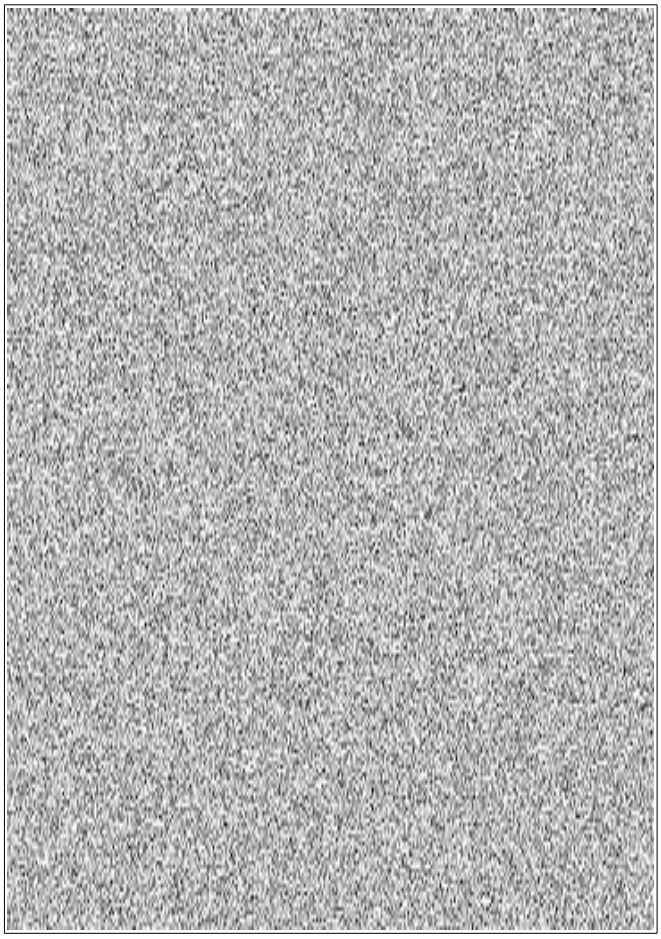
MM7D Air quality measuring device

Technical manual



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Software version: v0.1
Technical manual version: v1.0
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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

I. Hardware

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 (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 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 Creativ 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.)

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)

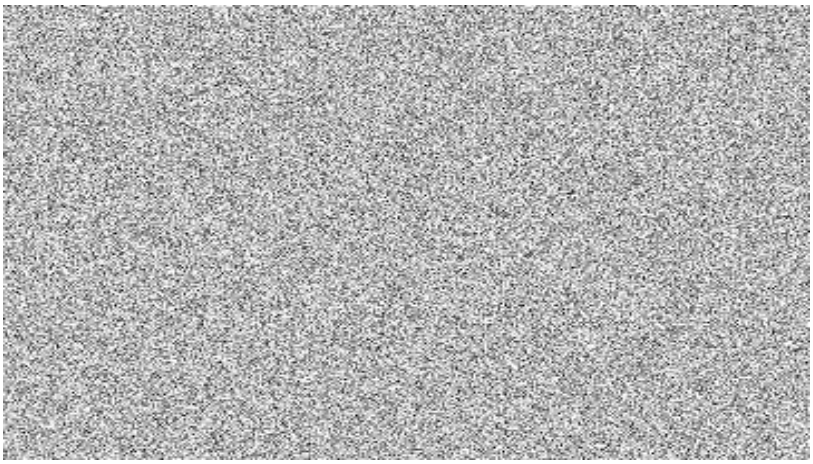


Figure 1: Manuals and connectors

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)

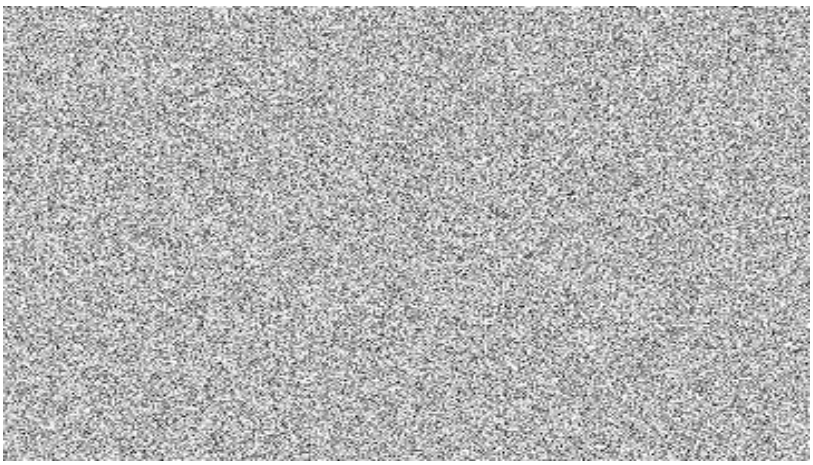


Figure 2: Internal construction

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:

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

II. Software

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 / password arguments 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 arguments:

http://192.168.1.12/set/greenled/off?username=bob

URL of information and data pages:

(On next page.)

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	username
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	

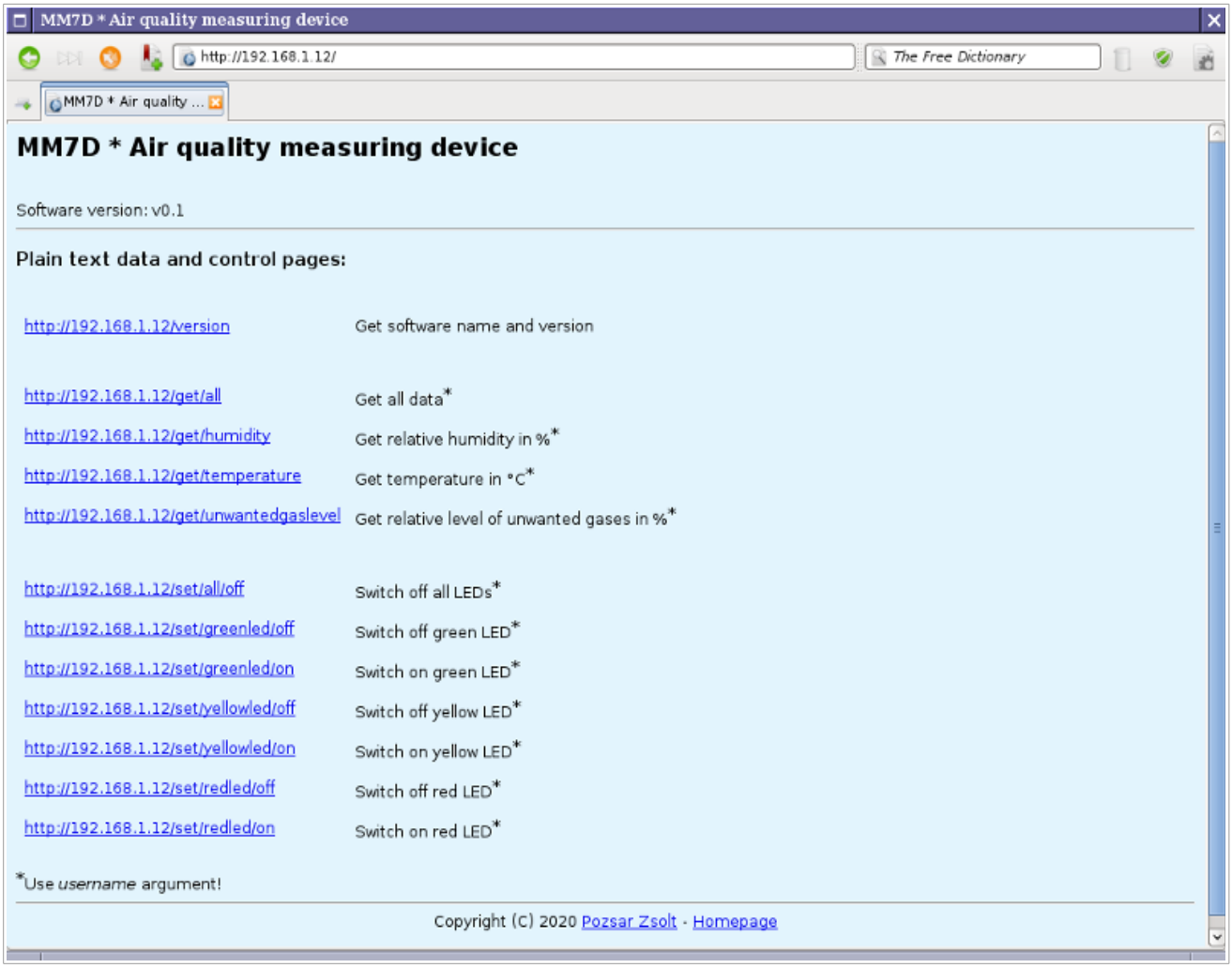


Figure 3: Start page

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.

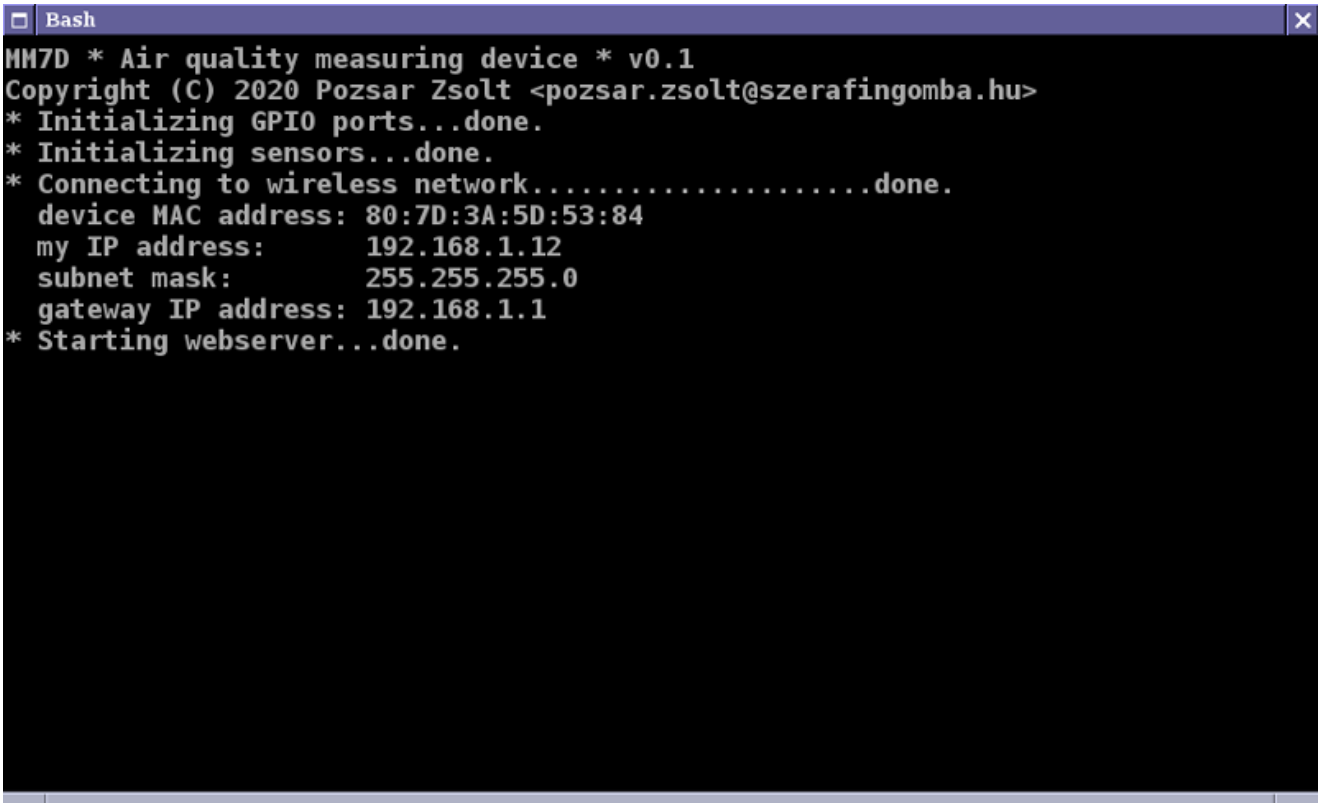


Figure 4: Serial console with messages

5. Check operation

You can check operation of controller with a web brower, 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.)

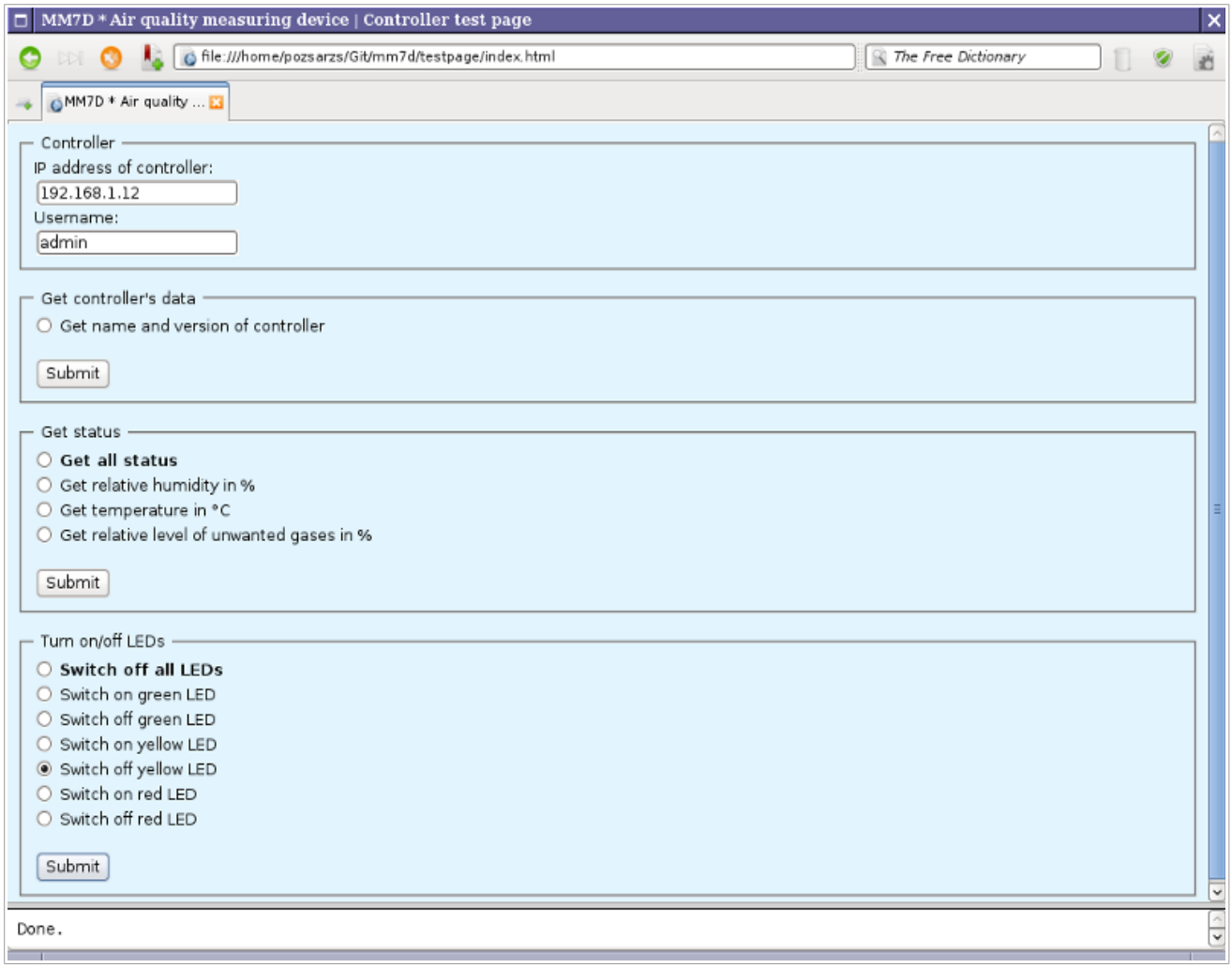


Figure 5: Test page

III. Related links

1. Hardware and software

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

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. 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/

3. Developer and manufacturer

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

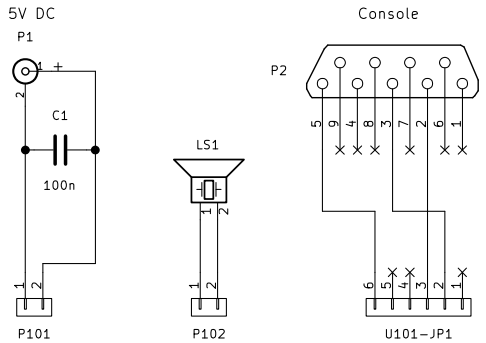
IV. Annexes

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 silkscren

Sign	Message	Web	Console	RED light	Sound
E01	Failed to read CO_2 sensor!	value: 999	yes	no	beep
E02	Failed to read T/RH sensor!	value: 999	yes	no	beep
E03	Authentication error!	yes	yes	no	2x beep
E04	Not allowed client IP address!	yes	yes	no	3 x beep

Annex 1: Error messages and signs



Draw no.: 59/12/6

Internal wiring

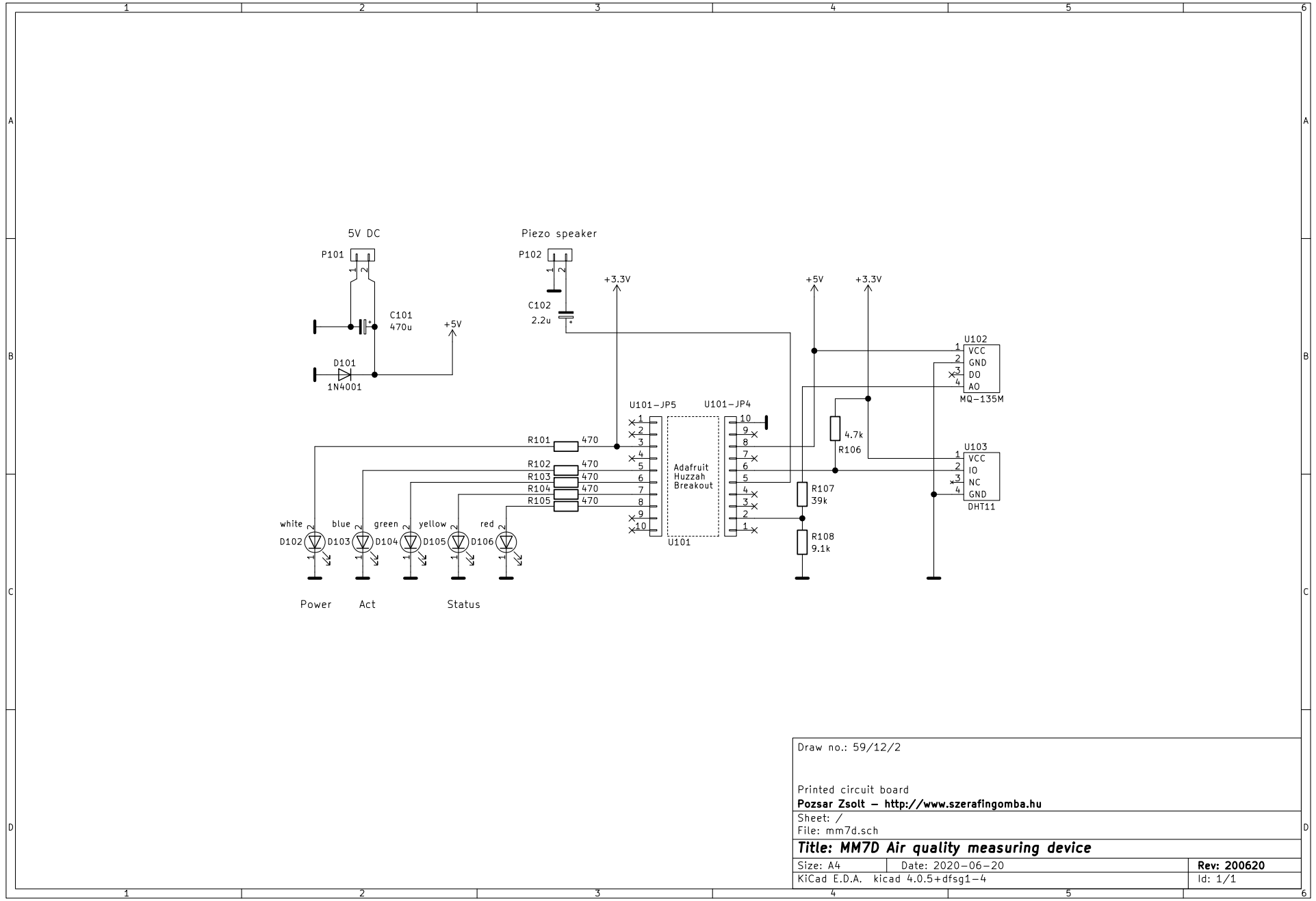
Pozsar Zsolt – http://www.szerafingomba.hu

Sheet: /
File: wiring.sch

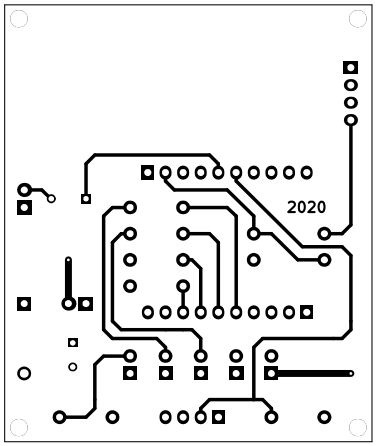
Title: MM7D Air quality measuring device

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

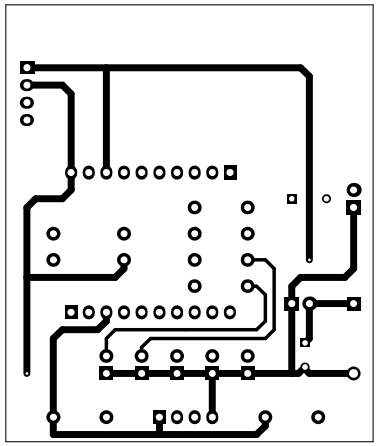
Pozsar Zsolt – http://www.szerafingomba.hu

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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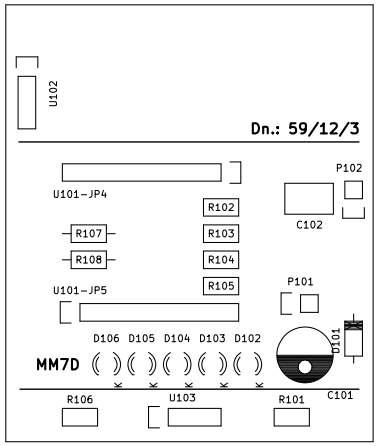
Sheet:
File: mm7d.kicad_pcb

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