

MM3D

growing house controlling and remote monitoring unit

User Manual



Hardware version: v190203
Software version: v0.4
User Manual version: v4.0
Issue date: 15/12/2019

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I. Hardware

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The device is capable of measuring, controlling and monitoring the characteristics of a growing site.

1. Technical data

Supply voltage:	5V DC (powered by 230 V AC/5 V DC adapter)
Supply current:	max. 2.5 A
Isolation class:	Class II.
Mechanical size:	190 x 140 x 70 mm
IP protection:	IP 54
IK protection:	IK 03
Material of cover:	termoplaszt (ABS)
LAN:	Ethernet (RJ45)

Measured data:

value	range	resolution	accuracy	note
temperature	-40...+80 °C	0,1 °C	< ±0,5 °C	Length of sensor ca.ble: max. 20 m
humidity	0-100% RH	0,1 % RH	±2 % RH	

Programmable in- and outputs:

sign	type	note
IN #1	input	TTL level inputs with pull-up resistor, theirs active state is „L”.
IN #2	input	
IN #3	input	
IN #4	input	
OUT #1	output	NO/NC relay contact outputs. Load capacity: 250V 10A AC or 30V 10A DC. The operation of the relays can be switched off with a key switch, this status is indicated by a red LED.
OUT #2	output	
OUT #3	output	
OUT #4	output	

Programmable error lights:

sign	note
ERR #1	Red LEDs on front panel.
ERR #2	
ERR #3	
ERR #4	

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2. Administration

Setting: via SSH
Access data: with web browser (via HTTP)

3. Description

The device is based on a Raspberry Pi 3 B + microcomputer with Raspbian operating system, which also includes software for operating the unit. No graphics system installed on it.

The device's four TTL-level inputs are equipped with pull-up resistors and have an active level of L. They can be used, for example, to check the position of air vents, doors and windows, check the functioning of the ventilation system (airflow sensor), the water pressure sensor, or the status of the motor or overcurrent protection devices with auxiliary contact.

The device has four relay contact outputs that are capable of switching to relatively high power (2.3 kW at 230V AC). The operation of the relays can be disabled by means of a front key switch; In all cases, external circuits must be provided with overcurrent protection.

There is no need to connect a keyboard or monitor to set up and operate the MM3D, and access to it is always done through SSH. Current status and measured data can be checked using a web browser.

4. Schematic and printed circuit draws

The wiring diagram of the device is shown in Annex 1, PCB draws are in Annex 3-7. You can download it as part of the complete documentation or in separate PS, PDF, SVG and KiCAD formats from the developer / manufacturer's website.

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 (English) text of the license online. (Refer to Chapter IV for references.)

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6. Look of the device

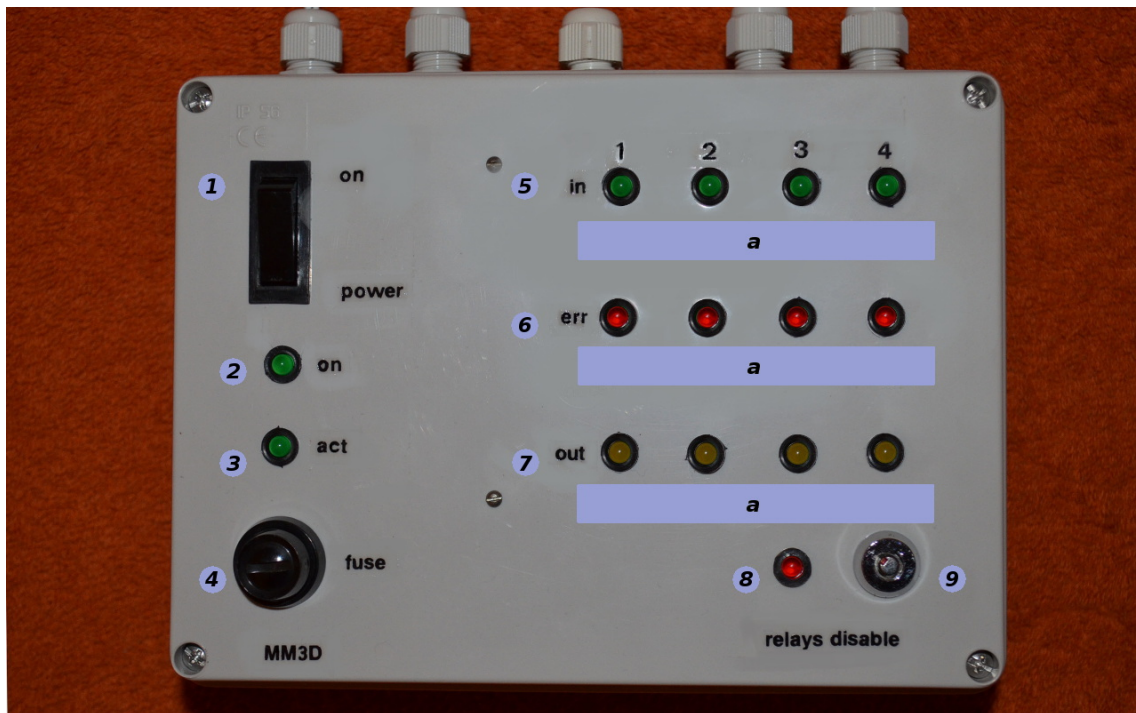


Figure 1: Front panel

a) Manuals and connectors

- 1: supply voltage on/off switch
- 2: power on light (green LED)
- 3: ACT light (green LED)
- 4: fuse of supply voltage (2,5 A F)
- 5: IN #1-#4 input active status lights (green LED)
- 6: OUT #1-#4 output active status lights (yellow LED)
- 7: ERR #1-#4 error lights (red LED)
- 8: disable output relays light (red LED)
- 9: disable output relays switch

a: place for sticky labels

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b) Connector pinout

Input terminal (J1):

- 1: IN GND
- 2: IN #1
- 3: IN #2
- 4: IN #3
- 5: IN #4
- 6: -
- 7: -
- 8: S1 GND (external sensor GND)
- 9: S1 data (external sensor data)
- 10: S1 +5V (external sensor +5V)
- 11: +5 V in (power voltage input)
- 12: GND in (power voltage input)

Output terminal (J3):

- 1: NC1
- 2: COM1
- 3: NO1
- 4: NC2
- 5: COM2
- 6: NO2
- 7: NC3
- 8: COM3
- 9: NO3
- 10: NC4
- 11: COM4
- 12: NO4

Numbering on both connectors (terminal blocks) is in the installed position of device from top to bottom.

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7. Downloadable documentation

The complete documentation of the hardware in the .tar.gz format compressed file can be downloaded from the manufacturer's website. (Refer to Chapter IV for references.)

Package's name: *mm3d-hw-190203-3.0.tar.gz*

Content:

mm3d-hw

cad_files

example

example_routing.pro
example_routing.sch
README
.

mm3d

mm3d_base.pro
mm3d_base.kicad_pcb
mm3d_front.pro
mm3d_front.kicad_pcb
mm3d.pro
mm3d.sch
.

documents

mm3d-hw_en.pdf
mm3d-hw_hu.pdf
pcb_mm3d_base-comp.ps
pcb_mm3d_base-silk.ps
pcb_mm3d_base-sold.ps
pcb_mm3d_front-silk.ps
pcb_mm3d_front-sold.ps
sch_example.pdf
sch_mm3d.pdf

pictures

mm3d.jpg
pcb_mm3d_base-comp.svg
pcb_mm3d_base-silk.svg
pcb_mm3d_base-sold.svg
pcb_mm3d_front-silk.svg
pcb_mm3d_front-sold.svg
sch_example.svg
sch_mm3d.svg

README

KiCAD files

example of application

project file
schematic draw
information
other files

MM3D unit

base panel project file
base printed circuit board
front panel project file
front printed circuit board
schematic project file
schematic draw
other files

documentation

User manual (EN)
User manual (HU)
base panel component side
base panel silkscreen
base panel solder side
front panel silkscreen
front panel solder side
example schematic draw
MM3D schematic draw

pictures

front panel
base panel component side
base panel silkscreen
base panel solder side
front panel silkscreen
front panel solder side
example schematic draw
MM3D schematic draw

short description (EN)

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II. Software

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1. General description

Operation of the device is provided by Python (control), Perl (data access) and Bash (utilities) scripts.

2. Prepare

Before installing the program, you must install Raspbian OS Lite on Raspberry Pi. Remember to change the default password for the user 'pi', configure the hostname and access to the local network. For easier remote access, use a permanent IP address or configure the IP address assignment on your router.

Prepare operation system:

```
pi@raspberrypi$ sudo apt-get update
pi@raspberrypi$ sudo apt-get upgrade
pi@raspberrypi$ sudo apt-get install git wget
pi@raspberrypi$ sudo echo "deb http://www.szerafingomba.hu/deb/ ." >> /etc/apt/sources.list
pi@raspberrypi$ sudo wget -q -O - http://www.szerafingomba.hu/deb/KEY.gpg | apt-key add -
pi@raspberrypi$ sudo apt-get update
pi@raspberrypi$ mkdir $HOME/download
```

3. Download

Download from homepage:

```
pi@raspberrypi$ cd $HOME/download
pi@raspberrypi$ wget http://www.szerafingomba.hu/softwares/mm3d/mm3d-sw-0.4-noarch.tar.gz
pi@raspberrypi$ tar -xzf mm3d-sw-0.3-noarch.tar.gz
```

Download new release from Github:

```
pi@raspberrypi$ cd $HOME/download
pi@raspberrypi$ git clone http://github.com/pozsarzs/mm3d-sw.git
```

4. Installation

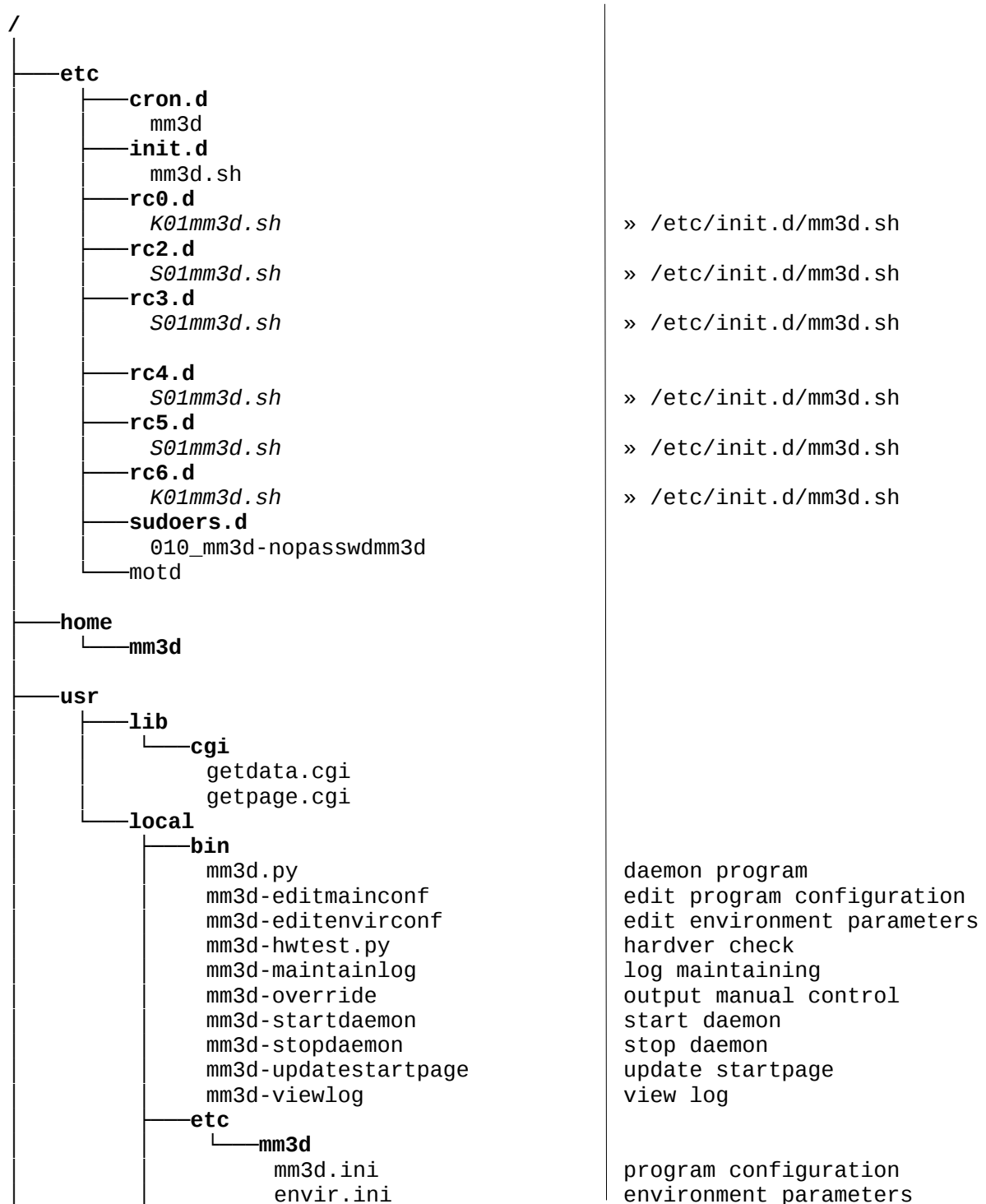
```
pi@raspberrypi$ cd mm3d-sw
pi@raspberrypi$ ./prepare
pi@raspberrypi$ ./install
```

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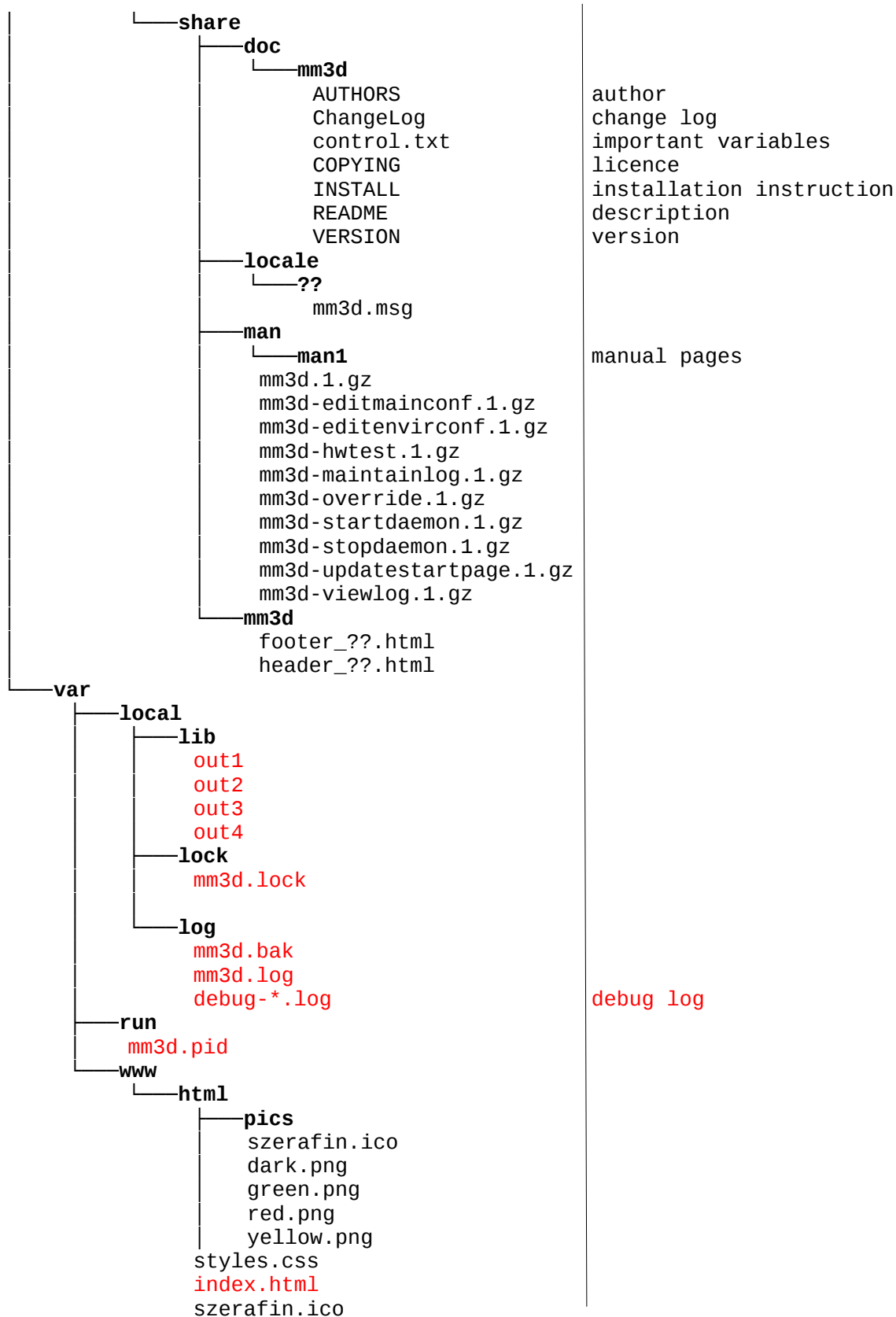
Install program from internet with package manager:

```
pi@raspberrypi$ cd $HOME/download
pi@raspberrypi$ wget http://www.szerafingomba.hu/softwares/mm3d/mm3d-0.4-prepare_os.sh
pi@raspberrypi$ ./mm3d-0.4-prepare_os.sh
pi@raspberrypi$ sudo apt-get install mm3d-sw mm3d-web mm3d-eec
```

The installed and **created** on runtime files:
(Important files with info and target of symbolic links.)



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The program that is installed with the package manager is placed in the /usr directory instead of /usr/local.

3. Settings

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A program beállítása:

```
mm3d@raspberrypi$ mm3d-editmainconf
```

The shellscript stops the service and opens the mm3d.ini file in the default editor. After saving the file, it refreshes the homepage and launches daemont.

Content of configuration file:

```
; +-----+
; | MM3D v0.4 * Growing house controlling and remote monitoring system      |
; | Copyright (C) 2018-2019 Pozsár Zsolt <pozsar.zsolt@szerafingomba.hu>    |
; | mm3d.ini                                                                |
; | global configuration file                                              |
; +-----+

[user]
; User's data
usr_nam=User's name                ; user's name
usr_uid=00000000                  ; user's ID
usr_dt1=User's city               ; more data (eg. country)
usr_dt2=User's address            ; more data (eg. address)
usr_dt3=Growing house number      ; more data (eg. growing house)

[names]
; Name of error lights and ports
nam_err1=unnamed #1               ; name of error lights
nam_err2=unnamed #2
nam_err3=unnamed #3
nam_err4=unnamed #4
nam_in1=unnamed #1                ; name of inputs
nam_in2=unnamed #2
nam_in3=unnamed #3
nam_in4=unnamed #4
nam_out1=unnamed #1              ; name of outputs
nam_out2=unnamed #2
nam_out3=unnamed #3
nam_out4=unnamed #4

[ports]
; GPIO port number of error lights and ports
prt_act=24
prt_err1=14
prt_err2=15
prt_err3=18
prt_err4=23
prt_in1=2
prt_in2=3
prt_in3=4
prt_in4=17
prt_sens=11
prt_out1=27
prt_out2=22
prt_out3=10
prt_out4=9

[sensors]
; Type of temperature and humidity sensor
;sensor_type=AM2302
;sensor_type=DHT11
sensor_type=DHT22

[directories]
```

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```
; Directories of program
dir_htm=/var/www/html/           ; webserver's directory
dir_lck=/var/local/lock/         ; lock file's directory
dir_log=/var/local/log/          ; logfile's directory
dir_msg=/usr/local/share/locale/ ; message files' directory
dir_shr=/usr/local/share/mm3d/   ; other files' directory
dir_tmp=/var/tmp/                ; place of temporary files
dir_var=/var/local/lib/mm3d/     ; workfiles's directory

[openweathermap.org]            ;login data
api_key=00000000000000000000000000000000
base_url=http://api.openweathermap.org/data/2.5/weather?
city_name=Tiszafoldvar

[others]
; Language of webpage
;lng=cs
;lng=de
lng=en
;lng=hr
;lng=hu
;lng=ru
;lng=sk
;lng=sl
;lng=uk
; Storing time of log
day_log=7
; Enable/disable verbose debug log
dbg_log=0
```

Set growing environment parameters:

```
mm3d@raspberrypi$ mm3d-editenvirconf
```

The shell program starts the setup program and then resumes the service after saving and exiting.

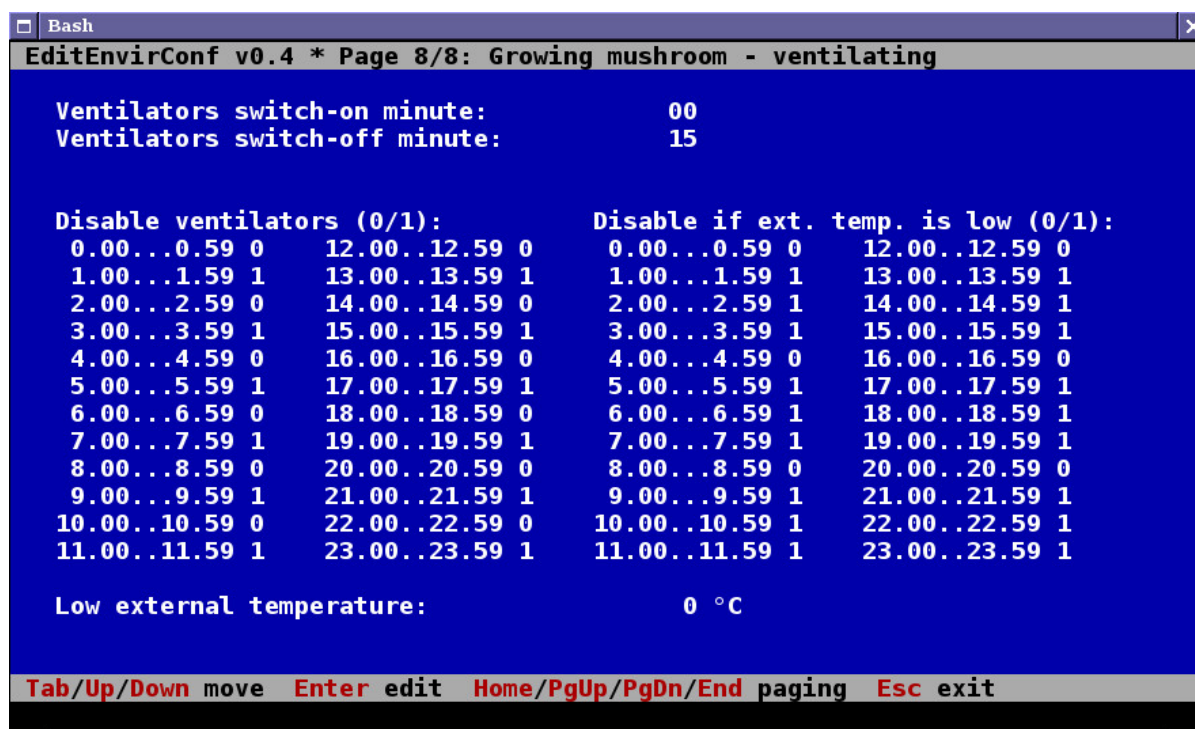


Figure 2: mm3d-editenvirconf

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6. Using the device

The device works automatically after installation and does not require human intervention. Checking and configuring your operation is only possible remotely via a network.

Connect with a web browser

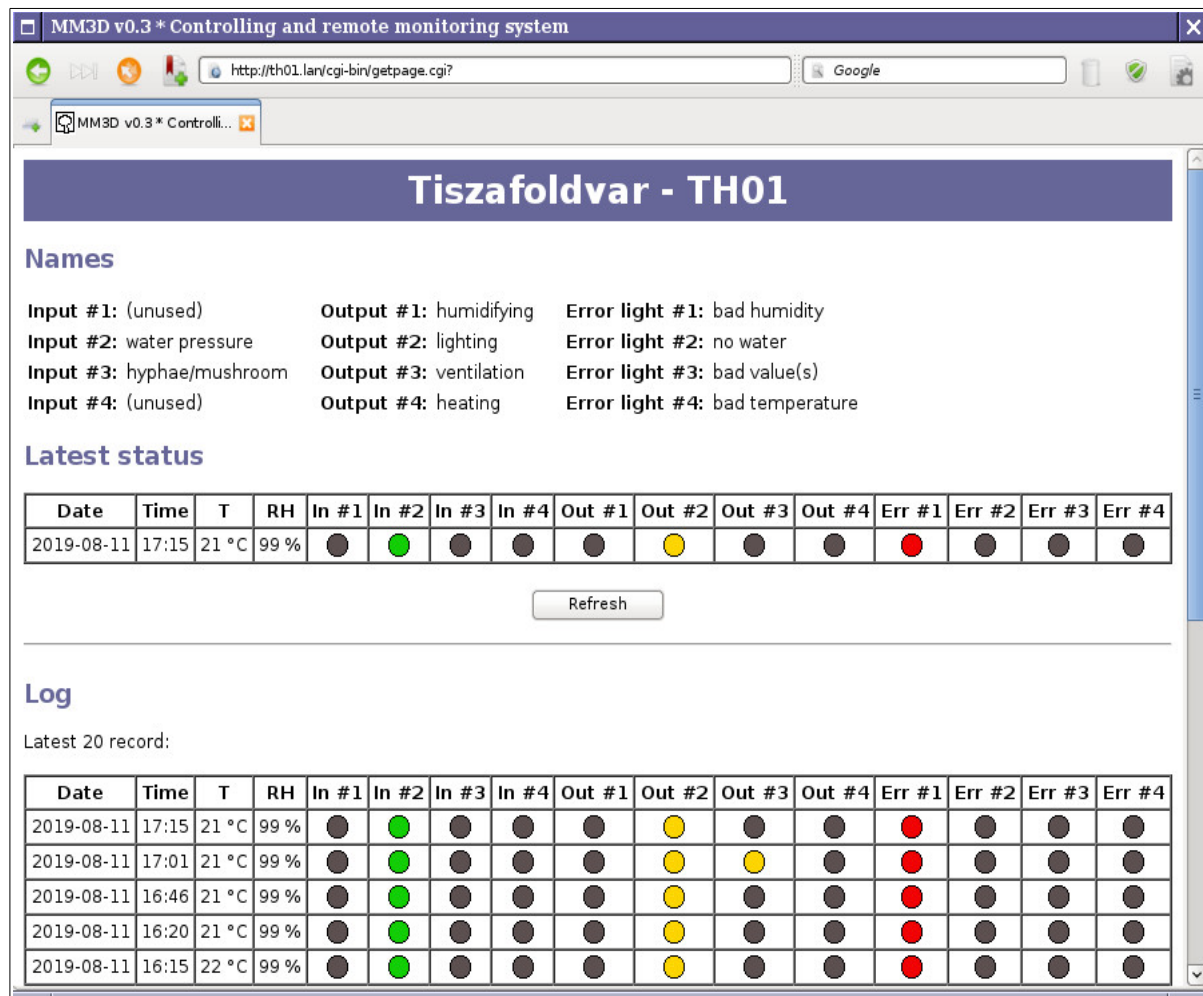


Figure 3: Measured data

Connect with SSH client

For proper character display, the terminal type must be set on non-Unix-like operating systems.

Connect with OpenSSH on Windows:

```
C:\Users\pozsarzs>set TERM=linux
C:\Users\pozsarzs>ssh mm3d@th01.lan
```

Connect with Putty on Windows:

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The type of terminal can be set in the field marked with the green frame. (Figure 4)

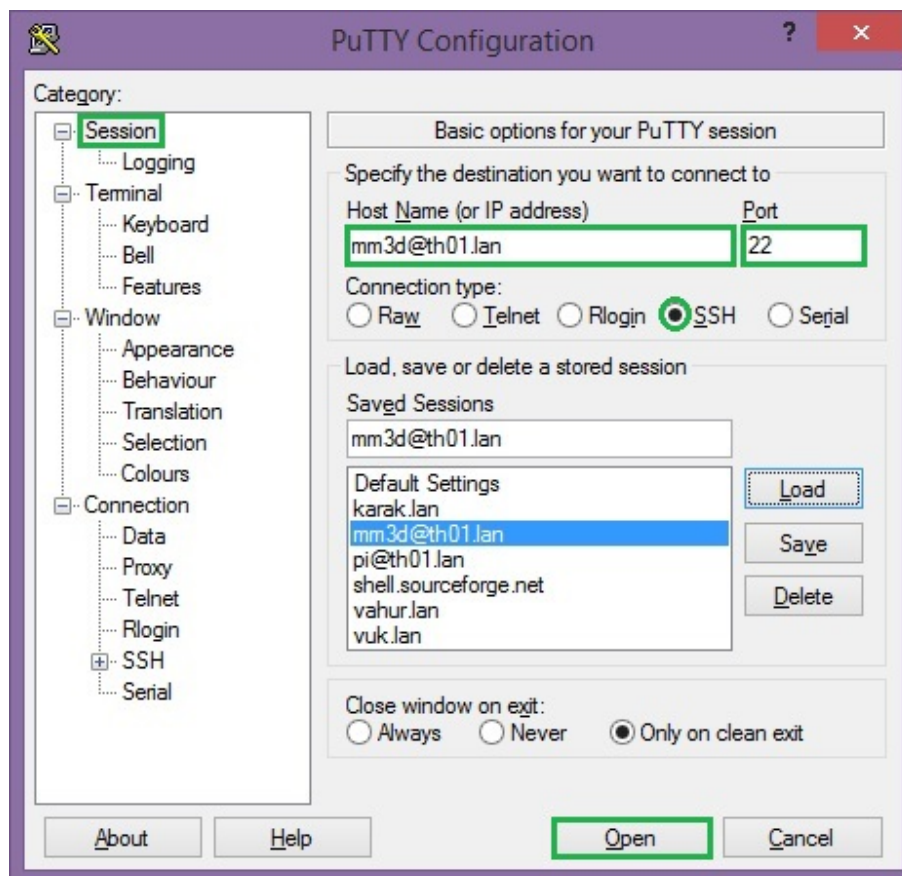


Figure 4: Connect with Putty

Connect with OpenSSH on linux:

```

Bash
pozsarzs@karak:~$ ssh mm3d@th01.lan
Linux th01.lan 4.19.66-v7+ #1253 SMP Thu Aug 15 11:49:46 BST 2019 armv7l

MM3D v0.4 * Growing house controlling and remote monitoring system
Copyright (C) 2018-2019 Pozsár Zsolt <pozsar.zsolt@szerafingomba.hu>

Use mm3d-editenvirconf program to set characteristics of growing
environment and mm3d-override command to override status of outputs.

See manual page of commands for more information.
Last login: Mon Dec 16 18:52:40 2019 from 192.168.0.11
mm3d@th01:~ $

```

Figure 5: Connect with OpenSSH

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7. Terms of use

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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 (English and Hungarian) text of the license online. (Refer to Chapter IV for references.)

8. Downloadable software package

The package can be downloaded from the manufacturer's website in a .tar.gz compressed file. (Refer to Chapter IV for references.) Name of current package: *mm3d-sw-0.4-armhf.tar.gz*

Content of package:

mm3d - sw

— **binary**

— **documents**

AUTHORS
ChangeLog
control.txt
COPYING
INSTALL
README
VERSION

— **manuals**

— **messages**

— **packaging**

— **programs**

— **scripts**

— **settings**

— **source**

— **webpage**

— install
— preinstall
— uninstall
— LICENCE
— README

binary files

documentation (EN)

author(s)
change log
important variables
EUPL v1.1
installation instruction
information
version

manual pages (EN)

translated webpage text

files for make deb packages

programs (Python)

programs (Bash)

settings

source code

components of webpage

installer script
preinstaller script
uninstaller script
terms of use
short description (en)

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III. Example of application

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The example illustrates the co-operation of the analog controllers MM1A and MM2A. The operation of the growing house requires controlled lighting and ventilation, heating and humidification. The wiring of the house is in annex 2.

Input and output function:

sign	function	note
<i>Inputs</i>		
IN #1	-	
IN #2	water pressure sensor	low pressure: opened contacts
IN #3	operation mode switch	growing mushroom: opened contacts
IN #4	-	
<i>Outputs</i>		
OUT #1	Humidifying	magnetic valve with 24V AC solenoid
OUT #2	Lighting	fluorescent lamps
OUT #3	Ventilation	
OUT #4	Heating	electrical heaters
<i>Error lights</i>		
ERR #1	Humidity	Bad humidity
ERR #2	Low water pressure	Pressure of the incoming water is low for the operation of the humidifier system.
ERR #3	Wrong values-	Wrong measured values.
ERR #4	Temperature	Bad temperature

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IV. Related links

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1. Hardware

Full documentation	http://www.szerafingomba.hu/equipments/mm3d/mm3d-hw-190203-4.0.tar.gz
Github	http://github.com/pozsarzs/mm3d-hw.git
User manual (EN)	http://www.szerafingomba.hu/equipments/mm3d/user-manual-190203-4.0-en.pdf
User manual (HU)	http://www.szerafingomba.hu/equipments/mm3d/user-manual-190203-4.0-hu.pdf

Kapcsolási rajzok:

Example (KiCAD)	http://www.szerafingomba.hu/equipments/mm3d/sch_mm3d-example.tar.gz
Example (PDF)	http://www.szerafingomba.hu/equipments/mm3d/sch_mm3d-example.pdf
Example (SVG)	http://www.szerafingomba.hu/equipments/mm3d/sch_mm3d-example.svg
MM3D (KiCAD)	http://www.szerafingomba.hu/equipments/mm3d/sch_mm3d.tar.gz
MM3D (PDF)	http://www.szerafingomba.hu/equipments/mm3d/sch_mm3d.pdf
MM3D (SVG)	http://www.szerafingomba.hu/equipments/mm3d/sch_mm3d.svg

Printed circuit boards:

MM3D base (PS)	http://www.szerafingomba.hu/equipments/mm3d/pcb_mm3d_base-ps.tar.gz
MM3D base (SVG)	http://www.szerafingomba.hu/equipments/mm3d/pcb_mm3d_base-svg.tar.gz
MM3D front (PS)	http://www.szerafingomba.hu/equipments/mm3d/pcb_mm3d_front-ps.tar.gz
MM3D front (SVG)	http://www.szerafingomba.hu/equipments/mm3d/pcb_mm3d_front-svg.tar.gz

2. Software

Software package	http://www.szerafingomba.hu/equipments/mm3d/mm3d-sw-0.4-armhf.tar.gz
Github	http://github.com/pozsarzs/mm3d-sw.git

3. Terms of use

CC-BY-NC-4.0 (EN)	https://creativecommons.org/licenses/by-nc/4.0/legalcode
CC-BY-NC-4.0 (EN)	https://creativecommons.org/licenses/by-nc/4.0/
CC-BY-NC-4.0 (HU)	https://creativecommons.org/licenses/by-nc/4.0/deed.hu
EUPL v1.2 (EN)	https://eupl.eu/1.2/en/
EUPL v1.2 (HU)	https://eupl.eu/1.2/hu/

4. Developer and manufacturer

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

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V. Annexes

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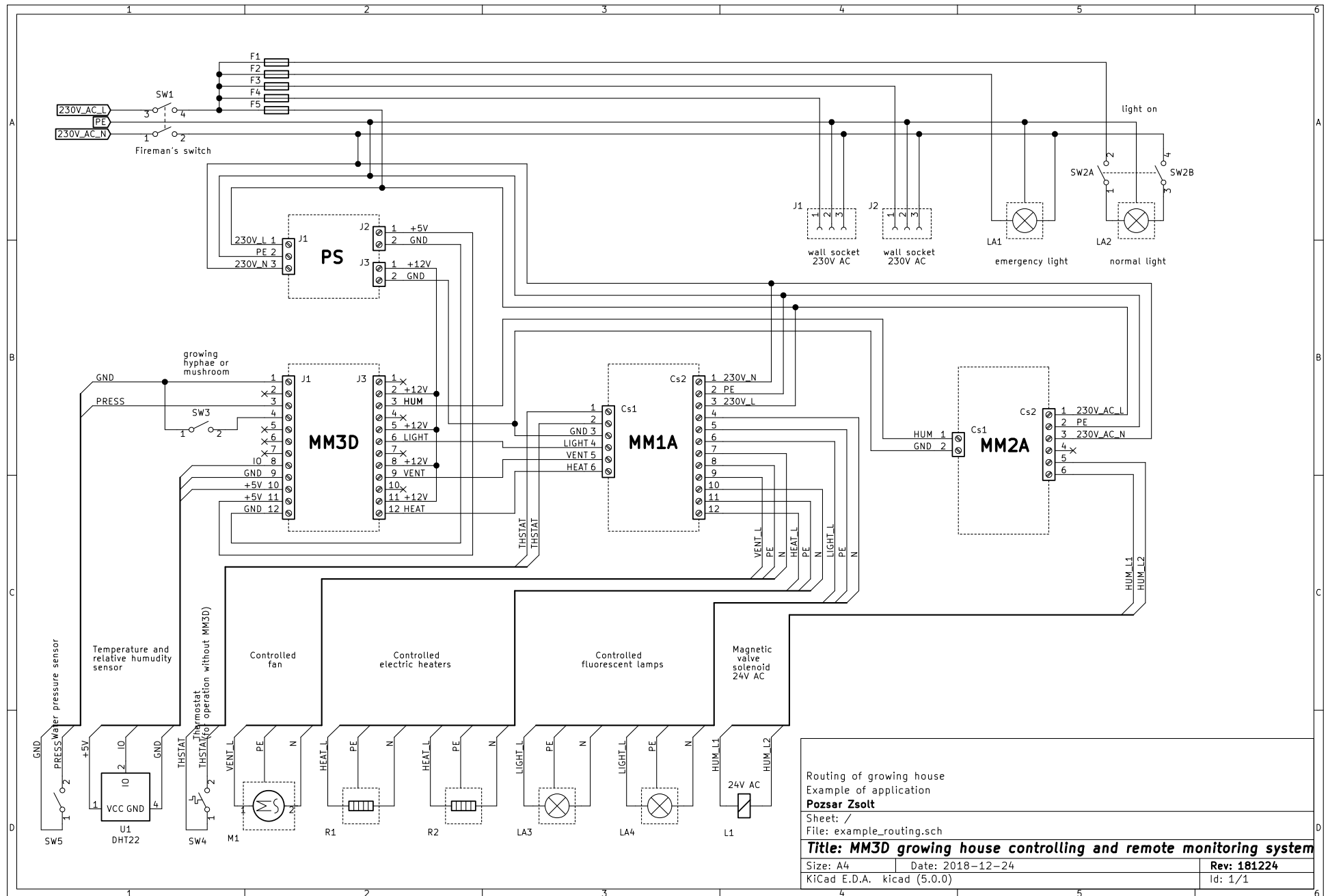
1. Schematic draws

1. Schematic of MM3D
2. Example of application

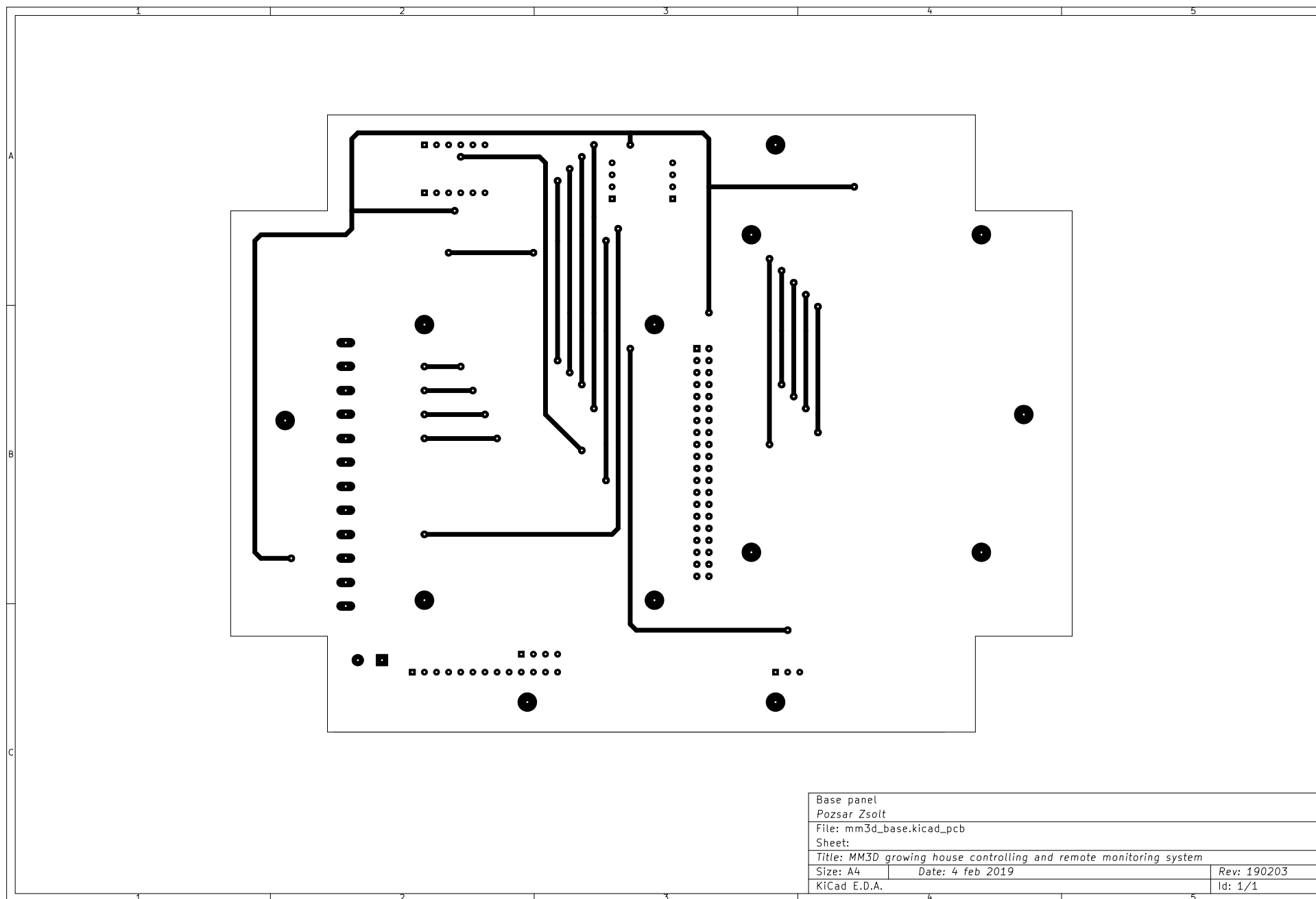
2. Printed circuit boards

3. Base panel component side
4. Base panel solder side
5. Base panel silkscreen
6. Front panel component side
7. Front panel silkscreen

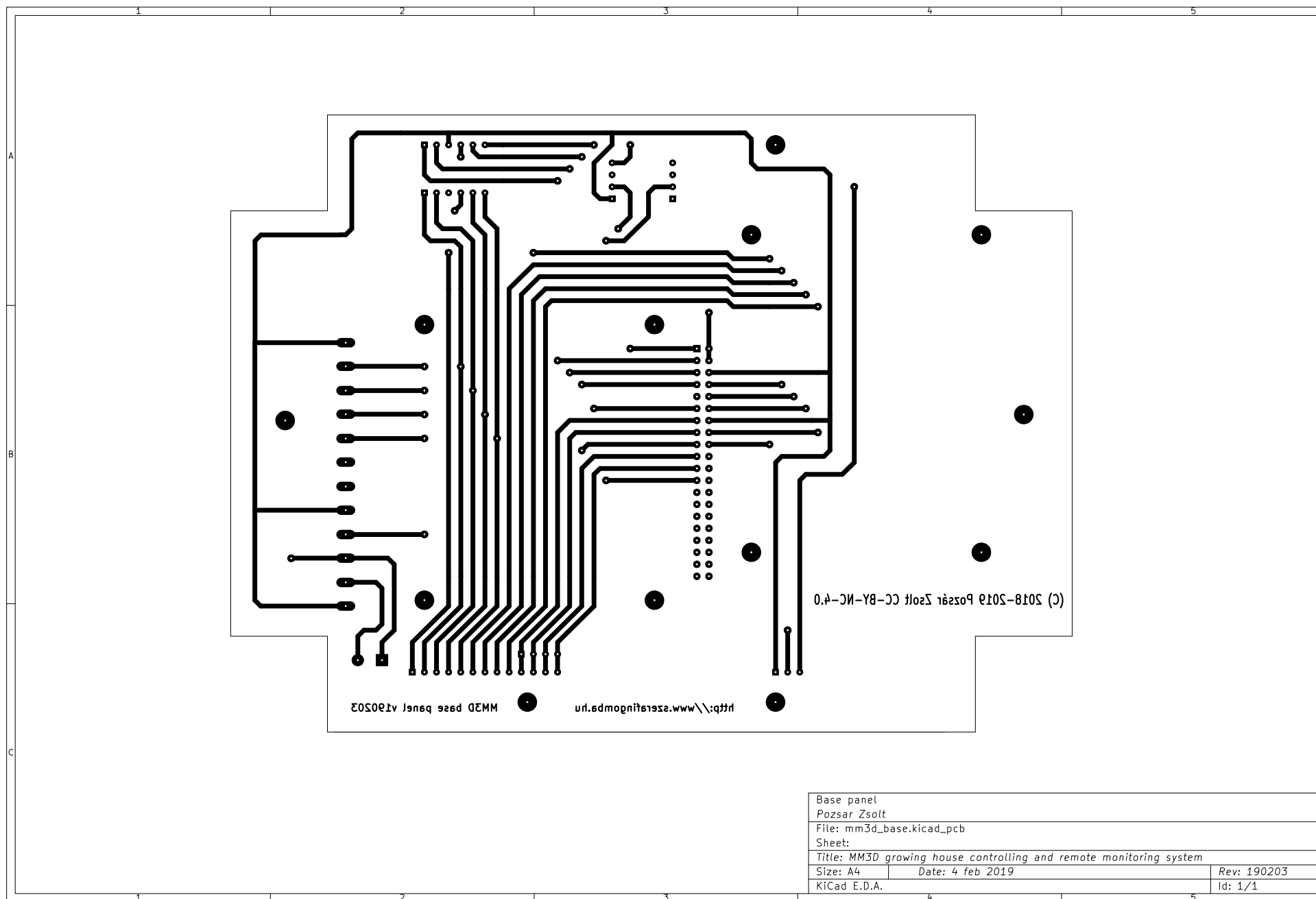
Titles:	MM3D growing house controlling and monitoring unit	Rev.:	190203	Pages:	23/31
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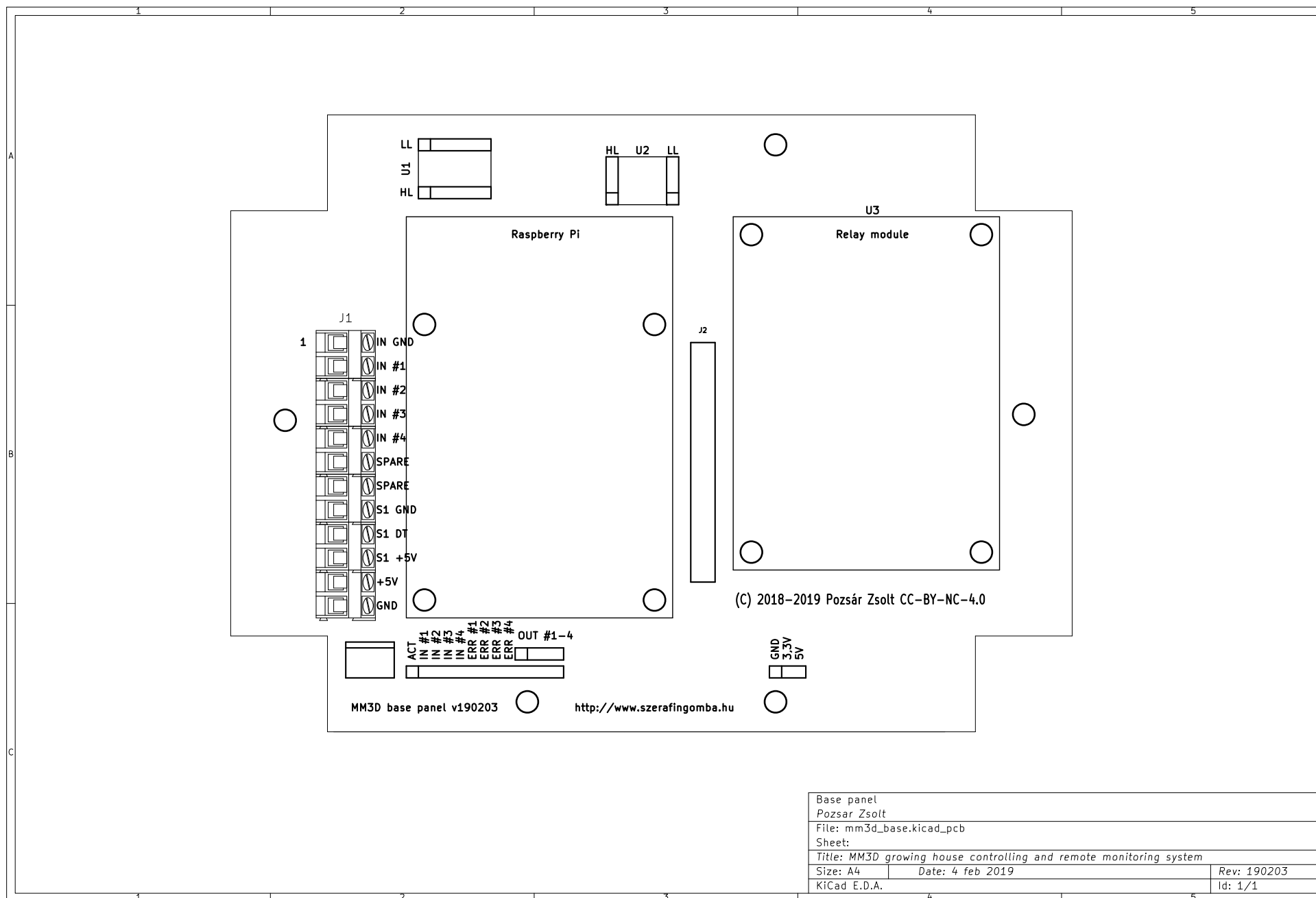
Annex 2: Example of application



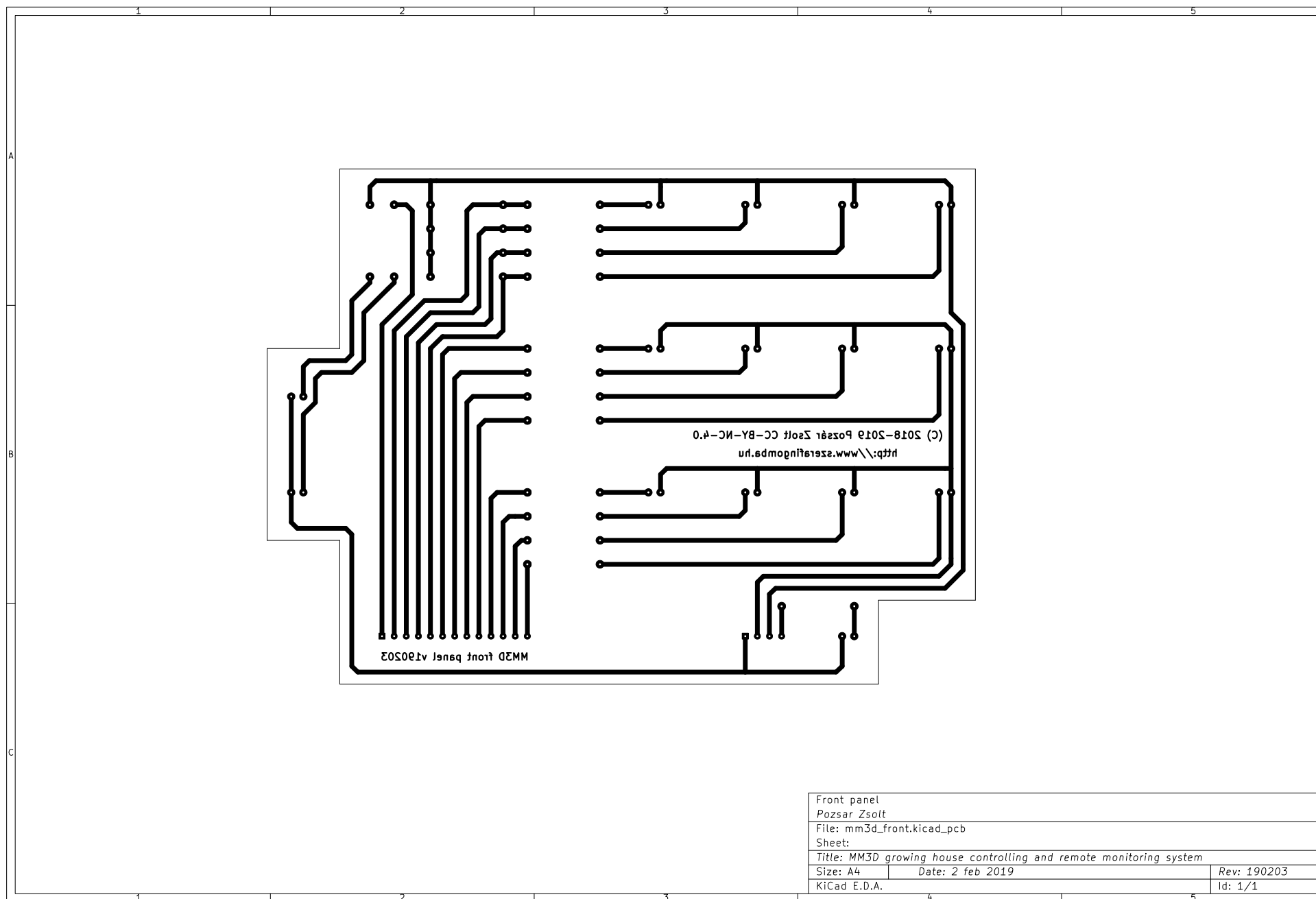
Annex 3: Base panel component side



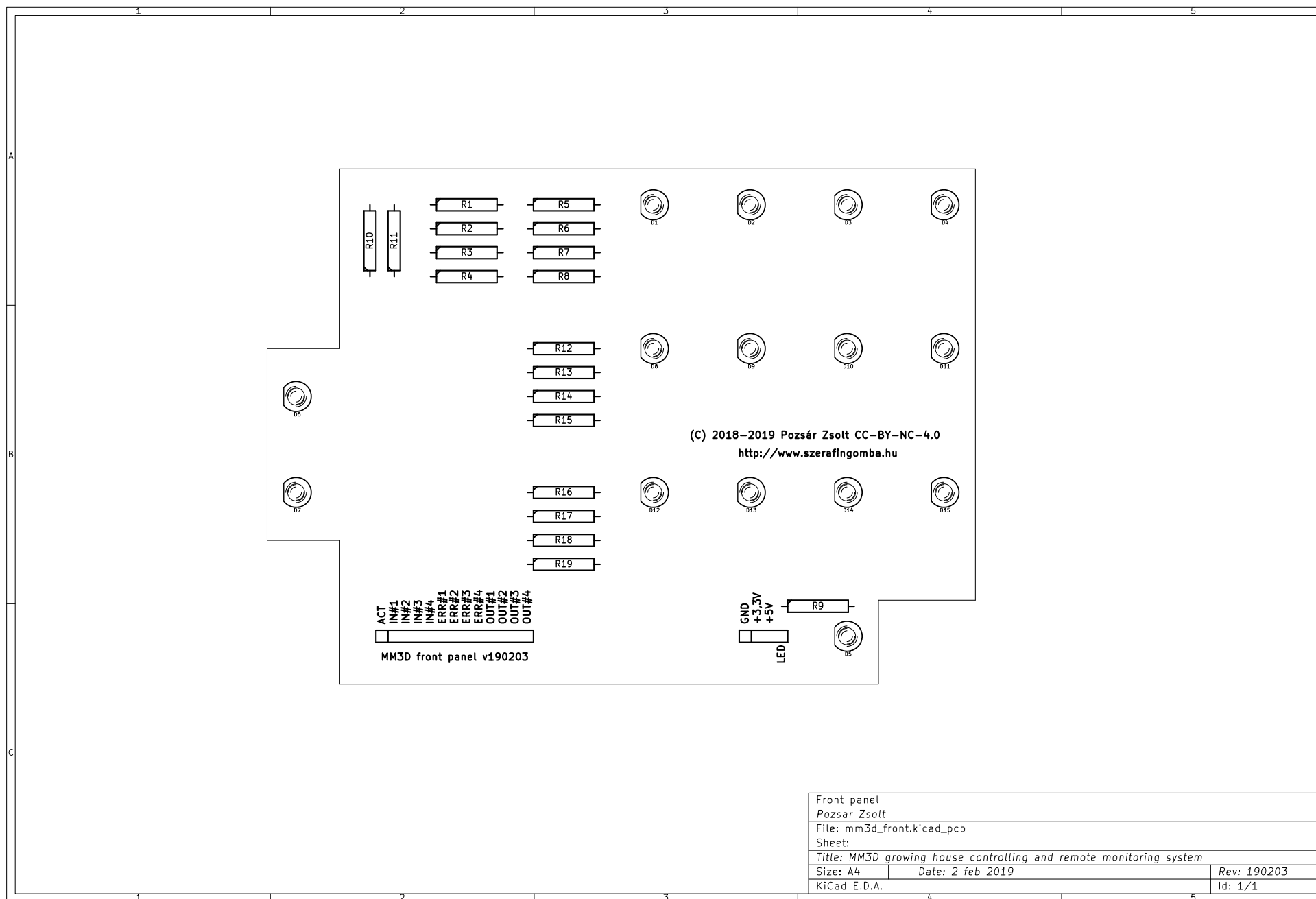
Annex 4: Base panel solder side



Annex 5: Base panel silkscreen



Annex 6: Front panel solder side



Annex 7: Front panel silkscreen