

PicoIRIS v1.1

User manual

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Contents

1	PicoIRIS	2
1.1	Specifications	2
1.2	Features	3
1.3	I/O pins and selection switches	4
2	Getting Started	5
2.1	Powering the Device	5
2.2	Connecting to PC/Laptop with Windows	5
2.2.1	Bluetooth pairing	6
2.2.2	Downloading PicoIRIS-GUI software	8
2.2.3	Safety undertaking	8
2.2.4	Connecting to PicoIRIS	9
2.3	Connecting to PC/Laptop with Ubuntu	9
2.3.1	Bluetooth pairing	9
2.3.1.1	On Ubuntu 21.04 or higher	9
2.3.1.2	On Ubuntu 16.04 or higher	11
2.3.2	Downloading PicoIRIS-GUI software	13
2.3.3	Safety undertaking	14
2.3.4	Connecting to PicoIRIS	14
3	Known issues	16
4	To be implemented	17

PicoIRIS

PicoIRIS is a PC based device which combines the following into a single compact affordable system for engineering students.

1. Function generator
2. Oscilloscope and
3. Power supply

1.1 Specifications

Table 1.1: Specifications of PicoIRIS v1.1

Feature/parameter	Specification
Oscilloscope	
Input frequency range	1 Hz - 200 kHz
Input voltage range	± 10 V (max.)
No. of input channels	2 single-ended channels
Input impedance	$1M\Omega$ (min.)
Function generator	
Output frequency range	1 Hz - 200 kHz
Output voltage range	± 10 V (max.)
Output functions	Sine, square, triangular
No. of output channels	2 channels
Power supply	
Power source	5V (2A or higher) charger
Power connector	USB-C / USB Micro-B
Output voltage options	+12V, -12V, +5V, +3.3V
Output current (each)	100 mA (max.)
Variable DC output	-10V to +10V (40mA max.)
OS Requirements	
Windows	10 and 11
Ubuntu	16.04 and above
macOS	not supported (to be implemented)

1.2 Features

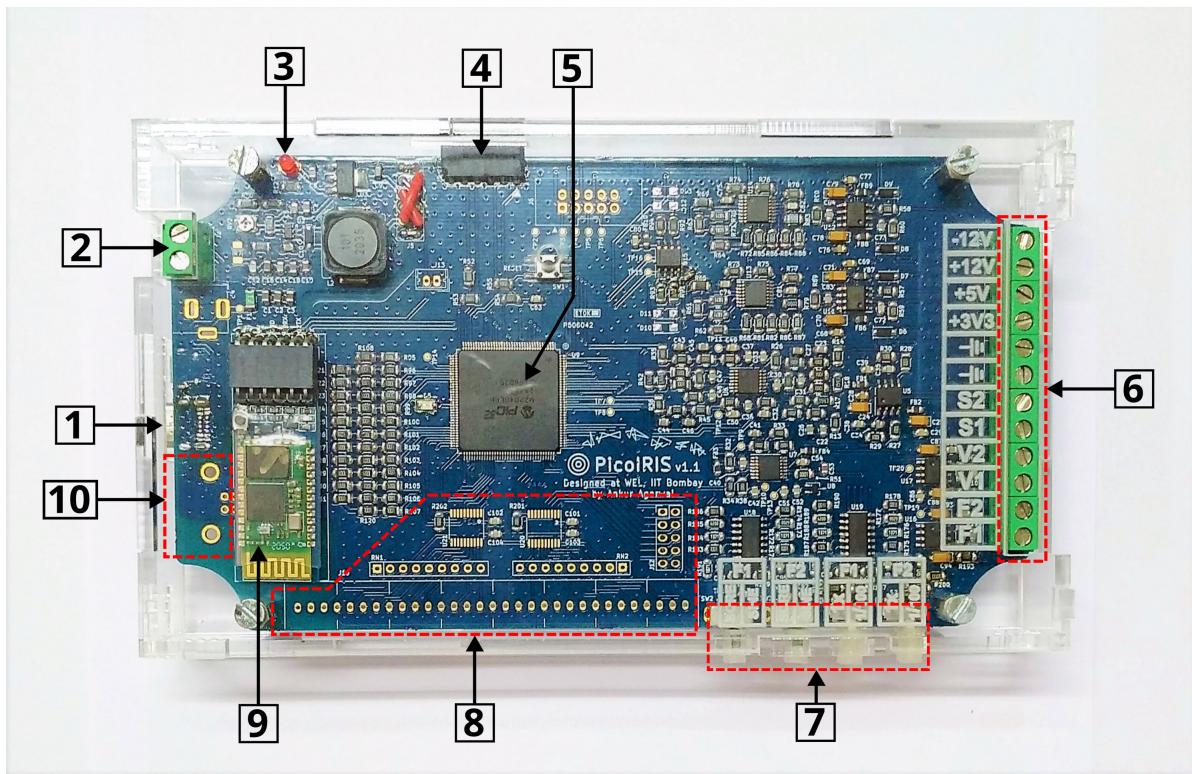


Figure 1.1: Photo of PicoIRIS with parts marked

1. USB-C or USB Micro-B connectors for power input only
2. External stable 5V power input terminals (Refer section 2.1)
3. Power indicator LED
4. ICSP interface to update firmware of PicoIRIS
5. PIC32MZ microcontroller
6. Power output and signal I/O terminals
7. Selection switches for function generator channels
8. Digital I/O channels (to be implemented)
9. HC-05 Bluetooth module
10. USB data interface (to be implemented)

1.3 I/O pins and selection switches

Table 1.2: I/O pins of PicoIRIS v1.1

Pin name	Function
-12V	-12 V Power supply output
+12V	+12 V Power supply output
+5V	+5 V Power supply output
+3.3V	+3.3 V Power supply output
GND Symbol	Common power and signal ground
GND Symbol	Common power and signal ground
S2	2 nd single ended channel input of oscilloscope
S1	1 st single ended channel input of oscilloscope
V2	2 nd ±10V variable DC output
V1	1 st ±10V variable DC output
F2	2 nd channel output of function generator
F1	1 st channel output of function generator

Table 1.3: Selection switches of PicoIRIS v1.1

Channel	Function	Description
F1	SQRE	To be selected for square and triangular wave output
F1	SINE	To be selected for sine wave output
F2	SQRE	To be selected for square and triangular wave output
F2	SINE	To be selected for sine wave output
F1	1x	Normal 1x mode
F1	1/100	Attenuate the function generator signal by 100
F2	1x	Normal 1x mode
F2	1/100	Attenuate the function generator signal by 100

Getting Started

2.1 Powering the Device

PicoIRIS needs to be powered with a **mobile charger of 5V/2A or 5V/3A** power rating for full functionality. It can also be powered with other chargers/adapters of 5V/1A or lower current rating, but this will accordingly limit the current output of the device.

Note: Use good quality branded mobile chargers for best results. Power line noise or ripples, if any, will affect the quality of signals measured/generated.



Figure 2.1: Image of USB-C and USB Micro-B cables needed

Connect the 5V mobile charger with USB-C or USB Micro-B cable (refer Figure 2.1) to the '**Power Only**' **USB-C / USB Micro-B** port of the PicoIRIS device. Optionally, you could use 2-pin Screw Terminal to supply stable 5V power from a bench-top power supply.

Warning: Do not connect any of the 'Power only' ports to PC/Laptop or any other host devices. Connecting to these ports may damage your PC/Laptop or the host device by drawing more current.

2.2 Connecting to PC/Laptop with Windows

PicoIRIS's Bluetooth needs to be paired with the PC/Laptop before establishing connection. PicoIRIS's Bluetooth device-ID is 'PicoIRIS_Bxxx' and the PIN to pair is '1234'.

2.2.1 Bluetooth pairing

On system with Windows 10/11, click on Windows Start icon and search for ‘Bluetooth’. Select the ‘Bluetooth and other devices settings’ option from the results. (Refer Figure 2.2)

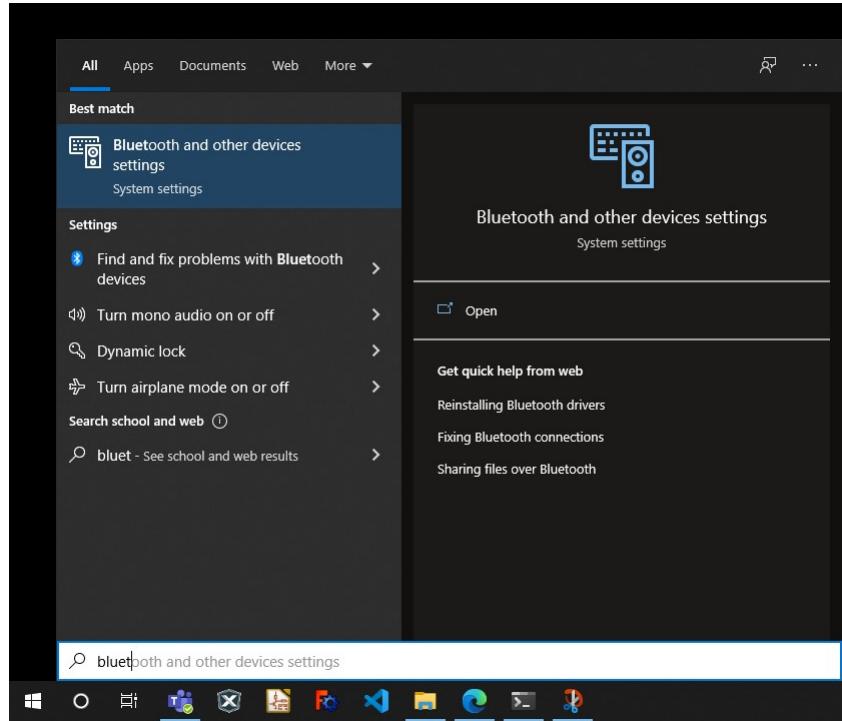


Figure 2.2: Screenshot of Bluetooth search

In the ‘Bluetooth & other devices’ settings window, select ‘Add Bluetooth or other devices’ option. (Refer Figure 2.3)

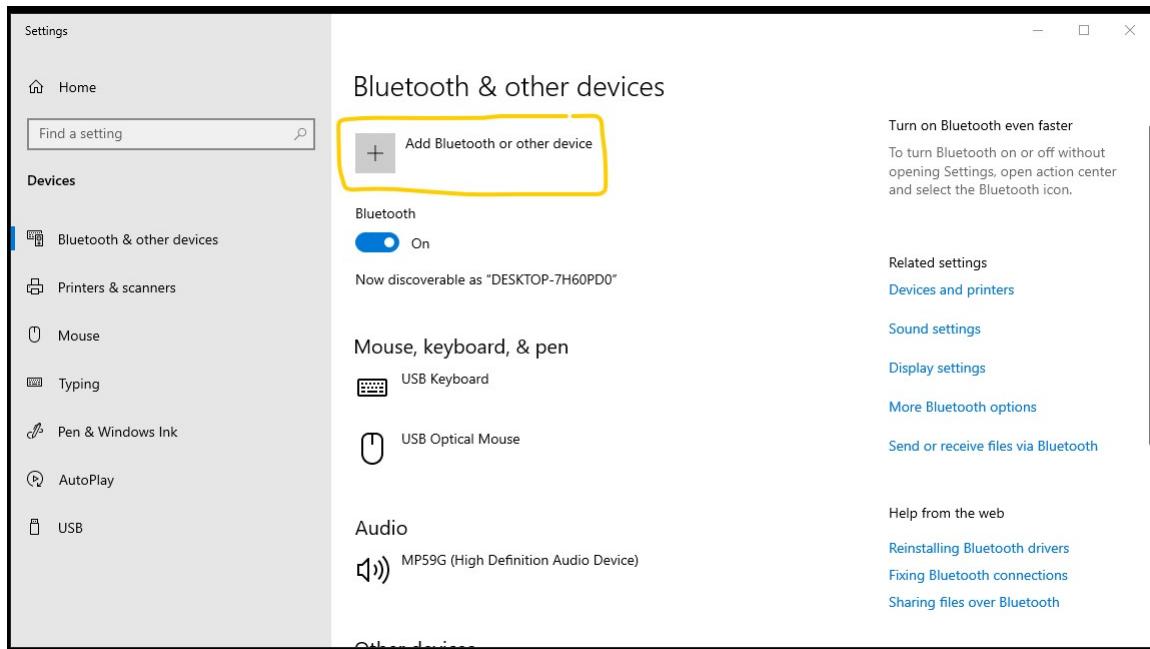


Figure 2.3: Screenshot of Bluetooth settings

In the ‘Add a device’ window, select ‘Bluetooth’. (Refer Figure 2.4)

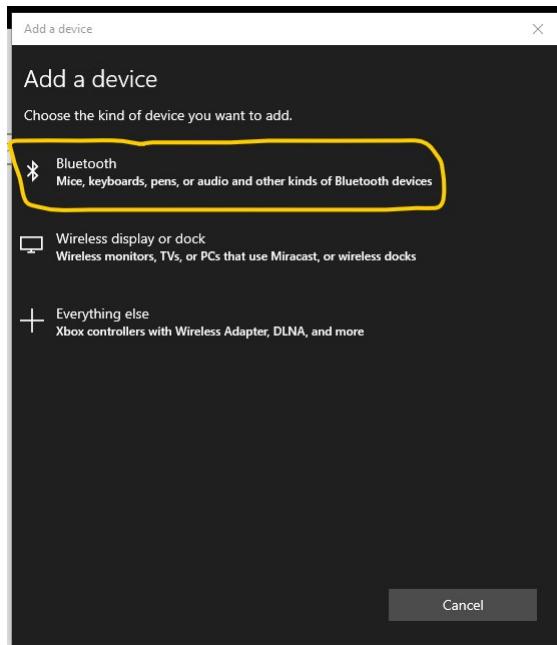


Figure 2.4: Screenshot of Add a device

After few seconds of searching, list of visible Bluetooth devices should appear.

Note: For the PicoIRIS's Device-ID to appear, PicoIRIS must be powered on.

PicoIRIS device should appear as **PicoIRIS-Bxxx**, where **xxx** denotes the corresponding device number. (Refer Figure 2.5)

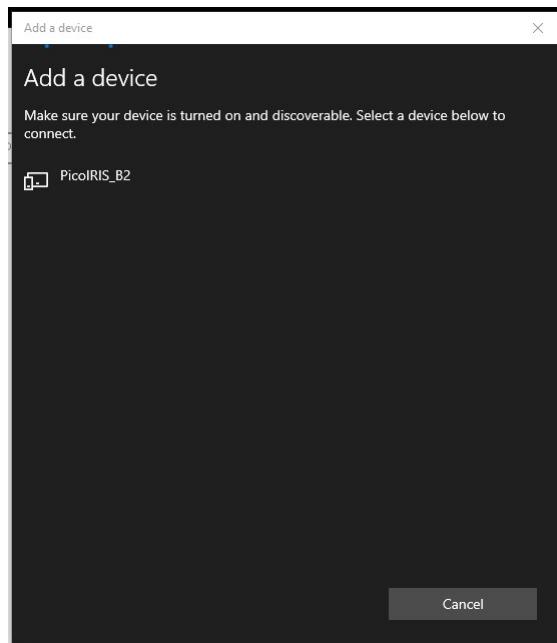


Figure 2.5: Screenshot of visible Bluetooth devices

Click on the PicoIRIS's Device-ID, enter the Bluetooth PIN corresponding to that device and select 'Connect' for pairing. By default the Bluetooth PIN is '1234'. (Refer Figure 2.6)

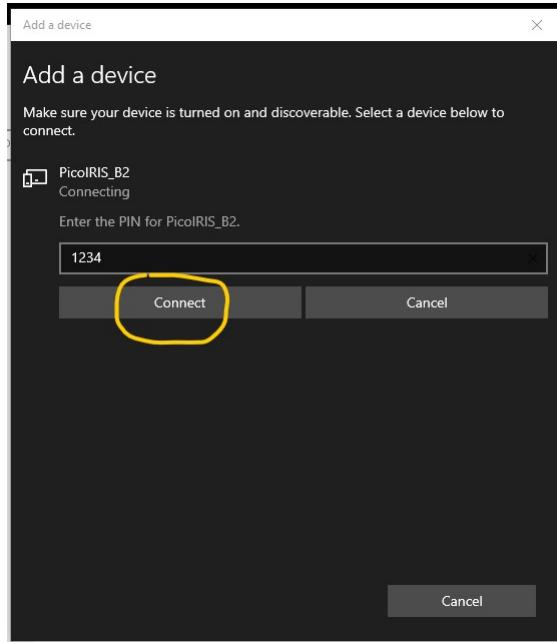


Figure 2.6: Screenshot of Bluetooth pairing

If all goes well, your PicoIRIS's Bluetooth should be paired with the PC/Laptop successfully.

2.2.2 Downloading PicoIRIS-GUI software

To use PicoIRIS, download the **PicoIRIS-GUI** software from the following link - <https://ankur-iitb.github.io/PicoIRIS-Manual/>. Under the 'Software' section, latest versions of the PicoIRIS-GUI software are available for both Windows and Ubuntu systems.

On a Windows 10/11 system, download the 'PicoIRIS-GUI-xxxxxx-windows-10.zip' file to your computer. Extract this zip file to your desired folder to get the 'PicoIRIS-GUI-xxxxxx-windows-10.exe' file. Double click this exe file to directly open the software. No installation is required.

Note: This software is not designed to work on Windows 7 or earlier versions, as they are obsolete. It may or may not work on these systems.

2.2.3 Safety undertaking



Figure 2.7: Screenshot of safety undertaking

Once the PicoIRIS-GUI software is opened, a ‘Safety Undertaking’ message pops-up. Please read the message carefully before you agree to use the device with care. In case you disagree to the safety undertaking, the software would close automatically. (Refer Figure 2.7)

Warning: PicoIRIS is a sensitive Test & Measurement electronic instrument. Please do not connect signals with voltages higher than 10 volt in either polarity. All signals, both input and output, are measured with respect to the device’s ‘GND’.

2.2.4 Connecting to PicoIRIS

Next step is to connect PicoIRIS-GUI with the PicoIRIS device. The process to connect is different between Windows and Ubuntu.

On a system with Windows 10/11, PicoIRIS devices are shown as COMxx ports. Clicking on ‘--Select device to connect--’ option, displays the list to devices available to connect. (Refer Figure 2.8)

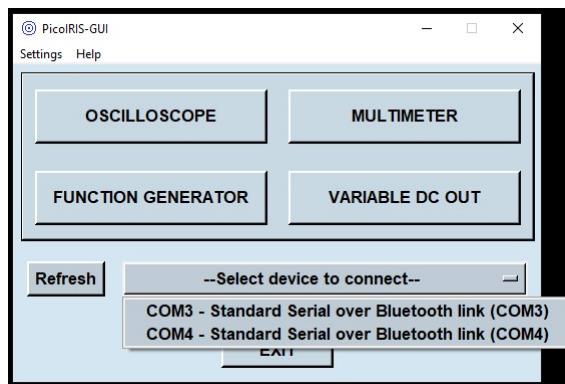


Figure 2.8: Screenshot of PicoIRIS-GUI with Bluetooth devices listed

PicoIRIS is listed as ‘COMx – Standard Serial over Bluetooth link’. As you can notice, there are two Bluetooth COM ports listed for each PicoIRIS device. Only one among the two COM ports is usable.

Note: Connecting to the wrong port hangs the software. You will have to close the PicoIRIS-GUI, restart it and connect to the other port.

This is a known issue of HC-05 Bluetooth hardware module on Windows. We have not been able to find a solution to this.

2.3 Connecting to PC/Laptop with Ubuntu

PicoIRIS’s Bluetooth needs to be paired with the PC/Laptop before establishing connection. PicoIRIS’s Bluetooth device-ID is ‘PicoIRIS_Bxxx’ and the PIN to pair is ‘1234’.

2.3.1 Bluetooth pairing

2.3.1.1 On Ubuntu 21.04 or higher

On system with Ubuntu 21.04 or higher, click on ‘Activities’ at the top left corner of the screen, and search for ‘Bluetooth’. (Refer Figure 2.9)

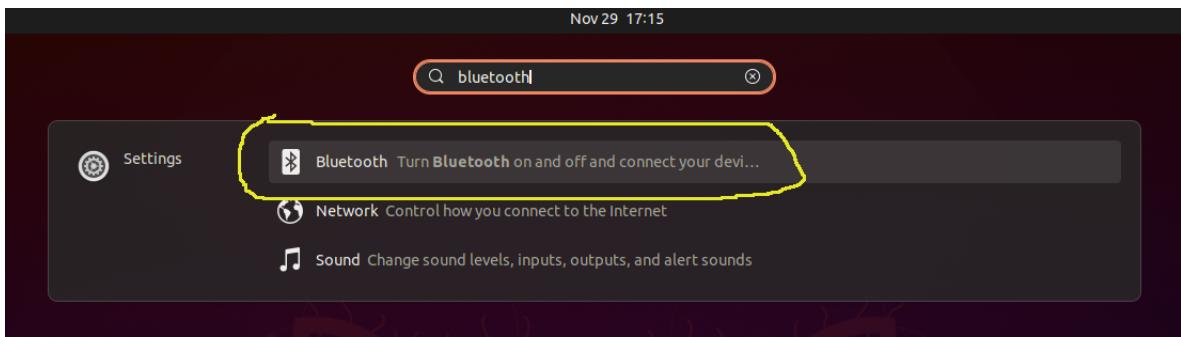


Figure 2.9: Screenshot of Ubuntu search

In the Bluetooth settings window, the PicoIRIS Device-ID should be visible. Remember to power on PicoIRIS device. (Refer Figure 2.10)

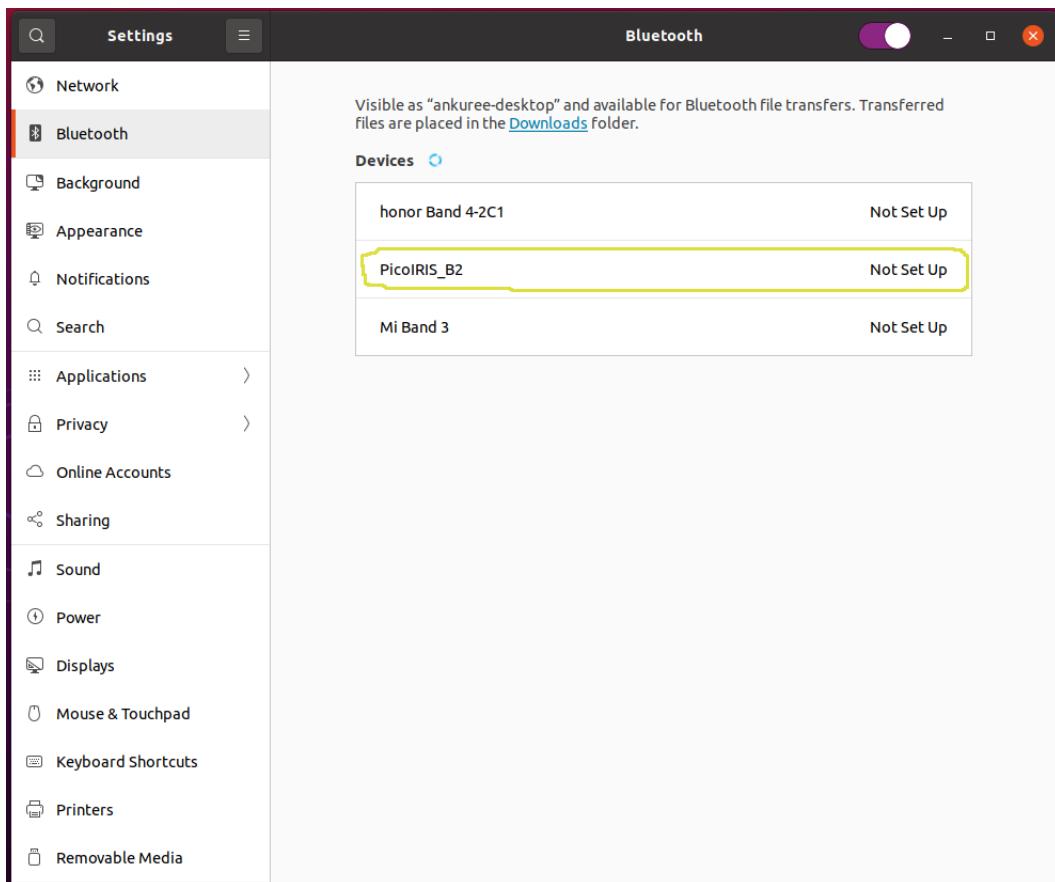


Figure 2.10: Screenshot of Bluetooth Settings

Click on 'PicoIRIS-Bxxx' where xxx is your device number, enter the Bluetooth PIN as prompted and select 'Confirm'. The default Bluetooth PIN is '1234'. (Refer Figure 2.11)



Figure 2.11: Screenshot of Bluetooth Setting's PIN prompt

If all goes well, PicoIRIS's Blueooth should be paired to your system successfully.

2.3.1.2 On Ubuntu 16.04 or higher

On system with Ubuntu 16.04 or higher, click on ‘Ubuntu Search’ icon at the top left of the screen and search for ‘bluetooth’. Open the ‘Bluetooth’ application that appears. (Refer Figure 2.12)



Figure 2.12: Screenshot of Bluetooth search

In the ‘Bluetooth Settings’ window, click on ‘+’ icon at the bottom to add a new device to the system. (Refer Figure 2.13)

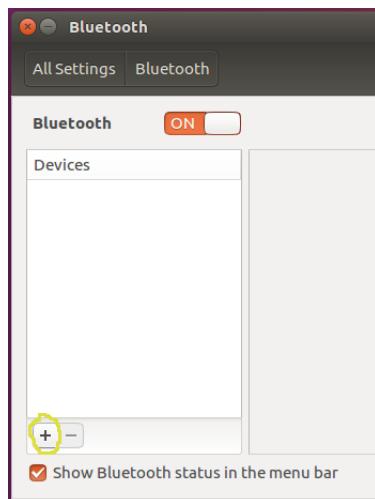


Figure 2.13: Screenshot of Bluetooth devices

In the ‘Device Search’ window, PicoIRIS’s Device-ID should be visible. Remember to power

on PicoIRIS device. Select ‘PicoIRIS-Bxxx’ where xxx is your device number and click on ‘PIN options...’ button below. (Refer Figure 2.14)

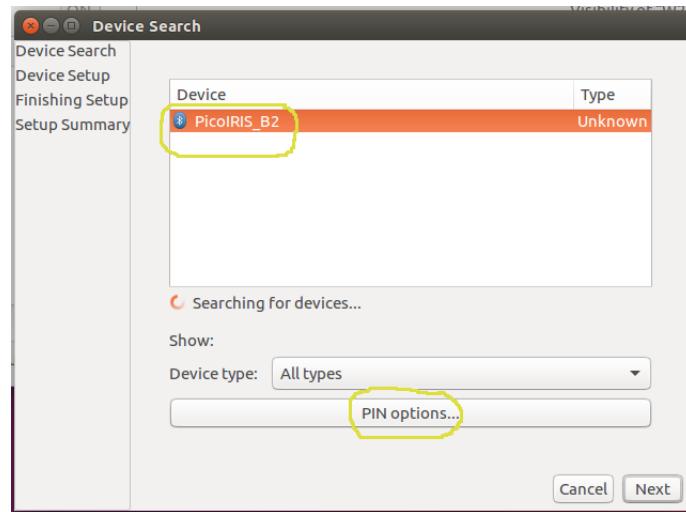


Figure 2.14: Screenshot of Bluetooth device search

In the ‘PIN Options’ window, select ‘Custom PIN’, enter the Bluetooth PIN mentioned on the PicoIRIS device and click ‘Close’. Default Bluetooth PIN is ‘1234’. (Refer Figure 2.15)

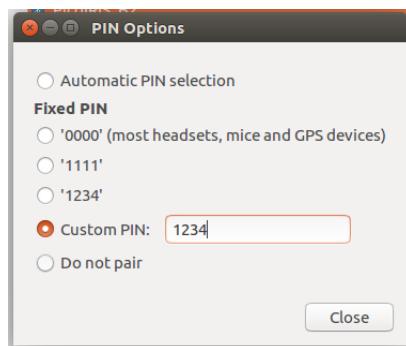


Figure 2.15: Screenshot of Bluetooth PIN options

Back in the ‘Device Search’ window, click ‘Next’. (Refer Figure 2.16)

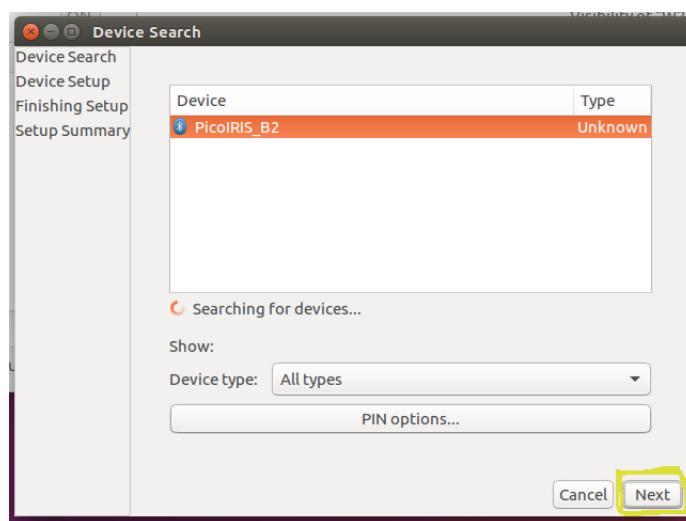


Figure 2.16: Screenshot of Bluetooth device search

If all goes well, PicoIRIS's Bluetooth should be successfully paired with the system.

2.3.2 Downloading PicoIRIS-GUI software

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- If you are on Ubuntu 21.04 or higher version, download the 'PicoIRIS-GUI-xxxxxx-ubuntu-21-04' file to the desired location on your computer.
- Else if you are on Ubuntu 16.04 or higher version, download the 'PicoIRIS-GUI-xxxxxx-ubuntu-16-04' file to the desired location on your computer.

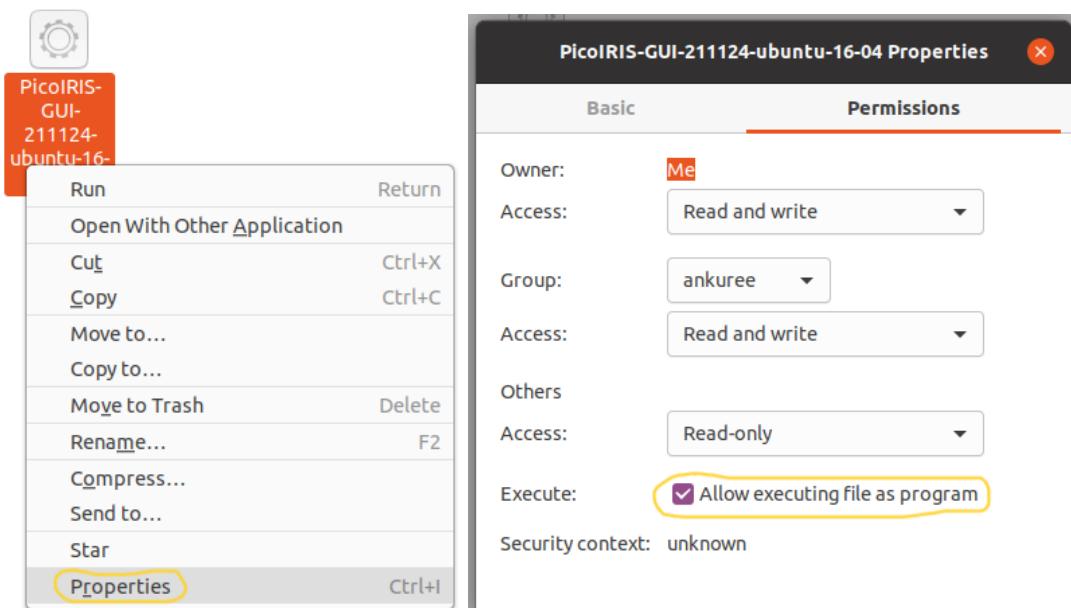


Figure 2.17: Screenshot of right-click menu and properties window

To run this software, go to folder where the software was downloaded. Right-click right click on the downloaded file, and go to 'Properties'. In the 'permissions' tab, check 'Allow executing file as program' option. It should be selected. (Refer Figure 2.17).

Now right-click on empty area and select 'Open Terminal' to open the default terminal window. Or else, open your desired Terminal application, and navigate to the directory of the downloaded software.

Note: On Ubuntu, this software requires `sudo` privilege to connect to the PicoIRIS device.

Enter the following command in the Terminal. Make sure to substitute 'xx' with the exact name of the file you downloaded.

```
sudo ./PicoIRIS-GUI-xxxxxx-ubuntu-xx-xx
```

Enter your password when prompted. After a few seconds delay, the PicoIRIS-GUI software should open.

2.3.3 Safety undertaking

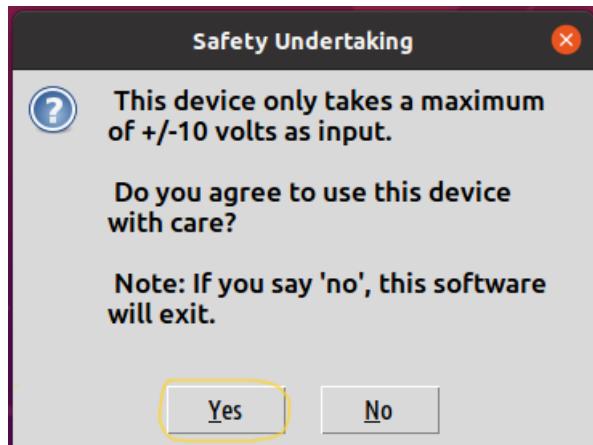


Figure 2.18: Screenshot of safety undertaking

Once the PicoIRIS-GUI software is opened, a ‘Safety Undertaking’ message pops-up. (Refer Figure 2.18). Please read the message carefully before you agree to use the device with care. In case you disagree to the safety undertaking, the software would close automatically.

Warning: PicoIRIS is a sensitive Test & Measurement electronic instrument. Please do not connect signals with voltages higher than 10 volt in either polarity. All signals, both input and output, are measured with respect to the device’s ‘GND’.

2.3.4 Connecting to PicoIRIS

Next step is to connect PicoIRIS-GUI with the PicoIRIS device. The process to connect is different between Windows and Ubuntu.

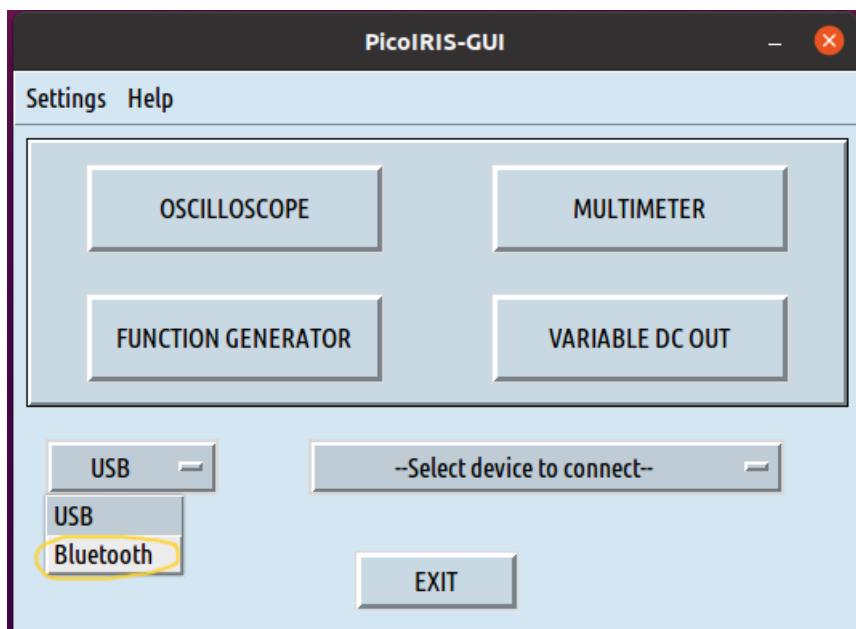


Figure 2.19: Screenshot of PicoIRIS-GUI on ubuntu

On a system with Ubuntu, the method in which Bluetooth devices get connected is different from that of USB devices. Because of this, you will have to first select the type of connection, ‘USB’ or ‘Bluetooth’ in the option. (Refer Figure 2.19).

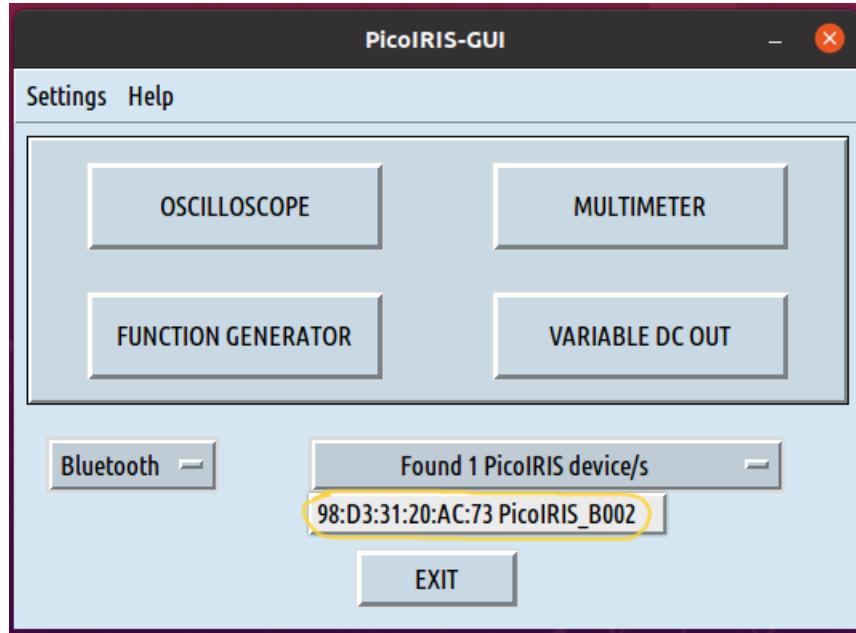


Figure 2.20: Screenshot of PicoIRIS-GUI on ubuntu

The software then scans for the available devices and updates the list. You can then select the particular device you want to connect to. (Refer Figure 2.20). If all goes well, PicoIRIS will be connected.

Known issues

1. 100 kHz, 100 mV noise may be visible on oscilloscope channel traces on GUI
2. DC offset upto 150 mV may be visible on oscilloscope channel traces on GUI
3. Output of variable DC channels may have an offset upto 150 mV.
4. ‘Multimeter’ option shown on GUI is not implemented. It will be replaced by ‘Digital I/O’ part in the next version.
5. While PicoIRIS is connected with PicoIRIS-GUI, if the oscilloscope window is closed and reopened, the signal is still visible while the channel is off.
6. In function generator window, ‘Off’ button does not work.

To be implemented

1. Provision for Digital I/O section is available on PCB but needs to be implemented on software.
2. Provision for USB based data transfer is available on PCB but needs to be implemented on firmware.
3. Support for macOS based PC/laptops needs to be implemented.

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