

ezRA - Easy Radio Astronomy – Installation - Windows

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ezRA - Easy Radio Astronomy
<https://github.com/tedcline/ezRA>

Windows Operating System Installation

For these instructions, I started with a Windows10 operating system.

ezRA Installation

Copy this installation instruction file onto the PC, to allow copy and paste of command lines.
Or use the ezRA file you are about to download.

The Windows10 FileExplorer program helps with many of the instructions below.
“Directory” is a word meaning “folder”.

Decide where you want to collect your ezRA experiments, and choose a directory name.
I suggest “ezRABase”.

With my “b” account Windows login, I chose to create this directory,

`C:\Users\b\Documents\ezRABase\`

In my Documents directory, I right-mouse-click in an open white space, choose “New”, and then choose “Folder”, and type

`ezRABase`

and tap the `Enter` keyboard key.

I double-left-mouse-click that new “ezRABase” to enter that directory.

Now inside that `ezRABase` directory, in the same way, I make one new directory, called “demo1”.

I now have a nested directory structure like this:

```
Documents\  
└── ezRABase\  
    └── demo1\  
        └──
```

I download the ezRA - Easy Radio Astronomy files.

I open a web browser (like Edge or Chrome or Firefox) to

<https://github.com/tedcline/ezRA>

I left-mouse-click on the top right `Green button` and choose "Download ZIP".

A file arrives in my Downloads directory, as

`ezRA-master.zip`

No need to unzip that `ezRA-master.zip` file, just reach deep inside it and copy and paste the `ezRA` directory:

In the Windows10 FileExplorer,
I open the `Downloads` directory, and
double-left-mouse-click that `ezRA-master.zip` file, and
double-left-mouse-click the `ezRA-master` directory inside, and
copy and paste the whole “ezRA” directory into my `ezRABase` directory.

I now have a nested directory structure like this:

```
Documents\  
└── ezRABase\  
    ├── ezRA\  
    └── demo1\
```

I open a Command Prompt window with `demo1` as the current directory.
You can start a Command Prompt from the Windows 10 Start Menu or Taskbar and
"change directory" (`cd`) to your `demo1` directory. ... or ...

Or try this simpler way: In the FileExplorer, with the `demo1` directory opened,
left-mouse-click on the right empty part of the Address Bar at the top, and type
`cmd`

and tap the Enter keyboard key, and a black-background Command Prompt window with `demo1` as
the current directory should pop up.

Maybe hold the Windows keyboard key (bottom left) down and tap the keyboard up arrow key (bottom
right) to maximize the size of that focused Command Prompt window. Or perhaps
double-left-mouse-click on the window’s title bar at the top.

On my screen, the Command Prompt window letters are too small. I right-mouse-click on the window
title bar at the top, choose "Properties", and under the "Font" tab, I set "Size" to 20 and click the "OK"
button at the bottom.

Into that Command Prompt window, type

```
DIR
```

(and tap the Enter keyboard key) to see a listing of files.

Probably no files yet, except the normal `"."` and `".."` directories:

The `"."` directory is the current directory, where you are standing.

The `".."` directory contains the current directory. The `".."` directory is above where you are standing.

Into that Command Prompt window, type

```
HELP
```

to see a listing of Command Prompt commands.

It is a long list, use your mouse wheel to scroll up and down.

Into that Command Prompt window, type

```
HELP DIR
```

to see a help screen for the `DIR` command.

Now you are getting dangerous.

Enter this Python command,

```
py --version
```

I see this error,

'py' is not recognized as an internal or external command, operable program or batch file.

So, I need to install Python (at least Python 3.6). I choose

<https://www.python.org/downloads/>

I had trouble completely installing with the current Python 3.11.0 (details far below).

On that web page, two paragraphs down, on the Python 3.10.8 line, I left-mouse-click on "Download".

On the next web page,

<https://www.python.org/downloads/release/python-3108/>

near the bottom, I left-mouse-click on "Windows installer (64-bit)".

I run the `python-3.10.8-amd64.exe` file now in my Downloads directory.

On the first installation screen, I put a check mark at the front of this line,

Add python.exe to PATH

Then I left-mouse-click this line,

Customize installation

On the Optional Features screen, I leave all checked and left-mouse-click the Next button.

On the Advanced Options screen, I put a check mark at the front of these 2 lines,

Install Python 3.10 for all users

Precompile standard library

I left-mouse-click the Install button and continue the installation.

I eventually see a screen starting with a "Setup was successful" message.

Near the bottom, if you see a "Disable path length limit" message, left-mouse-click it.

It allows more directories for your many Windows10 applications, like Python.

That Python installation changed the PATH system environment variable, so I close the Command Prompt window (left-mouse-click the "X" at the extreme top right).

Like before, I open a Command Prompt window with `demo1` as the current directory.

Now when I enter the command,

```
py --version
```

I see Python version "3.10.8".

Good, Python3 is working.

Python3 has many commands, but more are available from modules (libraries) that can be downloaded with pip, the "Pip Installs Packages" or "Pip Installs Python" or "Preferred Installer Program" software. The ezRA programs can tell us which of those additional modules are needed.

Enter the command,

```
pip --version
```

I see "pip 22.2.2 from C:\Program Files\Python310\lib\site-packages\pip (python 3.10)".

Good, pip is also working.

I now try to run an ezRA Python program.

Standing in the `demo1` directory, I enter the command,

```
py ..\ezRA\ezCon.py
```

On Windows, capitalization should not matter.

There may an anxious delay as the PC gathers the necessary software parts.

If it all works, it should eventually print a bunch of ezCon usage help text on the screen.

But I see an error message, ending with

```
ModuleNotFoundError: No module named 'seaborn'
```

I need to load the 'seaborn' module (a Python library of plotting code).

A Google.com search of that error message text suggests

```
error-importing-seaborn-module-in-python,
```

<https://stackoverflow.com/questions/28828917>

that says, in that Command Prompt window, I should enter the command

```
pip install seaborn
```

If no success, that same page suggests entering the command

```
py -m pip install seaborn
```

“Seaborn” is large and brings several needed modules with it.

Similar commands for ezCon, ezSky, and ezGal would say 2 additional modules are needed.

One at a time, I enter the commands,

```
pip install astropy
```

```
pip install scipy
```

Now when I again enter that command,

```
py ..\ezRA\ezCon.py
```

I see a difficult error ending with

```
from matplotlib._path import (  
  ImportError: DLL load failed while importing _path: The specified module  
  could not be found.
```

My Windows10 is a 64-bit operating system, so I eventually downloaded

Microsoft Visual C++ Redistributable packages for Visual Studio 2015, 2017, 2019, and 2022

<https://learn.microsoft.com/en-us/cpp/windows/latest-supported-vc-redist?view=msvc-170>

https://aka.ms/vs/17/release/vc_redist.x64.exe

I run the 25 MB `VC_redist.x64.exe` file now in my Downloads directory.

It says it is the "Microsoft Visual C++ 2015-2022 Redistributable (x64) - 14.32.31332".

Now when I again enter that command,

```
py ..\ezRA\ezCon.py
```

it runs without error, but because no data filenames were provided, ezCon prints out its help page, ending with a free advertisement:

```
The Society of Amateur Radio Astronomers (SARA)  
radio-astronomy.org
```

Same for similar ezPlot, ezSky, and ezGal commands.

Success !

If you do not need the ezCol program to create .txt data files, your ezRA installation is complete.

ezCol Needs More Installation

The ezCol program collects radio signals into ezRA .txt data files. You may already have radio data, and you may not need to install the ezCol program.

ezCol needs an additional Python3 module and a lower level library to control the SDR radio, and perhaps even more software to control a USB relay.

This requires more installation.

Similar to above, enter this command in the terminal window,

```
pip install pyrtlsdr
```

If you care, this higher level module comes from

<https://github.com/pyrtlsdr/pyrtlsdr>

That module calls this lower level library.

I open a web browser (like Edge or Firefox or Chrome) to

<https://github.com/librtlsdr/librtlsdr>

To the right of the top right Green button, I see an “About” section.

Below that, I see a “Releases” section.

I left-mouse-click on the “Latest” release. For me, that is “librtlsdr v0.8”.

A new web page appears, with a list of blue file links.

My Windows10 is a 64-bit operating system, so I look for a filename with “w64”.

I do not want a STATICally-linked library, I want a Dynamic-Link Library .DLL file, so I look for a filename with “w64_dll”.

I do not want a User Datagram Protocol UDP-Server, so I avoid the filenames with “_udpsrv”.

I choose the “rtlsdr-bin-w64_dlldep.zip” file, and I left-mouse-click that filename’s link.

A file arrives in my Downloads directory, as

rtlsdr-bin-w64_dlldep.zip

Inside that .zip file is a librtlsdr.dll file.

That higher level module page,

<https://github.com/pyrtlsdr/pyrtlsdr>

says to copy that librtlsdr.dll file to somewhere in your system path (a list of directories).

To display your system path, in the Command Prompt window, enter the command,

```
ECHO %path%
```

Since I just installed Python3.10, I see a long line of directories starting with

C:\Program Files\Python310\Scripts\;C:\Program Files\Python310\; ...

I will use the second directory,

C:\Program Files\Python310\

No need to unzip that rtlsdr-bin-w64_dlldep.zip file, I just double-left-mouse-click on that file in the Downloads directory, and I copy only the librtlsdr.dll file, and paste it into my

C:\Program Files\Python310\

directory.

In the same way, another source of a lower level library (librtlsdr.dll and libusb-1.0.dll files) is available

<https://gitea.osmocom.org/sdr/rtl-sdr>

<https://osmocom.org/projects/rtl-sdr/wiki>

from

<https://downloads.osmocom.org/binaries/windows/rtl-sdr/>

<https://ftp.osmocom.org/binaries/windows/rtl-sdr/>

Those .zip filenames include a YYYYMMDD date.

Here, I would have chosen the latest filename with “64bit”, for me, the very bottom file link,
rtl-sdr-64bit-20221106.zip

The ezCol program will create files, so collect them in that new demo1 directory.

From above, I still have a Command Prompt window with demo1 as the current directory.

Trying ezCol, with no USB receiver plugged in, I enter this command,

```
py ../ezRA/ezCol.py
```

I see an error message with the last line ending with

```
Could not open SDR (device index = 0)
```

Good.

The upper and lower libraries were found, but the lower library can not find the USB RTLSDR receiver hardware.

With no receiver plugged in, that is understandable.

Plug one USB SDR receiver into the PC.

The USB SDR receiver I used was either the

Nooelec NESDR SMARt v4 SDR

<https://www.nooelec.com/store/sdr/sdr-receivers/nesdr-smart-sdr.html>

or the version with the bias-tee voltage output,

Nooelec NESDR SMARtTee v2 SDR,

<https://www.nooelec.com/store/sdr/sdr-receivers/nesdr-smartee-sdr.html>

Trying ezCol again, with one receiver plugged in, I enter this command,

```
py ../ezRA/ezCol.py
```

and again, I see an error message with the last line ending with
Could not open SDR (device index = 0)

Windows10 is likely using the wrong USB hardware driver.

Following the lead from the `install-rtlsdr.bat` file inside the `sdrsharp-x86.zip` Airspy SDR# receiver software,

<https://airspy.com/download/>

pointing to the Zadig 2.4 release on

<https://github.com/pbatard/libwidi/releases>

I download

<https://github.com/pbatard/libwidi/releases/download/b721/zadig-2.4.exe>

A file arrives in my Downloads directory, as

zadig-2.4.exe

Following the Zadig instructions,

<https://www.rtl-sdr.com/getting-the-rtl-sdr-to-work-on-windows-10/>

SPECIFICALLY steps 6 through 11 on

<https://www.rtl-sdr.com/rtl-sdr-quick-start-guide/>

I change the driver for the

Bulk-In, Interface (Interface 0)

from

(NONE)

to

WinUSB (v6.1.7600.16385)

while my USB ID displayed says

0BDA 2838 00

by left-mouse-clicking the big button, saying "Install Driver".

Trying ezCol again, with one receiver plugged in, I enter this command,

```
py ../ezRA/ezCol.py
```

This time I see

Found Rafael Micro R820T/2 tuner

and more ezCol text.

Eventually a large "Figure 1" graphics window pops up.

Success !

When ready, stop the ezCol program by tapping

ctrl-C

on the keyboard, a couple of times, into the running Command Prompt window.

EzCol will create a `data` directory if needed.

I see one or more new .txt data files in that `data` directory, with this command,

```
DIR data
```

For testing, try carefully inserting an simple open straightened metal paper clip into only the center contact of the receiver input coax connector, and record the USA FM broadcast band centered on 100 MHz, with the command,

```
py ../ezRA/ezCol.py -ezColCenterFreqAnt 100
```

I see the spectra of local FM radio stations signals slowly bounce up and down. This proves many things are working: the ezCol program, PC, USB, SDR radio, and even the paper clip antenna. But with this FM radio data, I am not quite sure what to look for in the ezRA analysis plots.

ezCol With A USB Relay Needs Even More Installation

The ezCol program can control an HID (Human Interface Device) USB Relay, to control a source of Reference Samples.

I open a web browser (like Edge or Firefox or Chrome) to

https://github.com/pavel-a/usb-relay-hid/releases/tag/usb-relay-lib_v2.1

In the file list near the bottom, I left-mouse-click on

usb-relay-hid_bin-20150330a.zip

A file arrives in my Downloads directory, as

usb-relay-hid_bin-20150330a.zip

Just like above, no need to unzip that usb-relay-hid_bin-20150330a.zip file, I just double-left-mouse-click on that Downloads file,

usb-relay-hid_bin-20150330a.zip

and because my Windows10 is a 64-bit operating system, I double-left-mouse-click

the bin-Win64 directory, and I copy only

the hidusb-relay-cmd.exe file, and paste it into my

C:\Program Files\Python310\

directory.

From above, I still have a Command Prompt window with demo1 as the current directory.

With a simple single SPDT USB Relay plugged in, I enter this command,

```
hidusb-relay-cmd.exe on 1
```

and I hear the relay click on, illuminating an LED on the USB Relay.

I enter this command,

```
hidusb-relay-cmd.exe off 1
```

and I hear the relay click off, darkening the LED on the USB Relay.

I enter this command,

```
py ../ezRA/ezCol.py -ezColUsbRelay 1
```

Eventually a large org.matplotlib.Matplotlib3 graphics window pops up.

The USB relay slowly clicks on or off with each sample, illuminating and darkening the LED.

Success !

When ready, stop the ezCol program by tapping

ctrl-C

on the keyboard, a couple of times, into the running Command Prompt window.

The ezCol program may assume a double SPDT USB Relay, and so it may execute 2 commands,

```
hidusb-relay-cmd.exe on 1
```

```
hidusb-relay-cmd.exe on 2
```

See the related ezRA_11_Hardware_2.pdf documentation.

Current Trouble Installing Python 3.11

```
#####  
#####  
#####  
#####  
#####  
#####  
#####  
#####  
#####  
#####  
#####  
#####
```

Here is where I explain my installation error messages and my learnings.

blah, blah, blah