

MM7D Air quality measuring device

Technical manual



Hardware version: v200620

Software version: v0.1

Technical manual version: v1.0

Issue date: 2020.08.24.

Draw number: 59/12/1

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I. Hardware

| | | | | | |
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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: | Wireless LAN, TTL 3.3V serial port |
| Getting data: | via HTTP |
| Administration: | via serial connection |

2. General description

This device can measure temperature and humidity of growing house air, and detect some unwanted gas (CO₂, NH₃, NO_x, 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 draws

The wiring diagrams of the device is shown in Annex 1, PCB draws 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 draws and documents

Documentation package contents mechanical draw of used box in PDF.

5. Terms of use

Hardware documentation can be modified and/or redistributed under the Creative Commons 4.0 Attribution Non-Commercial (CC-BY-NC-4.0) License. You can read the full text of the license online. (Refer to Chapter III for references.)

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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

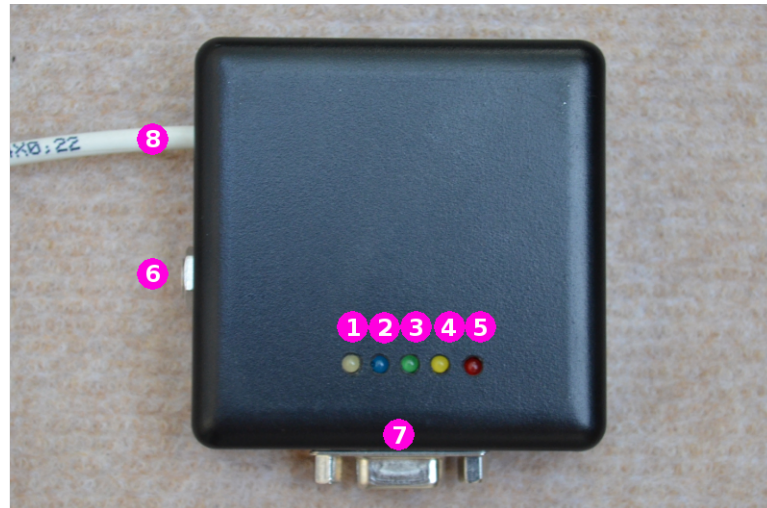


Figure 1: Manuals and connectors

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)

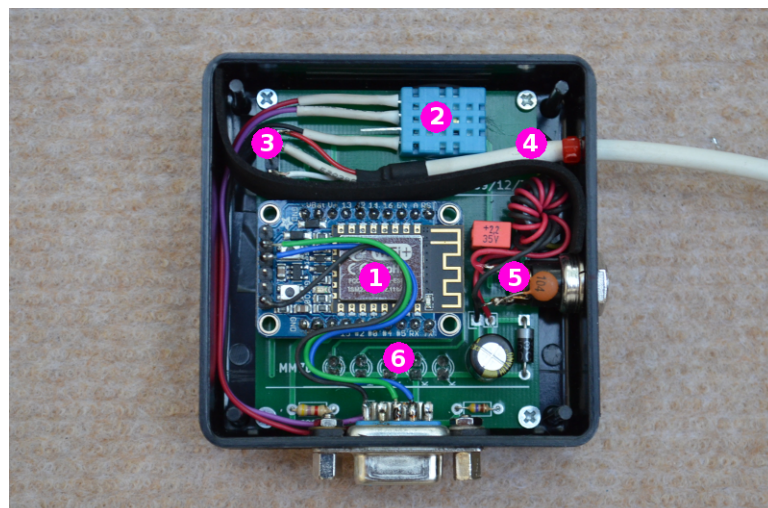


Figure 2: Internal construction

| | | | | | |
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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-200620-1.0.tar.gz*.

Content of package - only important files:

| | |
|----------------|-----------------------------|
| mm7d-hw | |
| cad_files | KiCAD files |
| mm7d | <i>documentation of PCB</i> |
| mm7d.pro | project file |
| mm7d.sch | schematic draw |
| mm7d.kicad_pcb | PCB draw |
| mm7d.drl | drilling file |
| mm7d-*.gbr | Gerber files |
| wiring | <i>internal wiring</i> |
| wiring.pro | project file |
| wiring.sch | schematic draw |
| documents | documentation |
| mm7d_en.pdf | Technical manual |
| pcb_*.pdf | pcb draws |
| sch_*.pdf | schematic draws |
| pictures | pictures |
| mm7d.jpg | look of the unit |
| pcb_*.svg | PCB draws |
| sch_*.svg | schematic draws |
| LICENCE | terms of use |
| README.md | short description |

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II. Software

| | | | | | |
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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

You can found source file of software in *software* directory. 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.

a) Data set and retrieval via HTTP

An example for how to use argument:

<http://192.168.1.12/set/greenled/off?uid=bob>

URL of information and data pages:

(On next page.)

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| URL | type | description | args. |
|---|------------|---------------------------------------|-------|
| http://ipaddress/ | text/html | Start and information page | |
| http://ipaddress/version | text/plain | Get software name and version | |
| http://ipaddress/get/all | | Get all data | uid |
| http://ipaddress/get/humidity | | Get relative humidity in % | |
| http://ipaddress/get/temperature | | Get temperature in °C | |
| http://ipaddress/get/unwantedgaslevel | | Get rel. level of unwanted gases in % | |
| http://ipaddress/set/all/off | | Switch off all LEDs | |
| http://ipaddress/set/greenled/off | | Switch off green LED | |
| http://ipaddress/set/greenled/on | | Switch on green LED | |
| http://ipaddress/set/redled/off | | Switch off red LED | |
| http://ipaddress/set/redled/on | | Switch on red LED | |
| http://ipaddress/set/yellowled/off | | Switch off yellow LED | |
| http://ipaddress/set/yellowled/on | | Switch on yellow LED | |

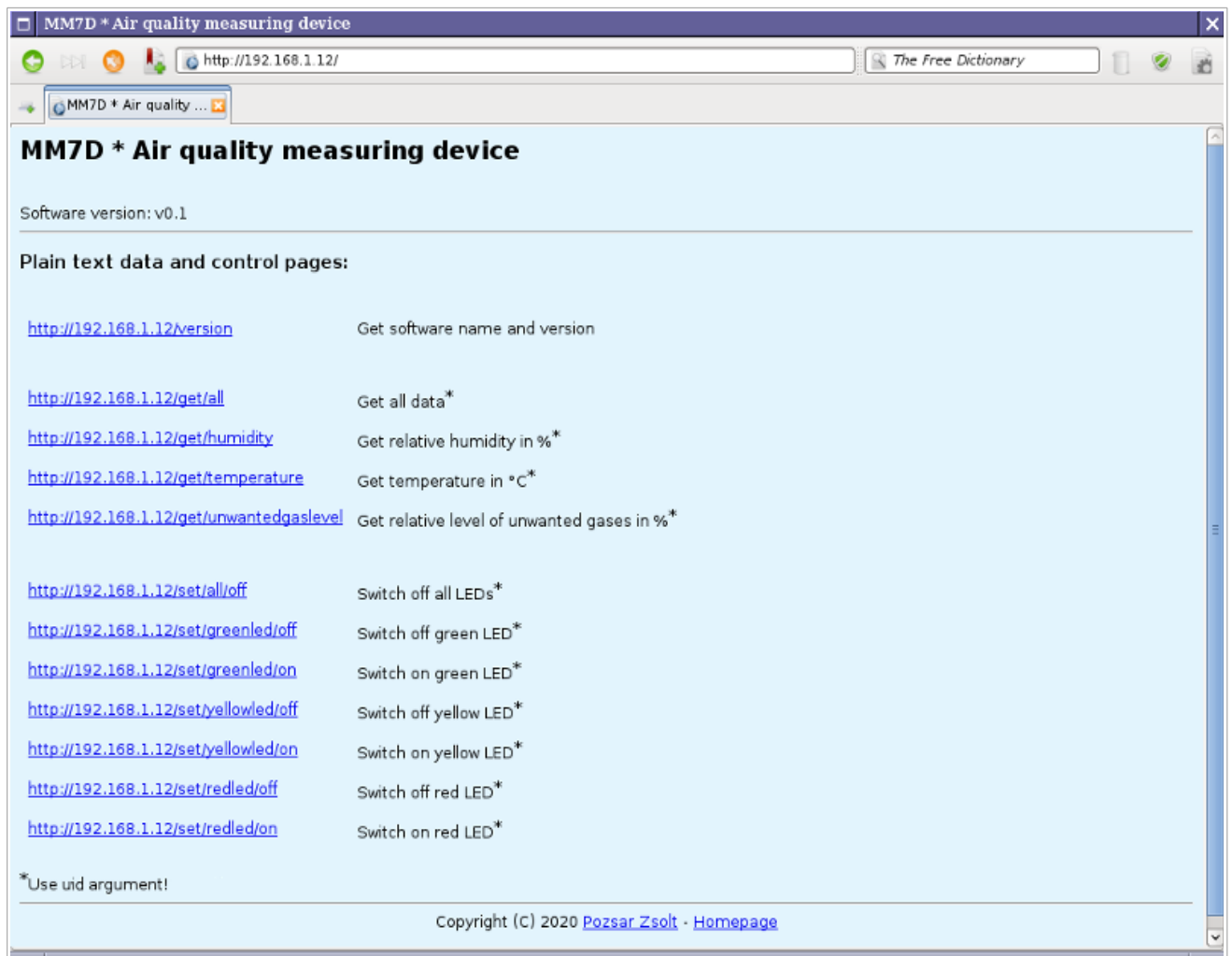


Figure 3: Start page

| | | | | | |
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b) 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.

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```

Bash
MM7D * Air quality measuring device * v0.1
Copyright (C) 2020 Pozsar Zsolt <pozsar.zsolt@szerafingomba.hu>
* Initializing GPIO ports...done.
* Initializing sensors...done.
* Connecting to wireless network.....done.
  device MAC address: 80:7D:3A:5D:53:84
  my IP address:      192.168.1.12
  subnet mask:       255.255.255.0
  gateway IP address: 192.168.1.1
* Starting webserver...done.

```

Figure 4: Serial console with messages

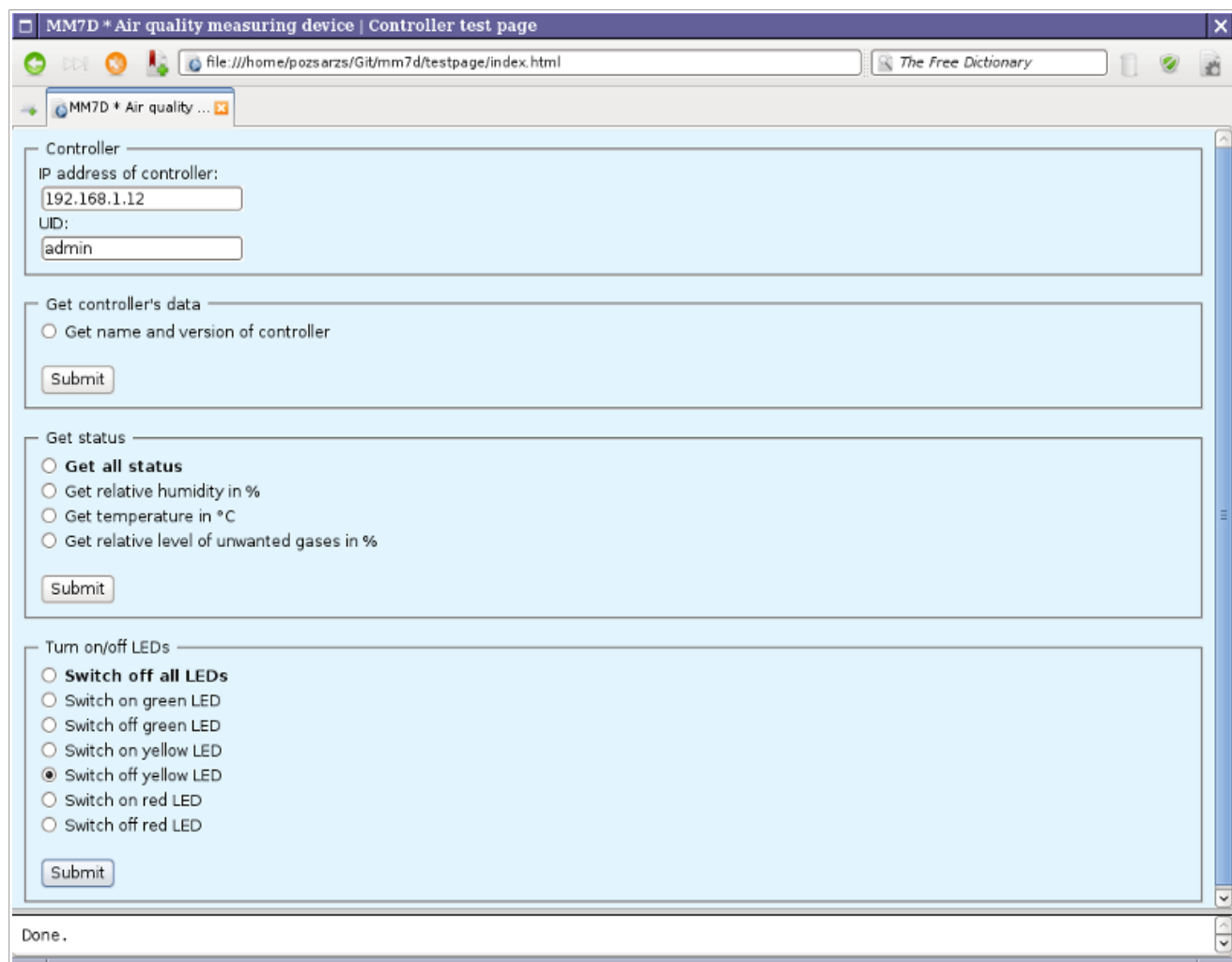


Figure 5: Test page

| | | | | | |
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5. Check operation

You can check operation of controller with a web browser, use index.html in *testpage* folder.

6. Terms of use

This program is free software: you can redistribute it and/or modify it under the terms of the European Union Public License 1.1 version.

This program is distributed in the hope that it 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. 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-0.1.tar.gz*.

Content of package - only important files:

| | |
|--------------------|---------------------------|
| mm7d-sw | |
| — documents | documentation |
| * | documentation |
| — libraries | external libraries |
| *.tar.gz | libraries in archive 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 |

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III. Related links

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1. Hardware

| | |
|----------------------|---|
| Full package | http://www.szerafingomba.hu/equipments/mm7d/mm7d-hw-200620-1.0.tar.gz |
| Download from Github | http://github.com/pozsarzs/mm7d-hw.git |
| Technical manual | http://www.szerafingomba.hu/equipments/mm7d/technical-manual-200620-0.1-1.0-en.pdf |

Schematic and PCB draws (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/equipments/mm7d/mm7d-sw-0.1.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 |

| | | | | | |
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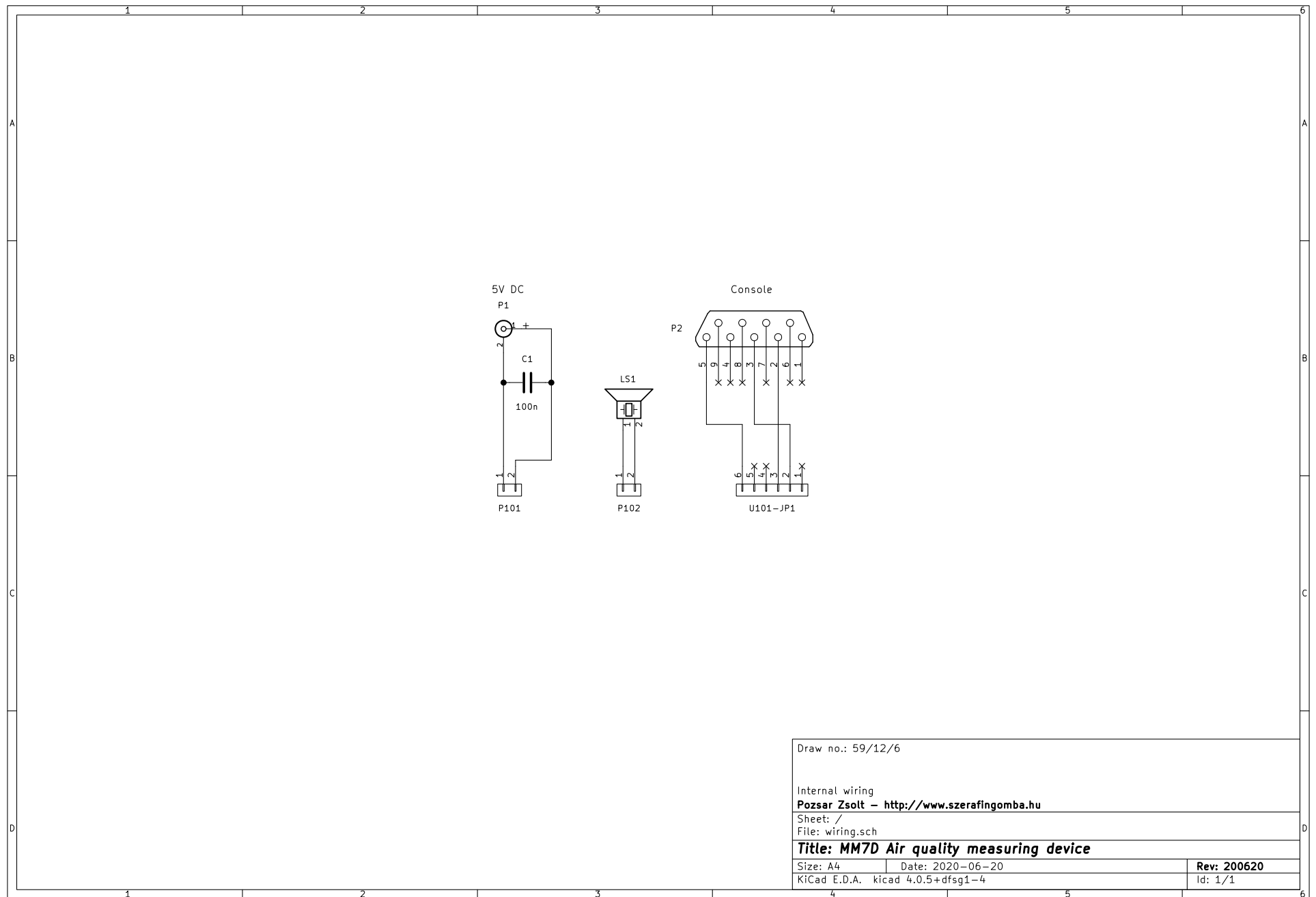
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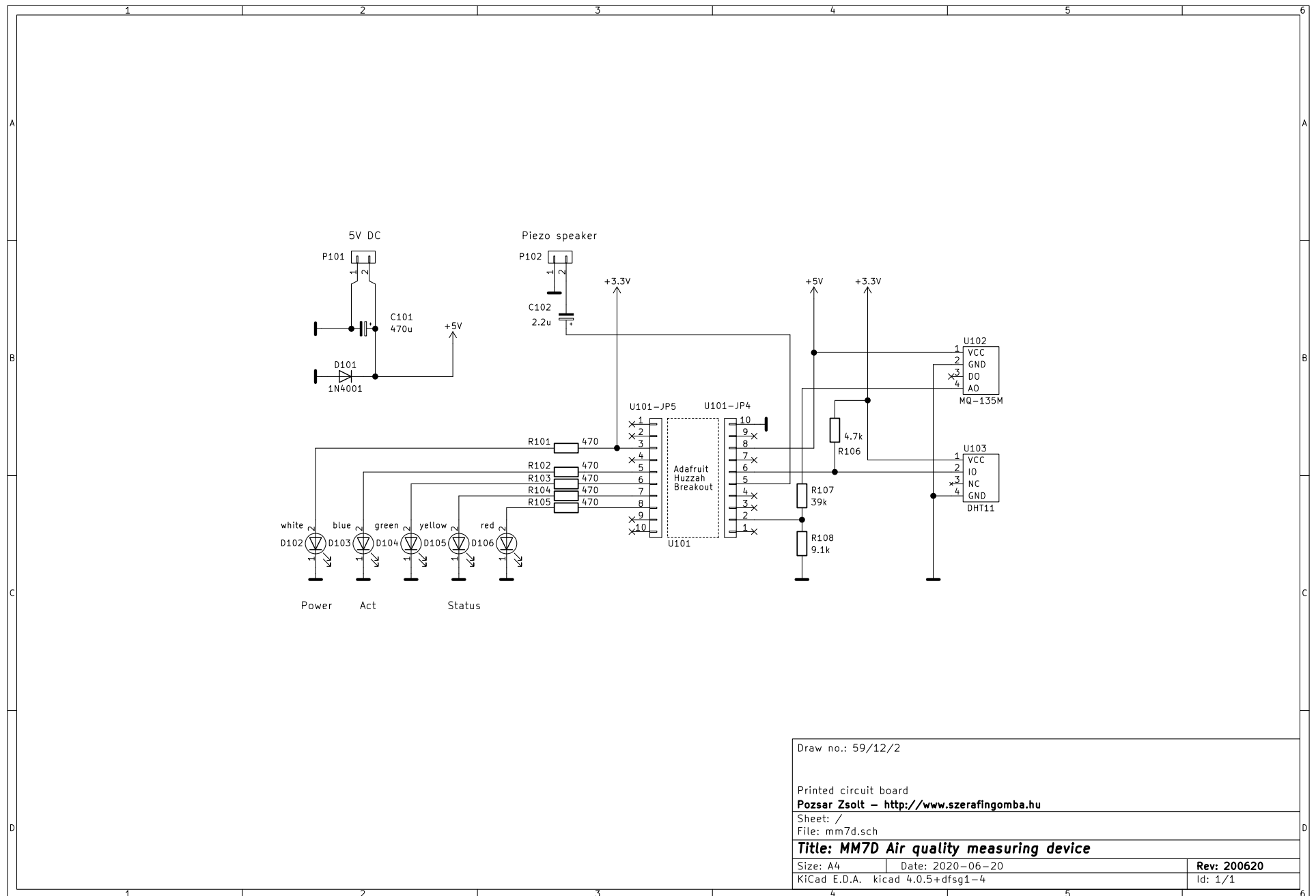
Content

1. Error messages and signs
2. Internal wiring
3. Schematic of printed circuit board
4. PCB solder side
5. PCB component side
6. PCB silkscreen

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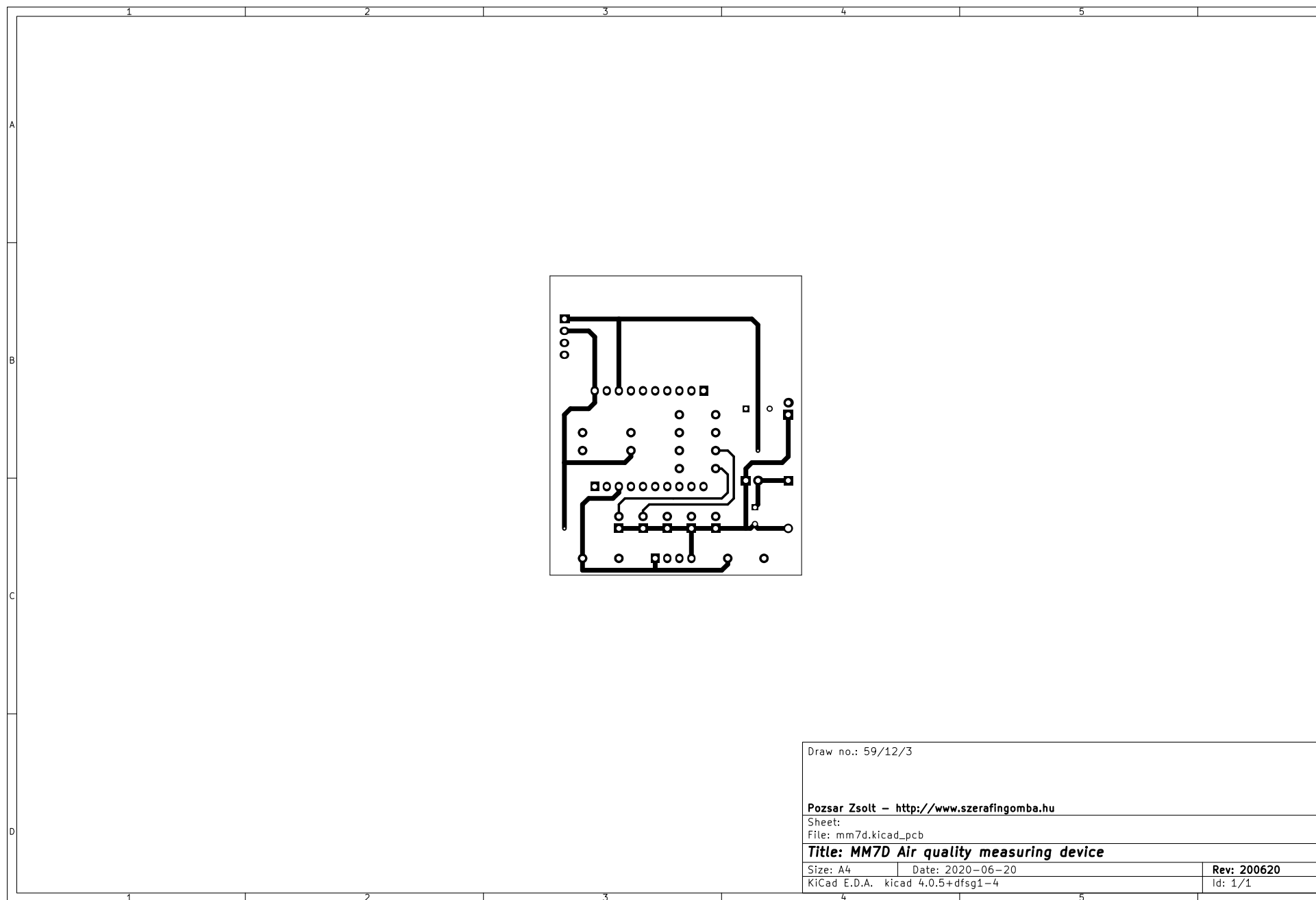


Annex 2: Internal wiring

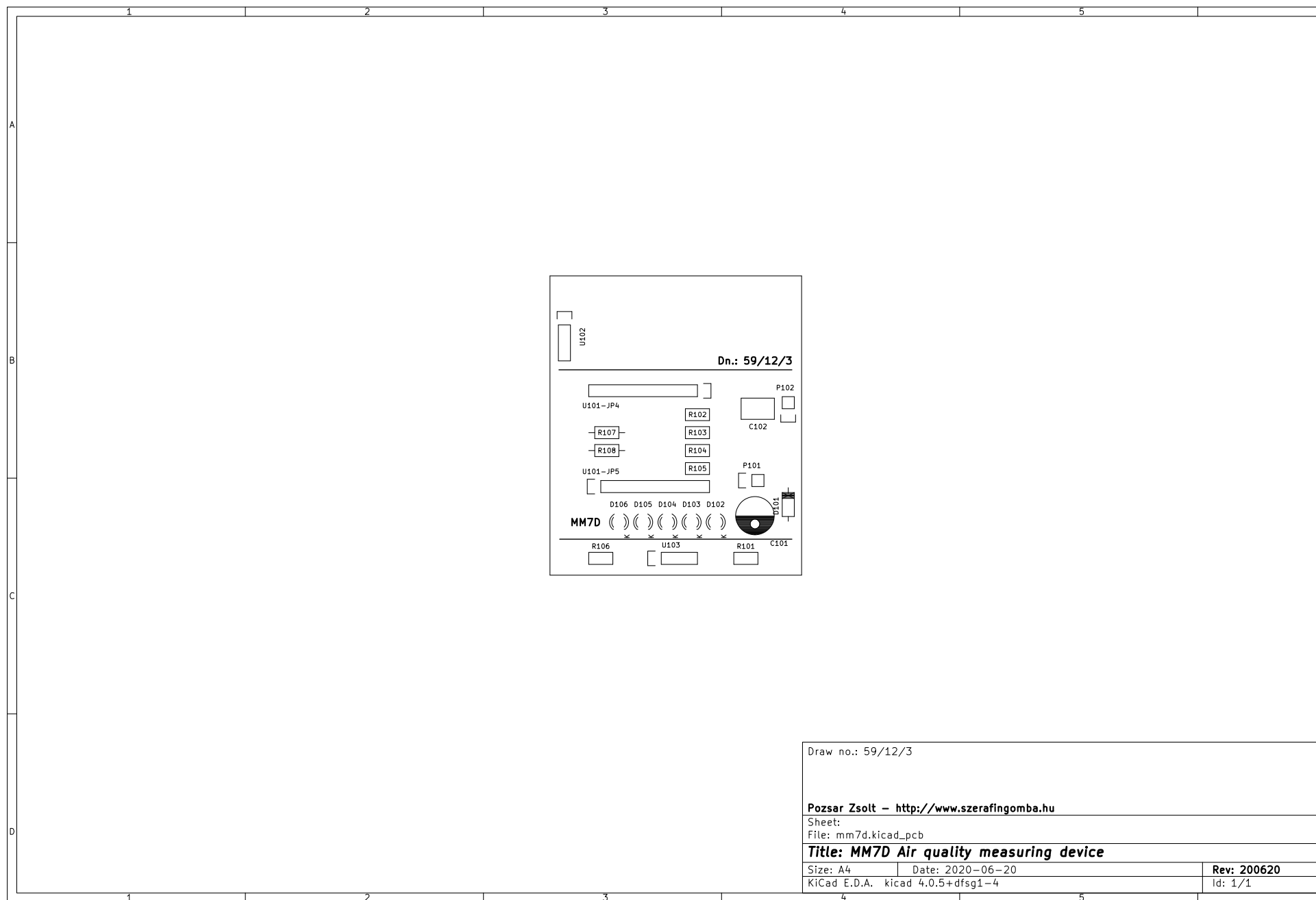


| | | |
|--|------------------|-------------|
| Draw no.: 59/12/2 | | |
| Printed circuit board | | |
| Pozsar Zsolt – http://www.szerafingomba.hu | | |
| Sheet: / | | |
| File: mm7d.sch | | |
| Title: MM7D Air quality measuring device | | |
| Size: A4 | Date: 2020-06-20 | Rev: 200620 |
| KiCad E.D.A. kicad 4.0.5+dfsg1-4 | | Id: 1/1 |

Annex 3: Schematic of printed circuit board



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 |