04 Python

AT A GLANCE

For	Test scripts: set resistances and sensor values, read and load user tables. Talks to the box over USB directly.
You need	Python 3.8 or newer (3.8 is the last for Windows 7), `pyserial` 3.5+, and the `ohmstar` package (0.1.0; not on PyPI yet: [package download link]). The Companion disconnected from the box.
Try it	No box needed: `MockBox` follows the same rules as a real one.

```
from ohmstar import Box, MockBox

with Box(MockBox("ohmSTAR+")) as box:
    print(box.model, box.firmware)        # ohmSTAR+ 6.1
    box.set("10k")
    print(box.last_sent)                  # 10000.0
    r = box.set_sensor("pt100", 25)
    print(r.ohms, r.sensor.name, r.others)  # 109.74 Pt100 a0.00385 2
```

Install and connect

1. `python -m venv .venv`
2. `.venv/bin/pip install <package folder>`
   Windows: `.venv\Scripts\pip`
3. Plug in the box, switch it on, disconnect the Companion.
4. Change one line of the example:

```
with Box.connect() as box:  # the one box
    box.set("4.7k")
box = Box.connect("COM4")   # a named port
```

Port names: `COM4`, `/dev/ttyUSB0`, `/dev/cu.usbserial-A1B2`.

Port	9600 baud, 8N1. FTDI only (`0403:6001`, `6014`, `6015`).
On opening	Only `Z` and `[` are sent. Not an ohmSTAR or ohmSTAR+: refused and closed.
Timeouts	`reply_timeout=1.5` s, `idle_time=0.15` s (keyword arguments)
Threads	One command at a time; threads sharing a `Box` take turns.

Reference

Call	Does
`Box.connect(port=None)`	Open and identify a box.
`Box(MockBox("ohmSTAR+"))`	A pretend box. `MockBox()` is an ohmSTAR+; `MockBox("ohmSTAR")` the other.
`find_ports()`	Lists FTDI ports. Sends nothing.
`box.model`, `box.firmware`	`"ohmSTAR+"`, `"6.1"`
`box.set(value)`	Ohms, or `"10k"`, `"1.5M"`. Rounded to the step, halves up. Returns ohms sent.
`box.last_sent`	Last value this script sent. `None` after a timeout or odd reply. Not a reading.
`box.set_sensor(s, v, unit=None)`	°C, or `unit="F"`; με for strain, % for position.
`ohmstar.sensors("10k ntc")`	Search the 128-curve library.
`Table.of(name, units, points)`	A table; `.problems()` lists faults.
`Table.from_file(p)`, `t.to_file(p)`	The manual's table file format.
`box.upload_table(slot, t, overwrite=False)`	Slots 1–9. Erase, write, read back, compare.
`box.read_table(slot)`	Read a user table.
`box.send_raw(line, allow_risky=False)`	Reads only: `t,…`, `Z`, `[`. Returns bytes.

Exceptions

Problem	Exception
Value out of range, bad slot, unknown sensor	`ValueError`
Bad table	`InvalidTableError`
Raw command refused	`UnsafeCommandError`
No box / several boxes	`NoBoxFoundError` / `SeveralBoxesError`
Port won't open	`PortOpenError`
Not an ohmSTAR	`NotABoxError`
No answer in time	`BoxTimeoutError`
Cable pulled, port closed	`BoxConnectionError`, `BoxClosedError`
Box answered `G`	`BoxRefusedError`
Slot in use	`SlotInUseError`
Upload cut short / differs	`UploadIncompleteError` / `TableMismatchError`

All but the `ValueError` family inherit from `OhmstarError`.

Real replies

```
box.set("6M")
ValueError: Nothing was sent. 6 megohms is out of
reach. The ohmSTAR+ goes from 1 ohm to 5 megohms.
box.set(138.505); box.last_sent  # 138.51
box.upload_table(2, other)
SlotInUseError: Slot 2 holds "Pt100" with 2
points.
Pass overwrite=True to replace it.
box.send_raw("t,0,31")  # b't,0,31,0.6\r\n' (mock)
```

Safety facts

- The box answers `y` to any `r`, even `rabc`. `set` checks first. Lower-case `m` is refused; no scientific notation is sent.
- No calibration method and no general write. `send_raw` refuses calibration writes even with `allow_risky=True`.
- A table name can't be blanked on a real box, so any named slot counts as in use.
- A timeout may mean the box switched itself off. Switch it on and retry.

ohmSTAR Console: the same package, no programming

For an older lab PC, or one where nothing may be installed. Unzip `ohmSTAR_Console_portable.zip` anywhere, even a USB stick, and double-click `ohmSTAR Console.bat` (Windows 7 SP1 and up; it carries its own Python). On a Mac or Linux PC, `ohmstar-console.command` uses the Python 3.8+ already there. Keys: the number or letter shown; B or Esc goes back.

- Set a resistance, or a value on any library sensor; step through a list or a range, timed or by key.
- All nine table slots at a glance, each as a chart; save one to a file, load a file (old table files work as they are), or make one from a sensor at the range and step you choose. Every table sent is read back and checked.
- `--demo` runs it on a pretend ohmSTAR+. Slot 0, the calibration, is never read or written.

Testing your scripts: `mock = MockBox(); box = Box(mock, reply_timeout=0.2); mock.switch_off()` makes the next call raise `BoxTimeoutError`. `mock.state` shows what the mock holds.