

Motor Abstraction Reference

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ABSTRACT MOTOR CLASS

```
class AbstractMotor (motor_id, **kwargs)
```

```
    Bases: abc.ABC
```

Abstract Motor Class

Required attributes:

- `motor_id` Motor ID (hexadecimal or otherwise). This is used both for low level communication and to refer to individual motors in communication with the user.

Recommended attributes:

- `motor` Motor object containing methods for low-level motor control. It may be provided by the user or by a library. For further reference consider the T-Motor AK80-6 and AK80-9 interfaces provided by [mini-cheetah-tmotor-python-can](#) (pip).

```
__getattr__ (name)
```

Override attribute retrieval.

Conduct motor configuration validation at attribute retrieval time, and apply boilerplate to communicate the motor's state after all commands and provide the user with logs.

1. Motor configuration validation

- Ensure motor instance has all required attributes
- Ensure motor instance has a declared `rest_state` before calling any function other than `__init__` or `rest_state`

2. Function boilerplate

- Push motor state via provided communication protocol after all motor commands
- Log motor disabling

```
__getattr__ (name)
```

Retrieve unknown attributes from motor controller.

```
__command (fn_command, *args, **kwargs)
```

```
__disable (fn_disable, *args, **kwargs)
```

rest_state(*x_r*)

Set rest state

abstract __init__(*motor_id*, ***kwargs*)

Abstract Motor Class

Required attributes:

- *motor_id* Motor ID (hexadecimal or otherwise). This is used both for low level communication and to refer to individual motors in communication with the user.

Recommended attributes:

- *motor* Motor object containing methods for low-level motor control. It may be provided by the user or by a library. For further reference consider the T-Motor AK80-6 and AK80-9 interfaces provided by [mini-cheetah-tmotor-python-can](#) (pip).

abstract enable()

Enable motor

abstract zero()

Zero at current motor position

abstract rest()

Rest position command

abstract command(*u*)

Motor command

abstract disable()

Disable motor

```
__abstractmethods__ = frozenset({'__init__', 'command', 'disable',  
'enable', 'rest', 'zero'})
```

```
__dict__ = mappingproxy({'__module__':  
'motor_abstraction.abstract_motor', '__getattr__': <function  
AbstractMotor.__getattr__>, '__getattribute__': <function  
AbstractMotor.__getattribute__>, '_command': <function  
AbstractMotor._command>, '_disable': <function  
AbstractMotor._disable>, 'rest_state': <function  
AbstractMotor.rest_state>, '__init__': <function  
AbstractMotor.__init__>, 'enable': <function AbstractMotor.enable>,  
'zero': <function AbstractMotor.zero>, 'rest': <function  
AbstractMotor.rest>, 'command': <function AbstractMotor.command>,  
'disable': <function AbstractMotor.disable>, '__dict__': <attribute  
'__dict__' of 'AbstractMotor' objects>, '__weakref__': <attribute  
'__weakref__' of 'AbstractMotor' objects>, '__doc__': None,  
'__abstractmethods__': frozenset({'command', 'disable', 'rest',  
'zero', 'enable', '__init__'}), '_abc_impl': <_abc_data object>,  
'__annotations__': {}})
```

```
__module__ = 'motor_abstraction.abstract_motor'
```

```
__slots__ = ()
```

```
__weakref__
```

list of weak references to the object (if defined)

```
_abc_impl = <_abc_data object>
```

```
class Protocol (*args, **kwargs)
```

Bases: `abc.ABC`

Initialize communication protocol for individual device

```
__init__ (*args, **kwargs)
```

Initialize communication protocol for individual device

```
abstract generate_bindings (*args, **kwargs)
```

Generate bindings

```
abstract push (*args, **kwargs)
```

```
abstract pull (*args, **kwargs)
```

```
__abstractmethods__ = frozenset({'generate_bindings', 'pull', 'push'})
```

```
__dict__ = mappingproxy({'__module__': 'motor_abstraction.communicator', '__init__': <function Protocol.__init__>, 'generate_bindings': <function Protocol.generate_bindings>, 'push': <function Protocol.push>, 'pull': <function Protocol.pull>, '__dict__': <attribute '__dict__' of 'Protocol' objects>, '__weakref__': <attribute '__weakref__' of 'Protocol' objects>, '__doc__': None, '__abstractmethods__': frozenset({'push', 'pull', 'generate_bindings'})}, '_abc_impl': <_abc_data object>, '__annotations__': {}})
```

```
__module__ = 'motor_abstraction.communicator'
```

```
__slots__ = ()
```

```
__weakref__
```

list of weak references to the object (if defined)

```
_abc_impl = <_abc_data object>
```

```
class lcm (topic, freq, generate_bindings=False)
```

Bases: `motor_abstraction.communicator.Protocol`

Initialize LCM protocol for individual device

```

__init__(topic, freq, generate_bindings=False)
    Initialize LCM protocol for individual device

generate_bindings(*args, **kwargs)
    Generate bindings

push(content)

pull(content)

__abstractmethods__ = frozenset({})

__annotations__ = {}

__dict__ = mappingproxy({'__module__':
'motor_abstraction.communicator', '__init__': <function
lcm.__init__>, 'generate_bindings': <function lcm.generate_bindings>,
'push': <function lcm.push>, 'pull': <function lcm.pull>, '__doc__':
None, '__abstractmethods__': frozenset(), '_abc_impl': <_abc_data
object>, '__annotations__': {}})

__module__ = 'motor_abstraction.communicator'

__slots__ = ()

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

_abc_impl = <_abc_data object>

load(robot)

exception _AddendumException(msg, add="", lst=[], ind='')
    Bases: Exception
    Exception with addendum for user guidance.

__init__(msg, add="", lst=[], ind='')

__cause__
    exception cause

__context__
    exception context

__delattr__(name, /)
    Implement delattr(self, name).

__dict__ = mappingproxy({'__module__':
'motor_abstraction.utils.exceptions', '__doc__': '\n Exception with
addendum for user guidance.\n ', '__init__': <function
_AddendumException.__init__>, '__weakref__': <attribute '__weakref__'
of '_AddendumException' objects>, '__annotations__': {}})

```

__getattr__(*name*, /)

Return getattr(self, name).

__module__ = 'motor_abstraction.utils.exceptions'

__new__(***kwargs*)

__reduce__()

Helper for pickle.

__repr__()

Return repr(self).

__setattr__(*name*, *value*, /)

Implement setattr(self, name, value).

__setstate__()

__str__()

Return str(self).

__suppress_context__

__traceback__

__weakref__

list of weak references to the object (if defined)

args

with_traceback()

Exception.with_traceback(tb) – set self.__traceback__ to tb and return self.

exception ConfigurationError(*msg*, *add*="", *lst*=[], *ind*='')

Bases: *motor_abstraction.utils.exceptions._AddendumException*

Raised when configuration errors are detected.

__annotations__ = {}

__cause__

exception cause

__context__

exception context

__delattr__(*name*, /)

Implement delattr(self, name).

```
__dict__ = mappingproxy({'__module__':  
'motor_abstraction.utils.exceptions', '__doc__': '\n Raised when  
configuration errors are detected.\n ', '__annotations__': {}})  
  
__getattr__ (name, /)  
    Return getattr(self, name).  
  
__init__ (msg, add="", lst=[], ind='')  
  
__module__ = 'motor_abstraction.utils.exceptions'  
  
__new__ (**kwargs)  
  
__reduce__ ()  
    Helper for pickle.  
  
__repr__ ()  
    Return repr(self).  
  
__setattr__ (name, value, /)  
    Implement setattr(self, name, value).  
  
__setstate__ ()  
  
__str__ ()  
    Return str(self).  
  
__suppress_context__  
  
__traceback__  
  
__weakref__  
    list of weak references to the object (if defined)  
  
args  
  
with_traceback ()  
    Exception.with_traceback(tb) – set self.__traceback__ to tb and return self.  
  
exception SafetyException (msg, add="", lst=[], ind='')  
    Bases: motor_abstraction.utils.exceptions._AddendumException  
    Raised when operational safety is compromised.  
  
    __annotations__ = {}  
  
    __cause__  
        exception cause  
  
    __context__  
        exception context
```



```
__delattr__ (name, /)
    Implement delattr(self, name).

__dict__ = mappingproxy({'__module__':
    'motor_abstraction.utils.exceptions', '__doc__': '\n Raised when
    operational safety is compromised.\n ', '__annotations__': {}})

__getattr__ (name, /)
    Return getattr(self, name).

__init__ (msg, add='', lst=[], ind='')

__module__ = 'motor_abstraction.utils.exceptions'

__new__ (**kwargs)

__reduce__ ()
    Helper for pickle.

__repr__ ()
    Return repr(self).

__setattr__ (name, value, /)
    Implement setattr(self, name, value).

__setstate__ ()

__str__ ()
    Return str(self).

__suppress_context__

__traceback__

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

args

with_traceback ()
    Exception.with_traceback(tb) – set self.__traceback__ to tb and return self.

fallback_disable (goal)

shout_error (error)

shout_disabled (motor)
```

BIBLIOGRAPHY

- [1] Russ Tedrake. Underactuated Robotics: Algorithms for Walking, Running, Swimming, Flying, and Manipulation (Course Notes for MIT 6.832). 2021. Downloaded on 28.07.2021 from <http://underactuated.mit.edu/>.

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