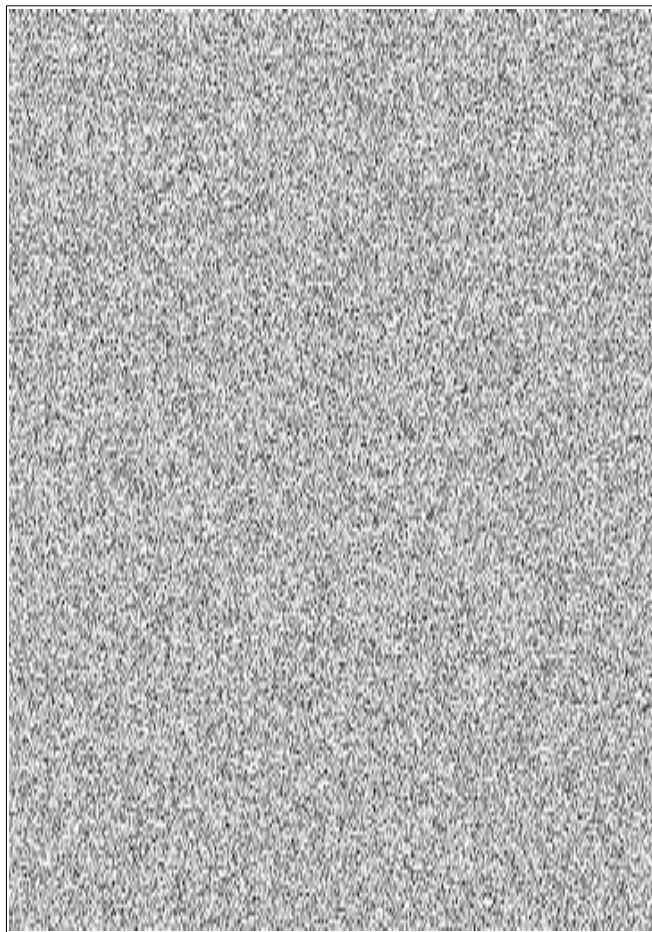


# MM7D Air quality measuring device

## Technical manual



Hardware version: v200620

Software version: v0.1

Technical manual version: v1.0

Issue date: 2020.06.20.

Draw number: 59/12/1

Titles:	MM7D Air quality measuring device	Rev.:	200620	Pages:	1/23
	Technical manual				
Name:	Pozsár Zsolt			Date:	2020.06.20.

# Content

I. Hardware.....	3
1. Technical data.....	4
2. General description.....	4
3. Schematic and PCB draws.....	4
4. Other draws and documents.....	4
5. Terms of use.....	4
6. Look of unit.....	5
a) Manuals and connectors.....	5
b) Internal construction.....	5
c) Pinout of connectors.....	6
7. Downloadable documentation.....	6
II. Software.....	7
1. General description.....	8
2. Setup.....	8
3. Installation.....	8
4. Using the device.....	8
a) Data set and retrieval via HTTP.....	8
b) Connect to console via serial port.....	10
5. Check operation.....	11
6. Terms of use.....	11
III. Related links.....	13
1. Hardware and software.....	14
2. Terms of use.....	14
3. Developer and manufacturer.....	14
IV. Annexes.....	15
Content.....	16

Titles:	MM7D Air quality measuring device	Rev.:	200620	Pages:	2/23
	Technical manual				
Name:	Pozsár Zsolt	Date:	2020.06.20.		

## I. Hardware

Titles:	MM7D Air quality measuring device	Rev.:	200620	Pages:	3/23
	Technical manual				
Name:	Pozsár Zsolt			Date:	2020.06.20.

## 1. Technical data

Supply voltage:	5 V DC
Supply current:	max. 1 A
Isolation class:	Class II
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 (CO<sub>2</sub>, NH<sub>3</sub>, NO<sub>x</sub>, 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 requires 5V DC supply voltage.

## 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 and drilling draws in PDF and DXF format.

## 5. Terms of use

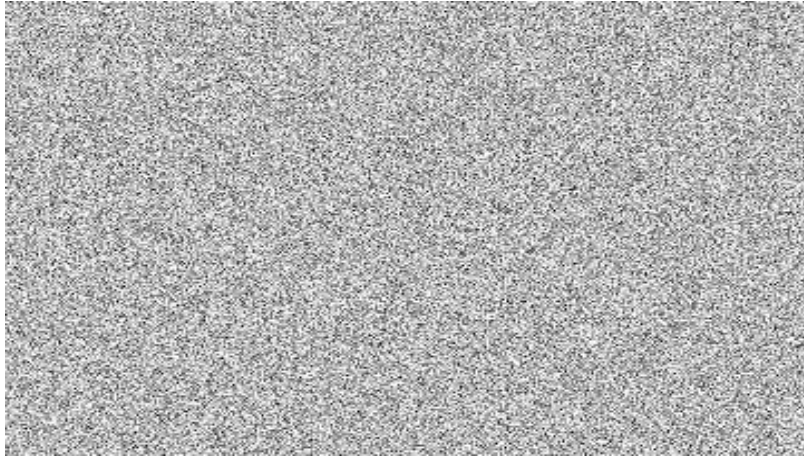
Hardware documentation can be modified and/or redistributed under the Creative Commons 4.0 Attribution Non-Commercial (CC-BY-NC-4.0) License. You can read the full text of the license online. (Refer to Chapter III for references.)

Titles:	MM7D Air quality measuring device	Rev.:	200620	Pages:	4/23
	Technical manual				
Name:	Pozsár Zsolt			Date:	2020.06.20.

## 6. Look of unit

### a) Manuals and connectors

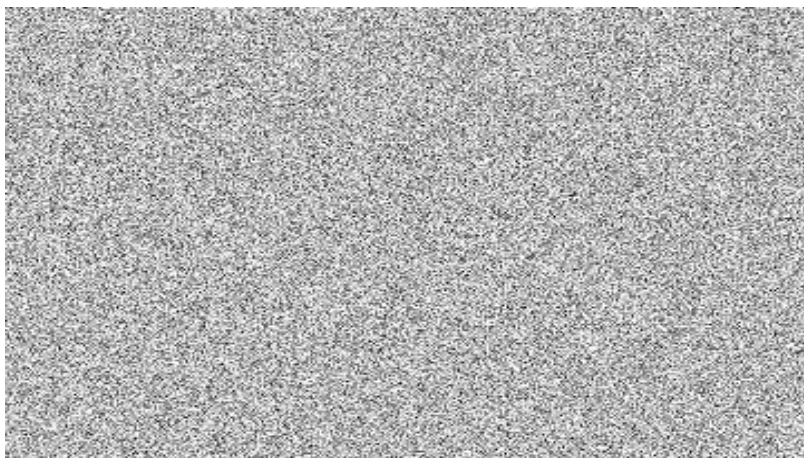
1. POWER signal light (white LED)
2. ACT signal light (blue LED)
3. STATUS signal light (green LED)
4. STATUS signal light (yellow LED)
5. STATUS signal light (red LED)
6. Power supply connector (P1)
7. Console connector (P2)



*Figure 1: Manuals and connectors*

### b) Internal construction

1. ESP 8266 Huzzah Breakout microcontroller (U101)
2. DHT11 sensor (U103)
3. MQ-135M sensor (U102)
4. Power voltage connector (P1)
5. Console connector (P2)



*Figure 2: Internal construction*

Titles:	MM7D Air quality measuring device	Rev.:	200620	Pages:	5/23
	Technical manual				
Name:	Pozsár Zsolt			Date:	2020.06.20.

### 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	

## 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-200620-0.1-1.0.tar.gz*.

Content of package - only important files:

<b>mm7d</b>	<b>KiCAD and LibreCAD files</b>
— <b>cad_files</b>	<i>drilling draws</i>
— <b>drilling</b>	front of box
front.dxf	mounting plate
mountingplate.dxf	<i>documentation of PCB</i>
— <b>mm7d</b>	project file
mm7d.pro	schematic draw
mm7d.sch	PCB draw
mm7d.kicad_pcb	drilling file
mm7d.drl	Gerber files
mm7d-*.gbr	<i>internal wiring</i>
— <b>wiring</b>	project file
wiring.pro	schematic draw
wiring.sch	<b>documentation</b>
— <b>documents</b>	Technical manual
mm7d_en.pdf	drilling draws
drl_*.pdf	pcb draws
pcb_*.pdf	schematic draws
sch_*.pdf	<b>external libraries</b>
— <b>libraries</b>	libraries in archive file
*.tar.gz	clone script
clone	<b>pictures</b>
— <b>pictures</b>	look of the unit
mm7d.jpg	PCB draws
pcb_*.svg	schematic draws
sch_*.svg	<b>software</b>
— <b>software</b>	source file
mm7d.ino	
LICENCE	terms of use
LICENCE-hw	terms of use of hardware
LICENCE-sw	terms of use of software
README	short description

Titles:	MM7D Air quality measuring device	Rev.:	200620	Pages:	6/23
	Technical manual				
Name:	Pozsár Zsolt	Date:	2020.06.20.		

## II. Software

Titles:	MM7D Air quality measuring device	Rev.:	200620	Pages:	7/23
	Technical manual				
Name:	Pozsár Zsolt			Date:	2020.06.20.

## 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 www_username  = "";
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?username=bob>

**URL of information and data pages:**

(On next page.)

Titles:	MM7D Air quality measuring device	Rev.:	200620	Pages:	8/23
	Technical manual				
Name:	Pozsár Zsolt	Date:	2020.06.20.		



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

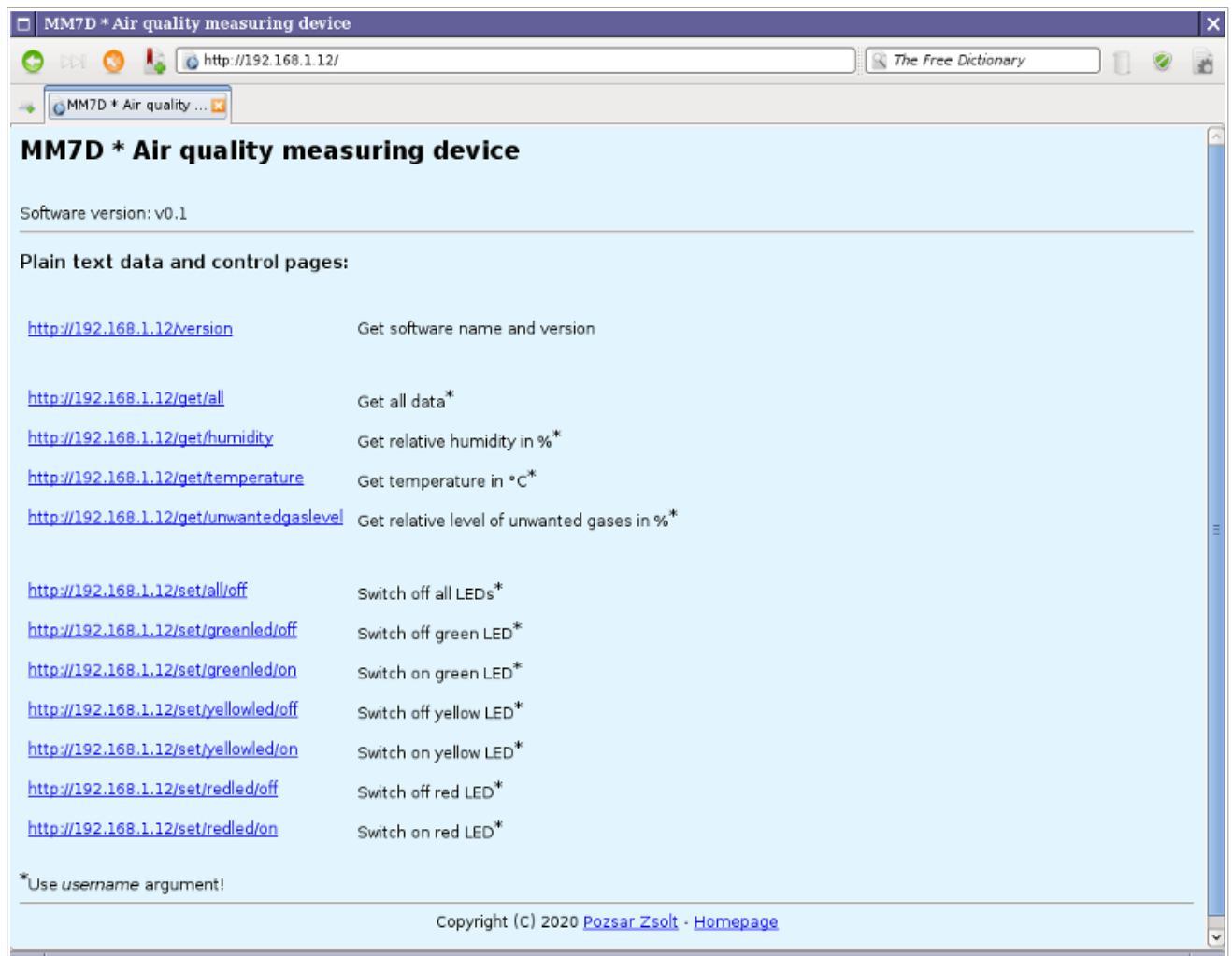


Figure 3: Start page

Titles:	MM7D Air quality measuring device	Rev.:	200620	Pages:	9/23
	Technical manual				
Name:	Pozsár Zsolt			Date:	2020.06.20.

## 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.

Titles:	MM7D Air quality measuring device	Rev.:	200620	Pages:	10/23
	Technical manual				
Name:	Pozsár Zsolt			Date:	2020.06.20.

```
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

## 5. Check operation

You can check operation of controller with a web browser, use index.html in *testpage* folder or open <http://szerafingomba.hu/equipments/mm7d/testpage/> url. It doesn't store any data on server.

## 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.)

Titles:	MM7D Air quality measuring device	Rev.:	200620	Pages:	11/23
	Technical manual				
Name:	Pozsár Zsolt			Date:	2020.06.20.

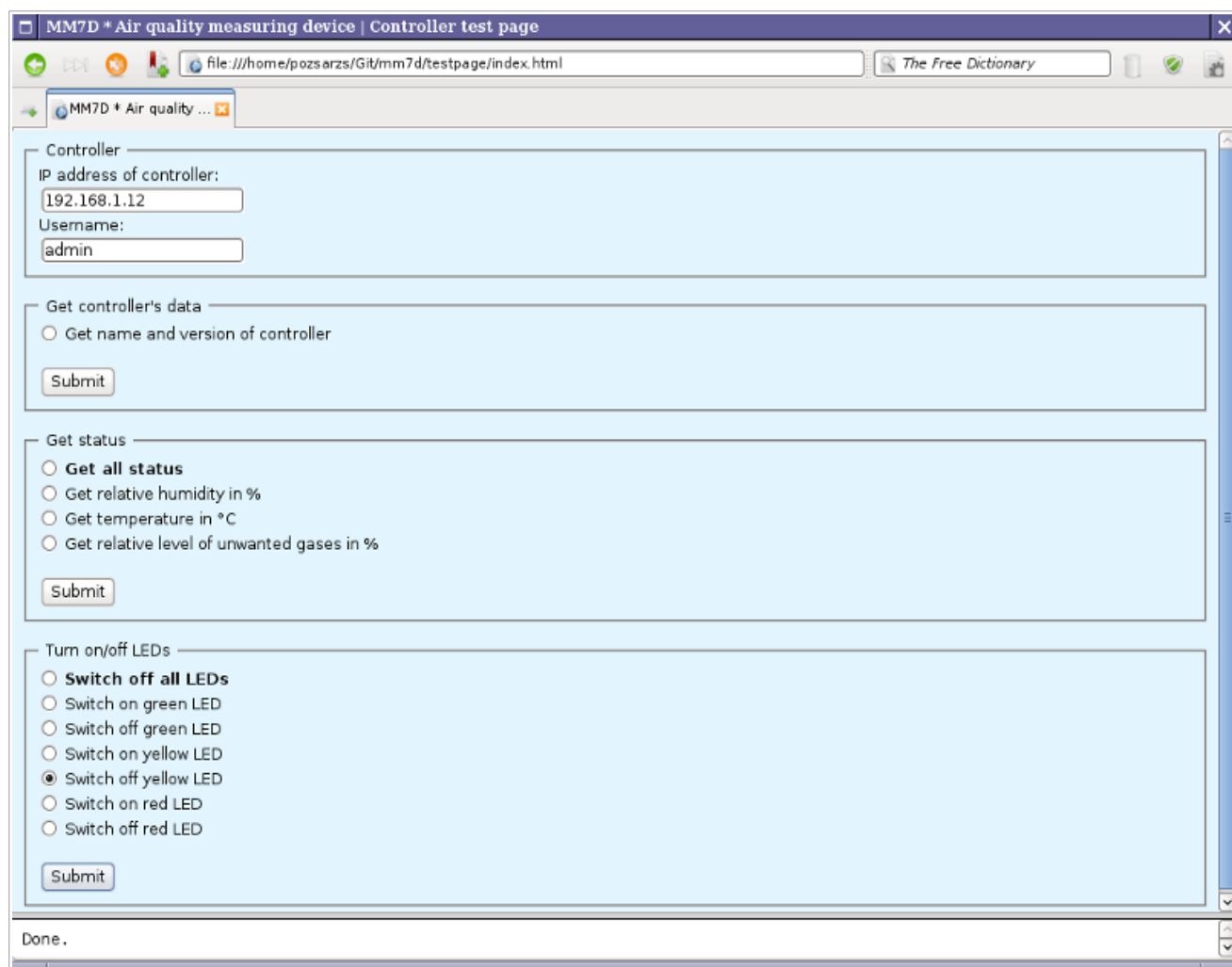


Figure 5: Test page

Titles:	MM7D Air quality measuring device	Rev.:	200620	Pages:	12/23
	Technical manual				
Name:	Pozsár Zsolt			Date:	2020.06.20.

### III. Related links

Titles:	MM7D Air quality measuring device	Rev.:	200620	Pages:	13/23
	Technical manual				
Name:	Pozsár Zsolt			Date:	2020.06.20.

## 1. Hardware and software

Full package	<a href="http://www.szerafingomba.hu/equipments/mm7d/mm7d-200620-0.1-1.0.tar.gz">http://www.szerafingomba.hu/equipments/mm7d/mm7d-200620-0.1-1.0.tar.gz</a>
Download from Github	<a href="http://github.com/pozsarzs/mm7d.git">http://github.com/pozsarzs/mm7d.git</a>
Technical manual	<a href="http://www.szerafingomba.hu/equipments/mm7d/technical-manual-200620-0.1-1.0-en.pdf">http://www.szerafingomba.hu/equipments/mm7d/technical-manual-200620-0.1-1.0-en.pdf</a>
Test page	<a href="http://szerafingomba.hu/equipments/mm7d/testpage/">http://szerafingomba.hu/equipments/mm7d/testpage/</a>

### Schematic and PCB draws (PDF):

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

## 2. Terms of use

CC-BY-NC-4.0	<a href="https://creativecommons.org/licenses/by-nc/4.0/legalcode">https://creativecommons.org/licenses/by-nc/4.0/legalcode</a>
CC-BY-NC-4.0	<a href="https://creativecommons.org/licenses/by-nc/4.0/">https://creativecommons.org/licenses/by-nc/4.0/</a>
EUPL v1.2	<a href="https://eupl.eu/1.2/en/">https://eupl.eu/1.2/en/</a>

## 3. Developer and manufacturer

Homepage	<a href="https://www.szerafingomba.hu">https://www.szerafingomba.hu</a>
E-mail	<a href="mailto:info@szerafingomba.hu">info@szerafingomba.hu</a>

Titles:	MM7D Air quality measuring device	Rev.:	200620	Pages:	14/23
	Technical manual				
Name:	Pozsár Zsolt			Date:	2020.06.20.

## IV. Annexes

Titles:	MM7D Air quality measuring device	Rev.:	200620	Pages:	15/23
	Technical manual				
Name:	Pozsár Zsolt			Date:	2020.06.20.

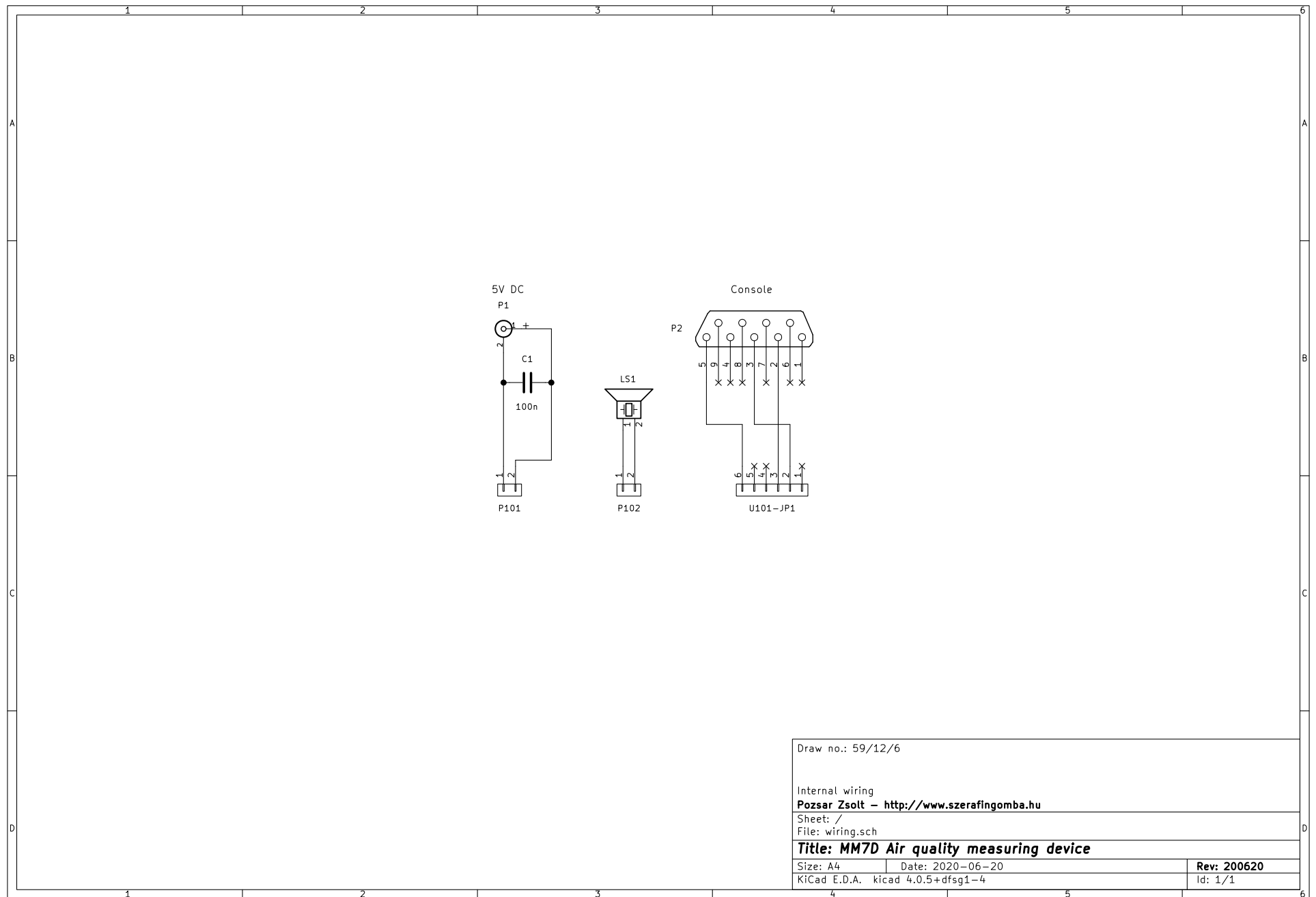
## Content

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

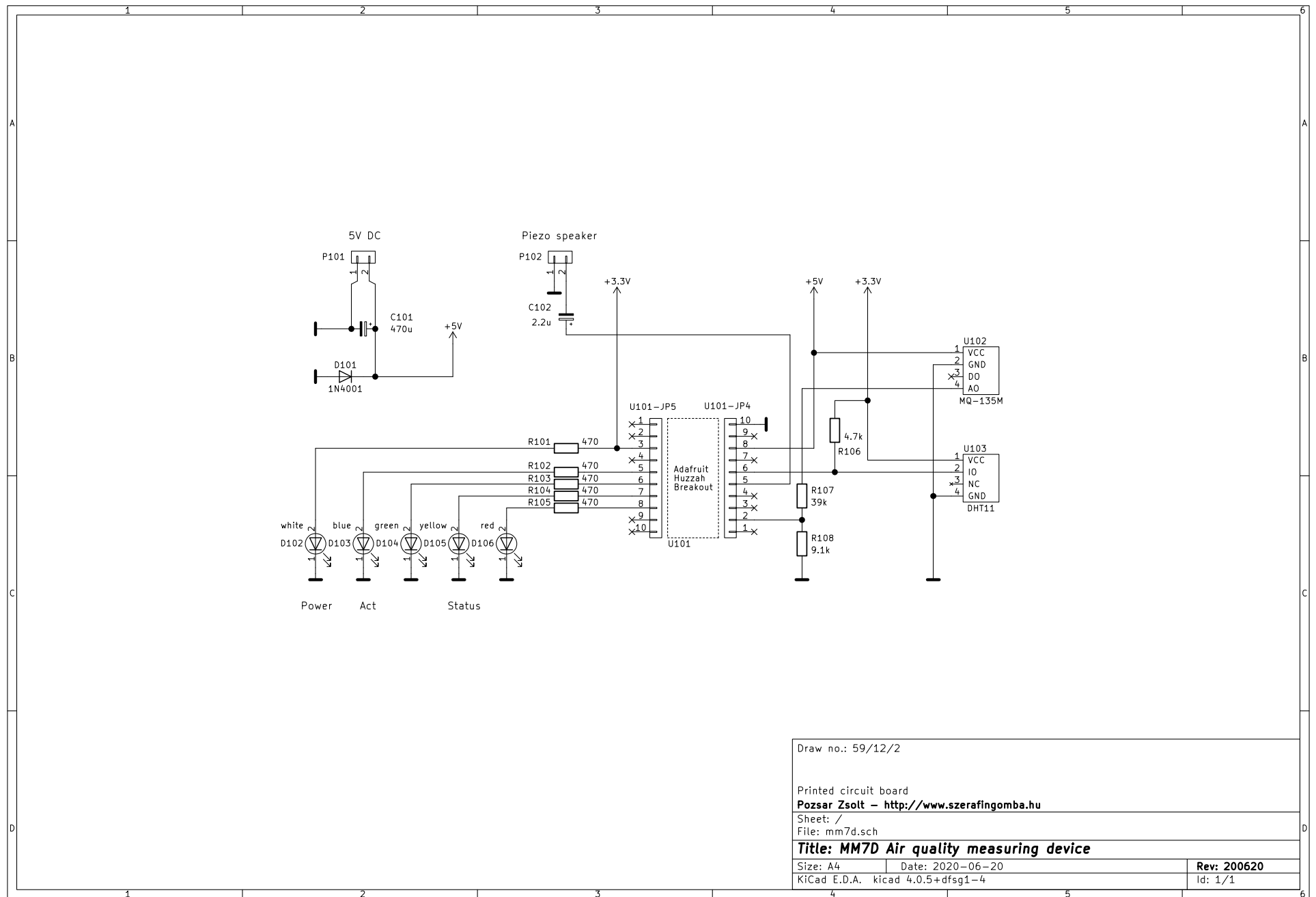
Titles:	MM7D Air quality measuring device	Rev.:	200620	Pages:	16/23
	Technical manual				
Name:	Pozsár Zsolt			Date:	2020.06.20.







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

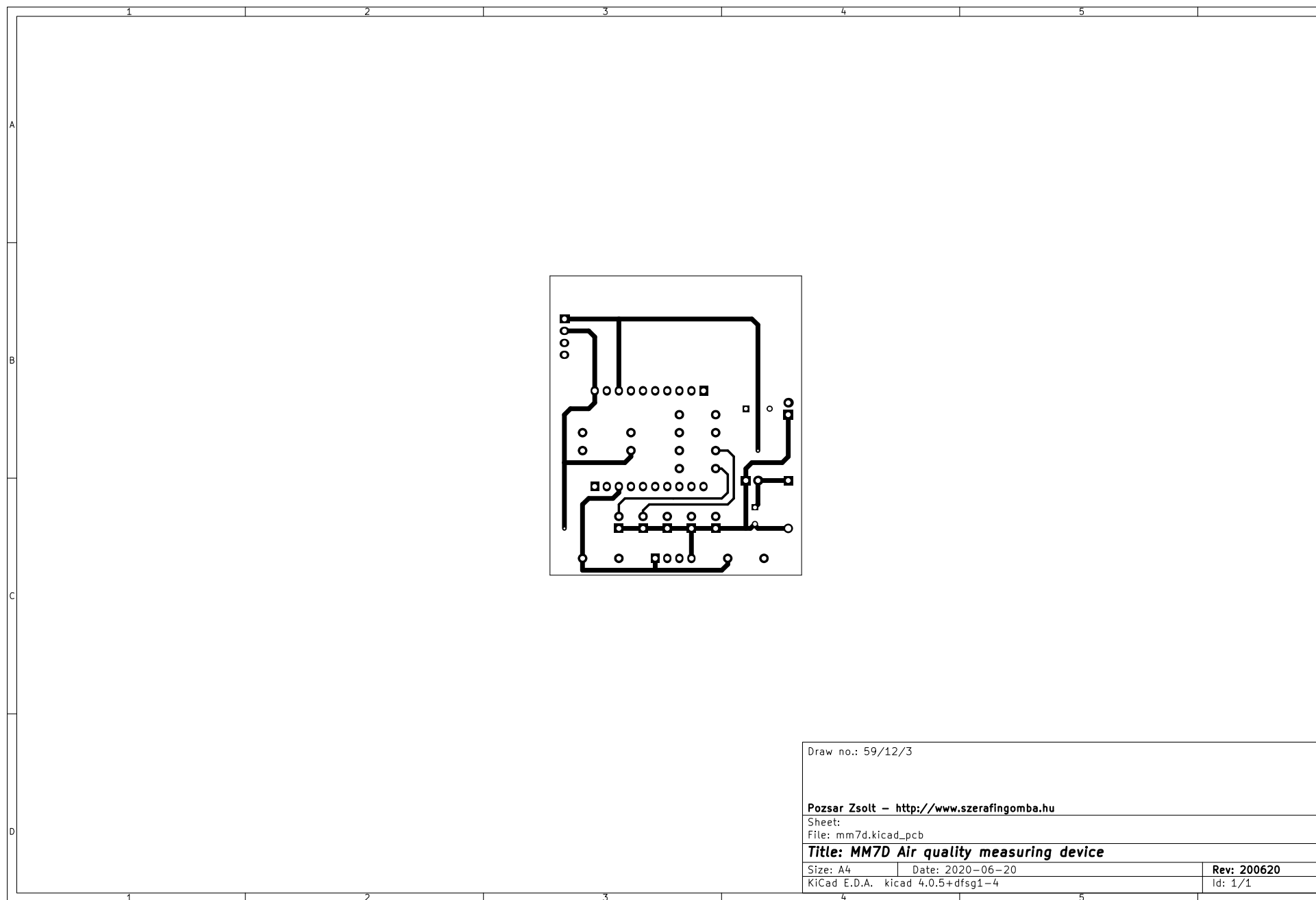
**Rev: 200620**

KiCad E.D.A. kicad 4.0.5+dfsg1-4

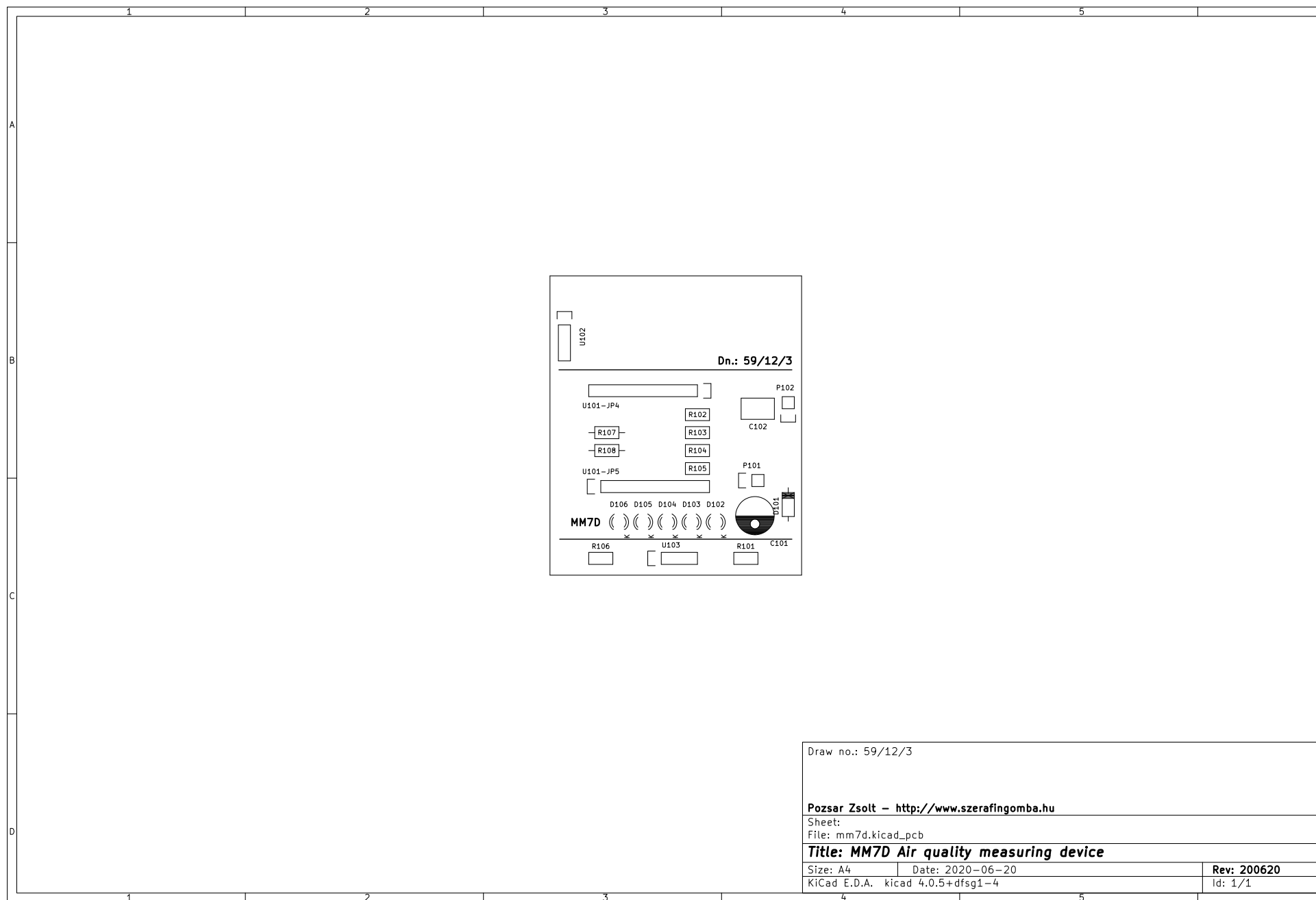
Id: 1/1

Annex 3: Schematic of printed circuit board





Annex 5: PCB component side



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