MM7D Air quality measuring device

Technical manual

Hardware version: v200620
MM7D software version: v0.3
Technical manual version: v3.0
Issue date: 2021.03.11.
Drawing number: 59/12/1

Content

I. Hardware

1. Technical data

Supply voltage:	5 V DC SELV
Supply current:	max. 1 A
Isolation class:	Class III
Mechanical size:	71 x 71 x 27 mm
IP protection:	IP 20
Mass of cover:	termoplast (ABS)
Communication:	HTTP via Wireless LAN for get/set data
	TTL 3.3V serial port (console)

2. General description

This device can measure temperature and humidity of growing house air, and detect some unwanted gas (CO2, NH3, NOx, alcohol, benzene etc.) and smoke, and has got three different color status LED. The measured values can be queried and LEDs can be turn on and off via wireless network via HTTP. The device box contains only the temperature and humidity sensor, the gas sensor must be connected with a short cable.

3. Schematic and PCB drawings

The wiring diagrams of the device is shown in Annex 1, PCB drawings are in Annex 2-4. You can download it as part of the complete documentation or in separate PDF, SVG and KiCAD formats from the developer/manufacturer's website. The Gerber files needed for production are included in the package.

4. Other drawings and documents

Documentation package contents mechanical drawing of used box in PDF.

5. Terms of use

6. Look of unit

a) Manuals and connectors

1. POWER signal light (white LED)
2. ACT signal light (blue LED)
3. STATUS signal light (green LED)
4. STATUS signal light (yellow LED)
5. STATUS signal light (red LED)
6. Power supply connector (P1)
7. Console connector (P2)
8. Cable of external gas sensor

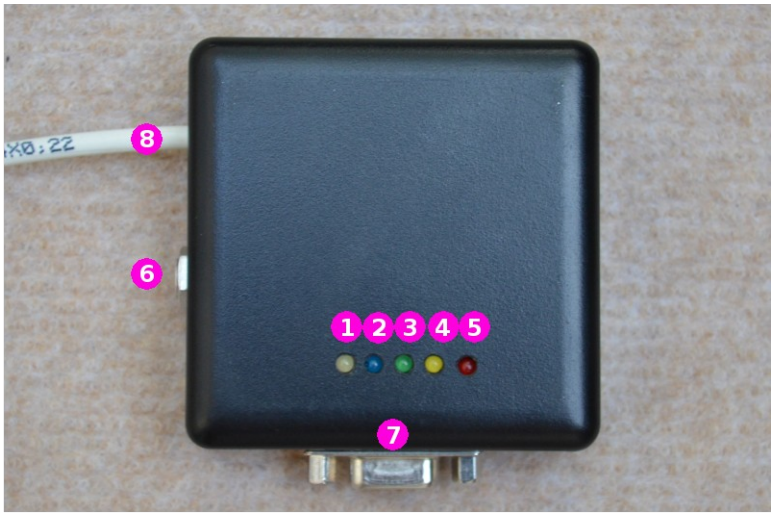


Figure 1: Manuals and connectors

b) Internal construction

1. Microcontroller (U101)
2. DHT11 sensor (U103)
3. Connector of external gas sensor (U102)
4. Cable of external gas sensor (U102)
5. Power voltage connector (P1)
6. Console connector (P2)

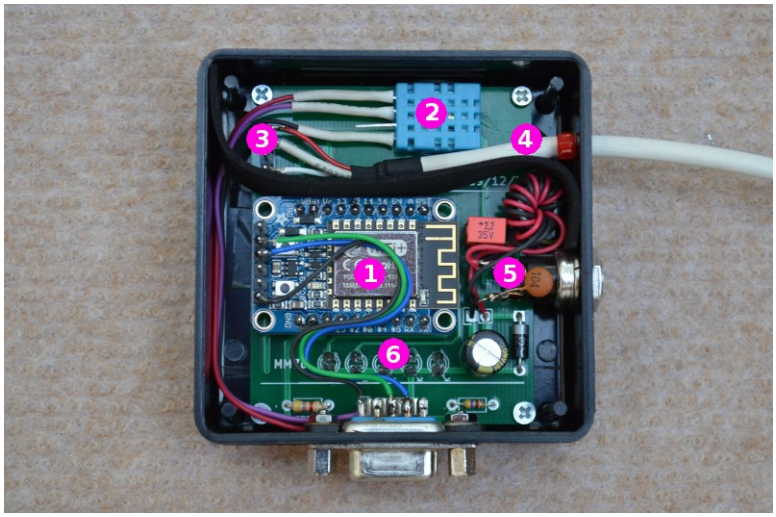


Figure 2: Internal construction

c) Pinout of connectors

connector	pin	function	note
P1	center	+ 5 V supply voltage input	ø 5.5/2.1 mm power connector
	shield	GND	
P2	2	serial port RXD	DB9F
	3	serial port TXD	
	5	GND	
U102	1	+5 V	
	2	GND	
	4	Analog data	

7. Downloadable documentation

The complete documentation of the hardware in the .tar.gz format compressed file can be downloaded from the manufacturer's website or Github. (Refer to Chapter III for references.) Name of package is: *mm7d-hw-200620-3.0.tar.gz.*

Content of package - only important files:

```
mm7d-hw
    ├──cad_files                                KiCAD files
    │       ├──mm7d                            documentation of PCB
    │       │       mm7d.pro                        project file
    │       │       mm7d.sch                        schematic drawing
    │       │       mm7d.kicad_pcb                  PCB drawing
    │       │       mm7d.drl                        drilling file
    │       │       mm7d-*.gbr                     Gerber files
    │       └──wiring                          internal wiring
    │               wiring.pro                      project file
    │               wiring.sch                      schematic drawing
    ├──documents                               documentation
    │       mm7d_en.pdf                            Technical manual
    │       pcb_*.pdf                              pcb drawings
    │       sch_*.pdf                              schematic drawings
    ├──pictures                                pictures
    │       mm7d.jpg                               look of the unit
    │       pcb_*.svg                              PCB drawings
    │       sch_*.svg                              schematic drawings
    │
    ├──LICENCE                                 terms of use
    └──README.md                               short description
```

II. Softwares

1. General description

The device measures three characteristics of the air, which can be queried remotely and it has got three status LED, which can be set remotely.

The program displays initialization steps and error messages on the serial console.

When an HTTP request is received, the client's IP address and username argument are checked. If appropriate, perform a measurement or turn the status LEDs on / off. After displays the result on the web interface. Incoming requests are indicated by the flashing of the blue activity LED.

2. Setup

Before installing the program, you need to set these values:

```
// settings
const char* wifi_ssid       = "";
const char* wifi_password   = "";
const String uid            = "";
const String allowedaddress = "";
```

3. Installation

Use a serial cable and Arduino IDE software to install program to microcontroller. Before installation procedure unpack required libraries from *libraries* directory or clone from Github.com to *~/Arduino/libraries/*.

4. Using the device

The device operates automatically does not require any human intervention.

5. Check operation

You can check operation of controller on serial console, with a web brower (use index.html in *testpage* folder) or with MM7DTest command line utility (on FreeDOS or GNU/Linux). You can download this program from homepage or Github.

Connect to console via serial port

The console connector of the device and the RS-232 serial port of the computer must be connected by means of a level shifter adapter with a null modem cable. The level shifter adapter is required due to the different voltages of the logic levels (0 V / 3.3 V and -12 V / + 12 V).

The console connector of the device and the USB port of the computer must be connected using

an Adafruit 954, FTDI TTL-232R-RPI or similar 3.3V serial / USB cable.

Connection parameters

speed (baudrate):	115 200 bps
data bits:	8
parity bit:	no
stop bit:	1
flow control:	no

Connect via linux terminal

Name of ports (device files):

RS-232 serial port:	/dev/ttyS0, /dev/ttyS1, ...
serial/USB converter:	/dev/ttyUSB0, /dev/ttyUSB1, ...

Make sure you are a member of the dialout group:

```
username@localhost$ id
```

If not, set up your group membership:

```
username@localhost$ sudo usermod -a -G dialout username
```

Connect with GNU Screen program:

```
username@localhost$ screen port_name 115200
```

Connect with Minicom program:

```
username@localhost$ minicom -b 115200 -o -D port_name
```

Connect with Windows terminal (Putty)

Name of ports:

RS-232 serial port:	COM1, COM2, ...
serial port/USB converter:	variable, see the device manager

Select the serial connection mode and communication port, set the speed and start the connection.

6. Terms of use

These programs are free softwares: you can redistribute they and/or modify they under the terms of the European Union Public License 1.1 version.

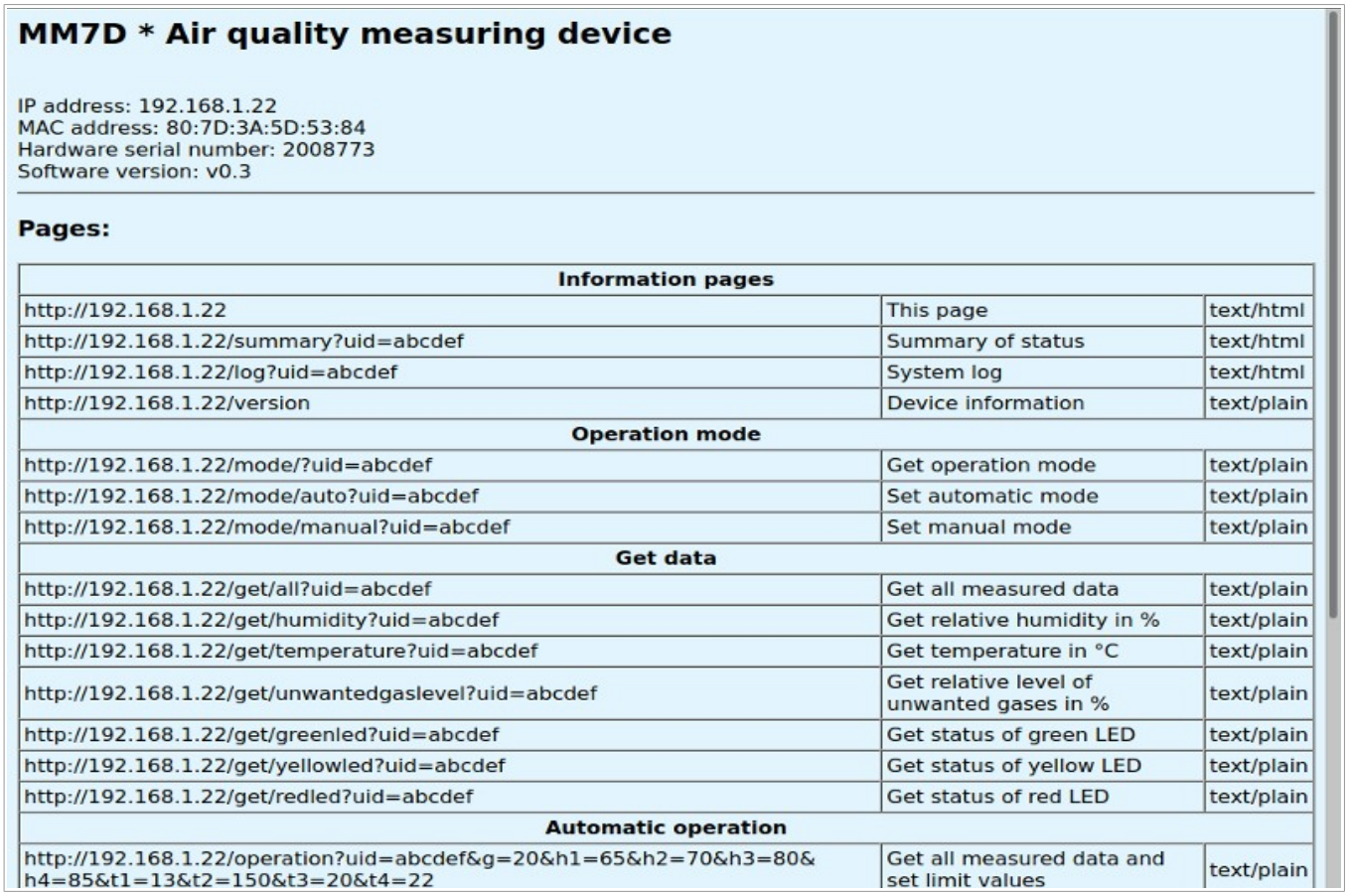
These programs are distributed in the hope that they will be useful, but WITHOUT ANY WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. You can read the full text of the license online. (Refer to Chapter III for references.)

7. Data set and retrieval via HTTP

URL	description	page type
Information pages		
http://192.168.1.22	Help page page	text/html
http://192.168.1.22/summary?uid=abcdef	Summary of status	text/html
http://192.168.1.22/log?uid=abcdef	System log	text/html
http://192.168.1.22/version	Device information	text/plain
Operation mode		
http://192.168.1.22/mode?uid=abcdef	Get operation mode	text/plain
http://192.168.1.22/mode/auto?uid=abcdef	Set automatic mode	text/plain
http://192.168.1.22/mode/manual?uid=abcdef	Set manual mode	text/plain
Get data		
http://192.168.1.22/get/all?uid=abcdef	Get all measured data	text/plain
http://192.168.1.22/get/humidity?uid=abcdef	Get relative humidity in %	text/plain
http://192.168.1.22/get/temperature?uid=abcdef	Get temperature in °C	text/plain
http://192.168.1.22/get/unwantedgaslevel?uid=abcdef	Get rel. level of unwanted gases in %	text/plain
http://192.168.1.22/get/greenled?uid=abcdef	Get status of green LED	text/plain
http://192.168.1.22/get/yellowled?uid=abcdef	Get status of yellow LED	text/plain
http://192.168.1.22/get/redled?uid=abcdef	Get status of red LED	text/plain
Automatic operation		
http://192.168.1.22/operation?uid=abcdef&g=20&h1=65&h2=70&h3=80&h4=85&t1=13&t2=150&t3=20&t4=22	Get all measured data and set limit values	text/plain
Manual operation		
http://192.168.1.22/set/all/off?uid=abcdef	Switch off all LEDs	text/plain
http://192.168.1.22/set/greenled/off?uid=abcdef	Switch off green LED	text/plain
http://192.168.1.22/set/greenled/on?uid=abcdef	Switch on green LED	text/plain
http://192.168.1.22/set/yellowled/off?uid=abcdef	Switch off yellow LED	text/plain
http://192.168.1.22/set/yellowled/on?uid=abcdef	Switch on yellow LED	text/plain
http://192.168.1.22/set/redled/off?uid=abcdef	Switch off red LED	text/plain
http://192.168.1.22/set/redled/on?uid=abcdef	Switch on red LED	text/plain

Arguments:

uid: user ID
h1-4: relative humidity limit values in percent
t1-4: temperature limit values in ˚C
g: relative unwanted gas level limit value in percent



MM7D * Air quality measuring device

IP address: 192.168.1.22
MAC address: 80:7D:3A:5D:53:84
Hardware serial number: 2008773
Software version: v0.3

Pages:

Information pages		
http://192.168.1.22	This page	text/html
http://192.168.1.22/summary?uid=abcdef	Summary of status	text/html
http://192.168.1.22/log?uid=abcdef	System log	text/html
http://192.168.1.22/version	Device information	text/plain
Operation mode		
http://192.168.1.22/mode/?uid=abcdef	Get operation mode	text/plain
http://192.168.1.22/mode/auto?uid=abcdef	Set automatic mode	text/plain
http://192.168.1.22/mode/manual?uid=abcdef	Set manual mode	text/plain
Get data		
http://192.168.1.22/get/all?uid=abcdef	Get all measured data	text/plain
http://192.168.1.22/get/humidity?uid=abcdef	Get relative humidity in %	text/plain
http://192.168.1.22/get/temperature?uid=abcdef	Get temperature in °C	text/plain
http://192.168.1.22/get/unwantedgaslevel?uid=abcdef	Get relative level of unwanted gases in %	text/plain
http://192.168.1.22/get/greenled?uid=abcdef	Get status of green LED	text/plain
http://192.168.1.22/get/yellowled?uid=abcdef	Get status of yellow LED	text/plain
http://192.168.1.22/get/redled?uid=abcdef	Get status of red LED	text/plain
Automatic operation		
http://192.168.1.22/operation?uid=abcdef&g=20&h1=65&h2=70&h3=80&h4=85&t1=13&t2=150&t3=20&t4=22	Get all measured data and set limit values	text/plain

Figure 3: Start page

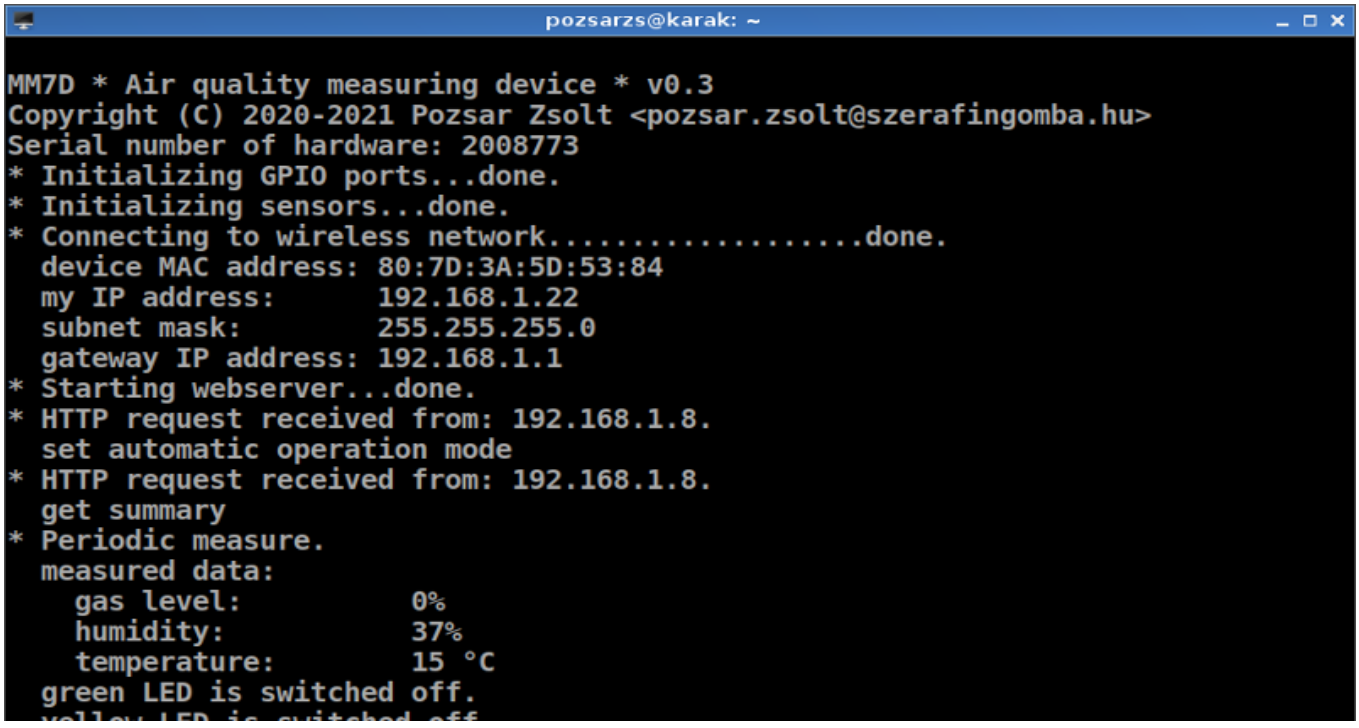


Figure 4: Serial console with messages

8. Downloadable software package

The software package in .tar.gz format compressed file can be downloaded from the manufacturer's website or Github. (Refer to Chapter III for references.)

Name of package is: *mm7d-sw-0.3.tar.gz.*

Content of package - only important files:

```
mm7d-sw
     ├──documents                    documentation
     │       *                            documentation
     ├──libraries                    external libraries
     │       *.tar.gz                     libraries in archive file
     │       clone.bat                    clone batch file
     │       clone                        clone script
     ├──testpage                     test page
     │       index.html                   startpage
     ├──source                       source code
     │       mm7d.ino                     source code
     │
     ├──LICENCE                      terms of use
     └──README.md                    short description
```

III. Related links

1. Hardware

Full package	http://www.szerafingomba.hu/equipments/mm7d/mm7d-hw-200620-3.0.tar.gz
Download from Github	http://github.com/pozsarzs/mm7d-hw.git
Technical manual	http://www.szerafingomba.hu/equipments/mm7d/technical-manual-200620-0.3-3.0-en.pdf

Schematic and PCB drawings (PDF):

Schematics	http://www.szerafingomba.hu/equipments/mm7d/sch_mm7d-1.pdf
	http://www.szerafingomba.hu/equipments/mm7d/sch_mm7d-2.pdf
PCB solder side	http://www.szerafingomba.hu/equipments/mm7d/pcb_mm7d-sold.pdf
PCB component side	http://www.szerafingomba.hu/equipments/mm7d/pcb_mm7d-comp.pdf
PCB silkscreen	http://www.szerafingomba.hu/equipments/mm7d/pcb_mm7d-silk.pdf

2. Software

Software package	http://www.szerafingomba.hu/softwares/mm7d/mm7d-sw-0.3.tar.gz
Download from Github	http://github.com/pozsarzs/mm7d-sw.git

3. Terms of use

CC-BY-NC-4.0	https://creativecommons.org/licenses/by-nc/4.0/legalcode
CC-BY-NC-4.0	https://creativecommons.org/licenses/by-nc/4.0/
EUPL v1.2	https://eupl.eu/1.2/en/

4. Developer and manufacturer

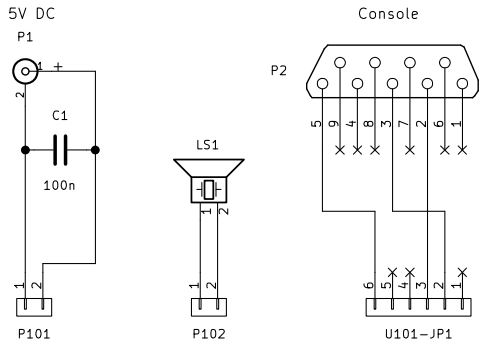
Homepage	https://www.szerafingomba.hu
E-mail	info@szerafingomba.hu

IV. Annexes

Content

Sign	Message	Web	Console	Yellow light	RED light	Sound
E01	Failed to read CO_2 sensor!	value: 999	yes	no	no	beep
E02	Failed to read T/RH sensor!	value: 999	yes	no	no	beep
E03	Authentication error!	yes	yes	no	no	2x beep
E04	Not allowed client IP address!	yes	yes	no	no	3 x beep
E05	Page not found!	yes	yes	no	no	no
	argument g = relative gas level	no	no	yes	no	no
	argument g < relative gas level	no	no	no	yes	no
	argument h1 < relative humidity	no	no	no	yes	no
	argument h1 < relative humidity < h2	no	no	yes	no	no
	argument h3 < relative humidity < h4	no	no	yes	no	no
	argument h4 < relative humidity	no	no	no	yes	no
	argument t1 < temperature	no	no	no	yes	no
	argument t1 < temperature < t2	no	no	yes	no	no
	argument t3 < temperature < t4	no	no	yes	no	no
	argument t4 < temperature	no	no	no	yes	no

Annex 1: Warning and error messages and signs



Draw no.: 59/12/6

Internal wiring

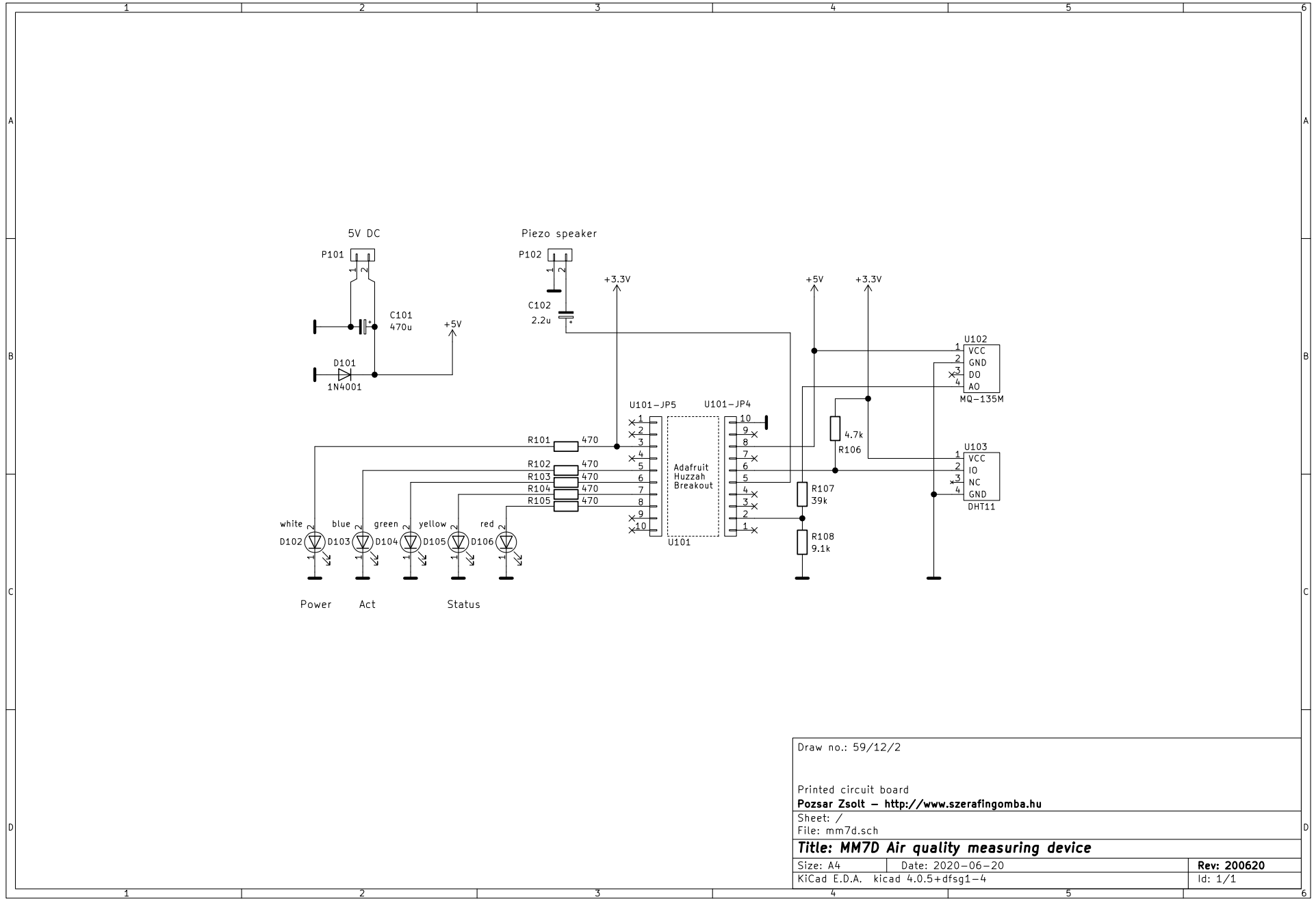
Pozsar Zsolt – http://www.szerafingomba.hu

Sheet: /
File: wiring.sch

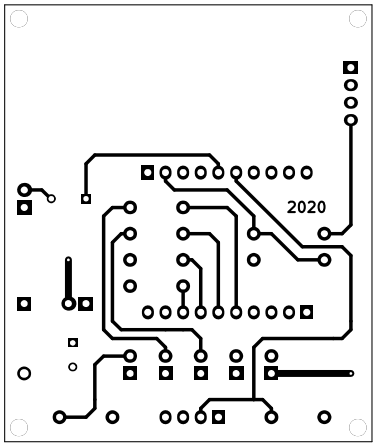
Title: MM7D Air quality measuring device

Size: A4	Date: 2020-06-20	**Rev: 200620**
KiCad E.D.A. kicad 4.0.5+dfsg1-4		Id: 1/1

Annex 2: Internal wiring



Annex 3: Schematic of printed circuit board



Draw no.: 59/12/3

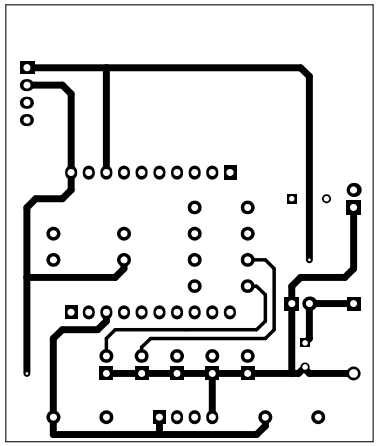
Pozsar Zsolt – http://www.szerafingomba.hu

Sheet:
File: mm7d.kicad_pcb

Title: MM7D Air quality measuring device

Size: A4	Date: 2020-06-20	**Rev: 200620**
KiCad E.D.A. kicad 4.0.5+dfsg1-4		Id: 1/1

Annex 4: PCB solder side



Draw no.: 59/12/3

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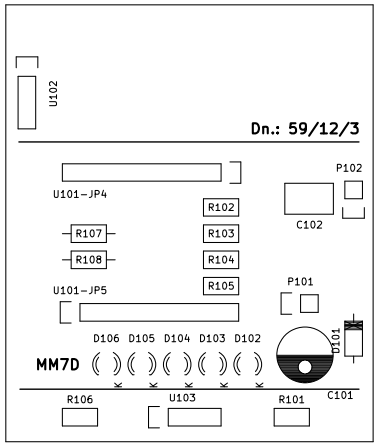
Sheet:
File: mm7d.kicad_pcb

Title: MM7D Air quality measuring device

Size: A4	Date: 2020-06-20	**Rev: 200620**
KiCad E.D.A. kicad 4.0.5+dfsg1-4		Id: 1/1

Annex 5: PCB component side



Draw no.: 59/12/3		
Pozsar Zsolt – http://www.szerafingomba.hu		
Sheet: File: mm7d.kicad_pcb		
Title: MM7D Air quality measuring device		
Size: A4	Date: 2020-06-20	**Rev: 200620**
KiCad E.D.A. kicad 4.0.5+dfsg1-4		Id: 1/1

Annex 6: PCB silkscreen