



HAT REFERENCE GUIDE

VIA AI Transforma Model 1

Enviro+ Air Quality HAT



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Revision History

Version	Date	Remarks
1.00	22/11/2024	Initial release

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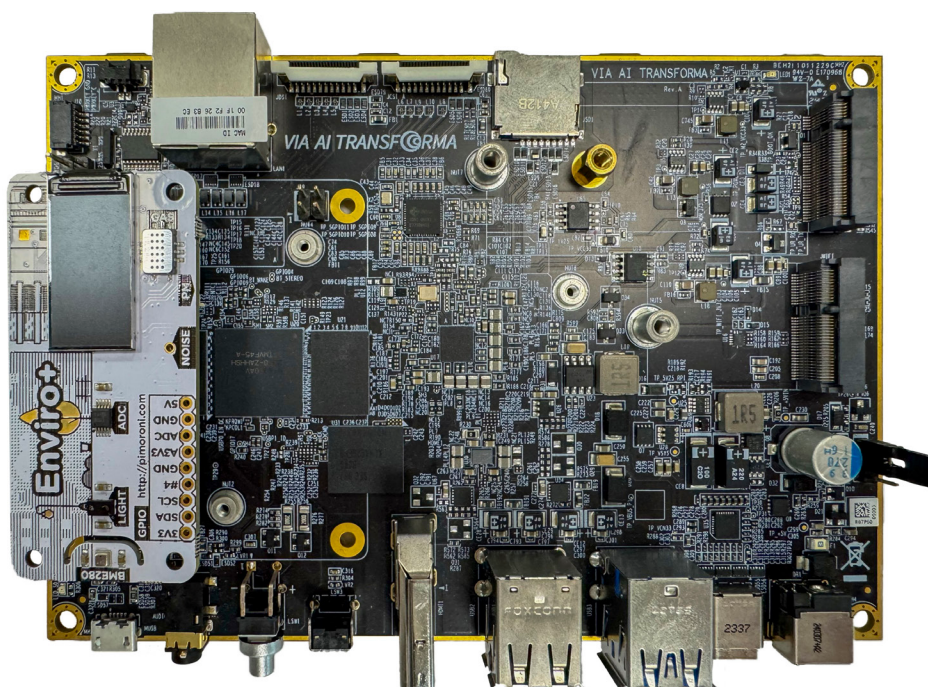
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1. Introduction

The Enviro+ Air Quality HAT is a sensor for environmental monitoring and lets you measure air quality (pollutant gases and particulates), temperature, pressure, humidity, light, and noise levels. This guide explains how to install the necessary libraries, setup proper configurations and settings to have the Enviro+ Air Quality HAT work on the VIA AI Transforma Model 1 board.

1.1 Install and Setup the HAT

Mount the Enviro+ Air Quality HAT to the 40-pin headers on the VIA AI Transforma Model 1 board, making sure that the board is powered off and the pins are properly aligned when stacking the Enviro+ Air Quality HAT.



1.2 Download and Install Libraries

Before running Enviro+ Air Quality HAT examples on the VIA AI Transforma Model 1 board, users must download and install the necessary libraries and reference code.

1.2.1 Install Libraries

Install the required packages on VIA AI Transforma board with the following commands:

```
# Download necessary libraries
debian@transforma:~$ sudo apt-get install libportaudio2
debian@transforma:~$ sudo pip3 install enviropius --break-system-packages
```

1.2.2 Download Source Code

Download the source code from <https://github.com/pimoroni/enviroplus-python> with the following commands:

```
# Download enviroplus sample codes
debian@transforma:~$ sudo apt-get install git
debian@transforma:~$ git clone https://github.com/pimoroni/enviroplus-python
```

Since the Enviro+ Air Quality HAT was designed for Raspberry Pi, some modifications are required to run the example codes on VIA AI Transforma Model 1 board:

Modify “/usr/local/lib/python3.11/dist-packages/ads1015/_init_.py” as below:

```
Add after Line 7:
from i2cdevice.adapter import Adapter, LookupAdapter
from smbus2 import SMBus

Modify Line 76:
def __init__(self, i2c_addr=I2C_ADDRESS_DEFAULT, alert_pin=None, i2c_dev=None):
--->
def __init__( self, i2c_addr=I2C_ADDRESS_DEFAULT, alert_pin=None, i2c_dev=SMBus(2)):
```

Modify “/usr/local/lib/python3.11/dist-packages/bme280/_init_.py” as below:

```
Add after Line 7:
from i2cdevice.adapter import Adapter, LookupAdapter
from smbus2 import SMBus

Modify Line 125:
self._i2c_dev = i2c_dev
--->
Self._i2c_dev = SMBus(2)
```

Modify “/usr/local/lib/python3.11/dist-packages/enviroplus/gas.py” as below:

```
Replace Line 7 and remove Lines 8 and 13
import gpio
import gpiod
import gpioddevice
from gpiod.line import Direction, Value

MICS6814_GAIN = 6.144

OUTH = gpiod.LineSettings(direction=Direction.OUTPUT, output_value=Value.ACTIVE)
--->
from periphery import GPIO
from gpiod.line import Direction, Value

MICS6814_GAIN = 6.144

Replace Line 64 with:
_heater = gpioddevice.get_pin("GPIO24", "EnviroPlus", OUTH)
--->
gpio_out = GPIO("/dev/gpiochip0", 40, "out") # GPIO40
gpio_out.write(True)
gpio_out.close()
Replace Lines 89,90,91,92 with:
def cleanup():
    if _heater is None:
        return
    lines, offset = _heater
    lines.set_value(offset, Value, INACTIVE)
--->
def cleanup():
    gpio_out = GPIO("/dev/gpiochip0", 40, "out") #GPIO40
    gpio_out.write(False)
    gpio_out.close()
```

Modify “/usr/local/lib/python3.11/dist-packages/enviopluse/noise.py” as below:

```
Modify Line 80:
device="adau7002",
--->
device="hw:0,8",
```

Modify “/usr/local/lib/python3.11/dist-packages/ltr559/_init_.py” as below:

```
Add after Line 5:
from i2cdevice.adapter import Adapter, LookupAdapter, U16ByteSwapAdapter
from smbus2 import SMBus

Modify Line 34:
class LTR559:
def __init__(self, i2c_dev=None, enable_interrupts=False, interrupt_pin_polarity=1,
timeout=5.0):
--->
class LTR559:
def __init__(self, i2c_dev=SMBus(2), enable_interrupts=False, interrupt_pin_polarity=1,
timeout=5.0):
```

Modify “/usr/local/lib/python3.11/dist-packages/pms5003/_init_.py” as below:

```
Remove Lines 4, 5 and replace Line 7 with:
import gpiod
import gpiodevice
import serial
from gpiod.line import Direction, Value
--->
import serial
from periphery import GPIO

Remove Lines 12,13:
OUTL = gpiod.LineSettings(direction=Direction.OUTPUT, output_value=Value.INACTIVE)
OUTH = gpiod.LineSettings(direction=Direction.OUTPUT, output_value=Value.ACTIVE)
PLATFORMS = {
"Radxa ROCK 5B": {"enable": ("PIN_15", OUTH), "reset": ("PIN_13", OUTL)},

Modify Line 90:
class PMS5003:
def __init__(self, device="/dev/ttyAMA0", baudrate=9600, pin_enable=None, pin_reset=None):
--->
class PMS5003:
def __init__(self, device="/dev/ttyS2", baudrate=9600, pin_enable=None, pin_reset=None):

Remove Lines 95,96,97:
gpiodevice.friendly_errors = True
self._pin_enable = gpiodevice.get_pin(pin_enable, "PMS5003_en", OUTH)
self._pin_reset = gpiodevice.get_pin(pin_reset, "PMS5003_rst", OUTL)
Replace lines 114 - 118:
time.sleep(0.1)
self.set_pin(self._pin_reset, False)
self._serial.flushInput()
time.sleep(0.1)
self.set_pin(self._pin_reset, True)
--->
gpio_out = GPIO("/dev/gpiochip0", 37, "out") #GPIO37
gpio_out.write(False)
time.sleep(0.1)
self._serial.flushInput()
time.sleep(0.1)
gpio_out.write(True)
gpio_out.close()
```

Modify “/usr/local/lib/python3.11/dist-packages/st7735/_init_.py” as below:

```

Replace Lines 24-28:
import gpiod
import gpiodevice
import numpy as np
import spidev
from gpiod.line import Direction, Value
--->
import numpy as np
import spidev
import periphery

Replace Line 28:
OUTL = gpiod.LineSettings(direction=Direction.OUTPUT, output_value=Value.INACTIVE)

Modify Line 142:
self._spi = spidev.SpiDev(port, cs)
--->
self._spi = spidev.SpiDev(port, 0)

Add after Line 145:
self._cs = periphery.GPIO("/dev/gpiochip0", 90, "out")

Remove Line 165:
gpiodevice.friendly_errors = True

Modify Line 167:
# Set DC as output.
self._dc = gpiodevice.get_pin(dc, "st7735-dc", OUTL)
--->
# Set DC as output.
self._dc = periphery.GPIO("/dev/gpiochip0", 82, "out")
self._dc.write(False)

Modify Line 179:
if backlight is not None:
    self._bl = gpiodevice.get_pin(backlight, "st7735-bl", OUTL)
--->
if backlight is not None:
    self._bl = periphery.GPIO("/dev/gpiochip0", 28, "out")

Modify Lines 184,185:
def set_pin(self, pin, state):
    lines, offset = pin
    lines.set_value(offset, Value.ACTIVE if state else Value.INACTIVE)
--->
def set_pin(self, pin, state):
    if state != 0:
        pin.write(True)
    else:
        pin.write(False)

Add after Line 202:
self.set_pin(self._cs, False)

Add after Line 207:
self.set_pin(self._cs, True)

```

2. Examples

There are 18 examples under the “enviropius-python/examples” folder. Examples which require the BME280 humidity sensor device are not included.

```
debian@transforma:~$ cd enviropius-python/examples
debian@transforma:~/enviropius-python/examples$ ls -al
total 132
drwxr-xr-x 3 debian debian 4096 Jul 18 09:48 .
drwxr-xr-x 8 debian debian 4096 Jul 18 09:48 ..
-rwxr-xr-x 1 debian debian 512 Jul 18 09:48 adc.py
-rwxr-xr-x 1 debian debian 4674 Jul 18 09:48 all-in-one-enviro-mini.py
-rwxr-xr-x 1 debian debian 5301 Jul 18 09:48 all-in-one-no-pm.py
-rwxr-xr-x 1 debian debian 6535 Jul 18 09:48 all-in-one.py
-rwxr-xr-x 1 debian debian 11341 Jul 18 09:48 combined.py
-rwxr-xr-x 1 debian debian 1388 Jul 18 09:48 compensated-temperature.py
-rwxr-xr-x 1 debian debian 470 Jul 18 09:48 gas.py
drwxr-xr-x 2 debian debian 4096 Jul 18 09:48 icons
-rwxr-xr-x 1 debian debian 1404 Jul 18 09:48 lcd.py
-rwxr-xr-x 1 debian debian 689 Jul 18 09:48 light.py
-rwxr-xr-x 1 debian debian 7789 Jul 18 09:48 mqtt-all.py
-rwxr-xr-x 1 debian debian 1190 Jul 18 09:48 noise-amps-at-freqs.py
-rwxr-xr-x 1 debian debian 899 Jul 18 09:48 noise-profile.py
-rwxr-xr-x 1 debian debian 604 Jul 18 09:48 particulates.py
-rwxr-xr-x 1 debian debian 6944 Jul 18 09:48 sensorcommunity.py
-rw-r--r-- 1 debian debian 13434 Jul 18 09:48 sensorcommunity_combined.py
-rwxr-xr-x 1 debian debian 13209 Jul 18 09:48 weather-and-light.py
-rwxr-xr-x 1 debian debian 679 Jul 18 09:48 weather.py
```

2.1 Example 1: Output Text on the LCD Display

This example shows how to display text on the LCD display. Execute the following command and check the display.

```
debian@transforma:~$ cd enviropius-python/examples
debian@transforma:~/enviropius-python/examples $ sudo python3 lcd.py
2024-06-19 03:18:39.785 INFO      lcd.py - Hello, World! example on the 0.96" LCD.

Press Ctrl+C to exit!
```

The text “Hello, World” will be shown on the LCD display.



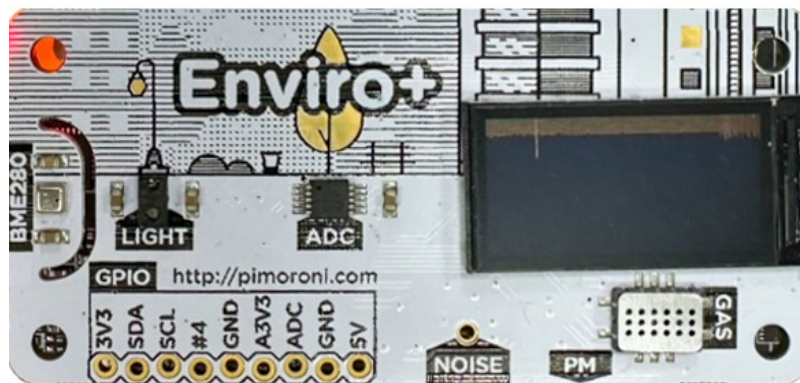
2.2 Example 2: Noise Profiling

This example shows how to read the ambient noise profile from the microphone and output the readings on the LCD display. Execute the following command and check the LCD Display:

```
debian@transforma:~$ cd enviroplus-python/examples
debian@transforma:~/enviroplus-python/examples $ sudo python3 noise-profile.py
noise-profile.py - Get a simple noise profile.
```

This example grabs a basic 3-bin noise profile of low, medium and high frequency noise, plotting the noise characteristics as coloured bars.

Press Ctrl+C to exit!



2.3 Example 3: Noise Frequency Profile

This example shows how to generate a three level noise frequency profile and output the readings on the LCD display. Execute the following command and check the display.

```
debian@transforma:~$ cd enviroplus-python/examples
debian@transforma:~/enviroplus-python/examples $ sudo python3 noise-amps-at-freqs.py
noise-amps-at-freqs.py - Measure amplitude from specific frequency bins
```

This example retrieves the median amplitude from 3 user-specified frequency ranges and plots them in Blue, Green and Red on the Enviro+ display.

As you play a continuous rising tone on your phone, you should notice peaks that correspond to the frequency entering each range.



2.4 Example 4: ADC Readings

This example shows how to read values from the ADC. Execute the following command to see the results:

```
debian@transforma:~$ cd enviroplus-python/examples
debian@transforma:~/enviroplus-python/examples $ sudo python3 adc.py
2024-11-14 08:26:06.260 INFO      adc.py - Print readings from the MICS6814 Gas sensor.
Press Ctrl+C to exit!

2024-11-14 08:26:06.471 INFO      Oxidising: 36414.44 Ohms
Reducing: 10281.10 Ohms
NH3: 207.58 Ohms
ADC: 00.56 Volts
```

2.5 Example 5: Gas Sensor Output

This example shows how to get the readings from the gas sensor. Execute the following command to see the results:

```
debian@transforma:~$ cd enviroplus-python/examples
debian@transforma:~/enviroplus-python/examples $ sudo python3 gas.py
2024-11-14 08:33:49.223 INFO      gas.py - Print readings from the MICS6814 Gas sensor.
Press Ctrl+C to exit!

2024-11-14 08:33:49.371 INFO      Oxidising: 12099.22 Ohms
Reducing: 86716.48 Ohms
NH3: 1282.34 Ohms
2024-11-14 08:33:50.408 INFO      Oxidising: 895.46 Ohms
Reducing: 120283.31 Ohms
NH3: 780.74 Ohms
```

2.6 Example 6: Light Sensor Output

This example shows how to get the readings from the light sensor. Execute the following command to see the results:

```
debian@transforma:~$ cd enviroplus-python/examples
debian@transforma:~/enviroplus-python/examples $ sudo python3 light.py
2024-11-14 08:35:46.357 INFO      light.py - Print readings from the LTR559 Light & Proximity
sensor.
Press Ctrl+C to exit!

2024-11-14 08:35:46.357 INFO      Light: 00.00 Lux
Proximity: 00.00
```

2.7 Example 7: Environment Readings

This example shows how to display the environment sensor readings. Execute the following command to see the results:

```
debian@transforma:~$ cd enviroplus-python/examples
debian@transforma:~/enviroplus-python/examples $ sudo python3 weather.py
Press Ctrl+C to exit!

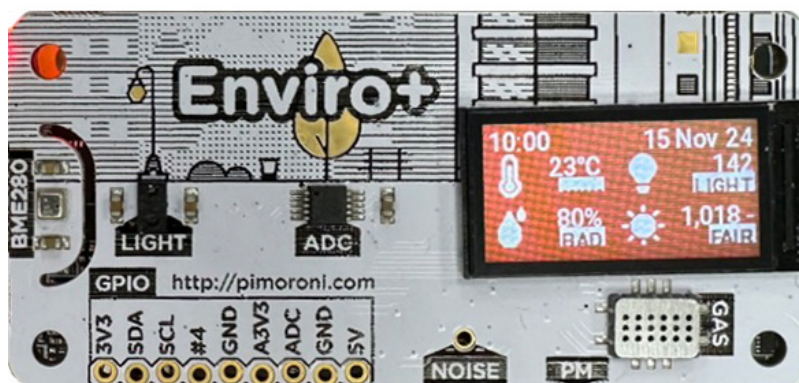
2024-11-14 08:53:12.991 INFO      Temperature: 25.07 °C
Pressure: 691.06 hPa
Relative humidity: 55.53 %
```

2.8 Example 8: Environment Profile on Display

This example shows how to display the environment profile on the LCD display. Execute the following command and check the LCD Display:

```
debian@transforma:~$ cd enviroplus-python/examples
debian@transforma:~/enviroplus-python/examples $ sudo python3 weather-and-light.py

Press Ctrl+C to exit!
```



3. References

Details of this HAT could be acquired from:

<https://learn.pimoroni.com/article/getting-started-with-enviro-plus#introduction>



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