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This module encapsulates the access for the serial port. It provides backends for Python running on Windows, OSX, Linux, BSD (possibly any POSIX compliant system) and IronPython. The module named “serial” automatically selects the appropriate backend.

Other pages (online)

• project page on GitHub
• Download Page with releases
• This page, when viewed online is at https://pyserial.readthedocs.io/en/latest/ or http://pythonhosted.org/pyserial/

Contents:
Overview

This module encapsulates the access for the serial port. It provides backends for Python running on Windows, OSX, Linux, BSD (possibly any POSIX compliant system) and IronPython. The module named “serial” automatically selects the appropriate backend.

It is released under a free software license, see LICENSE for more details.

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Other pages (online)

- project page on GitHub
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Features

- Same class based interface on all supported platforms.
- Access to the port settings through Python properties.
- Support for different byte sizes, stop bits, parity and flow control with RTS/CTS and/or Xon/Xoff.
- Working with or without receive timeout.
- File like API with “read” and “write” (“readline” etc. also supported).
- The files in this package are 100% pure Python.
- The port is set up for binary transmission. No NULL byte stripping, CR-LF translation etc. (which are many times enabled for POSIX.) This makes this module universally useful.
• Compatible with io library
• RFC 2217 client (experimental), server provided in the examples.

Requirements

• Python 2.7 or Python 3.4 and newer
• If running on Windows: Windows 7 or newer
• If running on Jython: “Java Communications” (JavaComm) or compatible extension for Java

For older installations (older Python versions or older operating systems), see older versions below.

Installation

This installs a package that can be used from Python (import serial).

To install for all users on the system, administrator rights (root) may be required.

From PyPI

pySerial can be installed from PyPI:

```
python -m pip install pyserial
```

Using the python/python3 executable of the desired version (2.7/3.x).

Developers also may be interested to get the source archive, because it contains examples, tests and the this documentation.

From source (zip/tar.gz or checkout)

Download the archive from http://pypi.python.org/pypi/pyserial or https://github.com/pyserial/pyserial/releases. Unpack the archive, enter the pyserial-x.y directory and run:

```
python setup.py install
```

Using the python/python3 executable of the desired version (2.7/3.x).

Packages

There are also packaged versions for some Linux distributions:

• Debian/Ubuntu: “python-serial”, “python3-serial”
• Fedora / RHEL / CentOS / EPEL: “pyserial”
• Arch Linux: “python-pyserial”
• Gentoo: “dev-python/pyserial”

Note that some distributions may package an older version of pySerial. These packages are created and maintained by developers working on these distributions.
References

- Python: http://www.python.org/
- Jython: http://www.jython.org/

Older Versions

Older versions are still available on the current download page or the old download page. The last version of pySerial’s 2.x series was 2.7, compatible with Python 2.3 and newer and partially with early Python 3.x versions.

pySerial 1.21 is compatible with Python 2.0 on Windows, Linux and several un*x like systems, MacOSX and Jython.

On Windows, releases older than 2.5 will depend on pywin32 (previously known as win32all). WinXP is supported up to 3.0.1.
Opening serial ports

Open port at “9600,8,N,1”, no timeout:

```python
>>> import serial

>>> ser = serial.Serial('/dev/ttyUSB0')  # open serial port
>>> print(ser.name)  # check which port was really used
>>> ser.write(b'hello')  # write a string
>>> ser.close()  # close port
```

Open named port at “19200,8,N,1”, 1s timeout:

```python
>>> with serial.Serial('/dev/ttyS1', 19200, timeout=1) as ser:
...     x = ser.read()  # read one byte
...     s = ser.read(10)  # read up to ten bytes (timeout)
...     line = ser.readline()  # read a '\n' terminated line
```

Open port at “38400,8,E,1”, non blocking HW handshaking:

```python
>>> ser = serial.Serial('COM3', 38400, timeout=0,
...     parity=serial.PARITY_EVEN, rtscts=1)
>>> s = ser.read(100)  # read up to one hundred bytes
...     # or as much is in the buffer
```

Configuring ports later

Get a Serial instance and configure/open it later:

```python
>>> ser = serial.Serial()
>>> ser.baudrate = 19200
>>> ser.port = 'COM1'
```
>>> ser
Serial1(id=0xa81c10, open=False>(port='COM1', baudrate=19200, bytesize=8, parity='N', ...
---stopbits=1, timeout=None, xonxoff=0, rtscts=0)
>>> ser.open()
>>> ser.is_open
True
>>> ser.close()
>>> ser.is_open
False

Also supported with *context manager*:

```
with serial.Serial() as ser:
    ser.baudrate = 19200
    ser.port = 'COM1'
    ser.open()
    ser.write(b'hello')
```

**Readline**

Be careful when using `readline()`! Do specify a timeout when opening the serial port otherwise it could block forever if no newline character is received. Also note that `readlines()` only works with a timeout. `readlines()` depends on having a timeout and interprets that as EOF (end of file). It raises an exception if the port is not opened correctly.

Do also have a look at the example files in the examples directory in the source distribution or online.

**Note:** The `eol` parameter for `readline()` is no longer supported when pySerial is run with newer Python versions (V2.6+) where the module `io` is available.

**EOL**

To specify the EOL character for `readline()` or to use universal newline mode, it is advised to use `io.TextIOWrapper`:

```
import serial
import io
ser = serial.serial_for_url('loop://', timeout=1)
sio = io.TextIOWrapper(io.BufferedRWPair(ser, ser))

sio.write(unicode("hello\n"))
sio.flush() # it is buffering. required to get the data out *now*
hello = sio.readline()
print(hello == unicode("hello\n"))
```
Testing ports

Listing ports

`python -m serial.tools.list_ports` will print a list of available ports. It is also possible to add a regexp as first argument and the list will only include entries that matched.

**Note:** The enumeration may not work on all operating systems. It may be incomplete, list unavailable ports or may lack detailed descriptions of the ports.

Accessing ports

pySerial includes a small console based terminal program called `serial.tools.miniterm`. It can be started with `python -m serial.tools.miniterm <port_name>` (use option `-h` to get a listing of all options).
Classes

Native ports

class serial.Serial

__init__(port=None, baudrate=9600, bytesize=EIGHTBITS, parity=PARITY_NONE, stopbits=STOPBITS_ONE, timeout=None, xonxoff=False, rtscts=False, write_timeout=None, dsrdtr=False, inter_byte_timeout=None, exclusive=None)

Parameters

• **port** – Device name or None.
• **baudrate** *(int)* – Baud rate such as 9600 or 115200 etc.
• **bytesize** – Number of data bits. Possible values: FIVEBITS, SIXBITS, SEVENBITS, EIGHTBITS
• **parity** – Enable parity checking. Possible values: PARITY_NONE, PARITY_EVEN, PARITY_ODD, PARITY_MARK, PARITY_SPACE
• **stopbits** – Number of stop bits. Possible values: STOPBITS_ONE, STOPBITS_ONE_POINT_FIVE, STOPBITS_TWO
• **timeout** *(float)* – Set a read timeout value.
• **xonxoff** *(bool)* – Enable software flow control.
• **rtscts** *(bool)* – Enable hardware (RTS/CTS) flow control.
• **dsrdtr** *(bool)* – Enable hardware (DSR/DTR) flow control.
• **write_timeout** *(float)* – Set a write timeout value.
• **inter_byte_timeout** *(float)* – Inter-character timeout, None to disable (default).
**exclusive** (*bool*) – Set exclusive access mode (POSIX only). A port cannot be opened in exclusive access mode if it is already open in exclusive access mode.

**Raises**

- **ValueError** – Will be raised when parameter are out of range, e.g. baud rate, data bits.
- **SerialException** – In case the device can not be found or can not be configured.

The port is immediately opened on object creation, when a `port` is given. It is not opened when `port` is `None` and a successive call to `open()` is required.

`port` is a device name: depending on operating system. E.g. `/dev/ttyUSB0` on GNU/Linux or `COM3` on Windows.

The parameter `baudrate` can be one of the standard values: 50, 75, 110, 134, 150, 200, 300, 600, 1200, 1800, 2400, 4800, 9600, 19200, 38400, 57600, 115200. These are well supported on all platforms.

Standard values above 115200, such as: 230400, 460800, 500000, 576000, 921600, 1000000, 1152000, 1500000, 2000000, 2500000, 3000000, 3500000, 4000000 also work on many platforms and devices.

Non-standard values are also supported on some platforms (GNU/Linux, MAC OSX >= Tiger, Windows). Though, even on these platforms some serial ports may reject non-standard values.

Possible values for the parameter `timeout` which controls the behavior of `read()`:

- `timeout = None`: wait forever / until requested number of bytes are received
- `timeout = 0`: non-blocking mode, return immediately in any case, returning zero or more, up to the requested number of bytes
- `timeout = x`: set timeout to `x` seconds (float allowed) returns immediately when the requested number of bytes are available, otherwise wait until the timeout expires and return all bytes that were received until then.

`write()` is blocking by default, unless `write_timeout` is set. For possible values refer to the list for `timeout` above.

Note that enabling both flow control methods (xonxoff and rtscts) together may not be supported. It is common to use one of the methods at once, not both.

`dsrdtr` is not supported by all platforms (silently ignored). Setting it to `None` has the effect that its state follows `rtscts`.

Also consider using the function `serial_for_url()` instead of creating Serial instances directly.

**Changed in version 3.0:** `dsrdtr` now defaults to `False` (instead of `None`)

**Changed in version 3.3:** exclusive flag

**open()**

Open port. The state of `rts` and `dtr` is applied.

**Note:** Some OS and/or drivers may activate RTS and or DTR automatically, as soon as the port is opened. There may be a glitch on RTS/DTR when `rts` or `dtr` are set differently from their default value (True / active).

**Note:** For compatibility reasons, no error is reported when applying `rts` or `dtr` fails on POSIX due to EINVAL (22) or ENOTTY (25).
close()
Close port immediately.

__del__()
Destructor, close port when serial port instance is freed.

The following methods may raise `SerialException` when applied to a closed port.

`read(size=1)`

**Parameters**
size – Number of bytes to read.

**Returns**
Bytes read from the port.

**Return type**
bytes

Read `size` bytes from the serial port. If a timeout is set it may return less characters as requested. With no timeout it will block until the requested number of bytes is read.

Changed in version 2.5: Returns an instance of `bytes` when available (Python 2.6 and newer) and `str` otherwise.

write(data)

**Parameters**
data – Data to send.

**Returns**
Number of bytes written.

**Return type**
int

**Raises**
`SerialTimeoutException` – In case a write timeout is configured for the port and the time is exceeded.

Write the bytes `data` to the port. This should be of type `bytes` (or compatible such as `bytearray` or `memoryview`). Unicode strings must be encoded (e.g. `'hello'.encode('utf-8')`).

Changed in version 2.5: Accepts instances of `bytes` and `bytearray` when available (Python 2.6 and newer) and `str` otherwise.

Changed in version 2.5: Write returned `None` in previous versions.

flush()
Flush of file like objects. In this case, wait until all data is written.

in_waiting

**Getter**
Get the number of bytes in the input buffer

**Type**
int

Return the number of bytes in the receive buffer.

Changed in version 3.0: changed to property from `inWaiting()`

out_waiting

**Getter**
Get the number of bytes in the output buffer

**Type**
int

**Platform**
Posix

**Platform**
Windows

Return the number of bytes in the output buffer.

Changed in version 2.7: (Posix support added)

Changed in version 3.0: changed to property from `outWaiting()`
reset_input_buffer()
Flush input buffer, discarding all its contents.
Changed in version 3.0: renamed from flushInput()

reset_output_buffer()
Clear output buffer, aborting the current output and discarding all that is in the buffer.
Note, for some USB serial adapters, this may only flush the buffer of the OS and not all the data that may be present in the USB part.
Changed in version 3.0: renamed from flushOutput()

send_break (duration=0.25)
Parameters duration (float) – Time to activate the BREAK condition.
Send break condition. Timed, returns to idle state after given duration.

break_condition
Getter Get the current BREAK state
Setter Control the BREAK state
Type bool
When set to True activate BREAK condition, else disable. Controls TXD. When active, no transmitting is possible.

rts
Setter Set the state of the RTS line
Getter Return the state of the RTS line
Type bool
Set RTS line to specified logic level. It is possible to assign this value before opening the serial port, then the value is applied uppon open () (with restrictions, see open ()).

dtr
Setter Set the state of the DTR line
Getter Return the state of the DTR line
Type bool
Set DTR line to specified logic level. It is possible to assign this value before opening the serial port, then the value is applied uppon open () (with restrictions, see open ()).

Read-only attributes:

name
Getter Device name.
Type str
New in version 2.5.

cts
Getter Get the state of the CTS line
Type bool
Return the state of the CTS line.
dsr
  Getter Get the state of the DSR line
  Type bool
  Return the state of the DSR line.

ri
  Getter Get the state of the RI line
  Type bool
  Return the state of the RI line.

cd
  Getter Get the state of the CD line
  Type bool
  Return the state of the CD line

is_open
  Getter Get the state of the serial port, whether it’s open.
  Type bool
  New values can be assigned to the following attributes (properties), the port will be reconfigured, even if it's opened at that time:

port
  Type str
  Read or write port. When the port is already open, it will be closed and reopened with the new setting.

baudrate
  Getter Get current baud rate
  Setter Set new baud rate
  Type int
  Read or write current baud rate setting.

bytesize
  Getter Get current byte size
  Setter Set new byte size. Possible values: FIVEBITS, SIXBITS, SEVENBITS, EIGHTBITS
  Type int
  Read or write current data byte size setting.

parity
  Getter Get current parity setting
  Setter Set new parity mode. Possible values: PARITY_NONE, PARITY_EVEN, PARITY_ODD, PARITY_MARK, PARITY_SPACE
  Read or write current parity setting.

stopbits
  Getter Get current stop bit setting
**Setter** Set new stop bit setting. Possible values: `STOPBITS_ONE`, `STOPBITS_ONE_POINT_FIVE`, `STOPBITS_TWO`

Read or write current stop bit width setting.

**timeout**

**Getter** Get current read timeout setting

**Setter** Set read timeout

**Type** float (seconds)

Read or write current read timeout setting.

**write_timeout**

**Getter** Get current write timeout setting

**Setter** Set write timeout

**Type** float (seconds)

Read or write current write timeout setting.

Changed in version 3.0: renamed from `writeTimeout`

**inter_byte_timeout**

**Getter** Get current inter byte timeout setting

**Setter** Disable (None) or enable the inter byte timeout

**Type** float or None

Read or write current inter byte timeout setting.

Changed in version 3.0: renamed from `interCharTimeout`

**xonxoff**

**Getter** Get current software flow control setting

**Setter** Enable or disable software flow control

**Type** bool

Read or write current software flow control rate setting.

**rtscts**

**Getter** Get current hardware flow control setting

**Setter** Enable or disable hardware flow control

**Type** bool

Read or write current hardware flow control setting.

**dsrdtr**

**Getter** Get current hardware flow control setting

**Setter** Enable or disable hardware flow control

**Type** bool

Read or write current hardware flow control setting.

**rs485_mode**
**Getter** Get the current RS485 settings

**Setter** Disable (None) or enable the RS485 settings

**Type** `rs485.RS485Settings` or None

**Platform** Posix (Linux, limited set of hardware)

Attribute to configure RS485 support. When set to an instance of `rs485.RS485Settings` and supported by OS, RTS will be active when data is sent and inactive otherwise (for reception). The `rs485.RS485Settings` class provides additional settings supported on some platforms.

New in version 3.0.

The following constants are also provided:

**BAUDRATES**
A list of valid baud rates. The list may be incomplete, such that higher and/or intermediate baud rates may also be supported by the device (Read Only).

**BYTESIZES**
A list of valid byte sizes for the device (Read Only).

**PARITIES**
A list of valid parities for the device (Read Only).

**STOPBITS**
A list of valid stop bit widths for the device (Read Only).

The following methods are for compatibility with the `io` library.

**readable()**

*Returns* True

New in version 2.5.

**writable()**

*Returns* True

New in version 2.5.

**seekable()**

*Returns* False

New in version 2.5.

**readinto**(b)

*Parameters* b – bytearray or array instance

*Returns* Number of byte read

Read up to len(b) bytes into `bytearray b` and return the number of bytes read.

New in version 2.5.

The port settings can be read and written as dictionary. The following keys are supported: write_timeout, inter_byte_timeout, dsrdtr, baudrate, timeout, parity, bytesize, rtscts, stopbits, xonxoff

**get_settings()**

*Returns* a dictionary with current port settings.
Return type dict

Get a dictionary with port settings. This is useful to backup the current settings so that a later point in time they can be restored using `apply_settings()`.

Note that the state of control lines (RTS/DTR) are not part of the settings.

New in version 2.5.

Changed in version 3.0: renamed from `getSettingsDict`

`apply_settings(d)`

Parameters `d` (dict) – a dictionary with port settings.

Applies a dictionary that was created by `get_settings()`. Only changes are applied and when a key is missing, it means that the setting stays unchanged.

Note that control lines (RTS/DTR) are not changed.

New in version 2.5.

Changed in version 3.0: renamed from `applySettingsDict`

This class can be used as context manager. The serial port is closed when the context is left.

__enter__()

Returns Serial instance

Returns the instance that was used in the `with` statement.

Example:

```python
>>> with serial.serial_for_url(port) as s:
...     s.write(b'hello')
```

The port is opened automatically:

```python
>>> port = serial.Serial()
>>> port.port = '...
>>> with port as s:
...     s.write(b'hello')
```

Which also means that `with` statements can be used repeatedly, each time opening and closing the port.

Changed in version 3.4: the port is automatically opened

__exit__(exc_type, exc_val, exc_tb)

Closes serial port (exceptions are not handled by __exit__).

Platform specific methods.

**Warning:** Programs using the following methods and attributes are not portable to other platforms!

`nonblocking()`

Platform Posix

Deprecated since version 3.2: The serial port is already opened in this mode. This method is not needed and going away.

`fileno()`
Returns  File descriptor.

Return file descriptor number for the port that is opened by this object. It is useful when serial ports are used with select.

**set_input_flow_control** *(enable)*

Platform  Posix

Parameters  enable *(bool)* – Set flow control state.

Manually control flow - when software flow control is enabled.

This will send XON (true) and XOFF (false) to the other device.

New in version 2.7: (Posix support added)

Changed in version 3.0: renamed from flowControlOut

**set_output_flow_control** *(enable)*

Platform  Posix (HW and SW flow control)

Platform  Windows (SW flow control only)

Parameters  enable *(bool)* – Set flow control state.

Manually control flow of outgoing data - when hardware or software flow control is enabled.

Sending will be suspended when called with False and enabled when called with True.

Changed in version 2.7: (renamed on Posix, function was called flowControl)

Changed in version 3.0: renamed from setXON

**cancel_read** *

Platform  Posix

Platform  Windows

Cancel a pending read operation from another thread. A blocking read() call is aborted immediately. read() will not report any error but return all data received up to that point (similar to a timeout).

On Posix a call to cancel_read() may cancel a future read() call.

New in version 3.1.

**cancel_write** *

Platform  Posix

Platform  Windows

Cancel a pending write operation from another thread. The write() method will return immediately (no error indicated). However the OS may still be sending from the buffer, a separate call to reset_output_buffer() may be needed.

On Posix a call to cancel_write() may cancel a future write() call.

New in version 3.1.

---

**Note:** The following members are deprecated and will be removed in a future release.
portstr
   Deprecated since version 2.5: use name instead

inWaiting()
   Deprecated since version 3.0: see in_waiting

isOpen()
   Deprecated since version 3.0: see is_open

writeTimeout
   Deprecated since version 3.0: see write_timeout

interCharTimeout
   Deprecated since version 3.0: see inter_byte_timeout

sendBreak(duration=0.25)
   Deprecated since version 3.0: see send_break()

flushInput()
   Deprecated since version 3.0: see reset_input_buffer()

flushOutput()
   Deprecated since version 3.0: see reset_output_buffer()

setBreak(level=True)
   Deprecated since version 3.0: see break_condition

setRTS(level=True)
   Deprecated since version 3.0: see rts

setDTR(level=True)
   Deprecated since version 3.0: see dtr

getCTS()
   Deprecated since version 3.0: see cts

getDSR()
   Deprecated since version 3.0: see dsr

getRI()
   Deprecated since version 3.0: see ri

getCD()
   Deprecated since version 3.0: see cd

getSettingsDict()
   Deprecated since version 3.0: see get_settings()

applySettingsDict(d)
   Deprecated since version 3.0: see apply_settings()

outWaiting()
   Deprecated since version 3.0: see out_waiting

setXON(level=True)
   Deprecated since version 3.0: see set_output_flow_control()

flowControlOut(enable)
   Deprecated since version 3.0: see set_input_flow_control()

rtsToggle
   Platform  Windows
Attribute to configure RTS toggle control setting. When enabled and supported by OS, RTS will be active when data is available and inactive if no data is available.

New in version 2.6.

Changed in version 3.0: (removed, see \texttt{rs485\_mode} instead)

Implementation detail: some attributes and functions are provided by the class \texttt{SerialBase} and some by the platform specific class and others by the base class mentioned above.

**RS485 support**

The \texttt{Serial} class has a \texttt{Serial.rs485\_mode} attribute which allows to enable RS485 specific support on some platforms. Currently Windows and Linux (only a small number of devices) are supported. \texttt{Serial.rs485\_mode} needs to be set to an instance of \texttt{rs485.RS485Settings} to enable or to \texttt{None} to disable this feature.

Usage:

```python
import serial
import serial.rs485
ser = serial.Serial(...)  
ser.rs485_mode = serial.rs485.RS485Settings(...)  
ser.write(b'hello')
```

There is a subclass \texttt{rs485.RS485} available to emulate the RS485 support on regular serial ports (\texttt{serial.rs485} needs to be imported).

**class rs485.RS485Settings**

A class that holds RS485 specific settings which are supported on some platforms.

New in version 3.0.

\texttt{__init__}(rts\_level\_for\_tx=True, rts\_level\_for\_rx=False, loopback=False, delay\_before\_tx=None, delay\_before\_rx=None):

\begin{itemize}
  \item \texttt{rts\_level\_for\_tx}(\texttt{bool}) – RTS level for transmission
  \item \texttt{rts\_level\_for\_rx}(\texttt{bool}) – RTS level for reception
  \item \texttt{loopback}(\texttt{bool}) – When set to True transmitted data is also received.
  \item \texttt{delay\_before\_tx}(\texttt{float}) – Delay after setting RTS but before transmission starts
  \item \texttt{delay\_before\_rx}(\texttt{float}) – Delay after transmission ends and resetting RTS
\end{itemize}

\texttt{rts\_level\_for\_tx}
RTS level for transmission.

\texttt{rts\_level\_for\_rx}
RTS level for reception.

\texttt{loopback}
When set to True transmitted data is also received.

\texttt{delay\_before\_tx}
Delay after setting RTS but before transmission starts (seconds as float).

\texttt{delay\_before\_rx}
Delay after transmission ends and resetting RTS (seconds as float).
class rs485.RS485
A subclass that replaces the Serial.write() method with one that toggles RTS according to the RS485 settings.

Usage:
```python
ser = serial.rs485.RS485(...)
ser.rs485_mode = serial.rs485.RS485Settings(...)  # Set RS485 mode
ser.write(b'hello')
```

**Warning:** This may work unreliably on some serial ports (control signals not synchronized or delayed compared to data). Using delays may be unreliable (varying times, larger than expected) as the OS may not support very fine grained delays (no smaller than in the order of tens of milliseconds).

**Note:** Some implementations support this natively in the class Serial. Better performance can be expected when the native version is used.

**Note:** The loopback property is ignored by this implementation. The actual behavior depends on the used hardware.

### RFC 2217 Network ports

**Warning:** This implementation is currently in an experimental state. Use at your own risk.

class rfc2217.Serial
This implements a RFC 2217 compatible client. Port names are URL in the form: rfc2217://<host>:<port>[:<option>[&<option>]]

This class API is compatible to Serial with a few exceptions:

- `write_timeout` is not implemented
- The current implementation starts a thread that keeps reading from the (internal) socket. The thread is managed automatically by the rfc2217.Serial port object on open()/close(). However it may be a problem for user applications that like to use select instead of threads.

Due to the nature of the network and protocol involved there are a few extra points to keep in mind:

- All operations have an additional latency time.
- Setting control lines (RTS/CTS) needs more time.
- Reading the status lines (DSR/DTR etc.) returns a cached value. When that cache is updated depends entirely on the server. The server itself may implement a polling at a certain rate and quick changes may be invisible.
- The network layer also has buffers. This means that flush(), reset_input_buffer() and reset_output_buffer() may work with additional delay. Likewise in_waiting returns the size of the data arrived at the objects internal buffer and excludes any bytes in the network buffers or any server side buffer.
• Closing and immediately reopening the same port may fail due to time needed by the server to get ready again.

Not implemented yet / Possible problems with the implementation:

• **RFC 2217** flow control between client and server (objects internal buffer may eat all your memory when never read).
• No authentication support (servers may not prompt for a password etc.)
• No encryption.

Due to lack of authentication and encryption it is not suitable to use this client for connections across the internet and should only be used in controlled environments.

New in version 2.5.

class rfc2217.PortManager

This class provides helper functions for implementing **RFC 2217** compatible servers.

Basically, it implements everything needed for the **RFC 2217** protocol. It just does not open sockets and read/write to serial ports (though it changes other port settings). The user of this class must take care of the data transmission itself. The reason for that is, that this way, this class supports all programming models such as threads and select.

Usage examples can be found in the examples where two TCP/IP - serial converters are shown, one using threads (the single port server) and an other using select (the multi port server).

---

**Note:** Each new client connection must create a new instance as this object (and the **RFC 2217** protocol) has internal state.

---

__init__(serial_port, connection, debug_output=False)

Parameters

• serial_port – a Serial instance that is managed.
• connection – an object implementing write(), used to write to the network.
• debug_output – enables debug messages: a logging.Logger instance or None.

Initializes the Manager and starts negotiating with client in Telnet and **RFC 2217** protocol. The negotiation starts immediately so that the class should be instantiated in the moment the client connects.

The serial_port can be controlled by **RFC 2217** commands. This object will modify the port settings (baud rate etc.) and control lines (RTS/DTR) send BREAK etc. when the corresponding commands are found by the filter() method.

The connection object must implement a write() function. This function must ensure that data is written at once (no user data mixed in, i.e. it must be thread-safe). All data must be sent in its raw form (escape() must not be used) as it is used to send Telnet and **RFC 2217** control commands.

For diagnostics of the connection or the implementation, debug_output can be set to an instance of a logging.Logger (e.g. logging.getLogger('rfc2217.server')). The caller should configure the logger using setLevel for the desired detail level of the logs.

---

escape(data)

Parameters data – data to be sent over the network.

Returns data, escaped for Telnet/**RFC 2217**

---

3.1. Classes 23
A generator that escapes all data to be compatible with RFC 2217. Implementors of servers should use this function to process all data sent over the network.

The function returns a generator which can be used in for loops. It can be converted to bytes using `serial.to_bytes()`.

```python
filter(data)
```

**Parameters**
- `data` – data read from the network, including Telnet and RFC 2217 controls.

**Returns**
- data, free from Telnet and RFC 2217 controls.

A generator that filters and processes all data related to RFC 2217. Implementors of servers should use this function to process all data received from the network.

The function returns a generator which can be used in for loops. It can be converted to bytes using `serial.to_bytes()`.

```python
check_modem_lines(force_notification=False)
```

**Parameters**
- `force_notification` – Set to false. Parameter is for internal use.

This function needs to be called periodically (e.g. every second) when the server wants to send NOTIFY_MODEMSTATE messages. This is required to support the client for reading CTS/DSR/RI/CD status lines.

The function reads the status line and issues the notifications automatically.

New in version 2.5.

**See also:**
- RFC 2217 - Telnet Com Port Control Option

### Exceptions

**exception** `serial.SerialException`
- Base class for serial port exceptions.

  Changed in version 2.5: Now derives from `IOError` instead of `Exception`

**exception** `serial.SerialTimeoutException`
- Exception that is raised on write timeouts.

### Constants

**Parity**

```
serial.PARITY_NONE
serial.PARITY_EVEN
serial.PARITY_ODD
serial.PARITY_MARK
serial.PARITY_SPACE
```

**Stop bits**

```
serial.STOPBITS_ONE
```
serial.STOPBITS_ONE_POINT_FIVE
serial.STOPBITS_TWO

Note that 1.5 stop bits are not supported on POSIX. It will fall back to 2 stop bits.

Byte size
serial.FIVEBITS
serial.SIXBITS
serial.SEVENBITS
serial.EIGHTBITS

Others
Default control characters (instances of bytes for Python 3.0+) for software flow control:
serial.XON
serial.XOFF

Module version:
serial.VERSION
A string indicating the pySerial version, such as 3.0.
New in version 2.3.

Module functions and attributes

serial.device (number)
   Changed in version 3.0: removed, use serial.tools.list_ports instead
serial.serial_for_url (url, *args, **kwargs)
   Parameters
      • url – Device name, number or URL
      • do_not_open – When set to true, the serial port is not opened.

   Returns an instance of Serial or a compatible object.

   Get a native or a RFC 2217 implementation of the Serial class, depending on port/url. This factory function is useful when an application wants to support both, local ports and remote ports. There is also support for other types, see URL section.

   The port is not opened when a keyword parameter called do_not_open is given and true, by default it is opened.
   New in version 2.5.

serial.protocol_handler_packages
This attribute is a list of package names (strings) that is searched for protocol handlers.

e.g. we want to support a URL foobar://. A module my_handlers.protocol_foobar is provided by the user:

```python
serial.protocol_handler_packages.append("my_handlers")
s = serial.serial_for_url("foobar://")
```
For an URL starting with `XY://` is the function `serial_for_url()` attempts to import `PACKAGE.protocol_XY` with each candidate for `PACKAGE` from this list.

New in version 2.6.

```python
serial.to_bytes(sequence)
```

**Parameters** `sequence` – bytes, bytearray or memoryview

**Returns** an instance of `bytes`

Convert a sequence to a `bytes` type. This is used to write code that is compatible to Python 2.x and 3.x.

In Python versions prior 3.x, `bytes` is a subclass of `str`. They convert `str([17])` to `'\x11'` instead of `'\[17]'` so a simple `bytes(sequence)` doesn’t work for all versions of Python.

This function is used internally and in the unit tests.

New in version 2.5.

```python
serial.iterbytes(sequence)
```

**Parameters** `sequence` – bytes, bytearray or memoryview

**Returns** a generator that yields `bytes`

Some versions of Python (3.x) would return integers instead of `bytes` when looping over an instance of `bytes`. This helper function ensures that `bytes` are returned.

New in version 3.0.

## Threading

New in version 3.0.

[Warning: This implementation is currently in an experimental state. Use at your own risk.]

This module provides classes to simplify working with threads and protocols.

```python
class serial.threaded.Protocol
    Protocol as used by the ReaderThread. This base class provides empty implementations of all methods.
    connection_made(transport)
        Parameters `transport` – instance used to write to serial port.
        Called when reader thread is started.
    data_received(data)
        Parameters `data` (bytes) – received bytes
        Called with snippets received from the serial port.
    connection_lost(exc)
        Parameters `exc` – Exception if connection was terminated by error else None
        Called when the serial port is closed or the reader loop terminated otherwise.
```
class serial.threaded.Packetizer(Protocol)

Read binary packets from serial port. Packets are expected to be terminated with a TERMINATOR byte (null byte by default).

The class also keeps track of the transport.

TERMINATOR = b'\0'
__init__()

connection_made(transport)
Stores transport.

connection_lost(exc)
Forgets transport.

data_received(data)

Parameters data(bytes) – partial received data

Buffer received data and search for TERMINATOR, when found, call handle_packet().

handle_packet(packet)

Parameters packet(bytes) – a packet as defined by TERMINATOR

Process packets - to be overridden by subclassing.

class serial.threaded.LineReader(Packetizer)

Read and write (Unicode) lines from/to serial port. The encoding is applied.

TERMINATOR = b'\r\n'
Line ending.

ENCODING = 'utf-8'
Encoding of the send and received data.

UNICODE_HANDLING = 'replace'
Unicode error handling policy.

handle_packet(packet)

Parameters packet(bytes) – a packet as defined by TERMINATOR

In this case it will be a line, calls handle_line() after applying the ENCODING.

handle_line(line)

Parameters line(str) – Unicode string with one line (excluding line terminator)

Process one line - to be overridden by subclassing.

write_line(text)

Parameters text(str) – Unicode string with one line (excluding line terminator)

Write text to the transport. text is expected to be a Unicode string and the encoding is applied before sending and also the TERMINATOR (new line) is appended.

class serial.threaded.ReaderThread(threading.Thread)

Implement a serial port read loop and dispatch to a Protocol instance (like the asyncio.Protocol) but do it with threads.

Calls to close() will close the serial port but it is also possible to just stop() this thread and continue to use the serial port instance otherwise.

__init__(serial_instance, protocol_factory)
Parameters

- **serial_instance** – serial port instance (opened) to be used.
- **protocol_factory** – a callable that returns a Protocol instance

Initialize thread.

Note that the serial_instance 's timeout is set to one second! Other settings are not changed.

```
stop()
```

Stop the reader thread.

```
run()
```

The actual reader loop driven by the thread. It calls Protocol.connection_made(), reads from the serial port calling Protocol.data_received() and finally calls Protocol.connection_lost() when close() is called or an error occurs.

```
write(data)
```

**Parameters** **data** *(bytes)* – data to write

Thread safe writing (uses lock).

```
close()
```

Close the serial port and exit reader thread, calls stop() (uses lock).

```
connect()
```

Wait until connection is set up and return the transport and protocol instances.

This class can be used as context manager, in this case it starts the thread and connects automatically. The serial port is closed when the context is left.

```
__enter__()
```

**Returns** **protocol**

Connect and return protocol instance.

```
__exit__(exc_type, exc_val, exc_tb)
```

Closes serial port.

Example:

```python
class PrintLines(LineReader):
    def connection_made(self, transport):
        super(PrintLines, self).connection_made(transport)
        sys.stdout.write('port opened\n')
        self.write_line('hello world')

    def handle_line(self, data):
        sys.stdout.write('line received: {}
'.format(repr(data)))

    def connection_lost(self, exc):
        if exc:
            traceback.print_exc(exc)
        sys.stdout.write('port closed\n')

ser = serial.serial_for_url('loop://', baudrate=115200, timeout=1)
with ReaderThread(ser, PrintLines) as protocol:
    protocol.write_line('hello')
time.sleep(2)
```
**asyncio**

asyncio was introduced with Python 3.4. Experimental support for pySerial is provided via a separate distribution pyserial-asyncio.

It is currently under development, see:

- [https://github.com/pyserial/pyserial-asyncio](https://github.com/pyserial/pyserial-asyncio)
serial.tools.list_ports

This module can be executed to get a list of ports (`python -m serial.tools.list_ports`). It also contains the following functions.

serial.tools.list_ports.comports(include_links=False)

Parameters

**include_links (bool)** – include symlinks under `/dev` when they point to a serial port

Returns

a list containing `ListPortInfo` objects.

Under Linux, OSX and Windows, extended information will be available for USB devices (e.g. the `ListPortInfo.hwid` string contains `VID:PID, SER (serial number), LOCATION (hierarchy)`, which makes them searchable via `grep()`). The USB info is also available as attributes of `ListPortInfo`.

If `include_links` is true, all devices under `/dev` are inspected and tested if they are a link to a known serial port device. These entries will include `LINK` in their `hwid` string. This implies that the same device listed twice, once under its original name and once under linked name.

**Note:** Support is limited to a number of operating systems. On some systems description and hardware ID will not be available (None).

Under Linux, OSX and Windows, extended information will be available for USB devices (e.g. the `ListPortInfo.hwid` string contains `VID:PID, SER (serial number), LOCATION (hierarchy)`, which makes them searchable via `grep()`). The USB info is also available as attributes of `ListPortInfo`.

If `include_links` is true, all devices under `/dev` are inspected and tested if they are a link to a known serial port device. These entries will include `LINK` in their `hwid` string. This implies that the same device listed twice, once under its original name and once under linked name.

**Platform** Posix (/dev files)

**Platform** Linux (/dev files, sysfs)

**Platform** OSX (iokit)

**Platform** Windows (setupapi, registry)
serial.tools.list_ports.grep(regexp, include_links=False)

Parameters

• **regexp** – regular expression (see stdlib `re`)
• **include_links** (bool) – include symlinks under `/dev` when they point to a serial port

Returns an iterable that yields `ListPortInfo` objects, see also `comports()`.

Search for ports using a regular expression. Port name, description and hwid are searched (case insensitive). The function returns an iterable that contains the same data that `comports()` generates, but includes only those entries that match the regexp.

class serial.tools.list_ports.ListPortInfo

This object holds information about a serial port. It supports indexed access for backwards compatibility, as in `port, desc, hwid = info`.

device
Full device name/path, e.g. `/dev/ttyUSB0`. This is also the information returned as first element when accessed by index.

name
Short device name, e.g. `ttyUSB0`.

description
Human readable description or n/a. This is also the information returned as second element when accessed by index.

hwid
Technical description or n/a. This is also the information returned as third element when accessed by index.

USB specific data, these are all `None` if it is not an USB device (or the platform does not support extended info).

vid
USB Vendor ID (integer, 0...65535).

pid
USB product ID (integer, 0...65535).

serial_number
USB serial number as a string.

location
USB device location string (“<bus>-<port>[<port>]...”)

manufacturer
USB manufacturer string, as reported by device.

product
USB product string, as reported by device.

interface
Interface specific description, e.g. used in compound USB devices.

Comparison operators are implemented such that the `ListPortInfo` objects can be sorted by `device`. Strings are split into groups of numbers and text so that the order is “natural” (i.e. `com1 < com2 < com10`).

Command line usage

Help for `python -m serial.tools.list_ports:`
usage: list_ports.py [-h] [-v] [-q] [-n N] [-s] [regexp]

Serial port enumeration

positional arguments:
  regexp only show ports that match this regex

optional arguments:
  -h, --help show this help message and exit
  -v, --verbose show more messages
  -q, --quiet suppress all messages
  -n N only output the N-th entry
  -s, --include-links include entries that are symlinks to real devices

Examples:

- List all ports with details:

  $ python -m serial.tools.list_ports -v
  /dev/ttyS0
      desc: ttyS0
      hwid: PNP0501
  /dev/ttyUSB0
      desc: CP2102 USB to UART Bridge Controller
      hwid: USB VID:PID=10C4:EA60 SER=0001 LOCATION=2-1.6
  2 ports found

- List the 2nd port matching a USB VID:PID pattern:

  $ python -m serial.tools.list_ports 1234:5678 -q -n 2
  /dev/ttyUSB1

New in version 2.6.

Changed in version 3.0: returning ListPortInfo objects instead of a tuple

serial.tools.miniterm

This is a console application that provides a small terminal application.

Miniterm itself does not implement any terminal features such as VT102 compatibility. However it may inherit these features from the terminal it is run. For example on GNU/Linux running from an xterm it will support the escape sequences of the xterm. On Windows the typical console window is dumb and does not support any escapes. When ANSI.sys is loaded it supports some escapes.

The default is to filter terminal control characters, see --filter for different options.

Miniterm:

--- Miniterm on /dev/ttyS0: 9600,8,N,1 ---
--- Quit: Ctrl+] | Menu: Ctrl+T | Help: Ctrl+T followed by Ctrl+H ---

Command line options can be given so that binary data including escapes for terminals are escaped or output as hex.

Miniterm supports RFC 2217 remote serial ports and raw sockets using URL Handlers such as rfc2217://<host>:<port> respectively socket://<host>:<port> as port argument when invoking.

Command line options python -m serial.tools.miniterm -h:

Miniterm - A simple terminal program for the serial port.

positional arguments:
  port serial port name
  baudrate set baud rate, default: 9600

optional arguments:
  -h, --help show this help message and exit

port settings:
  --parity {N,E,O,S,M} set parity, one of {N E O S M}, default: N
  --rtscts enable RTS/CTS flow control (default off)
  --xonxoff enable software flow control (default off)
  --rts RTS set initial RTS line state (possible values: 0, 1)
  --dtr DTR set initial DTR line state (possible values: 0, 1)
  --ask ask again for port when open fails

data handling:
  -e, --echo enable local echo (default off)
  --encoding CODEC set the encoding for the serial port (e.g. hexlify, Latin1, UTF-8), default: UTF-8
  -f NAME, --filter NAME add text transformation
  --eol {CR,LF,CRLF} end of line mode
  --raw Do no apply any encodings/transformations

hotkeys:
  --exit-char NUM Unicode of special character that is used to exit the application, default: 29
  --menu-char NUM Unicode code of special character that is used to control miniterm (menu), default: 20

diagnostics:
  -q, --quiet suppress non-error messages
  --develop show Python traceback on error

Available filters (--filter option):
  • colorize: Apply different colors for received and echo
  • debug: Print what is sent and received
  • default: remove typical terminal control codes from input
  • direct: do-nothing: forward all data unchanged
  • nocontrol: Remove all control codes, incl. CR+LF
  • printable: Show decimal code for all non-ASCII characters and replace most control codes

Miniterm supports some control functions while being connected. Typing Ctrl+T Ctrl+H when it is running shows the help text:
--- pySerial (3.0a) - miniterm - help
---
--- Ctrl+] Exit program
--- Ctrl+T Menu escape key, followed by:
--- Menu keys:
--- Ctrl+T Send the menu character itself to remote
--- Ctrl+] Send the exit character itself to remote
--- Ctrl+I Show info
--- Ctrl+U Upload file (prompt will be shown)
--- Ctrl+A encoding
--- Ctrl+F edit filters
--- Toggles:
--- Ctrl+R RTS Ctrl+D DTR Ctrl+B BREAK
--- Ctrl+E echo Ctrl+L EOL
---
--- Port settings (Ctrl+T followed by the following):
--- p change port
--- 7 8 set data bits
--- N E O S M change parity (None, Even, Odd, Space, Mark)
--- 1 2 3 set stop bits (1, 2, 1.5)
--- b change baud rate
--- x X disable/enable software flow control
--- r R disable/enable hardware flow control

Ctrl+T s suspends the connection (port is opened) and reconnects when a key is pressed. This can be used to temporarily access the serial port with an other application, without exiting miniterm. If reconnecting fails it is also possible to exit (Ctrl+]) or change the port (p).

Changed in version 2.5: Added Ctrl+T menu and added support for opening URLs.

Changed in version 2.6: File moved from the examples to `serial.tools.miniterm`.

Changed in version 3.0: Apply encoding on serial port, convert to Unicode for console. Added new filters, default to stripping terminal control sequences. Added `--ask` option.
Overview

The function `serial_for_url()` accepts the following types of URLs:

- `rfc2217://<host>:<port>[?<option>&<option>...]`
- `socket://<host>:<port>[?logging={debug|info|warning|error}]`
- `loop://[?logging={debug|info|warning|error}]`
- `hwgrep://<regexp>&skip_busy][&n=N]`
- `spy://port[?option=value][&option=value]]`
- `alt://port?class=<classname>`

Changed in version 3.0: Options are specified with `?` and `&` instead of `/`

Device names are also supported, e.g.:

- `/dev/ttyUSB0` (Linux)
- `COM3` (Windows)

Future releases of pySerial might add more types. Since pySerial 2.6 it is also possible for the user to add protocol handlers using `protocol_handler_packages`.

**rfc2217://**

Used to connect to RFC 2217 compatible servers. All serial port functions are supported. Implemented by `rfc2217.Serial`.

Supported options in the URL are:
• `ign_set_control` does not wait for acknowledges to SET_CONTROL. This option can be used for non-compliant servers (i.e., when getting an remote rejected value for option 'control' error when connecting).

• `poll_modem`: The client issues NOTIFY_MODEMSTATE requests when status lines are read (CTS/DTR/RI/CD). Without this option it relies on the server sending the notifications automatically (that's what the RFC suggests and most servers do). Enable this option when cts does not work as expected, i.e., for servers that do not send notifications.

• `timeout=<value>`: Change network timeout (default 3 seconds). This is useful when the server takes a little more time to send its answers. The timeout applies to the initial Telnet / RFC 2271 negotiation as well as changing port settings or control line change commands.

• `logging={debug|info|warning|error}`: Prints diagnostic messages (not useful for end users). It uses the logging module and a logger called pySerial.rfc2217 so that the application can setup up logging handlers etc. It will call `logging.basicConfig()` which initializes for output on `sys.stderr` (if no logging was set up already).

**Warning:** The connection is not encrypted and no authentication is supported! Only use it in trusted environments.

### socket://

The purpose of this connection type is that applications using pySerial can connect to TCP/IP to serial port converters that do not support RFC 2217.

Uses a TCP/IP socket. All serial port settings, control and status lines are ignored. Only data is transmitted and received.

Supported options in the URL are:

• `logging={debug|info|warning|error}`: Prints diagnostic messages (not useful for end users). It uses the logging module and a logger called pySerial.socket so that the application can setup up logging handlers etc. It will call `logging.basicConfig()` which initializes for output on `sys.stderr` (if no logging was set up already).

**Warning:** The connection is not encrypted and no authentication is supported! Only use it in trusted environments.

### loop://

The least useful type. It simulates a loop back connection (RX<->TX RTS<->CTS DTR<->DSR). It could be used to test applications or run the unit tests.

Supported options in the URL are:

• `logging={debug|info|warning|error}`: Prints diagnostic messages (not useful for end users). It uses the logging module and a logger called pySerial.loop so that the application can setup up logging handlers etc. It will call `logging.basicConfig()` which initializes for output on `sys.stderr` (if no logging was set up already).
**hwgrep://**

This type uses `serial.tools.list_ports` to obtain a list of ports and searches the list for matches by a regexp that follows the slashes (see Python's `re` module for detailed syntax information).

Note that options are separated using the character `&`, this also applies to the first, where URLs usually use `?`. This exception is made as the question mark is used in regexp itself.

Depending on the capabilities of the `list_ports` module on the system, it is possible to search for the description or hardware ID of a device, e.g. USB VID:PID or texts.

Unfortunately, on some systems `list_ports` only lists a subset of the port names with no additional information. Currently, on Windows and Linux and OSX it should find additional information.

Supported options in the URL are:

- `n=N`: pick the N’th entry instead of the first
- `skip_busy`: skip ports that can not be opened, e.g. because they are already in use. This may not work as expected on platforms where the file is not locked automatically (e.g. Posix).

**spy://**

Wrapping the native serial port, this protocol makes it possible to intercept the data received and transmitted as well as the access to the control lines, break and flush commands. It is mainly used to debug applications.

Supported options in the URL are:

- `file=FILENAME` output to given file or device instead of stderr
- `color` enable ANSI escape sequences to colorize output
- `raw` output the read and written data directly (default is to create a hex dump). In this mode, no control line and other commands are logged.
- `all` also show `in_waiting` and empty `read()` calls (hidden by default because of high traffic).

Example:

```python
import serial

with serial.serial_for_url('spy:///dev/ttyUSB0?file=test.txt', timeout=1) as s:
    s.dtr = False
    s.write('hello world')
    s.read(20)
    s.dtr = True
    s.write(serial.to_bytes(range(256)))
    s.read(400)
    s.send_break()

with open('test.txt') as f:
    print(f.read())
```

Outputs:

```
000000.002 Q-RX reset_input_buffer
000000.002 DTR inactive
000000.002 TX 0000 68 65 6C 6C 6F 20 77 6F 72 6C 64 hello world
000001.015 RX 0000 68 65 6C 6C 6F 20 77 6F 72 6C 64 hello world
```
000001.015 DTR active
000001.015 TX 0000 00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F ..............
  ...
000001.015 TX 0010 10 11 12 13 14 15 16 17 18 19 1A 1B 1C 1D 1E 1F !"#$%&'()++,-
  ...
000001.015 TX 0020 20 21 22 23 24 25 26 27 28 29 2A 2B 2C 2D 2E 2F ................
  ...
000001.015 TX 0030 30 31 32 33 34 35 36 37 38 39 3A 3B 3C 3D 3E 3F 0123456789;,
  ...
000001.016 TX 0040 40 41 42 43 44 45 46 47 48 49 4A 4B 4C 4D 4E 4F ................
  ...
000001.016 TX 0050 50 51 52 53 54 55 56 57 58 59 5A 5B 5C 5D 5E 5F ................
  ...
000001.016 TX 0060 60 61 62 63 64 65 66 67 68 69 6A 6B 6C 6D 6E 6F ................
  ...
000001.016 TX 0070 70 71 72 73 74 75 76 77 78 79 7A 7B 7C 7D 7E 7F pqrstuvwxyz{|}
  ...
000001.016 TX 0080 80 81 82 83 84 85 86 87 88 89 8A 8B 8C 8D 8E 8F ................
  ...
000001.016 TX 0090 90 91 92 93 94 95 96 97 98 99 9A 9B 9C 9D 9E 9F ................
  ...
000001.016 TX 00A0 A0 A1 A2 A3 A4 A5 A6 A7 A8 A9 AA AB AC AD AE AF ................
  ...
000001.016 TX 00B0 B0 B1 B2 B3 B4 B5 B6 B7 B8 B9 BA BB BC BD BE BF ............... 
  ...
000001.016 TX 00C0 C0 C1 C2 C3 C4 C5 C6 C7 C8 C9 CA CB CC CD CE CF ............. 
  ...
000001.016 TX 00D0 D0 D1 D2 D3 D4 D5 D6 D7 D8 D9 DA DB DC DD DE DF .......... 
  ...
000001.016 TX 00E0 E0 E1 E2 E3 E4 E5 E6 E7 E8 E9 EA EB EC ED EE EF ............ 
  ...
000001.016 TX 00F0 F0 F1 F2 F3 F4 F5 F6 F7 F8 F9 FA FB FC FD FE FF ............. 
  ...
000002.284 RX 0000 00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F ..............
  ...
000002.284 RX 0010 10 11 12 13 14 15 16 17 18 19 1A 1B 1C 1D 1E 1F ..............
  ...
000002.284 RX 0020 20 21 22 23 24 25 26 27 28 29 2A 2B 2C 2D 2E 2F !"#$%&'()++,-
  ...
000002.284 RX 0030 30 31 32 33 34 35 36 37 38 39 3A 3B 3C 3D 3E 3F 0123456789;,
  ...
000002.284 RX 0040 40 41 42 43 44 45 46 47 48 49 4A 4B 4C 4D 4E 4F ................
  ...
000002.284 RX 0050 50 51 52 53 54 55 56 57 58 59 5A 5B 5C 5D 5E 5F ................
  ...
000002.284 RX 0060 60 61 62 63 64 65 66 67 68 69 6A 6B 6C 6D 6E 6F ................
  ...
000002.284 RX 0070 70 71 72 73 74 75 76 77 78 79 7A 7B 7C 7D 7E 7F pqrstuvwxyz{|}
  ...
000002.284 RX 0080 80 81 82 83 84 85 86 87 88 89 8A 8B 8C 8D 8E 8F ................
  ...
000002.284 RX 0090 90 91 92 93 94 95 96 97 98 99 9A 9B 9C 9D 9E 9F ................
  ...
000002.284 RX 00A0 A0 A1 A2 A3 A4 A5 A6 A7 A8 A9 AA AB AC AD AE AF ............... 
  ...
000002.284 RX 00B0 B0 B1 B2 B3 B4 B5 B6 B7 B8 B9 BA BB BC BD BE BF ............. 
  ...
000002.284 RX 00C0 C0 C1 C2 C3 C4 C5 C6 C7 C8 C9 CA CB CC CD CE CF ............. 
  ...

000001.015 TX 0000 00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F ..............
  ...
000001.015 TX 0010 10 11 12 13 14 15 16 17 18 19 1A 1B 1C 1D 1E 1F !"#$%&'()++,-
  ...
000001.015 TX 0020 20 21 22 23 24 25 26 27 28 29 2A 2B 2C 2D 2E 2F ................
  ...
000001.015 TX 0030 30 31 32 33 34 35 36 37 38 39 3A 3B 3C 3D 3E 3F 0123456789;,
  ...
000001.016 TX 0040 40 41 42 43 44 45 46 47 48 49 4A 4B 4C 4D 4E 4F ................
  ...
000001.016 TX 0050 50 51 52 53 54 55 56 57 58 59 5A 5B 5C 5D 5E 5F ................
  ...
000001.016 TX 0060 60 61 62 63 64 65 66 67 68 69 6A 6B 6C 6D 6E 6F ................
  ...
000001.016 TX 0070 70 71 72 73 74 75 76 77 78 79 7A 7B 7C 7D 7E 7F pqrstuvwxyz{|}
  ...
000001.016 TX 0080 80 81 82 83 84 85 86 87 88 89 8A 8B 8C 8D 8E 8F ................
  ...
000001.016 TX 0090 90 91 92 93 94 95 96 97 98 99 9A 9B 9C 9D 9E 9F ................
  ...
000001.016 TX 00A0 A0 A1 A2 A3 A4 A5 A6 A7 A8 A9 AA AB AC AD AE AF ............... 
  ...
000001.016 TX 00B0 B0 B1 B2 B3 B4 B5 B6 B7 B8 B9 BA BB BC BD BE BF ............. 
  ...
000001.016 TX 00C0 C0 C1 C2 C3 C4 C5 C6 C7 C8 C9 CA CB CC CD CE CF ............. 
  ...

Chapter 5. URL Handlers
Another example, on POSIX, open a second terminal window and find out it’s device (e.g. with the `ps` command in the TTY column), assumed to be `/dev/pts/2` here, double quotes are used so that the ampersand in the URL is not interpreted by the shell:

```python
python -m serial.tools.miniterm "spy:///dev/ttyUSB0?file=/dev/pts/2&color" 115200
```

The spy output will be live in the second terminal window.

New in version 3.0.

### `alt://`

This handler allows to select alternate implementations of the native serial port.

Currently only the POSIX platform provides alternative implementations.

- **PosixPollSerial** Poll based read implementation. Not all systems support poll properly. However this one has better handling of errors, such as a device disconnecting while it’s in use (e.g. USB-serial unplugged).
- **VTIMESerial** Implement timeout using `VTIME/VMIN` of TTY device instead of using `select`. This means that inter character timeout and overall timeout can not be used at the same time. Overall timeout is disabled when inter-character timeout is used. The error handling is degraded.

Examples:

```alt://
alt:///dev/ttyUSB0?class=PosixPollSerial
alt:///dev/ttyUSB0?class=VTIMESerial
```

New in version 3.0.

### Examples

- `rfc2217://localhost:7000`
- `rfc2217://localhost:7000?poll_modem`
- `rfc2217://localhost:7000?ign_set_control&timeout=5.5`
- `socket://localhost:7777`
- `loop://?logging=debug`
- `hwgrep://0451:f432 (USB VID:PID)`
- `spy://COM54?file=log.txt`
- `alt:///dev/ttyUSB0?class=PosixPollSerial`
Miniterm

Miniterm is now available as module instead of example. see `serial.tools.miniterm` for details.

`miniterm.py` The miniterm program.

`setup-miniterm-py2exe.py` This is a py2exe setup script for Windows. It can be used to create a standalone `miniterm.exe`.

TCP/IP - serial bridge

This program opens a TCP/IP port. When a connection is made to that port (e.g. with telnet) it forwards all data to the serial port and vice versa.

This example only exports a raw socket connection. The next example below gives the client much more control over the remote serial port.

- The serial port settings are set on the command line when starting the program.
- There is no possibility to change settings from remote.
- All data is passed through as-is.

```
usage: tcp_serial_redirect.py [-h] [-q] [--parity {N,E,O,S,M}] [--rtscts]
                           [--xonxoff] [--rts RTS] [--dtr DTR]
                           [-P LOCALPORT]
                           SERIALPORT [BAUDRATE]
```

Simple Serial to Network (TCP/IP) redirector.

Positional arguments:

- `SERIALPORT` serial port name
- `BAUDRATE` set baud rate, default: 9600
optional arguments:
- h, --help show this help message and exit
- q, --quiet suppress non error messages

serial port:
- --parity {N,E,O,S,M} set parity, one of {N E O S M}, default: N
- --rtscts enable RTS/CTS flow control (default off)
- --xonxoff enable software flow control (default off)
- --rts RTS set initial RTS line state (possible values: 0, 1)
- --dtr DTR set initial DTR line state (possible values: 0, 1)

network settings:
- P LOCALPORT, --localport LOCALPORT
  local TCP port

NOTE: no security measures are implemented. Anyone can remotely connect to
this service over the network. Only one connection at once is supported. When
the connection is terminated it waits for the next connect.

---

tcp_serial_redirect.py Main program.

**Single-port TCP/IP - serial bridge (RFC 2217)**

Simple cross platform RFC 2217 serial port server. It uses threads and is portable (runs on POSIX, Windows, etc).

- The port settings and control lines (RTS/DTR) can be changed at any time using RFC 2217 requests. The status lines (DSR/CTS/RI/CD) are polled every second and notifications are sent to the client.
- Telnet character IAC (0xff) needs to be doubled in data stream. IAC followed by another value is interpreted as Telnet command sequence.
- Telnet negotiation commands are sent when connecting to the server.
- RTS/DTR are activated on client connect and deactivated on disconnect.
- Default port settings are set again when client disconnects.

```
usage: rfc2217_server.py [-h] [-p TCPPORT] [-v] SERIALPORT
RFC 2217 Serial to Network (TCP/IP) redirector.
```

**New in version 2.5.**
rfc2217_server.py  Main program.

setup-rfc2217_server-py2exe.py  This is a py2exe setup script for Windows. It can be used to create a standalone
rfc2217_server.exe.

Multi-port TCP/IP - serial bridge (RFC 2217)

This example implements a TCP/IP to serial port service that works with multiple ports at once. It uses select, no
threads, for the serial ports and the network sockets and therefore runs on POSIX systems only.

- Full control over the serial port with RFC 2217.
- Check existence of /tty/USB0...8. This is done every 5 seconds using os.path.exists.
- Send zeroconf announcements when port appears or disappears (uses python-avahi and dbus). Service name: _serial_port._tcp.
- Each serial port becomes available as one TCP/IP server. e.g. /dev/ttyUSB0 is reachable at <host>:7000.
- Single process for all ports and sockets (not per port).
- The script can be started as daemon.
- Logging to stdout or when run as daemon to syslog.
- Default port settings are set again when client disconnects.
- modem status lines (CTS/DSR/RI/CD) are not polled periodically and the server therefore does not send NOTIFY_MODEMSTATE on its own. However it responds to request from the client (i.e. use the poll_modem option in the URL when using a pySerial client.)

```bash
usage: port_publisher.py [options]

Announce the existence of devices using zeroconf and provide a TCP/IP <-> serial port gateway (implements RFC 2217).

If running as daemon, write to syslog. Otherwise write to stdout.

optional arguments:
  -h, --help         show this help message and exit

serial port settings:
  --ports-regex REGEX specify a regex to search against the serial devices
                         and their descriptions (default: /dev/ttyUSB[0-9]+)

network settings:
  --tcp-port PORT    specify lowest TCP port number (default: 7000)

daemon:
  -d, --daemon       start as daemon
  --pidfile FILE     specify a name for the PID file

diagnostics:
  -o FILE, --logfile FILE   write messages file instead of stdout
  -q, --quiet            suppress most diagnostic messages
  -v, --verbose          increase diagnostic messages
```

NOTE: no security measures are implemented. Anyone can remotely connect to
this service over the network. Only one connection at once, per port, is supported. When the connection is terminated, it waits for the next connect.

Requirements:

- Python (>= 2.4)
- python-avahi
- python-dbus
- python-serial (>= 2.5)

Installation as daemon:

- Copy the script `port_publisher.py` to `/usr/local/bin`.
- Copy the script `port_publisher.sh` to `/etc/init.d`.
- Add links to the runlevels using `update-rc.d port_publisher.sh defaults 99`.
- That’s it :-) the service will be started on next reboot. Alternatively run `invoke-rc.d port_publisher.sh start` as root.

New in version 2.5: new example

`port_publisher.py` Multi-port TCP/IP-serial converter (RFC 2217) for POSIX environments.

`port_publisher.sh` Example init.d script.

wxPython examples

A simple terminal application for wxPython and a flexible serial port configuration dialog are shown here.

`wxTerminal.py` A simple terminal application. Note that the length of the buffer is limited by wx and it may suddenly stop displaying new input.

`wxTerminal.wxg` A wxGlade design file for the terminal application.

`wxSerialConfigDialog.py` A flexible serial port configuration dialog.

`wxSerialConfigDialog.wxg` The wxGlade design file for the configuration dialog.

`setup-wxTerminal-py2exe.py` A py2exe setup script to package the terminal application.

Unit tests

The project uses a number of unit test to verify the functionality. They all need a loop back connector. The scripts itself contain more information. All test scripts are contained in the directory `test`.

The unit tests are performed on port `loop://` unless a different device name or URL is given on the command line (`sys.argv[1]`). e.g. to run the test on an attached USB-serial converter `hwgrep://USB` could be used or the actual name such as `/dev/ttyUSB0` or `COM1` (depending on platform).

`run_all_tests.py` Collect all tests from all `test*` files and run them. By default, the `loop://` device is used.

`test.py` Basic tests (binary capabilities, timeout, control lines).

`test_advanced.py` Test more advanced features (properties).

`test_high_load.py` Tests involving sending a lot of data.
test_readline.py  Tests involving *readline*.

test_iolib.py  Tests involving the *io* library. Only available for Python 2.6 and newer.

test_url.py  Tests involving the *URL* feature.
How To

Enable RFC 2217 (and other URL handlers) in programs using pySerial. Patch the code where the `Serial` is instantiated. E.g. replace:

```python
s = serial.Serial(...)  
```

it with:

```python
s = serial.serial_for_url(...)  
```

or for backwards compatibility to old pySerial installations:

```python
try:
    s = serial.serial_for_url(...)  
except AttributeError:
    s = serial.Serial(...)  
```

Assuming the application already stores port names as strings that’s all that is required. The user just needs a way to change the port setting of your application to an `rfc2217:// URL` (e.g. by editing a configuration file, GUI dialog etc.).

Please note that this enables all `URL` types supported by pySerial and that those involving the network are unencrypted and not protected against eavesdropping.

Test your setup. Is the device not working as expected? Maybe it’s time to check the connection before proceeding. `serial.tools.miniterm` from the Examples can be used to open the serial port and do some basic tests.

To test cables, connecting RX to TX (loop back) and typing some characters in `serial.tools.miniterm` is a simple test. When the characters are displayed on the screen, then at least RX and TX work (they still could be swapped though).

There is also a `spy:// URL` handler. It prints all calls (read/write, control lines) to the serial port to a file or stderr. See `spy://` for details.
FAQ

Example works in `serial.tools.miniterm` but not in script. The RTS and DTR lines are switched when the port is opened. This may cause some processing or reset on the connected device. In such cases an immediately following call to `write()` may not be received by the device.

A delay after opening the port, before the first `write()`, is recommended in this situation. E.g. a `time.sleep(1)`

Application works when `.py` file is run, but fails when packaged (py2exe etc.) py2exe and similar packaging programs scan the sources for import statements and create a list of modules that they package. pySerial may create two issues with that:

- implementations for other modules are found. On Windows, it's safe to exclude ‘serialposix’, ‘serialjava’ and ‘serialcli’ as these are not used.
- `serial.serial_for_url()` does a dynamic lookup of protocol handlers at runtime. If this function is used, the desired handlers have to be included manually (e.g. ‘serial.urlhandler.protocol_socket’, ‘serial.urlhandler.protocol_rfc2217’, etc.). This can be done either with the “includes” option in `setup.py` or by a dummy import in one of the packaged modules.

User supplied URL handlers `serial.serial_for_url()` can be used to access “virtual” serial ports identified by an URL scheme. E.g. for the RFC 2217: `rfc2217://`

Custom URL handlers can be added by extending the module search path in `serial.protocol_handler_packages`. This is possible starting from pySerial V2.6.

Permission denied errors On POSIX based systems, the user usually needs to be in a special group to have access to serial ports.

On Debian based systems, serial ports are usually in the group dialout, so running `sudo adduser $USER dialout` (and logging-out and -in) enables the user to access the port.

Support for Python 2.6 or earlier  Support for older Python releases than 2.7 will not return to pySerial 3.x. Python 2.7 is now many years old (released 2010). If you insist on using Python 2.6 or earlier, it is recommend to use pySerial 2.7 (or any 2.x version).

Related software


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