether this is a ConnectionClosed message.

**Return type** bool

**Returns** True

**received_by** ( *visitor* )
Call visitor.receive_connection_closed.

**class** AYABInterface.communication.hardware_messages. **FirmwareVersion** ( *major*, *minor* )

Bases: tuple

**__getnewargs__** ( )
Return self as a plain tuple. Used by copy and pickle.

**__getstate__** ( )
Exclude the OrderedDict from pickling

**static __new__** ( *_cls*, *major*, *minor* )
Create new instance of FirmwareVersion(major, minor)

**__repr__** ( )
Return a nicely formatted representation string

**major**
Alias for field number 0

**minor**
Alias for field number 1

**class** AYABInterface.communication.hardware_messages. **FixedSizeMessage** ( *file*, *communication* )

Bases: *AYABInterface.communication.hardware_messages.Message*

This is a message of fixed size.

**__init__** ( *file*, *communication* )
Create a new Message.

**read_end_of_message** ( )
Read the b"rn" at the end of the message.

### 3.3.5 host_messages Module

This module contains the messages that are sent to the controller.

**class** AYABInterface.communication.host_messages. **Message** ( *file*, *communication*, **args*, ***kw* )

Bases: object

This is the interface for sent messages.

**MESSAGE_ID = None**
the first byte to identify this message

**__init__** ( *file*, *communication*, **args*, ***kw* )
Create a new Request object

**__repr__** ( )
This message as string inclding the bytes.

**Return type** str

**__weakref__**
list of weak references to the object (if defined)

**as_bytes** ( )
The message represented as bytes.

**Return type** *bytes*

**content_bytes** ( )
The message content as bytes.

**Return type** *bytes*

**init** ( )
Override this method.

**is_from_controller** ( )
Whether this message is sent by the controller.

**Return type** bool

**Returns** `False`

**is_from_host** ( )
Whether this message is sent by the host.

**Return type** bool

**Returns** `True`

**send** ( )
Send this message to the controller.

**class** AYABInterface.communication.host_messages. **StartRequest** ( *file*, *communication*, **args*, ***kw* )
Bases: *AYABInterface.communication.host_messages.Message*

This is the start of the conversation.

**See also:**

*The reqStart Message*

**MESSAGE_ID = 1**
the first byte to identify this message

**content_bytes** ( )
Return the start and stop needle.

**Return type** *bytes*

**init** ( *left_end_needle*, *right_end_needle* )
Initialize the StartRequest with start and stop needle.

**Raises**

- **TypeError** – if the arguments are not integers
- **ValueError** – if the values do not match the *specification*

**left_end_needle**
The needle to start knitting with.

**Return type** int

**Returns** value where `0 <= value <= 198`

**right_end_needle**
The needle to start knitting with.

**Return type** int

**Returns** value where `1 <= value <= 199`

**class** AYABInterface.communication.host_messages.**LineConfirmation**(*file*, *communication*, **args*, ***kw*)

Bases: *AYABInterface.communication.host_messages.Message*

This message send the data to configure a line.

**See also:**

*The cnfLine Message*

**MESSAGE_ID = 66**
the first byte to identify this message

**content_bytes**()
Return the start and stop needle.

**init**(*line_number*)
Initialize the StartRequest with the line number.

**class** AYABInterface.communication.host_messages.**InformationRequest**(*file*, *communication*, **args*, ***kw*)

Bases: *AYABInterface.communication.host_messages.Message*

Start the initial handshake.

**See also:**

*The reqInfo Message*, *InformationConfirmation*

**MESSAGE_ID = 3**
the first byte to identify this message

**class** AYABInterface.communication.host_messages.**TestRequest**(*file*, *communication*, **args*, ***kw*)

Bases: *AYABInterface.communication.host_messages.Message*

Start the test mode of the controller.

**See also:**

*The reqTest Message*, *InformationConfirmation*

**MESSAGE_ID = 4**
the first byte to identify this message

### 3.3.6 `states` Module

This module contains the state machine for the communication class.

Click on this image to go to the states from the diagram:

**class** AYABInterface.communication.states. **State** ( *communication*)
Bases: object

The base class for states.

**__init__** ( *communication*)
Create a new state.

Please use the subclasses of this.

**Parameters** **communication** (AYABInterface.communication.Communication) – the communication object which is in this state

**__repr__** ( )
This object as string.

**Return type** str

**__weakref__**
list of weak references to the object (if defined)

**communication_started** ( )
Call when the communication starts.

**enter** ( )
Called when the state is entered.

The *AYABInterface.communication.Communication.state* is set to this state.

**exit** ( )
Called when this state is left.

The *AYABInterface.communication.Communication.state* is set to this state.

**is_before_knitting** ( )
Whether the knitting should start soon.

**Return type** bool

**Returns** False

**is_connection_closed** ( )
Whether the connection is closed.

**Return type** bool

**Returns** False

**is_final** ( )
Whether the communication is over.

**Return type** bool

**Returns** False

**is_initial_handshake** ( )
Whether the communication object is in the intial handshake.

**Return type** bool

**Returns** False

**is_initializing_machine** ( )
Whether the machine is currently being initialized.

**Return type** bool

**Returns** `False`

**is_knitting** ( )
Whether the machine ready to knit or knitting.

**Return type** bool

**Returns** `False`

**is_knitting_line** ( )
Whether the machine knits a line.

**Return type** bool

**Returns** `False`

**is_knitting_started** ( )
Whether the machine ready to knit the first line.

**Return type** bool

**Returns** `false`

**is_starting_to_knit** ( )
Whether the machine initialized and knitting starts.

**Return type** bool

**Returns** `False`

**is_unsupported_api_version** ( )
Whether the API version of communcation and controller do not match.

**Return type** bool

**Returns** `False`

**is_waiting_for_start** ( )
Whether this state is waiting for the start.

**Return type** bool

**Returns** `False`

**is_waiting_for_the_communication_to_start** ( )
Whether the communication can be started.

When this is `True` , you call call *AYABInterface.communication.Communication.start()* to leave the state.

**Return type** bool

**Returns** `False`

**receive_connection_closed** ( *message*)
Receive a ConnectionClosed message.

**Parameters** **message** – a *ConnectionClosed* message

If the is called, the communication object transits into the *ConnectionClosed* .

**receive_debug** ( *message*)
Receive a Debug message.

**Parameters** **message** – a *Debug* message

This logs the debug message.

**receive_information_confirmation** ( *message*)
Receive a InformationConfirmation message.

**Parameters** **message** – a *InformationConfirmation* message

**receive_line_request** ( *message*)
Receive a LineRequest message.

**Parameters** **message** – a *LineRequest* message

**receive_message** ( *message*)
Receive a message from the controller.

**Parameters** **message** (AYABInterface.communication.hardware_messages.Message) – the message to receive

This method calls `message.received_by` which dispatches the call to the `receive_*` methods.

**receive_start_confirmation** ( *message*)
Receive a StartConfirmation message.

**Parameters** **message** – a *StartConfirmation* message

**receive_state_indication** ( *message*)
Receive a StateIndication message.

**Parameters** **message** – a *StateIndication* message

**receive_test_confirmation** ( *message*)
Receive a TestConfirmation message.

**Parameters** **message** – a *TestConfirmation* message

**receive_unknown** ( *message*)
Receive a UnknownMessage message.

**Parameters** **message** – a *UnknownMessage* message

**class** AYABInterface.communication.states. **ConnectionClosed** ( *communication*)
Bases: *AYABInterface.communication.states.FinalState*

The connection is closed.

**is_connection_closed** ( )
The connection is closed.

**Return type** bool

**Returns** `True`

**class** AYABInterface.communication.states. **WaitingForStart** ( *communication*)
Bases: *AYABInterface.communication.states.State*

Waiting for the start() method to be called.

This is the initial state of a *AYABInterface.communication.Communication*.

**communication_started** ( )
Call when the communication starts.

The communication object transits into *InitialHandshake*.

**is_before_knitting** ( )
Whether the knitting should start soon.

**Return type** bool

**Returns** `True`

**is_waiting_for_start** ( )
Whether this state is waiting for the start.

Call `AYABInterface.communication.Comunication.start()` to leave this state.

**Return type** bool

**Returns** `True`

**class** `AYABInterface.communication.states.` **InitialHandshake** ( *communication*)
Bases: *AYABInterface.communication.states.State*

The communication has started.

**enter** ( )
This starts the handshake.

A *AYABInterface.communication.host_messages.InformationRequest* is sent to the controller.

**is_before_knitting** ( )
Whether the knitting should start soon.

**Return type** bool

**Returns** `True`

**is_initial_handshake** ( )
Whether the communication object is in the intial handshake.

**Return type** bool

**Returns** `True`

**receive_information_confirmation** ( *message*)
A InformationConfirmation is received.

If *the api version is supported* , the communication object transitions into a *InitializingMachine* , if unsupported, into a *UnsupportedApiVersion*

**class** `AYABInterface.communication.states.` **UnsupportedApiVersion** ( *communication*)
Bases: *AYABInterface.communication.states.FinalState*

The api version of the controller is not supported.

**is_unsupported_api_version** ( )
Whether the API version of communcation and controller do not match.

**Return type** bool

**Returns** `True`

**class** `AYABInterface.communication.states.` **InitializingMachine** ( *communication*)
Bases: *AYABInterface.communication.states.State*

The machine is currently being intialized.

**is_before_knitting** ( )
Whether the knitting should start soon.

**Return type** bool

**Returns** True

**is_initializing_machine** ( )
Whether the machine is currently being initialized.

**Return type** bool

**Returns** True

**is_waiting_for_carriage_to_pass_the_left_turn_mark** ( )
The carriage should be moved over the left turn mark.

**Return type** bool

**Returns** True

**receive_state_indication** ( *message*)
Receive a StateIndication message.

**Parameters** **message** – a *StateIndication* message

If the message says that the controller is *is ready to knit* , there is a transition to *StartingToKnit* or else the messages are ignored because they come from *The reqTest Message*.

**class** AYABInterface.communication.states. **StartingToKnit** ( *communication*)
Bases: *AYABInterface.communication.states.State*

*The cnfStart Message* is sent and we wait for an answer.

**enter** ( )
Send a StartRequest.

**is_before_knitting** ( )
The knitting should start soon.

**Return type** bool

**Returns** True

**is_starting_to_knit** ( )
The machine initialized and knitting starts.

**Return type** bool

**Returns** True

**receive_start_confirmation** ( *message*)
Receive a StartConfirmation message.

**Parameters** **message** – a *StartConfirmation* message

If the message indicates success, the communication object transitions into *KnittingStarted* or else, into *StartingFailed* .

**class** AYABInterface.communication.states. **StartingFailed** ( *communication*)
Bases: *AYABInterface.communication.states.FinalState*

The starting process has failed.

**is_starting_failed** ( )
The machine machine could not be configured to start.

**Return type** bool

**Returns** True

**class** AYABInterface.communication.states. **KnittingStarted** ( *communication*)
Bases: *AYABInterface.communication.states.State*

The knitting started and we are ready to receive *The reqLine Message*.

**is_knitting** ( )
The machine ready to knit or knitting.

**Return type** bool

**Returns** True

**is_knitting_started** ( )
The machine ready to knit the first line.

**Return type** bool

**Returns** True

**receive_line_request** ( *message*)
Receive a LineRequest message.

**Parameters** **message** – a *LineRequest* message

The communicaion transisitions into a *KnittingLine* .

**class** AYABInterface.communication.states. **KnittingLine** ( *communication*, *line_number*)
Bases: *AYABInterface.communication.states.State*

The machine is currently knitting a line.

**__init__** ( *communication*, *line_number*)
The machine is knitting a line.

**enter** ( )
Send a LineConfirmation to the controller.

When this state is entered, a *AYABInterface.communication.host_messages.LineConfirmation* is sent to the controller. Also, the *last line requested* is set.

**is_knitting** ( )
The machine ready to knit or knitting.

**Return type** bool

**Returns** True

**is_knitting_last_line** ( )
Whether the line currently knit is the last line.

**Return type** bool

**is_knitting_line** ( )
The machine knits a line.

**Return type** bool

**Returns** True

**line_number**
The number if the line which is currently knit.

**Return type** int

**receive_line_request** ( *message*)
Receive a LineRequest message.

**Parameters** **message** – a *LineRequest* message

The communicaion transisitions into a *KnittingLine* .

**class** AYABInterface.communication.states. **FinalState** ( *communication*)

Bases: *AYABInterface.communication.states.State*

Base class for states that can not reach knitting.

**is_final** ( )

From the current state, the knitting can not be reached.

**Return type** bool

**Returns** True

CHAPTER 4

# Communication Specification

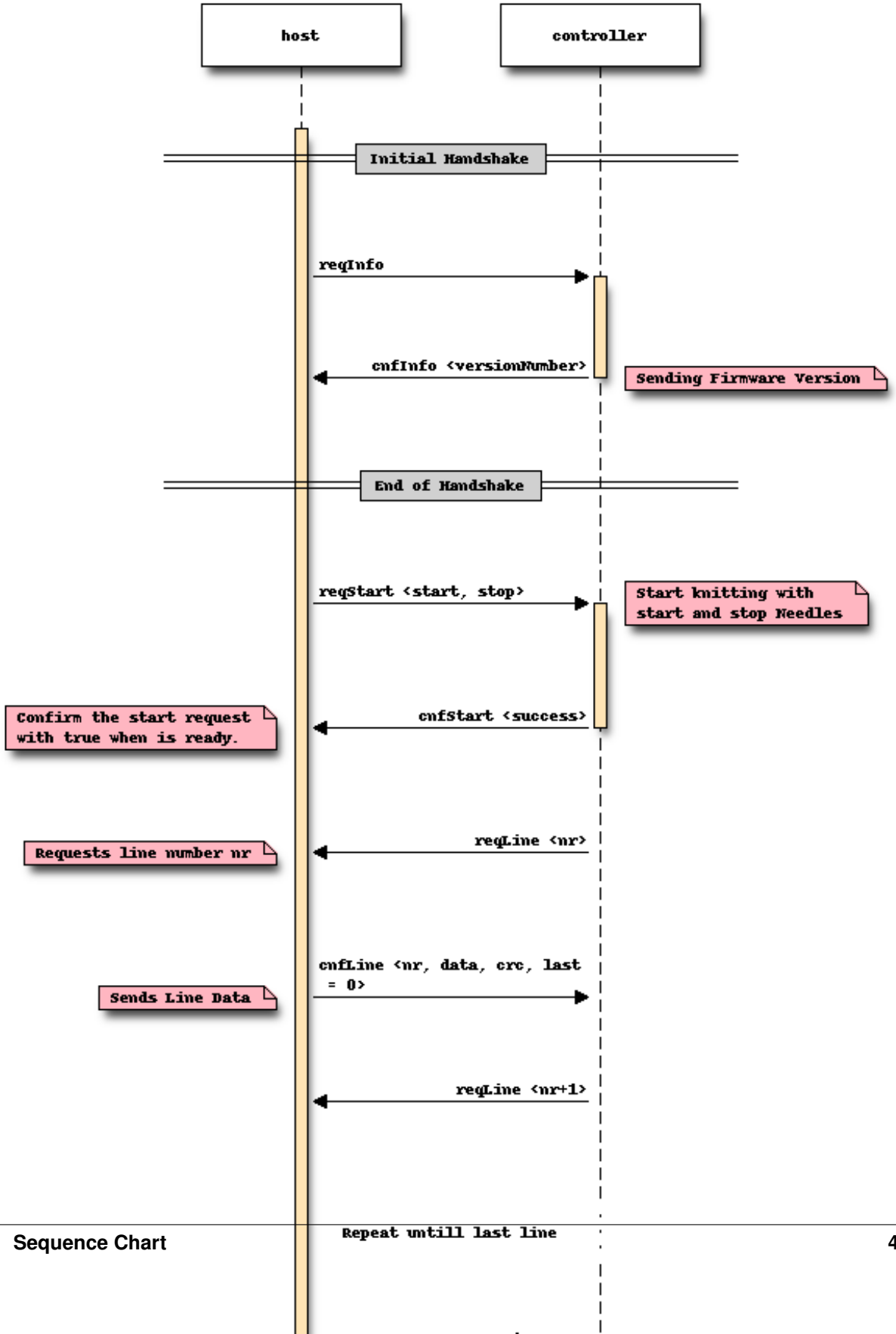
This document specifies the communication between the host and a controller with the AYAB firmware.

## 4.1 Serial Communication

115200 baud

Line Ending: `\n\r` (10 13) Each message ends with a Line Ending.

## 4.2 Sequence Chart



The host waits for a **indState(true)** message before requesting to start the knitting. On startup, the Arduino continuously checks for the initialization of the machine (carriage passed left hall sensor). When this happens, it sends an **indState(true)** to tell the host that the machine is ready to knit. After receiving this message, the host sends a **reqStart** message, which is immediately confirmed with a **cnfStart** message. When **reqStart** was successful, the Arduino begins to poll the host for line data with **reqLine**, the host answers with **cnfLine**. This reqLine/cnfLine happens each time the carriage moves passed the borders given by the Start/StopNeedle parameters in **reqStart**. When the host does not have any more lines to send, it marks the last line with the *lastLine* flag in its last **cnfLine** message.

To see an example implementation, see the `states of the communication module`.

## 4.3 Message Identifier Format

Messages start with a byte that identifies their type. This byte is called "id" or "message id" in the following document. This table lists all the bits of this byte and assigns their purpose:

| Bit | Value | Name | Description and Values |
|---|---|---|---|
| 7 | 128 | message source | • 0 = the message is from the host<br>• 1 = the message is from the controller |
| 6 | 64 | message type | • 0 = the message is a request<br>• 1 = the message is a confirmation of a request |
| 5 | 32 | reserved | must be zero |
| 4 | 16 | | |
| 3 | 8 | message identifier | These are the values that identify the message. |
| 2 | 4 | | |
| 1 | 2 | | |
| 0 | 1 | | |

**See also:**

## 4.4 Message definitions (API v4)

*Message definitions (API v4)*

The length is the total length with *id* and parameters. Note that the two characters `\r\n` following the message are not included in the length.

| source | name | id | length | parameters |
|---|---|---|---|---|
| host | *reqStart* | 0x01 | 3 | `0xaa 0xbb`<br>• `aa` = left end needle (Range: 0..198)<br>• `bb` = right end needle (Range: 1..199)<br>Start and |
| hardware | *cnfStart* | 0xC1 | 2 | `0x0a`<br>• `a` = success (0 = false, 1 = true) |
| hardware | *reqLine* | 0x82 | 2 | `0xaa`<br>• `aa` = line number (Range: 0..255) |
| host | *cnfLine* | 0x42 | 29 | `0xaa 0xbb[24,23,22,... 1,0] 0xcc 0xdd`<br>• `aa` = line number (Range: 0..255)<br>• `bb[24 to 0]` = binary pixel data<br>• `cc` = flags (bit 0: lastLine)<br>• `dd` = CRC8 Checksum |
| host | *reqInfo* | 0x03 | 1 | |
| hardware | *cnfInfo* | 0xC3 | 4 | `0xaa 0xbb 0xcc`<br>• `aa` = API Version Identifier<br>• `bb` = Firmware Major Version<br>• `cc` = Firmware Minor Version |
| hardware | *indState* | 0x84 | 8 | `0x0a 0xBB 0xbb 0xCC 0xcc 0xdd 0xee`<br>• `a` = ready (0 = false, 1 = true)<br>• `BBbb` = `int` left hall sensor value<br>• `CCcc` = `int` right hall sensor value<br>• `dd` = the carriage<br>– `0` = no carriage detected<br>– `1` = knit carriage |

### 4.4.1 The `reqStart` Message

The host starts the knitting process.

- Python: *`StartRequest`*
- Arduino: h_reqStart
- table: *reqStart*
- requests answer: *The cnfStart Message*
- direction: host → controller

### 4.4.2 The `cnfStart` Message

The controller indicates the success of *The reqStart Message*.

- Python: *`StartConfirmation`*
- Arduino: h_reqStart
- table: *reqStart*
- answers: *The reqStart Message*
- direction: controller → host

### 4.4.3 The `reqLine` Message

The controller requests a new line from the host.

More than 256 lines are supported. There are three possibilities for the next line based on the last line:

1. the new line is greater than the last line
2. the new line is lower than the last line
3. the new line is the last line

We choose the line closest to the last line. This is trivial for (3). In case two lines are equally distant from the last line, we choose the smaller line.

This is computed by the function *`AYABInterface.utils.next_line()`* which is tested and can be seen as a reference implementation for other languages.

- Python: *`LineRequest`*
- Arduino: Knitter::reqLine
- table: *reqLine*
- requests answer: *The cnfLine Message*
- direction: controller → host

### 4.4.4 The `cnfLine` Message

The host answers *The reqLine Message* with a line configuration. This table shows the message content without the first byte that identifies the message:

| Byte | Name | Description |
|---|---|---|
| 0 | line number | These are the lowest 8 bit of the line. They must match the line number in *The reqLine Message*. |
| 1<br>2<br>...<br>24<br>25 | needle positions | Each bit of the bytes represents a needle position.<br><br>0 = "B"<br>1 = "D" |
| 26 | flags | Bits: `0000000L`<br>• `L` - "LastLine" (0 = false, 1 = true) |
| 27 | crc8 checksum | This checksum is computed from bytes 0 to 26, including byte 26. The controller may use this checksum to check the result and if the checksum does not match, it can send *The reqLine Message* anew. |

In the following table, you can see the mapping of bytes to needles.

**Note:**

- The **Needles** are counted from the leftmost needle on the machine.
- The **Needle** count starts with `0` .
- The **Byte** numbering is taken from *the table above*.
- The **Bit** numbering is consistent with *Message Identifier Format*. The highest bit has the number 7 and the lowest bit has number 0.

For the exact mapping of bits to needles see the *table below*.

| Byte | 0 | | | | | | | | 1 | | | | | | | | 2 | | | 24 | | | | | | | | 25 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bit | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | ... | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Needle | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | ... | | | | | | | | | | | | | | | | | | | | | 198 | 199 | |

- Python: `LineConfirmation`
- Arduino: h_cnfLine
- table: *cnfLine*
- answers: *The reqLine Message*
- direction: host → controller

### 4.4.5 The `reqInfo` Message

The host initializes the handshake.

- Python: `InformationRequest`
- Arduino: h_reqInfo
- table: *reqInfo*
- requests answer: *The reqInfo Message*

- direction: host → controller

### 4.4.6 The `cnfInfo` Message

The controller answers *The reqInfo Message* with the API version.

- Python: `InformationConfirmation`
- Arduino: h_reqInfo
- table: *cnfInfo*
- answers: *The reqInfo Message*
- direction: controller → host

### 4.4.7 The `indState` Message

This is sent when the controller indicates its state. When `ready` it is

- `1` , then this is the first state indication. The machine is now ready to knit
- `0` , the controller is in test mode. This message is sent periodically. *The reqTest Message* switches this on.
- Python: `StateIndication`
- Arduino: Knitter::indState
- table: *indState*
- direction: controller → host

### 4.4.8 The `debug` Message

This message ends with a `\r\n` like evey message. It contains debug information from the controller.

- Python: `Debug`
- Arduino: DEBUG_PRINT
- table: *debug*
- direction: controller → host

### 4.4.9 The `reqTest` Message

This message puts the controller in a test mode instead of a knitting mode.

- Python: `TestRequest`
- Arduino: h_reqTest
- table: *reqTest*
- requests answer: *The cnfTest Message*
- direction: host → controller

### 4.4.10 The `cnfTest` Message

This messsage confirms whether the controller is in the test mode. If success is indicated, the controller sends *The indState Message* messages periodically, containing the sensor and position values.

- Python: `TestConfirmation`
- Arduino: h_reqTest
- table: *cnfTest*
- answers: *The reqTest Message*
- direction: controller → host

### 4.4.11 References

**See also:**

- the original specification
- the `hardware messages module` for messages sent by the hardware
- the `host messages module` for messages sent by the host
- a discussion about the specification

CHAPTER 5

# Indices and tables

- genindex
- modindex
- search

## a

## Symbols

## A



## B



## C

## K



## L



## M

## N



## O



## P



## R

## S



## T



## U



## W