

# **pyModbusTCP documentation**

**version 0.0.13**

**Loic Lefebvre**

**December 24, 2015**



# Contents

|   |           |
|---|-----------|
| <b>Welcome to pyModbusTCP's documentation</b>     | <b>1</b>  |
| Quick start guide                                 | 1         |
| Overview of the package                           | 1         |
| Package setup                                     | 1         |
| ModbusClient: init                                | 1         |
| ModbusClient: manage TCP link                     | 1         |
| ModbusClient: available modbus requests functions | 2         |
| ModbusClient: debug mode                          | 2         |
| utils module: Modbus data mangling                | 3         |
| pyModbusTCP modules documentation                 | 4         |
| Module pyModbusTCP.client                         | 4         |
| class pyModbusTCP.client.ModbusClient             | 4         |
| Module pyModbusTCP.utils                          | 7         |
| pyModbusTCP examples                              | 8         |
| Simple read registers example                     | 8         |
| Simple read bits example                          | 9         |
| Simple write bits example                         | 9         |
| An example with a modbus polling thread           | 10        |
| <b>Indices and tables</b>                         | <b>11</b> |
| <b>Index</b>                                      | <b>13</b> |
| <b>Python Module Index</b>                        | <b>15</b> |



# Welcome to pyModbusTCP's documentation

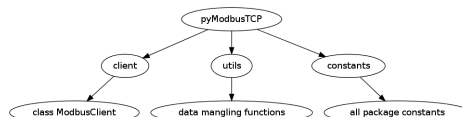
## Quick start guide

### Overview of the package

pyModbusTCP give access to modbus/TCP server through the ModbusClient object. This class is define in the client module.

To deal with frequent need of modbus data mangling (for example 32 bits IEEE float to 2x16 bits words conversion) a special module named utils provide some helpful functions.

**Package map:**



### Package setup

from PyPi:

```
# for Python 2.7
sudo pip-2.7 install pyModbusTCP
# or for Python 3.2
sudo pip-3.2 install pyModbusTCP
# or upgrade from an older release
sudo pip-3.2 install pyModbusTCP --upgrade
```

from Github:

```
git clone https://github.com/sourceperl/pyModbusTCP.git
cd pyModbusTCP
# here change "python" by your python target(s) version(s) (like python3.2)
sudo python setup.py install
```

### ModbusClient: init

init module from constructor (raise ValueError if host/port error):

```
from pyModbusTCP.client import ModbusClient
try:
    c = ModbusClient(host="localhost", port=502)
except ValueError:
    print("Error with host or port params")
```

you can also init module from functions host/port return None if error:

```
from pyModbusTCP.client import ModbusClient
c = ModbusClient()
if not c.host("localhost"):
    print("host error")
if not c.port(502):
    print("port error")
```

### ModbusClient: manage TCP link

Now, it's possible to use auto mode to let module deal with TCP open/close.

For keep TCP open, add auto\_open=True in init:

```
c = ModbusClient(host="localhost", auto_open=True)
```

For open/close socket before/after read or write, do this:

```
c = ModbusClient(host="localhost", auto_open=True, auto_close=True)
```

You can also open manually the TCP link. After this, you call a modbus request function (see list in next section):

```
if c.open():
    regs_list_1 = c.read_holding_registers(0, 10)
    regs_list_2 = c.read_holding_registers(55, 10)
    c.close()
```

With a forever polling loop, TCP always open (auto-reconnect code):

```
while True:
    if c.is_open():
        regs_list_1 = c.read_holding_registers(0, 10)
        regs_list_2 = c.read_holding_registers(55, 10)
    else:
        c.open()
    time.sleep(1)
```

## ***ModbusClient: available modbus requests functions***

See <http://en.wikipedia.org/wiki/Modbus> for full table.

| Domain     | Function name                 | Function code | ModbusClient function                   |
|------------|-------------------------------|---------------|---|
| Bit        | Read Discrete Inputs          | 2             | <code>read_discrete_inputs()</code>     |
|            | Read Coils                    | 1             | <code>read_coils()</code>               |
|            | Write Single Coil             | 5             | <code>write_single_coil()</code>        |
|            | Write Multiple Coils          | 15            | n/a                                     |
| Register   | Read Input Registers          | 4             | <code>read_input_registers()</code>     |
|            | Read Holding Registers        | 3             | <code>read_holding_registers()</code>   |
|            | Write Single Register         | 6             | <code>write_single_register()</code>    |
|            | Write Multiple Registers      | 16            | <code>write_multiple_registers()</code> |
|            | Read/Write Multiple Registers | 23            | n/a                                     |
|            | Mask Write Register           | 22            | n/a                                     |
| File       | Read FIFO Queue               | 24            | n/a                                     |
|            | Read File Record              | 20            | n/a                                     |
|            | Write File Record             | 21            | n/a                                     |
|            | Read Exception Status         | 7             | n/a                                     |
| Diagnostic | Diagnostic                    | 8             | n/a                                     |
|            | Get Com Event Counter         | 11            | n/a                                     |
|            | Get Com Event Log             | 12            | n/a                                     |
|            | Report Slave ID               | 17            | n/a                                     |
|            | Read Device Identification    | 43            | n/a                                     |

## ***ModbusClient: debug mode***

If need, you can enable a debug mode for ModbusClient like this:

```
from pyModbusTCP.client import ModbusClient
c = ModbusClient(host="localhost", port=502, debug=True)
```

or:

```
c.debug(True)
```

when debug is enable all debug message is print on console and you can see modbus frame:

```
c.read_holding_registers(0, 4)
```

print:

```
Tx
[E7 53 00 00 00 06 01] 03 00 00 00 04
Rx
[E7 53 00 00 00 0B 01] 03 08 00 00 00 6F 00 00 00 00
[0, 111, 0, 0]
```

## utils module: Modbus data mangling

Sample data mangling, usefull for interface PLC device.

- 16 bits to 32 bits integers:

```
from pyModbusTCP import utils
list_16_bits = [0x0123, 0x4567, 0x89ab, 0xcdef]

# big endian sample (default)
list_32_bits = utils.word_list_to_long(list_16_bits)
# display "['0x1234567', '0x89abcdef']"
print([hex(i) for i in list_32_bits])

# little endian sample
list_32_bits = utils.word_list_to_long(list_16_bits, big_endian=False)
# display "['0x45670123', '0xcdef89ab']"
print([hex(i) for i in list_32_bits])
```

- two's complement (see [http://en.wikipedia.org/wiki/Two%27s\\_complement](http://en.wikipedia.org/wiki/Two%27s_complement)):

```
from pyModbusTCP import utils
list_16_bits = [0x0000, 0xFFFF, 0x00FF, 0x8001]

# display "[0, -1, 255, -32767]"
print(utils.get_list_2comp(list_16_bits, 16))

# display "-1"
print(utils.get_2comp(list_16_bits[1], 16))
```

- an integer of val\_size bits (default is 16) to an array of boolean:

```
from pyModbusTCP import utils
# display "[True, False, True, False, False, False, False]"
print(utils.get_bits_from_int(0x05, val_size=8))
```

- gateway between IEEE single precision float and python float:

```
from pyModbusTCP import utils

# convert python float 0.3 to 0x3e99999a (32 bits IEEE representation)
# display "0x3e99999a"
print(hex(utils.encode_ieee(0.3)))

# convert python float 0.3 to 0x3e99999a (32 bits IEEE representation)
# display "0.300000011921" (it's not 0.3, precision leak with float...)
print(utils.decode_ieee(0x3e99999a))
```

## pyModbusTCP modules documentation

Contents:

### Module *pyModbusTCP.client*

This module provide the *ModbusClient* class used to deal with modbus server.

#### *class pyModbusTCP.client.ModbusClient*

*class* pyModbusTCP.client.**ModbusClient** (*host=None, port=None, unit\_id=None, timeout=None, debug=None, auto\_open=None, auto\_close=None*)

Client Modbus TCP

**\_\_init\_\_** (*host=None, port=None, unit\_id=None, timeout=None, debug=None, auto\_open=None, auto\_close=None*)

Constructor

Modbus server params (host, port) can be set here or with *host()*, *port()* functions. Same for debug option. Use functions avoid to launch *ValueError* except if params is incorrect.

**Parameters:**

- **host** (*str*) -- hostname or IPv4/IPv6 address server address (optional)
- **port** (*int*) -- TCP port number (optional)
- **unit\_id** (*int*) -- unit ID (optional)
- **timeout** (*float*) -- socket timeout in seconds (optional)
- **debug** (*bool*) -- debug state (optional)
- **auto\_open** (*bool*) -- auto TCP connect (optional)
- **auto\_close** (*bool*) -- auto TCP close (optional)

**Returns:** Object *ModbusClient*

**Return type:** *ModbusClient*

**Raises** if a set parameter value is incorrect

**ValueError:**

**auto\_close** (*state=None*)

Get or set automatic TCP close mode (after each request)

**Parameters:** **state** (*bool or None*) -- auto\_close state or None for get value

**Returns:** auto\_close state or None if set fail

**Return type:** bool or None

**auto\_open** (*state=None*)

Get or set automatic TCP connect mode

**Parameters:** **state** (*bool or None*) -- auto\_open state or None for get value

**Returns:** auto\_open state or None if set fail

**Return type:** bool or None

**close** ()

Close TCP connection

**Returns:** close status (True for close/None if already close)

**Return type:** bool or None

**debug** (*state=None*)

Get or set debug mode



**Parameters:** **state** (*bool or None*) -- debug state or None for get value

**Returns:** debug state or None if set fail

**Return type:** bool or None

**host** (*hostname=None*)

Get or set host (IPv4/IPv6 or hostname like 'plc.domain.net')

**Parameters:** **hostname** (*str or None*) -- hostname or IPv4/IPv6 address or None for get value

**Returns:** hostname or None if set fail

**Return type:** str or None

**is\_open** ()

Get status of TCP connection

**Returns:** status (True for open)

**Return type:** bool

**last\_error** ()

Get last error code

**Returns:** last error code

**Return type:** int

**last\_except** ()

Get last except code

**Returns:** last except code

**Return type:** int

**mode** (*mode=None*)

Get or set modbus mode (TCP or RTU)

**Parameters:** **mode** (*int*) -- mode (MODBUS\_TCP/MODBUS\_RTU) to set or None for get value

**Returns:** mode or None if set fail

**Return type:** int or None

**open** ()

Connect to modbus server (open TCP connection)

**Returns:** connect status (True if open)

**Return type:** bool

**port** (*port=None*)

Get or set TCP port

**Parameters:** **port** (*int or None*) -- TCP port number or None for get value

**Returns:** TCP port or None if set fail

**Return type:** int or None

**read\_coils** (*bit\_addr, bit\_nb=1*)

Modbus function READ\_COILS (0x01)

**Parameters:**

- **bit\_addr** (*int*) -- bit address (0 to 65535)

- **bit\_nb** (*int*) -- number of bits to read (1 to 2000)

**Returns:** bits list or None if error

**Return type:** list of bool or None

**read\_discrete\_inputs** (*bit\_addr, bit\_nb=1*)

Modbus function READ\_DISCRETE\_INPUTS (0x02)

**Parameters:**

- **bit\_addr** (*int*) -- bit address (0 to 65535)
- **bit\_nb** (*int*) -- number of bits to read (1 to 2000)

**Returns:** bits list or None if error

**Return type:** list of bool or None

**read\_holding\_registers** (*reg\_addr, reg\_nb=1*)

Modbus function READ\_HOLDING\_REGISTERS (0x03)

**Parameters:**

- **reg\_addr** (*int*) -- register address (0 to 65535)
- **reg\_nb** (*int*) -- number of registers to read (1 to 125)

**Returns:** registers list or None if fail

**Return type:** list of int or None

**read\_input\_registers** (*reg\_addr, reg\_nb=1*)

Modbus function READ\_INPUT\_REGISTERS (0x04)

**Parameters:**

- **reg\_addr** (*int*) -- register address (0 to 65535)
- **reg\_nb** (*int*) -- number of registers to read (1 to 125)

**Returns:** registers list or None if fail

**Return type:** list of int or None

**timeout** (*timeout=None*)

Get or set timeout field

**Parameters:** **timeout** (*float or None*) -- socket timeout in seconds or None for get value

**Returns:** timeout or None if set fail

**Return type:** float or None

**unit\_id** (*unit\_id=None*)

Get or set unit ID field

**Parameters:** **unit\_id** (*int or None*) -- unit ID (0 to 255) or None for get value

**Returns:** unit ID or None if set fail

**Return type:** int or None

**version** ()

Get package version

**Returns:** current version of the package (like "0.0.1")

**Return type:** str

**write\_multiple\_registers** (*reg\_addr, regs\_value*)

Modbus function WRITE\_MULTIPLE\_REGISTERS (0x10)

**Parameters:**

- **reg\_addr** (*int*) -- registers address (0 to 65535)
- **reg\_value** (*list*) -- registers value to write

**Returns:** True if write ok or None if fail

**Return type:** bool or None

**write\_single\_coil** (*bit\_addr, bit\_value*)

Modbus function WRITE\_SINGLE\_COIL (0x05)

**Parameters:**

- **bit\_addr** (*int*) -- bit address (0 to 65535)
- **bit\_value** (*bool*) -- bit value to write

**Returns:** True if write ok or None if fail

**Return type:** bool or None

**write\_single\_register** (*reg\_addr*, *reg\_value*)  
Modbus function WRITE\_SINGLE\_REGISTER (0x06)

**Parameters:**

- **reg\_addr** (*int*) -- register address (0 to 65535)
- **reg\_value** (*int*) -- register value to write

**Returns:** True if write ok or None if fail

**Return type:** bool or None

## Module *pyModbusTCP.utils*

*This module provide a set of functions for modbus data mangling.*

`pyModbusTCP.utils.decode_ieee` (*val\_int*)

Decode Python int (32 bits integer) as an IEEE single precision format  
Support NaN.

**Parameters:** **val\_int** (*int*) -- a 32 bit integer as an int Python value

**Returns:** float result

**Return type:** float

`pyModbusTCP.utils.encode_ieee` (*val\_float*)

Encode Python float to int (32 bits integer) as an IEEE single precision  
Support NaN.

**Parameters:** **val\_float** (*float*) -- float value to convert

**Returns:** IEEE 32 bits (single precision) as Python int

**Return type:** int

`pyModbusTCP.utils.get_2comp` (*val\_int*, *val\_size=16*)

Get the 2's complement of Python int *val\_int*

**Parameters:**

- **val\_int** (*int*) -- int value to apply 2's complement
- **val\_size** (*int*) -- bit size of int value (word = 16, long = 32) (optional)

**Returns:** 2's complement result

**Return type:** int

`pyModbusTCP.utils.get_bits_from_int` (*val\_int*, *val\_size=16*)

Get the list of bits of *val\_int* integer (default size is 16 bits)  
Return bits list, least significant bit first. Use `list.reverse()` if need.

**Parameters:**

- **val\_int** (*int*) -- integer value
- **val\_size** (*int*) -- bit size of integer (word = 16, long = 32) (optional)

**Returns:** list of boolean "bits" (least significant first)

**Return type:** list

`pyModbusTCP.utils.get_list_2comp` (*val\_list*, *val\_size=16*)

Get the 2's complement of Python list *val\_list*

**Parameters:**

- **val\_list** (*list*) -- list of int value to apply 2's complement
- **val\_size** (*int*) -- bit size of int value (word = 16, long = 32) (optional)

**Returns:** 2's complement result

**Return type:** list

pyModbusTCP.utils.**word\_list\_to\_long** (val\_list, big\_endian=True)

Word list (16 bits int) to long list (32 bits int)

By default word\_list2long() use big endian order. For use little endian, set big\_endian param to False.

**Parameters:**

- **val\_list** (list) -- list of 16 bits int value
- **big\_endian** (bool) -- True for big endian/False for little (optional)

**Returns:** 2's complement result

**Return type:** list

## pyModbusTCP examples

Here some examples to see pyModbusTCP in some usages cases

### Simple read registers example

```
#!/usr/bin/env python
# -*- coding: utf-8 -*-

# read_register
# read 10 registers and print result on stdout

# you can use the tiny modbus server "mbserverd" to test this code
# mbserverd is here: https://github.com/sourceperl/mbserverd

# the command line modbus client mbtget can also be useful
# mbtget is here: https://github.com/sourceperl/mbtget

from pyModbusTCP.client import ModbusClient
import time

SERVER_HOST = "localhost"
SERVER_PORT = 502

c = ModbusClient()

# uncomment this line to see debug message
#c.debug(True)

# define modbus server host, port
c.host(SERVER_HOST)
c.port(SERVER_PORT)

while True:
    # open or reconnect TCP to server
    if not c.is_open():
        if not c.open():
            print("unable to connect to "+SERVER_HOST+": "+str(SERVER_PORT))

    # if open() is ok, read register (modbus function 0x03)
    if c.is_open():
        # read 10 registers at address 0, store result in regs list
        regs = c.read_holding_registers(0, 10)
        # if success display registers
        if regs:
            print("reg ad #0 to 9: "+str(regs))
```

```
# sleep 2s before next polling
time.sleep(2)
```

## Simple read bits example

```
#!/usr/bin/env python
# -*- coding: utf-8 -*-

# read_bit
# read 10 bits and print result on stdout

from pyModbusTCP.client import ModbusClient
import time

SERVER_HOST = "localhost"
SERVER_PORT = 502

c = ModbusClient()

# uncomment this line to see debug message
#c.debug(True)

# define modbus server host, port
c.host(SERVER_HOST)
c.port(SERVER_PORT)

while True:
    # open or reconnect TCP to server
    if not c.is_open():
        if not c.open():
            print("unable to connect to "+SERVER_HOST+": "+str(SERVER_PORT))

    # if open() is ok, read coils (modbus function 0x01)
    if c.is_open():
        # read 10 bits at address 0, store result in regs list
        bits = c.read_coils(0, 10)
        # if success display registers
        if bits:
            print("bit ad #0 to 9: "+str(bits))

    # sleep 2s before next polling
    time.sleep(2)
```

## Simple write bits example

```
#!/usr/bin/env python
# -*- coding: utf-8 -*-

# write_bit
# write 4 bits to True, wait 2s, write False, restart...

from pyModbusTCP.client import ModbusClient
import time

SERVER_HOST = "localhost"
SERVER_PORT = 502

c = ModbusClient()
```

```

# uncomment this line to see debug message
#c.debug(True)

# define modbus server host, port
c.host(SERVER_HOST)
c.port(SERVER_PORT)

toggle = True

while True:
    # open or reconnect TCP to server
    if not c.is_open():
        if not c.open():
            print("unable to connect to "+SERVER_HOST+": "+str(SERVER_PORT))

    # if open() is ok, write coils (modbus function 0x01)
    if c.is_open():
        # write 4 bits in modbus address 0 to 3
        print("")
        print("write bits")
        print("-----")
        print("")
        for addr in range(4):
            is_ok = c.write_single_coil(addr, toggle)
            if is_ok:
                print("bit #" + str(addr) + ": write to " + str(toggle))
            else:
                print("bit #" + str(addr) + ": unable to write " + str(toggle))
            time.sleep(0.5)

        time.sleep(1)

        print("")
        print("read bits")
        print("-----")
        print("")
        bits = c.read_coils(0, 4)
        if bits:
            print("bits #0 to 3: "+str(bits))
        else:
            print("unable to read")

        toggle = not toggle
        # sleep 2s before next polling
        time.sleep(2)

```

## An example with a modbus polling thread

```

#!/usr/bin/env python
# -*- coding: utf-8 -*-

# modbus_thread
# start a thread for polling a set of registers, display result on console
# exit with ctrl+c

import time
from threading import Thread, Lock
from pyModbusTCP.client import ModbusClient

```

```

SERVER_HOST = "localhost"
SERVER_PORT = 502

# set global
regs = []

# init a thread lock
regs_lock = Lock()

# modbus polling thread
def polling_thread():
    global regs
    c = ModbusClient(host=SERVER_HOST, port=SERVER_PORT)
    # polling loop
    while True:
        # keep TCP open
        if not c.is_open():
            c.open()
        # do modbus reading on socket
        reg_list = c.read_holding_registers(0,10)
        # if read is ok, store result in regs (with thread lock synchronization)
        if reg_list:
            with regs_lock:
                regs = reg_list
        # 1s before next polling
        time.sleep(1)

# start polling thread
tp = Thread(target=polling_thread)
# set daemon: polling thread will exit if main thread exit
tp.daemon = True
tp.start()

# display loop (in main thread)
while True:
    # print regs list (with thread lock synchronization)
    with regs_lock:
        print(regs)
    # 1s before next print
    time.sleep(1)

```

## Indices and tables

- *genindex*
- *modindex*
- *search*





# Index

`__init__()` (pyModbusTCP.client.ModbusClient method)

## A

`auto_close()` (pyModbusTCP.client.ModbusClient method)  
`auto_open()` (pyModbusTCP.client.ModbusClient method)

## C

`close()` (pyModbusTCP.client.ModbusClient method)

## D

`debug()` (pyModbusTCP.client.ModbusClient method)  
`decode_ieee()` (in module pyModbusTCP.utils)

## E

`encode_ieee()` (in module pyModbusTCP.utils)

## G

`get_2comp()` (in module pyModbusTCP.utils)  
`get_bits_from_int()` (in module pyModbusTCP.utils)  
`get_list_2comp()` (in module pyModbusTCP.utils)

## H

`host()` (pyModbusTCP.client.ModbusClient method)

## I

`is_open()` (pyModbusTCP.client.ModbusClient method)

## L

`last_error()` (pyModbusTCP.client.ModbusClient method)  
`last_except()` (pyModbusTCP.client.ModbusClient method)

## M

`ModbusClient` (class in pyModbusTCP.client)  
`mode()` (pyModbusTCP.client.ModbusClient method)

## O

`open()` (pyModbusTCP.client.ModbusClient method)

## P

`port()` (pyModbusTCP.client.ModbusClient method)

`pyModbusTCP.client` (module)

`pyModbusTCP.utils` (module)

## R

`read_coils()` (pyModbusTCP.client.ModbusClient method)  
`read_discrete_inputs()` (pyModbusTCP.client.ModbusClient method)  
`read_holding_registers()` (pyModbusTCP.client.ModbusClient method)  
`read_input_registers()` (pyModbusTCP.client.ModbusClient method)

## T

`timeout()` (pyModbusTCP.client.ModbusClient method)

## U

`unit_id()` (pyModbusTCP.client.ModbusClient method)

## V

`version()` (pyModbusTCP.client.ModbusClient method)

## W

`word_list_to_long()` (in module pyModbusTCP.utils)  
`write_multiple_registers()` (pyModbusTCP.client.ModbusClient method)  
`write_single_coil()` (pyModbusTCP.client.ModbusClient method)  
`write_single_register()` (pyModbusTCP.client.ModbusClient method)



# Python Module Index

## *p*

[pyModbusTCP](#)

[pyModbusTCP.client](#)

[pyModbusTCP.utils](#)