

# Vention Python API V1.13.1

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# MachineLogic Python Programming v1.13.1 Interface

# Change Log

## [1.13.1] - 2024-07-18

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### Added

- Introduced the new Scene class to the SDK, accessible off of Machine class by a new method `get_scene()`. Scene is a software representation of the scene containing assets such as reference frames and targets for robots as defined within the MachineLogic Scene Assets pane.
- Added `get_calibration_frame` method to the new Scene class which returns a software representation of a Calibration Frame (CalibrationFrame) as defined within the scene assets pane.
- Added `get_default_value`, `get_calibrated_value`, and `set_calibrated_value` to the new CalibrationFrame class, allowing users to calibrate their robot programmatically.

### Changed

- Updated the documentation to reflect the new classes Scene, and CalibrationFrame, along with their respective methods: `get_calibration_frame` (Scene), `get_default_value` (CalibrationFrame), `get_calibrated_value`(CalibrationFrame), and `set_calibrated_value` (CalibrationFrame).
- New compatibility matrix in documentation to define compatibilities between SDK versions, MachineMotion versions and Pendant versions.

## [1.13.0] - 2024-04-28

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### Added

- Made `ip_address` optional in Machine class constructor to allow for more flexible deployment configurations.
- New PathFollower class implemented and importable through `machinelogic`. A Path Follower Object is a group of Actuators, Digital Inputs and Digital Outputs that enable execution of smooth predefined paths. These paths are defined with G-Code instructions. See Vention's [G-code interface documentation](#) for a list of supported commands:

### Changed

- Updated documentation to reflect the new optional `ip_address` parameter in the Machine class.

## [1.12.1] - 2023-02-28

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- Initial python package release

# Compatibility

## Compatibility

---

This table specifies the compatibility of the Python package versions with the Vention's MachineMotion and Pendant versions.

Package	MachineMotion	Pendant
---------	---------------	---------

Package	MachineMotion	Pendant
v1.12.x*	v2.13.x	v3.2 and v3.3
v1.13.0	v2.14.x	v3.4
v1.13.1	v2.15.x	v3.5

You can download current and previous Python packages from Pypi [here](#).

\*Package versions <1.13.0 were published to PyPi under the package name machine-code-python-sdk

## Motion Features

When the Python program ends, any motion that is still executing will continue their execution. If you want to wait for a motion to complete, you should call:

```
actuator.wait_for_move_completion()
```

Asynchronous moves will not wait for the motion to complete before terminating the program.

The 'continuous\_move' function will run forever if not stopped by the program.

## Machine

A software representation of the entire Machine. A Machine is defined as any number of MachineMotions, each containing their own set of axes, outputs, inputs, pneumatics, bag grippers, and AC Motors. The Machine class offers a global way to retrieve these various components using the friendly names that you've defined in your MachineLogic configuration.

To create a new Machine with default settings, you can simply write:

```
machine = Machine()
```

If you need to connect to services running on a different machine or IP address, you can specify the IP address as follows:

```
machine = Machine("192.168.7.2")
```

You should only ever have a single instance of this object in your program.

### get\_ac\_motor

- **Description** Retrieves an AC Motor by name.
  - **Parameters**
    - **name**
      - **Description** The name of the AC Motor.
      - **Type** str
  - **Returns**
    - **Description** The AC Motor that was found.
    - **Type** IACMotor
  - **Raises**
    - **Type** MachineMotionException
      - **Description** If it is not found.

### get\_actuator

- **Description** Retrieves an Actuator by name.
  - **Parameters**
    - **name**
      - **Description** The name of the Actuator.
      - **Type** str
  - **Returns**
    - **Description** The Actuator that was found.
    - **Type** IActuator
  - **Raises**
    - **Type** MachineException
      - **Description** If we cannot find the Actuator.

```

from machinelogic import Machine

machine = Machine()
my_actuator = machine.get_actuator("Actuator")

# Always home the actuator before starting to ensure position is properly calibrated.
my_actuator.home(timeout=10)

start_position = my_actuator.state.position
print("starting at position: ", start_position)

target_distance = 150.0 # mm

my_actuator.move_relative(
    distance=target_distance,
    timeout=10, # seconds
)

# first_move_end_position is approx. equal to start_position + target_distance.
first_move_end_position = my_actuator.state.position
print("first move finished at position: ", first_move_end_position)

# move back to starting position
target_distance = -1 * target_distance
my_actuator.move_relative(
    distance=target_distance,
    timeout=10, # seconds
)

# approx. equal to start_position,
end_position = my_actuator.state.position
print("finished back at position: ", end_position)

```

## get\_bag\_gripper

- **Description** Retrieves a Bag Gripper by name.
  - **Parameters**
    - **name**
      - **Description** The name of the Bag Gripper
      - **Type** str
  - **Returns**
    - **Description** The Bag Gripper that was found.
    - **Type** IBagGripper
  - **Raises**
    - **Type** MachineMotionException

- **Description** If it is not found.

```
from machinelogic import Machine

machine = Machine()
my_bag_gripper = machine.get_bag_gripper("Bag Gripper")
```

## get\_input

- **Description** Retrieves an DigitalInput by name.
  - **Parameters**
    - **name**
      - **Description** The name of the DigitalInput.
      - **Type** str
  - **Returns**
    - **Description** The DigitalInput that was found.
    - **Type** IDigitalInput
  - **Raises**
    - **Type** MachineException
      - **Description** If we cannot find the DigitalInput.

```
from machinelogic import Machine

machine = Machine()

my_input = machine.get_input("Input")

if my_input.state.value:
    print(f"{my_input.configuration.name} is HIGH")
else:
    print(f"{my_input.configuration.name} is LOW")
```

## get\_machine\_motion

- **Description** Retrieves an IMachineMotion instance by name.
  - **Parameters**
    - **name**
      - **Description** The name of the MachineMotion.
      - **Type** str
  - **Returns**
    - **Description** The MachineMotion that was found.
    - **Type** IMachineMotion
  - **Raises**
    - **Type** MachineException
      - **Description** If we cannot find the MachineMotion.

```
from machinelogic import Machine, MachineException

machine = Machine()

my_controller_1 = machine.get_machine_motion("Controller 1")

configuration = my_controller_1.configuration

print("Name:", configuration.name)
print("IP Address:", configuration.ip_address)
```

## get\_output

---

- **Description** Retrieves an Output by name.
  - **Parameters**
    - **name**
      - **Description** The name of the Output
      - **Type** str
  - **Returns**
    - **Description** The Output that was found.
    - **Type** IOutput
  - **Raises**
    - **Type** MachineException
      - **Description** If we cannot find the Output.

```
from machinelogic import Machine, MachineException, DigitalOutputException

machine = Machine()
my_output = machine.get_output("Output")

my_output.write(True) # Write "true" to the Output
my_output.write(False) # Write "false" to the Output
```

## get\_pneumatic

---

- **Description** Retrieves a Pneumatic by name.
  - **Parameters**
    - **name**
      - **Description** The name of the Pneumatic.
      - **Type** str
  - **Returns**
    - **Description** The Pneumatic that was found.
    - **Type** IPneumatic
  - **Raises**
    - **Type** MachineException
      - **Description** If we cannot find the Pneumatic.

```

import time
from machinelogic import Machine

machine = Machine()
my_pneumatic = machine.get_pneumatic("Pneumatic")

# Idle
my_pneumatic.idle_async()
time.sleep(1)

# Push
my_pneumatic.push_async()
time.sleep(1)

# Pull
my_pneumatic.pull_async()
time.sleep(1)

```

## get\_robot

- **Description** Retrieves a Robot by name. If no name is specified, then returns the first Robot.
- **Parameters**
  - **name**
    - **Description** The Robot name. If it's None, then the first Robot in the Robot list is returned.
    - **Type** str
- **Returns**
  - **Description** The Robot that was found.
  - **Type** IRobot
- **Raises**
  - **Type** MachineException
    - **Description** If the Robot is not found.

```

from machinelogic import Machine

machine = Machine()
my_robot = machine.get_robot("Robot")

# Example of use: moving robot to specified joint angles in deg
my_robot.movej([0, -90, 120, -90, -90, 0])

```

## get\_scene

- **Description** Returns the scene instance
- **Returns**
  - **Description** The instance of the scene containing the scene assets.
  - **Type** IScene
- **Raises**
  - **Type** MachineException
    - **Description** If failed to find the scene

## on\_mqtt\_event

- **Description** Attach a callback function to an MQTT topic.

- **Parameters**

- **topic**

- **Description** The topic to listen on.

- **Type** str

- **callback**

- **Description** A callback where the first argument is the topic and the second is the message.

- **Type** Union[Callable[[str, str], None], None]

```
import time
from machinelogic import Machine

machine = Machine()

my_event_topic = "my_custom/event/topic"

# A "callback" function called everytime a new mqtt event on my_event_topic is received.
def event_callback(topic: str, message: str):
    print("new mqtt event:", topic, message)

machine.on_mqtt_event(my_event_topic, event_callback)
machine.publish_mqtt_event(my_event_topic, "my message")

time.sleep(2)

machine.on_mqtt_event(my_event_topic, None) # remove the callback.
```

## publish\_mqtt\_event

- **Description** Publish an MQTT event.

- **Parameters**

- **topic**

- **Description** Topic to publish.

- **Type** str

- **message**

- **Description** Optional message.

- **Type** Optional[str]

- **Default** None



```

import time
import json
from machinelogic import Machine

machine = Machine()

# Example for publishing a cycle-start and cycle-end topic and message
# to track application cycles in MachineAnalytics
cycle_start_topic = "application/cycle-start"
cycle_end_topic = "application/cycle-end"
cycle_message = {
    "applicationId": "My Python Application",
    "cycleId": "default"
}
json_cycle_message = json.dumps(cycle_message)

while True:
    machine.publish_mqtt_event(cycle_start_topic, json_cycle_message)
    print("Cycle Start")
    time.sleep(5)
    machine.publish_mqtt_event(cycle_end_topic, json_cycle_message)
    time.sleep(1)
    print("Cycle end")

```

## MachineMotion

A software representation of a MachineMotion controller. The MachineMotion is comprised of many actuators, inputs, outputs, pneumatics, ac motors, and bag grippers. It keeps a persistent connection to MQTT as well.

You should NEVER construct this object yourself. Instead, it is best to rely on the Machine instance to provide you with a list of the available MachineMotions.

### configuration

- **Description** MachineMotionConfiguration: The representation of the configuration associated with this MachineMotion.

## Actuator

A software representation of an Actuator. An Actuator is defined as a motorized axis that can move by discrete distances. It is not recommended that you construct this object yourself. Rather, you should query it from a Machine instance:

E.g.:

```

machine = Machine()
my_actuator = machine.get_actuator("Actuator")

```

In this example, "New actuator" is the friendly name assigned to the Actuator in the MachineLogic configuration page.

### configuration

- **Description** ActuatorConfiguration: The representation of the configuration associated with this MachineMotion.

## home

---

- **Description** Home the Actuator synchronously.
  - **Parameters**
    - **timeout**
      - **Description** The timeout in seconds.
      - **Type** float
  - **Raises**
    - **Type** ActuatorException
      - **Description** If the home was unsuccessful or request timed out.

```
from machinelogic import Machine

machine = Machine()
my_actuator = machine.get_actuator("Actuator")

my_actuator.home(timeout=10)
```

## lock\_brakes

---

- **Description** Locks the brakes on this Actuator.
  - **Raises**
    - **Type** ActuatorException
      - **Description** If the brakes failed to lock.

```
from machinelogic import Machine

machine = Machine()
my_actuator = machine.get_actuator("Actuator")

my_actuator.unlock_brakes()

# Home the actuator before starting to ensure position is properly calibrated
my_actuator.home(timeout=10)
my_actuator.move_relative(distance=100.0)

my_actuator.lock_brakes()

# This move will fail because the brakes are now locked.
my_actuator.move_relative(distance=-100.0)
```

## move\_absolute

---

- **Description** Moves absolute synchronously to the specified position.
  - **Parameters**
    - **position**
      - **Description** The position to move to.
      - **Type** float
    - **timeout**
      - **Description** The timeout in seconds.
      - **Type** float
  - **Raises**
    - **Type** ActuatorException
      - **Description** If the move was unsuccessful.

```

from machinelogic import Machine

machine = Machine()
my_actuator = machine.get_actuator("Actuator")

# Always home the actuator before starting to ensure position is properly calibrated.
my_actuator.home(timeout=10)

my_actuator.move_absolute(
    position=150.0, # millimeters
    timeout=10, # seconds
)

```

## move\_absolute\_async

- **Description** Moves absolute asynchronously.
  - **Parameters**
    - **position**
      - **Description** The position to move to.
      - **Type** float
  - **Raises**
    - **Type** ActuatorException
      - **Description** If the move was unsuccessful.

```

import time
from machinelogic import Machine

machine = Machine()
my_actuator = machine.get_actuator("Actuator")

# Always home the actuator before starting to ensure position is properly calibrated.
my_actuator.home(timeout=10)

target_position = 150.0 # millimeters

# move_*_async will start the move and return without waiting for the move to complete.
my_actuator.move_absolute_async(target_position)

while my_actuator.state.move_in_progress:
    print("move is in progress...")
    time.sleep(1)

# end_position will be approx. equal to target_position.
end_position = my_actuator.state.position
print("finished at position: ", end_position)

```

## move\_continuous\_async

- **Description** Starts a continuous move. The Actuator will keep moving until it is stopped.
  - **Parameters**
    - **speed**
      - **Description** The speed to move with.
      - **Type** float

- **Default** 100.0
- **acceleration**
  - **Description** The acceleration to move with.
  - **Type** float
  - **Default** 100.0
- **Raises**
  - **Type** ActuatorException
  - **Description** If the move was unsuccessful.

```
import time
from machinelogic import Machine

machine = Machine()
my_actuator = machine.get_actuator("Actuator")

# Always home the actuator before starting to ensure position is properly calibrated.
my_actuator.home(timeout=10)

target_speed = 100.0 # mm/s
target_acceleration = 500.0 # mm/s^2
target_deceleration = 600.0 # mm/s^2

# move_*_async will start the move and return without waiting for the move to complete.
my_actuator.move_continuous_async(target_speed, target_acceleration)

time.sleep(10) # move continuously for ~10 seconds.

my_actuator.stop(target_deceleration) # decelerate to stopped.
```

## move\_relative

- **Description** Moves relative synchronously by the specified distance.
  - **Parameters**
    - **distance**
      - **Description** The distance to move.
      - **Type** float
    - **timeout**
      - **Description** The timeout in seconds.
      - **Type** float
  - **Raises**
    - **Type** ActuatorException
    - **Description** If the move was unsuccessful.

```

from machinelogic import Machine

machine = Machine()
my_actuator = machine.get_actuator("Actuator")

# Always home the actuator before starting to ensure position is properly calibrated.
my_actuator.home(timeout=10)

start_position = my_actuator.state.position
print("starting at position: ", start_position)

target_distance = 150.0 # mm

my_actuator.move_relative(
    distance=target_distance,
    timeout=10, # seconds
)

# first_move_end_position is approx. equal to start_position + target_distance.
first_move_end_position = my_actuator.state.position
print("first move finished at position: ", first_move_end_position)

# move back to starting position
target_distance = -1 * target_distance
my_actuator.move_relative(
    distance=target_distance,
    timeout=10, # seconds
)

# approx. equal to start_position,
end_position = my_actuator.state.position
print("finished back at position: ", end_position)

```

## move\_relative\_async

- **Description** Moves relative asynchronously by the specified distance.
- **Parameters**
  - **distance**
    - **Description** The distance to move.
    - **Type** float
- **Raises**
  - **Type** ActuatorException
    - **Description** If the move was unsuccessful.

```

import time
from machinelogic import Machine

machine = Machine()
my_actuator = machine.get_actuator("Actuator")

# Always home the actuator before starting to ensure position is properly calibrated.
my_actuator.home(timeout=10)

start_position = my_actuator.state.position
print("starting at position: ", start_position)

target_distance = 150.0 # mm

# move_*_async will start the move and return without waiting for the move to complete.
my_actuator.move_relative_async(distance=150.0)

while my_actuator.state.move_in_progress:
    print("move is in progress...")
    time.sleep(1)

# end_position will be approx. equal to start_position + target_distance.
end_position = my_actuator.state.position
print("finished at position", end_position)

```

## set\_acceleration

- **Description** Sets the max acceleration for the Actuator.
  - **Parameters**
    - **acceleration**
      - **Description** The new acceleration.
      - **Type** float
  - **Raises**
    - **Type** ActuatorException
    - **Description** If the request was unsuccessful.

```

from machinelogic import Machine

machine = Machine()
my_actuator = machine.get_actuator("Actuator")

target_speed = 100.0 # mm/s
target_acceleration = 500.0 # mm/s^2

my_actuator.set_speed(target_speed)
my_actuator.set_acceleration(target_acceleration)

```

## set\_speed

- **Description** Sets the max speed for the Actuator.
  - **Parameters**
    - **speed**
      - **Description** The new speed.
      - **Type** float
  - **Raises**

- **Type** ActuatorException
  - **Description** If the request was unsuccessful.

```
from machinelogic import Machine

machine = Machine()
my_actuator = machine.get_actuator("Actuator")

target_speed = 100.0 # mm/s
target_acceleration = 500.0 # mm/s^2

my_actuator.set_speed(target_speed)
my_actuator.set_acceleration(target_acceleration)
```

## state

---

- **Description** ActuatorState: The representation of the current state of this MachineMotion.

## stop

---

- **Description** Stops movement on this Actuator. If no argument is provided, then a quickstop is emitted which will abruptly stop the motion. Otherwise, the actuator will decelerate following the provided acceleration.
- **Parameters**
  - **acceleration**
    - **Description** Deceleration speed.
    - **Type** float
- **Raises**
  - **Type** ActuatorException
    - **Description** If the Actuator failed to stop.

```
from machinelogic import Machine

machine = Machine()
my_actuator = machine.get_actuator("Actuator")

deceleration = 500 # mm/s^2
my_actuator.stop(deceleration) # Deceleration is an optional parameter
# The actuator will stop as quickly as possible if no deceleration is specified.
```

## unlock\_brakes

---

- **Description** Unlocks the brakes on this Actuator.
- **Raises**
  - **Type** ActuatorException
    - **Description** If the brakes failed to unlock.

```

from machinelogic import Machine

machine = Machine()
my_actuator = machine.get_actuator("Actuator")

my_actuator.unlock_brakes()

# Home the actuator before starting to ensure position is properly calibrated
my_actuator.home(timeout=10)
my_actuator.move_relative(distance=100.0)

my_actuator.lock_brakes()

# This move will fail because the brakes are now locked.
my_actuator.move_relative(distance=-100.0)

```

## wait\_for\_move\_completion

- **Description** Waits for motion to complete before commencing the next action.
  - **Parameters**
    - **timeout**
      - **Description** The timeout in seconds, after which an exception will be thrown.
      - **Type** float
  - **Raises**
    - **Type** ActuatorException
      - **Description** If the request fails or the move did not complete in the allocated amount of time.

```

from machinelogic import Machine

machine = Machine()
my_actuator = machine.get_actuator("Actuator")

# Always home the actuator before starting to ensure position is properly calibrated.
my_actuator.home(timeout=10)

target_position = 150.0 # millimeters
# move*_async will start the move and return without waiting for the move to complete.
my_actuator.move_absolute_async(target_position)

print("move started...")
my_actuator.wait_for_move_completion(timeout=10)
print("motion complete.")

# end_position will be approx. equal to target_position.
end_position = my_actuator.state.position
print("finished at position: ", end_position)

```

## ActuatorState

Representation of the current state of an Actuator instance. The values in this class are updated in real time to match the physical reality of the Actuator.



## brakes

---

- **Description** float: The current state of the brakes of the Actuator. Set to 1 if locked, otherwise 0.

```
from machinelogic import Machine

machine = Machine()
my_actuator = machine.get_actuator("Actuator")
print(my_actuator.state.brakes)
```

## end\_sensors

---

- **Description** Tuple[bool, bool]: A tuple representing the state of the [ home, end ] sensors.

```
from machinelogic import Machine

machine = Machine()
my_actuator = machine.get_actuator("Actuator")
print(my_actuator.state.end_sensors)
```

## move\_in\_progress

---

- **Description** bool: The boolean is True if a move is in progress, otherwise False.

```
from machinelogic import Machine

machine = Machine()
my_actuator = machine.get_actuator("Actuator")
print(my_actuator.state.move_in_progress)
```

## output\_torque

---

- **Description** dict[str, float]: The current torque output of the Actuator.

```
from machinelogic import Machine

machine = Machine()
my_actuator = machine.get_actuator("Actuator")
print(my_actuator.state.output_torque)
```

## position

---

- **Description** float: The current position of the Actuator.

```
from machinelogic import Machine

machine = Machine()
my_actuator = machine.get_actuator("Actuator")
print(my_actuator.state.position)
```

## speed

- **Description** float: The current speed of the Actuator.

```
from machinelogic import Machine

machine = Machine()
my_actuator = machine.get_actuator("Actuator")
print(my_actuator.state.speed)
```

# ActuatorConfiguration

Representation of the configuration of an Actuator instance. This configuration defines what your Actuator is and how it should behave when work is requested from it.

## actuator\_type

- **Description** ActuatorType: The type of the Actuator.

```
from machinelogic import Machine

machine = Machine()
my_actuator = machine.get_actuator("Actuator")
print(my_actuator.configuration.actuator_type)
```

## controller\_id

- **Description** str: The controller id of the Actuator

## home\_sensor

- **Description** Literal["A", "B"]: The home sensor port, either A or B.

```
from machinelogic import Machine

machine = Machine()
my_actuator = machine.get_actuator("Actuator")
print(my_actuator.configuration.home_sensor)
```

## ip\_address

- **Description** str: The IP address of the Actuator.

```
from machinelogic import Machine

machine = Machine()
my_actuator = machine.get_actuator("Actuator")
print(my_actuator.configuration.ip_address)
```

## name

- **Description** str: The name of the Actuator.

```
from machinelogic import Machine

machine = Machine()
my_actuator = machine.get_actuator("Actuator")
print(my_actuator.configuration.name)
```

## units

- **Description** Literal["deg", "mm"]: The units that the Actuator functions in.

```
from machinelogic import Machine

machine = Machine()
my_actuator = machine.get_actuator("Actuator")
print(my_actuator.configuration.units)
```

## uuid

- **Description** str: The Actuator's ID.

```
from machinelogic import Machine

machine = Machine()
my_actuator = machine.get_actuator("Actuator")
print(my_actuator.configuration.uuid)
```

A helper class used to group N-many Actuator instances together so that they can be acted upon as a group. An ActuatorGroup may only contain Actuators that are on the same MachineMotion controller.

E.g.:

```
machine = Machine()
my_actuator_1 = machine.get_actuator("Actuator 1")
my_actuator_2 = machine.get_actuator("Actuator 2")
actuator_group = ActuatorGroup(my_actuator_1, my_actuator_2)
```

## lock\_brakes

- **Description** Locks the brakes for all Actuators in the group.
  - **Raises**
    - **Type** ActuatorGroupException
      - **Description** If the brakes failed to lock on a single Actuator in the group.

```
from machinelogic import Machine, ActuatorGroup

machine = Machine()
my_actuator_1 = machine.get_actuator("Actuator 1")
my_actuator_2 = machine.get_actuator("Actuator 2")

# Always home the actuators before starting to ensure position is properly calibrated.
my_actuator_1.home(timeout=10)
my_actuator_2.home(timeout=10)

actuator_group = ActuatorGroup(my_actuator_1, my_actuator_2)
actuator_group.set_speed(100.0) # mm/s
actuator_group.set_acceleration(500.0) # mm/s^2

actuator_group.lock_brakes()

# This move will fail because the brakes are locked.
actuator_group.move_absolute((50.0, 120.0), timeout=10)
```

## move\_absolute

- **Description** Moves absolute synchronously to the tuple of positions.
  - **Parameters**
    - **position**
      - **Description** The positions to move to. Each value corresponds 1-to-1 with the actuators tuple provided to the constructor.
      - **Type** Tuple[float, ...]
    - **timeout**
      - **Description** The timeout in seconds after which an exception is thrown.
      - **Type** float
      - **Default** DEFAULT\_MOVEMENT\_TIMEOUT\_SECONDS
  - **Raises**
    - **Type** ActuatorGroupException
      - **Description** If the request fails or the timeout occurs.

```

from machinelogic import Machine, ActuatorGroup

machine = Machine()
my_actuator_1 = machine.get_actuator("Actuator 1")
my_actuator_2 = machine.get_actuator("Actuator 2")

# Always home the actuators before starting to ensure position is properly calibrated.
my_actuator_1.home(timeout=10)
my_actuator_2.home(timeout=10)

actuator_group = ActuatorGroup(my_actuator_1, my_actuator_2)
actuator_group.set_speed(100.0) # mm/s
actuator_group.set_acceleration(500.0) # mm/s^2

target_positions = (100.0, 200.0) # (mm - actuator1, mm - actuator2)

actuator_group.move_absolute(target_positions, timeout=10)

```

## move\_absolute\_async

- **Description** Moves absolute asynchronously to the tuple of positions.
  - **Parameters**
    - **distance**
      - **Description** The positions to move to. Each value corresponds 1-to-1 with the actuators tuple provided to the constructor.
      - **Type** Tuple[float, ...]
  - **Raises**
    - **Type** ActuatorGroupException
      - **Description** If the request fails.

```

from machinelogic import Machine, ActuatorGroup

machine = Machine()
my_actuator_1 = machine.get_actuator("Actuator 1")
my_actuator_2 = machine.get_actuator("Actuator 2")

# Always home the actuators before starting to ensure position is properly calibrated.
my_actuator_1.home(timeout=10)
my_actuator_2.home(timeout=10)

actuator_group = ActuatorGroup(my_actuator_1, my_actuator_2)
actuator_group.set_speed(100.0) # mm/s
actuator_group.set_acceleration(500.0) # mm/s^2

target_positions = (75.0, 158.0) # (mm - actuator1, mm - actuator2)

# move_*_async will start the move and return without waiting for the move to complete.
actuator_group.move_absolute_async(target_positions)
print("move started..")

actuator_group.wait_for_move_completion()
print("motion completed.")

```

## move\_relative

- **Description** Moves relative synchronously by the tuple of distances.
  - **Parameters**
    - **distance**
      - **Description** The distances to move each Actuator. Each value corresponds 1-to-1 with the actuators tuple provided to the constructor.
      - **Type** Tuple[float, ...]
    - **timeout**
      - **Description** The timeout in seconds after which an exception is thrown.
      - **Type** float
      - **Default** DEFAULT\_MOVEMENT\_TIMEOUT\_SECONDS
  - **Raises**
    - **Type** ActuatorGroupException
      - **Description** If the request fails or the timeout occurs

```

from machinelogic import Machine, ActuatorGroup

machine = Machine()
my_actuator_1 = machine.get_actuator("Actuator 1")
my_actuator_2 = machine.get_actuator("Actuator 2")

# Always home the actuators before starting to ensure position is properly calibrated.
my_actuator_1.home(timeout=10)
my_actuator_2.home(timeout=10)

actuator_group = ActuatorGroup(my_actuator_1, my_actuator_2)
actuator_group.set_speed(100.0) # mm/s
actuator_group.set_acceleration(500.0) # mm/s^2

target_distances = (-120.0, 240.0) # (mm - actuator1, mm - actuator2)

actuator_group.move_relative(target_distances, timeout=10)

```

## move\_relative\_async

- **Description** Moves relative asynchronously by the tuple of distances.
  - **Parameters**
    - **distance**
      - **Description** The distances to move each Actuator. Each value corresponds 1-to-1 with the actuators tuple provided to the constructor.
      - **Type** Tuple[float, ...]
  - **Raises**
    - **Type** ActuatorGroupException
      - **Description** If the request fails.

```

import time
from machinelogic import Machine, ActuatorGroup

machine = Machine()
actuator1 = machine.get_actuator("My Actuator #1")
actuator2 = machine.get_actuator("My Actuator #2")

# Always home the actuators before starting to ensure position is properly calibrated.
actuator1.home(timeout=10)
actuator2.home(timeout=10)

actuator_group = ActuatorGroup(actuator1, actuator2)
actuator_group.set_speed(100.0) # mm/s
actuator_group.set_acceleration(500.0) # mm/s^2

target_distances = (-120.0, 240.0) # (mm - actuator1, mm - actuator2)

# move_*_async will start the move and return without waiting for the move to complete.
actuator_group.move_relative_async(target_distances)

while actuator_group.state.move_in_progress:
    print("motion is in progress..")
    time.sleep(1)

print("motion complete")

```

## set\_acceleration

---

- **Description** Sets the acceleration on all Actuators in the group.
  - **Parameters**
    - **acceleration**
      - **Description** The acceleration to set on all Actuators in the group.
      - **Type** float
  - **Raises**
    - **Type** ActuatorGroupException
      - **Description** If the acceleration failed to set on any Actuator in the group.

## set\_speed

---

- **Description** Sets the speed on all Actuators in the group.
  - **Parameters**
    - **speed**
      - **Description** The speed to set on all Actuators in the group.
      - **Type** float
  - **Raises**
    - **Type** ActuatorGroupException
      - **Description** If the speed failed to set on any Actuator in the group.

## state

---

- **Description** ActuatorGroupState: The state of the ActuatorGroup.

## stop

---

- **Description** Stops movement on all Actuators in the group.
  - **Raises**
    - **Type** ActuatorGroupException
      - **Description** If any of the Actuators in the group failed to stop.

## unlock\_brakes

---

- **Description** Unlocks the brakes on all Actuators in the group.
  - **Raises**
    - **Type** ActuatorGroupException
      - **Description** If the brakes failed to unlock on a single Actuator in the group.

```
from machinelogic import Machine, ActuatorGroup

machine = Machine()
my_actuator_1 = machine.get_actuator("Actuator 1")
my_actuator_2 = machine.get_actuator("Actuator 2")

# Always home the actuators before starting to ensure position is properly calibrated.
my_actuator_1.home(timeout=10)
my_actuator_2.home(timeout=10)

actuator_group = ActuatorGroup(my_actuator_1, my_actuator_2)
actuator_group.set_speed(100.0) # mm/s
actuator_group.set_acceleration(500.0) # mm/s^2

actuator_group.lock_brakes()

# This move will fail because the brakes are locked.
actuator_group.move_absolute((50.0, 120.0), timeout=10)
```

## wait\_for\_move\_completion

---

- **Description** Waits for motion to complete on all Actuators in the group.
  - **Parameters**
    - **timeout**
      - **Description** The timeout in seconds, after which an exception will be thrown.
      - **Type** float
  - **Raises**
    - **Type** ActuatorGroupException
      - **Description** If the request fails or the move did not complete in the allocated amount of time.



```

from machinelogic import Machine, ActuatorGroup

machine = Machine()
my_actuator_1 = machine.get_actuator("Actuator 1")
my_actuator_2 = machine.get_actuator("Actuator 2")

# Always home the actuators before starting to ensure position is properly calibrated.
my_actuator_1.home(timeout=10)
my_actuator_2.home(timeout=10)

actuator_group = ActuatorGroup(my_actuator_1, my_actuator_2)
actuator_group.set_speed(100.0) # mm/s
actuator_group.set_acceleration(500.0) # mm/s^2

target_positions = (75.0, 158.0) # (mm - actuator1, mm - actuator2)

# move_*_async will start the move and return without waiting for the move to complete.
actuator_group.move_absolute_async(target_positions)
print("move started..")

actuator_group.wait_for_move_completion()
print("motion completed.")

```

## Robot

A software representation of a Robot. It is not recommended that you construct this object yourself. Rather, you should query it from a Machine instance:

E.g.:

```

machine = Machine()
my_robot = machine.get_robot("Robot")

```

In this example, "Robot" is the friendly name assigned to the actuator in the MachineLogic configuration page.

### compute\_forward\_kinematics

- **Description** Computes the forward kinematics from joint angles.
- **Parameters**
  - **joint\_angles**
    - **Description** The 6 joint angles, in degrees.
    - **Type** JointAnglesDegrees
- **Returns**
  - **Description** Cartesian pose, in mm and degrees
  - **Type** CartesianPose
- **Raises**
  - **Type** ValueError
    - **Description** Throws an error if the joint angles are invalid.

```

from machinelogic import Machine

machine = Machine()
my_robot = machine.get_robot("Robot")

# Joint angles, in degrees
joint_angles = [
    176.68, # j1
    -35.95, # j2
    86.37, # j3
    -150.02, # j4
    -90.95, # j5
    -18.58, # j6
]
computed_robot_pose = my_robot.compute_forward_kinematics(joint_angles)
print(computed_robot_pose)

```

## compute\_inverse\_kinematics

- **Description** Computes the inverse kinematics from a Cartesian pose.
  - **Parameters**
    - **cartesian\_position**
      - **Description** The end effector's pose, in mm and degrees, where the angles are extrinsic Euler angles in XYZ order.
      - **Type** CartesianPose
  - **Returns**
    - **Description** Joint angles, in degrees.
    - **Type** JointAnglesDegrees
  - **Raises**
    - **Type** ValueError
      - **Description** Throws an error if the inverse kinematic solver fails.

```

from machinelogic import Machine

machine = Machine()
my_robot = machine.get_robot("Robot")

cartesian_position = [
    648.71, # x in millimeters
    -313.30, # y in millimeters
    159.28, # z in millimeters
    107.14, # rx in degrees
    -145.87, # ry in degrees
    15.13, # rz in degrees
]

computed_joint_angles = my_robot.compute_inverse_kinematics(cartesian_position)
print(computed_joint_angles)

```

## configuration

- **Description** The Robot configuration.

## create\_sequence

- **Description** Creates a sequence-builder object for building a sequence of robot movements. This method is expected to be used with the `append_*` methods.
  - **Returns**
    - **Description** A sequence builder object.
    - **Type** `SequenceBuilder`

```
from machinelogic import Machine

machine = Machine()
my_robot = machine.get_robot("Robot")

# Create an arbitrary Cartesian waypoint, that is 10mm or 10 degrees away from the current position
cartesian_waypoint = [i + 10 for i in my_robot.state.cartesian_position]

# Create an arbitrary joint waypoint, that is 10 degrees away from the current joint angles
joint_waypoint = [i + 10 for i in my_robot.state.joint_angles]

cartesian_velocity = 100.0 # millimeters per second
cartesian_acceleration = 100.0 # millimeters per second squared
blend_factor_1 = 0.5

joint_velocity = 10.0 # degrees per second
joint_acceleration = 10.0 # degrees per second squared
blend_factor_2 = 0.5

with my_robot.create_sequence() as seq:
    seq.append_move(
        cartesian_waypoint, cartesian_velocity, cartesian_acceleration, blend_factor_1
    )
    seq.append_movej(joint_waypoint, joint_velocity, joint_acceleration, blend_factor_2)

# Alternate Form:
seq = my_robot.create_sequence()
seq.append_move(cartesian_waypoint)
seq.append_movej(joint_waypoint)
my_robot.execute_sequence(seq)
```

## execute\_sequence

- **Description** Moves the robot through a specific sequence of joint and linear motions.
  - **Parameters**
    - **sequence**
      - **Description** The sequence of target points.
      - **Type** `SequenceBuilder`
  - **Returns**
    - **Description** True if successful.
    - **Type** `bool`

```

from machinelogic import Machine

machine = Machine()
my_robot = machine.get_robot("Robot")

# Create an arbitrary Cartesian waypoint, that is 10mm or 10 degrees away from the current position
cartesian_waypoint = [i + 10 for i in my_robot.state.cartesian_position]

# Create an arbitrary joint waypoint, that is 10 degrees away from the current joint angles
joint_waypoint = [i + 10 for i in my_robot.state.joint_angles]

cartesian_velocity = 100.0 # millimeters per second
cartesian_acceleration = 100.0 # millimeters per second squared
blend_factor_1 = 0.5

joint_velocity = 10.0 # degrees per second
joint_acceleration = 10.0 # degrees per second squared
blend_factor_2 = 0.5

seq = my_robot.create_sequence()
seq.append_move(
    cartesian_waypoint, cartesian_velocity, cartesian_acceleration, blend_factor_1
)
seq.append_movej(joint_waypoint, joint_velocity, joint_acceleration, blend_factor_2)
my_robot.execute_sequence(seq)

```

## move\_stop

- **Description** Stops the robot current movement.
  - **Returns**
    - **Description** True if the robot was successfully stopped, False otherwise.
    - **Type** bool

```

from machinelogic import Machine

machine = Machine()
my_robot = machine.get_robot("Robot")

my_robot.move_stop()

```

## movej

- **Description** Moves the robot to a specified joint position.
  - **Parameters**
    - **target**
      - **Description** The target joint angles, in degrees.
      - **Type** JointAnglesDegrees
    - **velocity**
      - **Description** The joint velocity to move at, in degrees per second.
      - **Type** DegreesPerSecond
    - **acceleration**
      - **Description** The joint acceleration to move at, in degrees per second squared.
      - **Type** DegreesPerSecondSquared

```
from machinelogic import Machine

machine = Machine()
my_robot = machine.get_robot("Robot")

joint_velocity = 10.0 # degrees per second
joint_acceleration = 10.0 # degrees per second squared

# Joint angles, in degrees
joint_angles = [
    86.0, # j1
    0.0, # j2
    88.0, # j3
    0.0, # j4
    91.0, # j5
    0.0, # j6
]

my_robot.movej(
    joint_angles,
    joint_velocity,
    joint_acceleration,
)
```

## movef

- **Description** Moves the robot to a specified Cartesian position.
  - **Parameters**
    - **target**
      - **Description** The end effector's pose, in mm and degrees, where the angles are extrinsic Euler angles in XYZ order.
      - **Type** CartesianPose
    - **velocity**
      - **Description** The velocity to move at, in mm/s.
      - **Type** MillimetersPerSecond
    - **acceleration**
      - **Description** The acceleration to move at, in mm/s<sup>2</sup>.
      - **Type** MillimetersPerSecondSquared
    - **reference\_frame**
      - **Description** The reference frame to move relative to. If None, the robot's base frame is used.
      - **Type** CartesianPose

```

from machinelogic import Machine

machine = Machine()
my_robot = machine.get_robot("Robot")

linear_velocity = 100.0 # millimeters per second
linear_acceleration = 100.0 # millimeters per second squared

# Target Cartesian pose, in millimeters and degrees
cartesian_pose = [
    -1267.8, # x in millimeters
    -89.2, # y in millimeters
    277.4, # z in millimeters
    -167.8, # rx in degrees
    179.7, # ry in degrees
    -77.8, # rz in degrees
]

reference_frame = [
    23.56, # x in millimeters
    -125.75, # y in millimeters
    5.92, # z in millimeters
    0.31, # rx in degrees
    0.65, # ry in degrees
    90.00, # rz in degrees
]

my_robot.move(
    cartesian_pose,
    linear_velocity, # Optional
    linear_acceleration, # Optional
    reference_frame, # Optional
)

```

## on\_log\_alarm

- **Description** Set a callback to the log alarm.
  - **Parameters**
    - **callback**
      - **Description** A callback function to be called when a robot alarm is received.
      - **Type** Callable[[IRobotAlarm], None]
  - **Returns**
    - **Description** The callback ID.
    - **Type** int

```

from machinelogic import Machine

machine = Machine()
my_robot = machine.get_robot("Robot")

# The function defined here is called when the specified alarm occurs
def handle_log_alarm(alarm):
    print(alarm.level, alarm.error_code, alarm.description)

my_robot.on_log_alarm(handle_log_alarm)

```

## on\_system\_state\_change

- **Description** Registers a callback for system state changes.
  - **Parameters**
    - **callback**
      - **Description** The callback function.
      - **Type** Callable[[RobotOperationalState, RobotSafetyState], None]
  - **Returns**
    - **Description** The callback ID.
    - **Type** int

```
from machinelogic import Machine
from machinelogic.machinelogic.robot import RobotOperationalState, RobotSafetyState

machine = Machine()
my_robot = machine.get_robot("Robot")

# The function defined here is called when the specified state change occurs
def handle_state_change(robot_operational_state: RobotOperationalState, safety_state: RobotSafetyState):
    """
    A function that is called when the specified state change occurs.

    Args:
        robot_operational_state (RobotOperationalState): The current operational state of the robot.
        safety_state (RobotSafetyState): The current safety state of the robot.
    """
    print(robot_operational_state, safety_state)

callback_id = my_robot.on_system_state_change(handle_state_change)
print(callback_id)
```

## reset

- **Description** Attempts to reset the robot to a normal operational state.
  - **Returns**
    - **Description** True if successful.
    - **Type** bool

```
from machinelogic import Machine

machine = Machine()
my_robot = machine.get_robot("Robot")

did_reset = my_robot.reset()
print(did_reset)

# Robot state should be 'Normal'
print(my_robot.state.operational_state)
```

## set\_payload

- **Description** Sets the payload of the robot.
  - **Parameters**
    - **payload**
      - **Description** The payload, in kg.
      - **Type** Kilograms
  - **Returns**
    - **Description** True if successful.
    - **Type** bool

```
from machinelogic import Machine

machine = Machine()
my_robot = machine.get_robot("Robot")

# Weight in Kilograms
weight = 2.76
is_successful = my_robot.set_payload(weight)
print(is_successful)
```

## set\_tcp\_offset

- **Description** Sets the tool center point offset.
  - **Parameters**
    - **tcp\_offset**
      - **Description** The TCP offset, in mm and degrees, where the angles are extrinsic Euler angles in XYZ order.
      - **Type** CartesianPose
  - **Returns**
    - **Description** True if the TCP offset was successfully set, False otherwise.
    - **Type** bool

```
from machinelogic import Machine

machine = Machine()
my_robot = machine.get_robot("Robot")

# This offset will be applied in reference
# to the end effector coordinate system
cartesian_offset = [
    10.87, # x in millimeters
    -15.75, # y in millimeters
    200.56, # z in millimeters
    0.31, # rx degrees
    0.65, # ry degrees
    0.00, # rz degrees
]

is_successful = my_robot.set_tcp_offset(cartesian_offset)
print(is_successful)
```

## set\_tool\_digital\_output

- **Description** Sets the value of a tool digital output.
  - **Parameters**



- **pin**
  - **Description** The pin number.
  - **Type** int
- **value**
  - **Description** The value to set, where 1 is high and 0 is low.
  - **Type** int
- **Returns**
  - **Description** True if successful.
  - **Type** bool

```
from machinelogic import Machine

machine = Machine()
# New robot must be configured in the Configuration pane
my_robot = machine.get_robot("Robot")

# digital output identifier
output_pin = 1
value = 0
is_successful = my_robot.set_tool_digital_output(output_pin, value)
print(is_successful)
```

## state

---

- **Description** The current Robot state.

## teach\_mode

---

- **Description** Put the robot into teach mode (i.e., freedrive).
  - **Returns**
    - **Description** A context manager that will exit teach mode when it is closed.
    - **Type** TeachModeContextManager

```
import time

from machinelogic import Machine

machine = Machine()
my_robot = machine.get_robot("Robot")

with my_robot.teach_mode(): # When all arguments inside this statement are complete, teach mode ends automatically
    print("Robot is now in teach mode for 5 seconds")
    time.sleep(5)

    # Robot should be in 'Freedrive'
    print(my_robot.state.operational_state)
    time.sleep(1)

time.sleep(1)

# Robot should be back to 'Normal'
print(my_robot.state.operational_state)
```

# RobotState

A representation of the robot current state.

## cartesian\_position

- **Description** The end effector's pose, in mm and degrees, where the angles are extrinsic Euler angles in XYZ order.

```
from machinelogic import Machine

machine = Machine()
my_robot = machine.get_robot("Robot")

end_effector_pose = my_robot.state.cartesian_position
end_effector_position_mm = end_effector_pose[:3]
end_effector_orientation_euler_xyz_deg = end_effector_pose[-3:]
print(f"End effector's pose: {end_effector_pose}")
print(f"End effector's Cartesian position: {end_effector_position_mm}")
print(f"End effector's Euler XYZ orientation: {end_effector_orientation_euler_xyz_deg}")
```

## get\_digital\_input\_value

- **Description** Returns the value of a digital input at a given pin.
  - **Parameters**
    - **pin**
      - **Description** The pin number.
      - **Type** int
  - **Returns**
    - **Description** True if the pin is high, False otherwise.
    - **Type** None

```
from machinelogic import Machine

machine = Machine()
my_robot = machine.get_robot("Robot")
print(my_robot.state.get_digital_input_value(0))
```

## joint\_angles

- **Description** The robot current joint angles.

```
from machinelogic import Machine

machine = Machine()
my_robot = machine.get_robot("Robot")

print(my_robot.state.joint_angles)
```

## operational\_state

---

- **Description** The current robot operational state.

```
from machinelogic import Machine

machine = Machine()
my_robot = machine.get_robot("Robot")
print(my_robot.state.operational_state)
```

## safety\_state

---

- **Description** The current robot safety state.

```
from machinelogic import Machine

machine = Machine()
my_robot = machine.get_robot("Robot")
print(my_robot.state.safety_state)
```

# RobotConfiguration

A representation of the configuration of a Robot instance. This configuration defines what your Robot is and how it should behave when work is requested from it.

## cartesian\_velocity\_limit

---

- **Description** The maximum Cartesian velocity of the robot, in mm/s.

```
from machinelogic import Machine

machine = Machine()
my_robot = machine.get_robot("Robot")
print(my_robot.configuration.cartesian_velocity_limit)
```

## joint\_velocity\_limit

---

- **Description** The robot joints' maximum angular velocity, in deg/s.

```
from machinelogic import Machine

machine = Machine()
my_robot = machine.get_robot("Robot")
print(my_robot.configuration.joint_velocity_limit)
```

## name

- **Description** The friendly name of the robot.

```
from machinelogic import Machine

machine = Machine()
my_robot = machine.get_robot("Robot")
print(my_robot.configuration.name)
```

## robot\_type

- **Description** The robot's type.

```
from machinelogic import Machine

machine = Machine()
my_robot = machine.get_robot("Robot")
print(my_robot.configuration.robot_type)
```

## uuid

- **Description** The robot's ID.

```
from machinelogic import Machine

machine = Machine()
my_robot = machine.get_robot("Robot")
print(my_robot.configuration.uuid)
```

# RobotOperationalState

The robot's operational state.

Possible values:

- `OFFLINE`
- `NON_OPERATIONAL`
- `FREEDRIVE`
- `NORMAL`
- `UNKNOWN`
- `NEED_MANUAL_INTERVENTION`

# RobotSafetyState

The robot's safety state.

Possible values:

- NORMAL
- EMERGENCY\_STOP
- REDUCED\_SPEED
- SAFEGUARD\_STOP
- UNKNOWN

# SequenceBuilder

A builder for a sequence of moves.

## append\_movej

---

- **Description** Append a movej to the sequence.
  - **Parameters**
    - **target**
      - **Description** The target joint angles, in degrees.
      - **Type** JointAnglesDegrees
    - **velocity**
      - **Description** The velocity of the move, in degrees per second.
      - **Type** DegreesPerSecond
      - **Default** 10.0
    - **acceleration**
      - **Description** The acceleration of the move, in degrees per second squared.
      - **Type** DegreesPerSecondSquared
      - **Default** 10.0
    - **blend\_radius**
      - **Description** The blend radius of the move, in millimeters.
      - **Type** Millimeters
      - **Default** 0.0
  - **Returns**
    - **Description** The builder.
    - **Type** SequenceBuilder

## append\_movel

---

- **Description** Append a movel to the sequence.
  - **Parameters**
    - **target**
      - **Description** The target pose.
      - **Type** CartesianPose
    - **velocity**
      - **Description** The velocity of the move, in millimeters per second.
      - **Type** MillimetersPerSecond
      - **Default** 100.0
    - **acceleration**
      - **Description** The acceleration of the move, in millimeters per second squared.
      - **Type** MillimetersPerSecondSquared
      - **Default** 100.0
    - **blend\_radius**
      - **Description** The blend radius of the move, in millimeters.
      - **Type** Millimeters
      - **Default** 0.0
    - **reference\_frame**
      - **Description** The reference frame for the target pose.
      - **Type** CartesianPose

- **Default** None
- **Returns**
  - **Description** The builder.
  - **Type** SequenceBuilder

## DigitalInput

A software representation of an DigitalInput. It is not recommended that you construct this object yourself. Rather, you should query it from a Machine instance.

### configuration

- **Description** DigitalInputConfiguration: The configuration of the DigitalInput.

### state

- **Description** DigitalInputState: The state of the DigitalInput.

```
from machinelogic import Machine

machine = Machine()

my_input = machine.get_input("Input")

if my_input.state.value:
    print(f"{my_input.configuration.name} is HIGH")
else:
    print(f"{my_input.configuration.name} is LOW")
```

## DigitalInputState

Representation of the current state of an DigitalInput/DigitalOutput instance.

### value

- **Description** bool: The current value of the IO pin. True means high, while False means low. This is different from active/inactive, which depends on the active\_high configuration.

## DigitalInputConfiguration

Representation of the configuration of an DigitalInput/DigitalOutput. This configuration is established by the configuration page in MachineLogic.

### active\_high

- **Description** bool: The value that needs to be set to consider the DigitalInput/DigitalOutput as active.

## device

---

- **Description** int: The device number of the DigitalInput/DigitalOutput.

## ip\_address

---

- **Description** str: The ip address of the DigitalInput/DigitalOutput.

## name

---

- **Description** str: The name of the DigitalInput/DigitalOutput.

## port

---

- **Description** int: The port number of the DigitalInput/DigitalOutput.

## uuid

---

- **Description** str: The unique ID of the DigitalInput/DigitalOutput.

# DigitalOutput

A software representation of an Output. It is not recommended that you construct this object yourself. Rather, you should query it from a Machine instance.

## configuration

---

- **Description** OutputConfiguration: The configuration of the Output.

## write

---

- **Description** Writes the value into the Output, with True being high and False being low.
  - **Parameters**
    - **value**
      - **Description** The value to write to the Output.
      - **Type** bool
  - **Raises**
    - **Type** DigitalOutputException
      - **Description** If we fail to write the value to the Output.

```
from machinelogic import Machine, MachineException, DigitalOutputException
```

```
machine = Machine()  
my_output = machine.get_output("Output")
```

```
my_output.write(True) # Write "true" to the Output  
my_output.write(False) # Write "false" to the Output
```

## DigitalOutputConfiguration

Representation of the configuration of an DigitalInput/DigitalOutput. This configuration is established by the configuration page in MachineLogic.

### active\_high

- **Description** bool: The value that needs to be set to consider the DigitalInput/DigitalOutput as active.

### device

- **Description** int: The device number of the DigitalInput/DigitalOutput.

### ip\_address

- **Description** str: The ip address of the DigitalInput/DigitalOutput.

### name

- **Description** str: The name of the DigitalInput/DigitalOutput.

### port

- **Description** int: The port number of the DigitalInput/DigitalOutput.

### uuid

- **Description** str: The unique ID of the DigitalInput/DigitalOutput.

## Pneumatic

A software representation of a Pneumatic. It is not recommended that you construct this object yourself. Rather, you should query it from a Machine instance:

E.g.:



```
machine = Machine()
my_pneumatic = machine.get_pneumatic("Pneumatic")
```

In this example, "Pneumatic" is the friendly name assigned to a Pneumatic in the MachineLogic configuration page.

## configuration

---

- **Description** PneumaticConfiguration: The configuration of the actuator.

## idle\_async

---

- **Description** Idles the Pneumatic.
  - **Raises**
    - **Type** PneumaticException
      - **Description** If the idle was unsuccessful.

## pull\_async

---

- **Description** Pulls the Pneumatic.
  - **Raises**
    - **Type** PneumaticException
      - **Description** If the pull was unsuccessful.

## push\_async

---

- **Description** Pushes the Pneumatic.
  - **Raises**
    - **Type** PneumaticException
      - **Description** If the push was unsuccessful.

## state

---

- **Description** PneumaticState: The state of the actuator.

# PneumaticConfiguration

Representation of a Pneumatic configuration.

## device

---

- **Description** int: The device of the axis.

## input\_pin\_pull

---

- **Description** Optional[int]: The optional pull in pin.

## input\_pin\_push

---

- **Description** Optional[int]: The optional push in pin.

## ip\_address

---

- **Description** str: The IP address of the axis.

## name

---

- **Description** str: The name of the Pneumatic.

## output\_pin\_pull

---

- **Description** int: The pull out pin of the axis.

## output\_pin\_push

---

- **Description** int: The push out pin of the axis.

## uuid

---

- **Description** str: The ID of the Pneumatic.

# ACMotor

A software representation of an AC Motor. It is not recommended that you construct this object yourself. Rather, you should query it from a Machine instance:

E.g.:

```
machine = Machine()
my_ac_motor = machine.get_ac_motor("AC Motor")
```

In this example, "AC Motor" is the friendly name assigned to an AC Motor in the MachineLogic configuration page.

## configuration

---

- **Description** ACMotorConfiguration: The configuration of the ACMotor.

## move\_forward

---

- **Description** Begins moving the AC Motor forward.
  - **Raises**
    - **Type** ACMotorException
      - **Description** If the move was unsuccessful.

```
from time import sleep
from machine import Machine

machine = Machine()
my_ac_motor = machine.get_ac_motor("AC Motor")

my_ac_motor.move_forward()
sleep(10)
my_ac_motor.stop()
```

## move\_reverse

---

- **Description** Begins moving the AC Motor in reverse.
  - **Raises**
    - **Type** ACMotorException
      - **Description** If the move was unsuccessful.

```
import time
from machine import Machine

machine = Machine()
my_ac_motor = machine.get_ac_motor("AC Motor")

# Move the AC motor in reverse
my_ac_motor.move_reverse()

# The AC motor will stop moving if the program terminates
time.sleep(10)
```

## stop

---

- **Description** Stops the movement of the AC Motor.
  - **Raises**
    - **Type** ACMotorException
      - **Description** If the stop was unsuccessful.

```
import time
from machinelogic import Machine

machine = Machine()

my_ac_motor = machine.get_ac_motor("AC Motor")

# Move the AC Motor forwards
my_ac_motor.move_forward()

# Do something here
time.sleep(10)

my_ac_motor.stop()
```

## ACMotorConfiguration

Representation of a ACMotor configuration.

### device

---

- **Description** int: The device of the axis.

### ip\_address

---

- **Description** str: The IP address of the axis.

### name

---

- **Description** str: The name of the Pneumatic.

### output\_pin\_direction

---

- **Description** int: The push out pin of the axis.

### output\_pin\_move

---

- **Description** int: The pull out pin of the axis.

### uuid

---

- **Description** str: The ID of the Pneumatic.

# BagGripper

A software representation of a Bag Gripper. It is not recommended that you construct this object yourself. Rather, you should query it from a Machine instance:

E.g.:

```
machine = Machine()
my_bag_gripper = machine.get_bag_gripper("Bag Gripper")
```

In this example, "Bag Gripper" is the friendly name assigned to a Bag Gripper in the MachineLogic configuration page.

## close\_async

- **Description** Closes the Bag Gripper.
  - **Raises**
    - **Type** BagGripperException
      - **Description** If the Bag Gripper fails to close.

```
import time
from machinelogic import Machine

machine = Machine()
my_bag_gripper = machine.get_bag_gripper("Bag Gripper")

# Open the Bag Gripper
my_bag_gripper.open_async()

# You can do something while the Bag Gripper is open
time.sleep(10)

# Close the Bag Gripper
my_bag_gripper.close_async()
```

## configuration

- **Description** BagGripperConfiguration: The configuration of the actuator.

## open\_async

- **Description** Opens the Bag Gripper.
  - **Raises**
    - **Type** BagGripperException
      - **Description** If the Bag Gripper fails to open.

```
import time
from machinelogic import Machine

machine = Machine()
my_bag_gripper = machine.get_bag_gripper("Bag Gripper")

# Open the Bag Gripper
my_bag_gripper.open_async()

# You can do something while the Bag Gripper is open
time.sleep(10)

# Close the Bag Gripper
my_bag_gripper.close_async()
```

## state

---

- **Description** BagGripperState: The state of the actuator.

# BagGripperConfiguration

Representation of a Bag gripper configuration.

## device

---

- **Description** int: The device of the Bag gripper.

## input\_pin\_close

---

- **Description** int: The close in pin of the Bag gripper.

## input\_pin\_open

---

- **Description** int: The open in pin of the Bag gripper.

## ip\_address

---

- **Description** str: The IP address of the Bag gripper.

## name

---

- **Description** str: The name of the Bag gripper.

## output\_pin\_close

---

- **Description** int: The close out pin of the Bag gripper.

## output\_pin\_open

---

- **Description** int: The open out pin of the Bag gripper.

## uuid

---

- **Description** str: The ID of the Bag gripper.

# PathFollower

Path Follower: A Path Follower Object is a group of Actuators, Digital Inputs and Digital Outputs that enable execution of smooth predefined paths. These paths are defined with G-Code instructions. See Vention's G-code interface documentation for a list of supported commands:  
<https://vention.io/resources/guides/path-following-interface-391#parser-configuration>

## add\_tool

---

- **Description** Add a tool to be referenced by the M(3-5) \$ commands
  - **Parameters**
    - **tool\_id**
      - **Description** Unique integer defining tool id.
      - **Type** int
    - **m3\_output**
      - **Description** Output to map to the M3 Gcode command
      - **Type** IDigitalOutput
    - **m4\_output**
      - **Description** Optional, Output to map to the M4 Gcode command
      - **Type** Union[IDigitalOutput, None]
  - **Raises**
    - **Type** PathFollowerException
      - **Description** If the tool was not properly added.

```

from machinelogic import Machine, PathFollower

machine = Machine()
x_axis = machine.get_actuator("X_Actuator")
y_axis = machine.get_actuator("Y_Actuator")
m3_output = machine.get_output("M3_Output")
m4_output = machine.get_output("M4_Output")

GCODE = """
G90 ; Absolute position mode
G0 X60 Y110 F1200 ; Rapid move at 1200 mm/minute
M3 $1 ; Start tool 1 in clockwise direction
G1 X110 Y110 F1000 ; Travel move at 1000 mm/minute
M4 $1 ; counter clockwise now
G0 X50 Y50
M5 $1 ; Stop tool 1
G0 X1 Y1
"""

# Create PathFollower instance
path_follower = PathFollower(x_axis, y_axis)

# Associate a digital output with a GCode tool number
path_follower.add_tool(1, m3_output, m4_output) # clockwise # counterclockwise

path_follower.start_path(GCODE)

```

## start\_path

---

- **Description** Start the path, returns when path is complete
  - **Parameters**
    - **gcode**
      - **Description** Gcode path
      - **Type** str
  - **Raises**
    - **Type** PathFollowerException
      - **Description** If failed to run start\_path



```

from machinelogic import Machine, PathFollower

machine = Machine()

# must be defined in ControlCenter
x_axis = machine.get_actuator("X_Actuator")
y_axis = machine.get_actuator("Y_Actuator")

GCODE = """
(Operational mode commands)
G90 ; Absolute position mode
G90.1 ; Absolute arc centre
G21 ; Use millimeter units
G17 ; XY plane arcs
G64 P0.5 ; Blend move mode, 0.5 mm tolerance
(Movement and output commands)
G0 X60 Y110 F1200 ; Rapid move at 1200 mm/minute
G1 X110 Y110 F1000 ; Travel move at 1000 mm/minute
G2 X110 Y10 I100 J60 ; Clockwise arc
G1 X60 Y10
G2 X60 Y110 I60 J60
G4 P1.0 ; Dwell for 1 second
G0 X1 Y1
"""

# Create PathFollower instance
path_follower = PathFollower(x_axis, y_axis)

# Run your Gcode
path_follower.start_path(GCODE)

```

## start\_path\_async

- **Description** Start the path, nonblocking, returns immediately
  - **Parameters**
    - **gcode**
      - **Description** Gcode path
      - **Type** str
  - **Raises**
    - **Type** PathFollowerException
      - **Description** If failed to run start\_path\_async

```

from machinelogic import Machine, PathFollower
import time

machine = Machine()

# must be defined in ControlCenter
x_axis = machine.get_actuator("X_Actuator")
y_axis = machine.get_actuator("Y_Actuator")

GCODE = """
(Operational mode commands)
G90 ; Absolute position mode
G90.1 ; Absolute arc centre
G21 ; Use millimeter units
G17 ; XY plane arcs
G64 P0.5 ; Blend move mode, 0.5 mm tolerance
(Movement and output commands)
G0 X60 Y110 F1200 ; Rapid move at 1200 mm/minute
G1 X110 Y110 F1000 ; Travel move at 1000 mm/minute
G2 X110 Y10 I100 J60 ; Clockwise arc
G1 X60 Y10
G2 X60 Y110 I60 J60
G4 P1.0 ; Dwell for 1 second
G0 X1 Y1
"""

path_follower = PathFollower(x_axis, y_axis)

# Run your Gcode
path_follower.start_path_async(GCODE)

PATH_IN_PROGRESS = True
while PATH_IN_PROGRESS:
    time.sleep(0.5)
    path_state = path_follower.state
    PATH_IN_PROGRESS = path_state.running
    print(
        {
            "running": path_state.running,
            "line_number": path_state.line_number,
            "current_command": path_state.current_command,
            "error": path_state.error,
            "speed": path_state.speed,
            "acceleration": path_state.acceleration,
        }
    )

```

## state

---

- **Description** Current state of the path follower

## stop\_path

---

- **Description** Abruptly stop the path following procedure. Affects all actuators in the PathFollower instance
  - **Raises**
    - **Type** PathFollowerException
      - **Description** If failed to stop path

## wait\_for\_path\_completion

- **Description** Wait for the path to complete

```
from machineologic import Machine, PathFollower

machine = Machine()

# must be defined in ControlCenter
x_axis = machine.get_actuator("X_Actuator")
y_axis = machine.get_actuator("Y_Actuator")

GCODE = """
(Operational mode commands)
G90 ; Absolute position mode
G90.1 ; Absolute arc centre
G21 ; Use millimeter units
G17 ; XY plane arcs
G64 P0.5 ; Blend move mode, 0.5 mm tolerance
(Movement and output commands)
G0 X60 Y110 F1200 ; Rapid move at 1200 mm/minute
G1 X110 Y110 F1000 ; Travel move at 1000 mm/minute
G2 X110 Y10 I100 J60 ; Clockwise arc
G1 X60 Y10
G2 X60 Y110 I60 J60
G4 P1.0 ; Dwell for 1 second
G0 X1 Y1
"""

# Create PathFollower instance
path_follower = PathFollower(x_axis, y_axis)

# Run your Gcode asynchronously
path_follower.start_path_async(GCODE)

# Waits for path completion before continuing with program
path_follower.wait_for_path_completion()
print("Path Complete")
```

## PathFollowerState

PathFollower State

### acceleration

- **Description** float: The current tool acceleration in millimeters/second<sup>2</sup>

### current\_command

- **Description** Union[str, None]: In-progress command of gcode script.

## error

---

- **Description** Union[str, None]: A description of errors encountered during path execution.

## line\_number

---

- **Description** int: Current line number in gcode script.

## running

---

- **Description** bool: True if path following in progress.

## speed

---

- **Description** float: The current tool speed in millimeters/second

# Scene

A software representation of the scene containing assets that describe and define reference frames and targets for robots.

Only a single instance of this object should exist in your program.

## get\_calibration\_frame

---

- **Description** Gets a calibration frame from scene assets by name
  - **Parameters**
    - **name**
      - **Description** Friendly name of the calibration frame asset
      - **Type** str
  - **Returns**
    - **Description** The found calibration frame
    - **Type** ICalibrationFrame
  - **Raises**
    - **Type** SceneException
      - **Description** If the scene asset is not found

```
from machinelogic import Machine

machine = Machine()
scene = machine.get_scene()

# Assuming we have a calibration frame defined
# in Scene Assets called "calibration_frame_1"
calibration_frame = scene.get_calibration_frame("calibration_frame_1")

default_value = calibration_frame.get_default_value()

print(default_value)
```

# CalibrationFrame

A calibration frame, as defined in the scene assets pane, is represented in software. It is measured in millimeters and degrees, with angles given as extrinsic Euler angles in XYZ order.

## get\_calibrated\_value

- **Description** Gets the calibration frame's calibrated values.
  - **Returns**
    - **Description** The calibrated value of the calibration frame in mm and degrees, where the angles are extrinsic Euler angles in XYZ order.
    - **Type** CartesianPose
  - **Raises**
    - **Type** SceneException
      - **Description** If failed to get the calibrated value

```
from machinelogic import Machine

machine = Machine()
scene = machine.get_scene()

# Assuming we have a calibration frame defined
# in Scene Assets called "calibration_frame_1"
calibration_frame = scene.get_calibration_frame("calibration_frame_1")

calibrated_value = calibration_frame.get_calibrated_value()

print(calibrated_value)
```

## get\_default\_value

- **Description** Gets the calibration frame's default values.
  - **Returns**
    - **Description** The nominal value of the calibration frame in mm and degrees, where the angles are extrinsic Euler angles in XYZ order.
    - **Type** CartesianPose
  - **Raises**
    - **Type** SceneException
      - **Description** If failed to get the default value

```
from machinelogic import Machine

machine = Machine()
scene = machine.get_scene()

# Assuming we have a calibration frame defined
# in Scene Assets called "calibration_frame_1"
calibration_frame = scene.get_calibration_frame("calibration_frame_1")

default_value = calibration_frame.get_default_value()

print(default_value)
```

## set\_calibrated\_value

- **Description** Sets the calibration frame's calibrated values.
  - **Parameters**
    - **frame**
      - **Description** The calibrated values of the Calibration Frame in mm and degrees, where the angles are extrinsic Euler angles in XYZ order.
      - **Type** CartesianPose
  - **Raises**
    - **Type** SceneException
      - **Description** If failed to set the calibrated value

```
from machinelogic import Machine

machine = Machine()
scene = machine.get_scene()

# Assuming we have a calibration frame defined
# in Scene Assets called "calibration_frame_1"
calibration_frame = scene.get_calibration_frame("calibration_frame_1")

# CartesianPose in mm and degrees, where the angles are
# extrinsic Euler angles in XYZ order.
calibrated_cartesian_pose = [100, 100, 50, 90, 90, 0]

calibration_frame.set_calibrated_value(calibrated_cartesian_pose)
```

# Exceptions

## ActuatorException

An exception thrown by an Actuator

Args:

```
VentionException (VentionException): Super class
```

### args

- **Description**

### with\_traceback

- **Description** Exception.with\_traceback(tb) – set self.traceback to tb and return self.

## MachineException

An exception thrown by the Machine

Args:

Exception (VentionException): Super class

### args

---

- **Description**

### with\_traceback

---

- **Description** Exception.with\_traceback(tb) – set self.traceback to tb and return self.

## RobotException

An exception thrown by a Robot

Args:

VentionException (VentionException): Super class

### args

---

- **Description**

### with\_traceback

---

- **Description** Exception.with\_traceback(tb) – set self.traceback to tb and return self.

## MachineMotionException

An exception thrown by a MachineMotion

Args:

VentionException (VentionException): Super class

### args

---

- **Description**

### with\_traceback

---

- **Description** Exception.with\_traceback(tb) – set self.traceback to tb and return self.

# DigitalInputException

An exception thrown by an INput

Args:

VentionException (VentionException): Super class

## args

- **Description**

## with\_traceback

- **Description** Exception.with\_traceback(tb) – set self.traceback to tb and return self.

# DigitalOutputException

An exception thrown by an Output

Args:

VentionException (VentionException): Super class

## args

- **Description**

## with\_traceback

- **Description** Exception.with\_traceback(tb) – set self.traceback to tb and return self.

# ActuatorGroupException

An exception thrown by an ActuatorGroup

Args:

VentionException (VentionException): Super class

## args

- **Description**



## with\_traceback

---

- **Description** Exception.with\_traceback(tb) – set self.traceback to tb and return self.

# EstopException

An exception thrown by the Machine

Args:

Exception (VentionException): Super class

## args

---

- **Description**

## with\_traceback

---

- **Description** Exception.with\_traceback(tb) – set self.traceback to tb and return self.

# PathFollowingException

An exception thrown by a path following operation

Args:

VentionException(\_\_type\_\_): Super class

## args

---

- **Description**

## with\_traceback

---

- **Description** Exception.with\_traceback(tb) – set self.traceback to tb and return self.

# Python limitations in MachineLogic

When executing your Python code in simulation, the script will run in a restricted environment to avoid abuses. Only a few Modules are allowed and some Built-in Functions are not available.

## Python Built-in Functions restrictions

---

The following Built-in Functions are currently restricted in simulation.

- compile
- dir
- eval
- exec
- globals
- input
- locals
- memoryview
- object
- open
- vars

## Modules restrictions

---

The following Modules are allowed in simulation.

- machinelogic
- time
- math
- copy
- json
- abc
- random
- numpy