Remote controlled lay-z-spas

photo cred: davidmardanielsson

photo cred: jarisiv

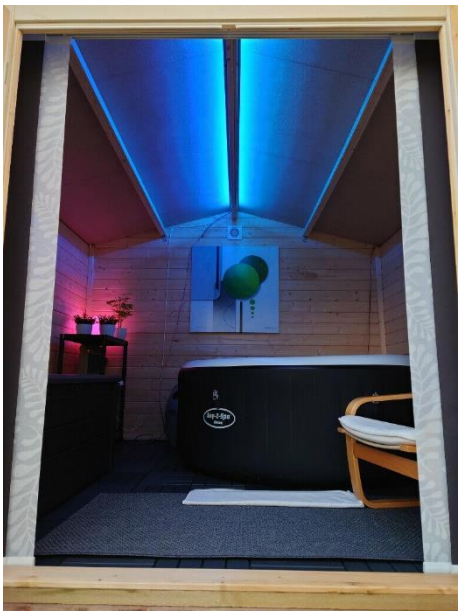


photo cred: torei

https://github.com/visualapproach/WiFi-remote-for-Bestway-Lay-Z-SPA
Last edited 2022-12-17 20:17

How to build the Wi-Fi remote for Bestway Lay-Z-Spa

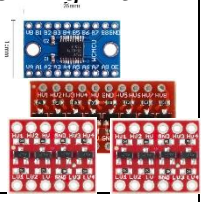
TOC

1) If you like this project, please buy me a coffee:
PayPal.me/TLandahl

Thank you!

2) Checking compatibility

Table of models (not exhaustive)

Alias examples These names can be sold with other pump models than listed here!	**Model Number**	Pump shape	Wires	Model.h MALDIVES2021=hydrojets MIAMI2021=no jets	Confirmed working with 1 2 
2021 Bali	**?**	Square 2021	6	MIAMI2021	
2021 Maldives/Hydrojets	**?**	Square 2021	6	MALDIVES2021	
Riviera	**12220**	Eggshape	?	?	
Coleman SaluSpa	**13804 ?**	Eggshape	6	PRE2021	
Dreamstream	**24949**	Square2021	6	MIAMI2021	2 (PCB_V2B)
Vegas	**54112**	?	4	NO54123	
Monaco	**54113**	Eggshape	?	?	
Vegas	**54122**	Eggshape	6	?	
Miami	**54123**	Eggshape	6/4	PRE2021/NO54123	
Palm Springs	**54129**	Eggshape	4	NO54154	
Hawaii/Hydrojet	**54138**	Square	4	NO54138	
Palm Springs/Hydrojet	**54144**	Square	?	Probably	
Paris	**54148**	Eggshape	?	?	
Bestway Paris	**54149E**	?	6	NO54149E	
Hawaii airjet	**54154**	Eggshape	6	PRE2021	2
Siena	**54156**	Eggshape	4	?	
2019 Maldives/Hydrojets	**54173**	Square	4	NO54173	
Honolulu	**54174**	Eggshape	6	?	
St. Moritz	**54175**	Eggshape	6	PRE2021	
Bali	**54183**	Eggshape	6	PRE2021	
Milan	**54184**	Eggshape	?	?	
Tahiti	**54186**	Eggshape	6	PRE2021	
Helsinki	**54189**	Eggshape	6	PRE2021	1+2
Cancun	**54286**	Eggshape	6	?	
Ibiza	**54291**	Eggshape	?	?	
Havana	**54298**	Eggshape	?	?	
	54327		6	PRE2021	
Coleman SaluSpa Cali	**90437E**	Eggshape	6	PRE2021	
Dreamstream P06461	**24949**	Square 2021	6	MIAMI2021	
St. Lucia/Rio	**S100101**	Square 2021	6	MIAMI2021	1+2
2021 Miami	**S100102**	Square 2021	6	MIAMI2021	
Helsinki	**S100103**		6	MIAMI2021	
SaluSpa Honolulu	**S100104**	Square 2021	6	MIAMI2021	
Maldives	**S100104**	Square 2021	6	MALDIVES2021	2
Saluspa Miami	**S100105**	Square 2021?	6	MIAMI2021	1
Santorini whirlpool	**S200102**	?	6	MIAMI2021	

Hawaii Hydrojet Pro	**S200102**	Square 2021	6	MALDIVES2021	2 (PCB_V2B)
Ibiza 2021	**60015**	Square 2021	6	MIAMI2021	1

General info on pump models

- If you find errors in the table above, or want to add information, please post a discussion on github.
- Some 4-wire models are reported to get communication error messages. Some due to poor power supply, some suspected to be caused by something else (no conclusions yet)
- 2021 and later 6-wire models may need 560-680 Ohms resistors between LLC and display (CLK, DATA, CS), as reported by cyberfly79. Use short wires. I can't say what models since the reports is differing on the same models. If the display flashes you need them. @SigmaPic came up with the idea of using other pins and it should hopefully solve this issue. See later in this doc.
- NO54149E may show sporadic button presses.

Open the pump to verify number of wires

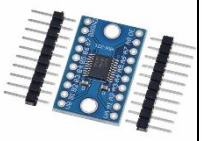
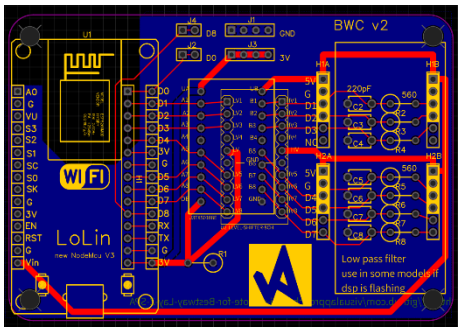
Unscrew the 6 screws as the picture shows, and carefully lift the display. It is attached with a cable with a connector on it. Check if there are 6 or 4 wires/pins. Other models can be disassembled in a similar manner. On the older Hydrojets you must remove the whole cover, not the display. That pump is heavy and fiddlier to disassemble on your own.

Example – eggshaped 6-wire pump

2021 square model

3) Hardware

BOM

ESP8266 NodeMCU 1.0 (12E) V3 (V3 is wider than V2) (NOT ESP32)	
8 channel bidirectional level converter TXS0108E (NOT TXB…)	 
6 or 4 pin male/female pair cable 0.1" spacing: JST SM Housing Connector www.wish.com	
PCB version 2 (better option) https://oshwlab.com/visualapproach/bestway-wireless-controller-2 https://easyeda.com/visualapproach/bestway-wireless-controller-2 PCB v1 https://oshwlab.com/Visualapproach/bestway-wifi-controller https://easyeda.com/Visualapproach/bestway-wifi-controller To order, scroll down to the PCB layout, click open in editor. Then go to Fabrication/download gerber files. *(I don't get % on your order. You pay same $ as I did)*	
Resistor, 10K Ohms, through hole	Optional For power-on stability. I run without it and it works fine.
Female header pins (0.1")	Optional but highly recommended! Make sockets for the ESP and LLC. Removing a broken part is very time consuming if soldered directly to the PCB.

Read discussion #312 if you want to experiment with D1_mini without extra components.

https://github.com/visualapproach/WiFi-remote-for-Bestway-Lay-Z-SPA
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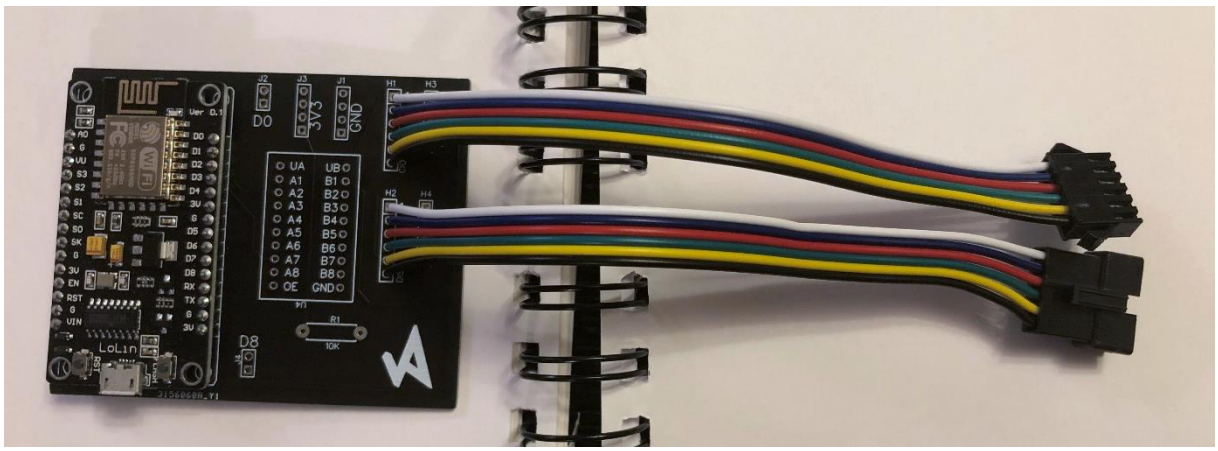
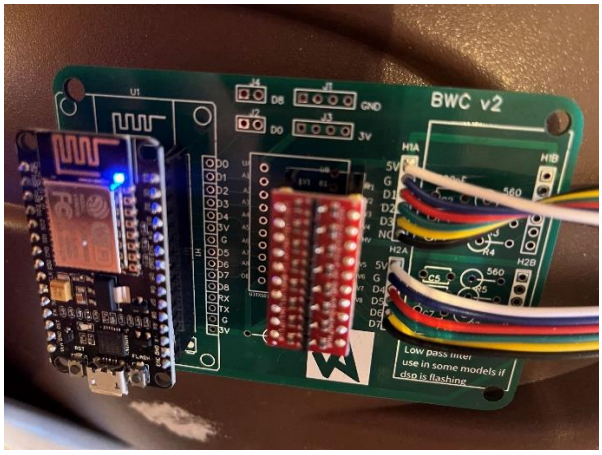
4) Build 6 wire

PCB version 1: Solder the 6-wire cables to the PCB (H1, H2):



PCB version 2 (recommended): Solder the 6-wire cables to the PCB (H1A, H2A):



On some 2021+ models you will *need* to use the red LLC and define the PCB_V2B in model.h. You also need to connect the wires according to this:

```
CIO_DATA (wire #3) : D1 (port H1A)
CIO_CLK (wire #4)  : D2 (port H1A)
CIO_CS (wire #5)   : D5 (port H2A)

DSP_DATA (wire #3) : D6 (port H2A)
DSP_CLK (wire #4)  : D4 (port H2A)
DSP_CS (wire #5)   : D3 (port H1A)
```

It will look like this:

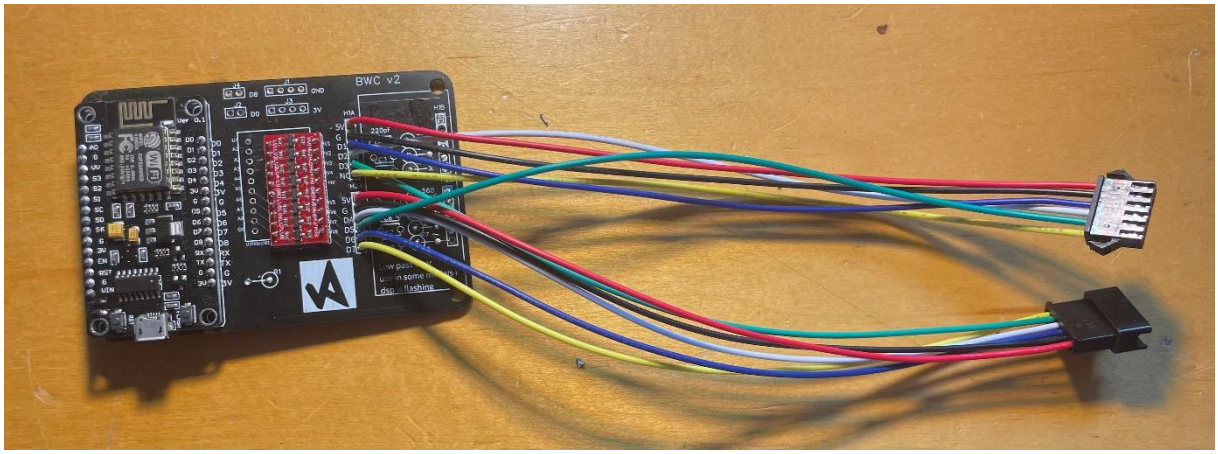


Image cred: @Bischof-Mak

The above method should take care of the problem with flashing display also.

Here is a picture of how the PCB definitions in code corresponds to the physical PCBs

								USE AS ALTERNATIVE PIN OUT WITH 2021+ PUMPS	
		PCB defined in model.h: PCB_V1		PCB defined in model.h: PCB_V2		PCB defined in model.h: PCB_V2B			
		Hardware PCB: PCB_V1		Hardware PCB: PCB_V2 (round corners)		NOT A PHYSICAL PCB.			
Pin/wire no	**Description**	**H1**	**H2**	**H1**	**H2**	**CIO**	**DSP**		
1	+5V	5V	5V	5V	5V	5V	5V		
2	GND	GND	GND	GND	GND	GND	GND		
3	DATA	D7	D5	D1	D4	D1	D6		
4	CLK	D2	D4	D2	D5	D2	D4		
5	CS	D1	D3	D3	D6	D5	D3		
6	AUD	NC	D6	NC	D7	NC	D7		

PCB defined in model.h: PCB_V2B			PCB defined in model.h: PCB_V2B		
Hardware PCB: PCB_V1			Hardware PCB: PCB_V2 (round corners)		
H1	**wire #**		**H1**	**wire #**	
5V	+5V		5V	+5V	
GND	GND		GND	GND	
D7	#6-DSP AUD		D1	#3-CIO DATA	
D2	#4-CIO CLK		D2	#4-CIO CLK	
D1	#3-CIO DATA		D3	#5-DSP CS	
NC			NC		
H2	**wire #**		**H2**	**wire #**	
5V	+5V		5V	+5V	
GND	GND		GND	GND	
D5	#5-CIO CS		D4	#4-DSP CLK	
D4	#4-DSP CLK		D5	#5-CIO CS	
D3	#5-DSP CS		D6	#3-DSP DATA	
D6	#3-DSP DATA		D7	#6-DSP AUD	

5) Build 4-wire

PCB v1

Solder the 4-wire cables to the headers H3/H4. Solder the 10 K resistor.

PCB v2 (recommended):

I suggest using the red LLC (voltage level shifter) in the “U2” socket on the PCB. The blue TXS0108E IC LLC is sometimes not working. Solder the 10 K resistor if using TXS0108E LLC.

“Lazy setup”

Solder the wires to the top holes in H1A and H2A headers .

“Ambitious setup”

Install the filter capacitors C2, C3, C5, C6 and resistors R2, R3, R5, R6. Then solder the wires to the top holes in H1B and H2B headers.

See issue #208 for some info about E13.

4-wire pinout on my test pump NO54138 (Colors and pinout on your pump may differ!):

1 (Uppermost. Black on pump) = 5V
2 (Red on pump) = GND
3 (Yellow on pump) = DSP TX
4 (Green on pump) = CIO TX

6) Build continued

You can go on and solder the LLC and ESP8266 directly to the PCB, but I recommend using female headers. In case you want to switch or reuse them. You will regret if not using headers…

D0, D8, 3V3 and GND is left empty. They are there for the possibility to connect auxiliary equipment. Special considerations needed. See ESP8266 datasheet.

Put the PCB in a box, plastic bag or something to protect against water if you want.

Don’t connect the connectors to the pump yet.

7) Software

6-wire and 4-wire versions

DL and install Visual studio code: https://code.visualstudio.com/download

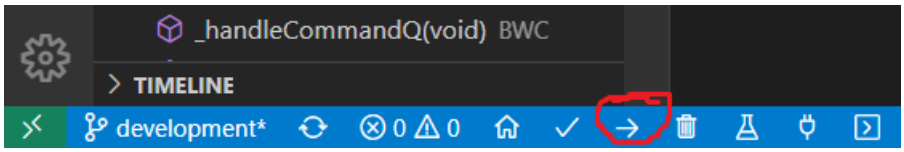
From within VSC, click on Extensions icon (ctrl+shift+X). Select PlatformIO IDE and install.

From the new platformio icon, open folder “6-wire-version” or “4-wire-version”.

Choose your model in the file ***“model.h”***. Only one model must be defined. Double slashes ‘//’ means the line is commented out. To change model, comment out PRE2021 by putting // in front of that line. Remove the ‘//’ from your model. Also choose the PCB version in the same manner. You must use the #defines already existing in this file.

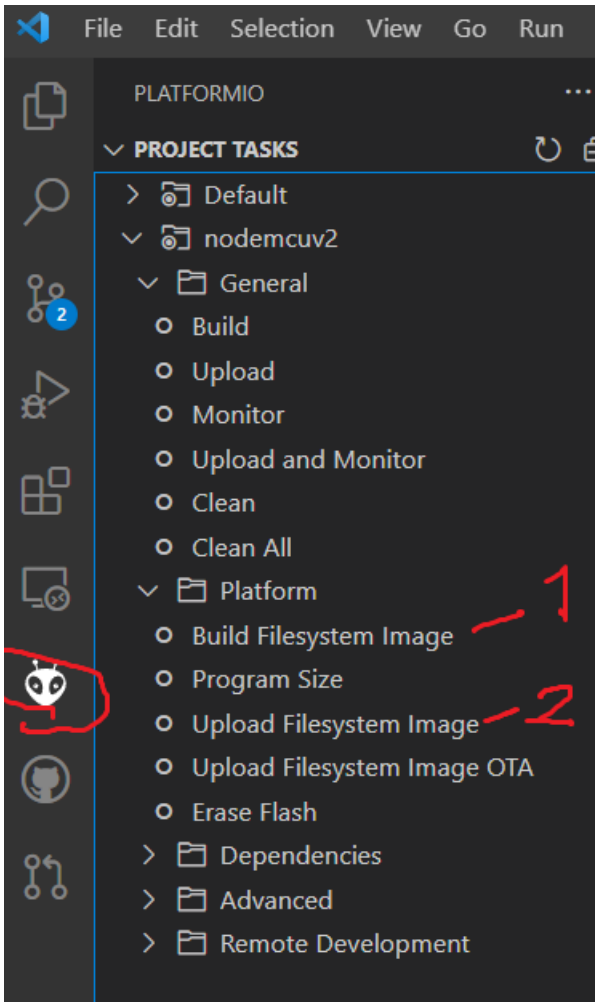
```
//uncomment your model and comment out the rest
//#define MODEL54149E   //Paris airjet 54149E
#define PRE2021         //the older one, no hydrojets
//#define MIAMI2021     //no hydrojets
//#define MALDIVES2021  //hydrojets
```

Upload firmware via USB. (Right arrow at bottom of screen)



Now pay attention! Uploading the firmware is only one part of the upload. You also need to upload the data files. I can’t stress this enough.

First build file system, then upload it. Se picture below.



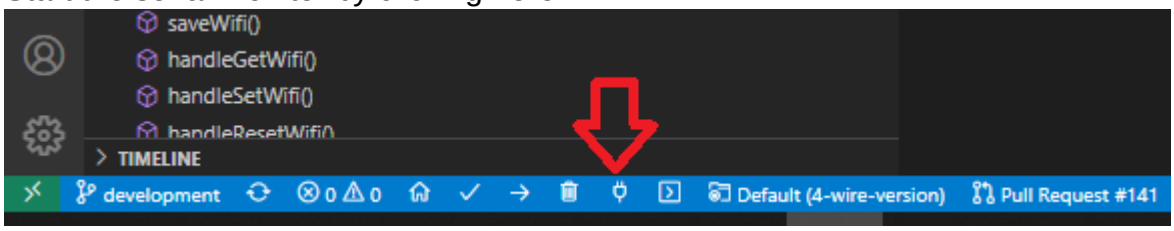
If you miss this step you will get a 404 error!

8) After upload. (Did you upload the data files as well?!)

An Access Point is created called "Lay-Z-Spa Module". Pswd "layzspam0dule".

Log in and enter your wifi credentials.
Visit http://layzspa.local and click on the hamburger menu in the top right corner.
Select “SPA config”. Enter your settings, click SAVE.

The device’s IP is shown in the serial monitor window and the pump display (only 6-wire).
Start the serial monitor by clicking here:



From now on you can update the device over the air (OTA) by editing platformio.ini file.

Default setting is to upload via USB cable:

```
upload_protocol = esptool
; upload_protocol = espota
; upload_port = layzspa.local
; upload_flags =
;   --auth=esp8266
```

Edit like this to upload Over The Air. If you have several devices you would want to use different hostnames.

```
; upload_protocol = esptool
upload_protocol = espota
upload_port = layzspa.local
upload_flags =
  --auth=esp8266
```

9) Extra features (only 6-wire)

You can disable the buttons on the display by editing this line in BWC_const.h

```
//set to zero to disable display buttons. Order as above.
//Example: to disable UNIT and TIMER set 1,1,0,1,0,1,1,1,1,1,1
const uint8_t EnabledButtons[] = {1,1,1,1,1,1,1,1,1,1,1};
```

Button presses will not be sent to the pump (CIO) but will be sent over WS/MQTT to be handled elsewhere.

“Countdown” or notifier

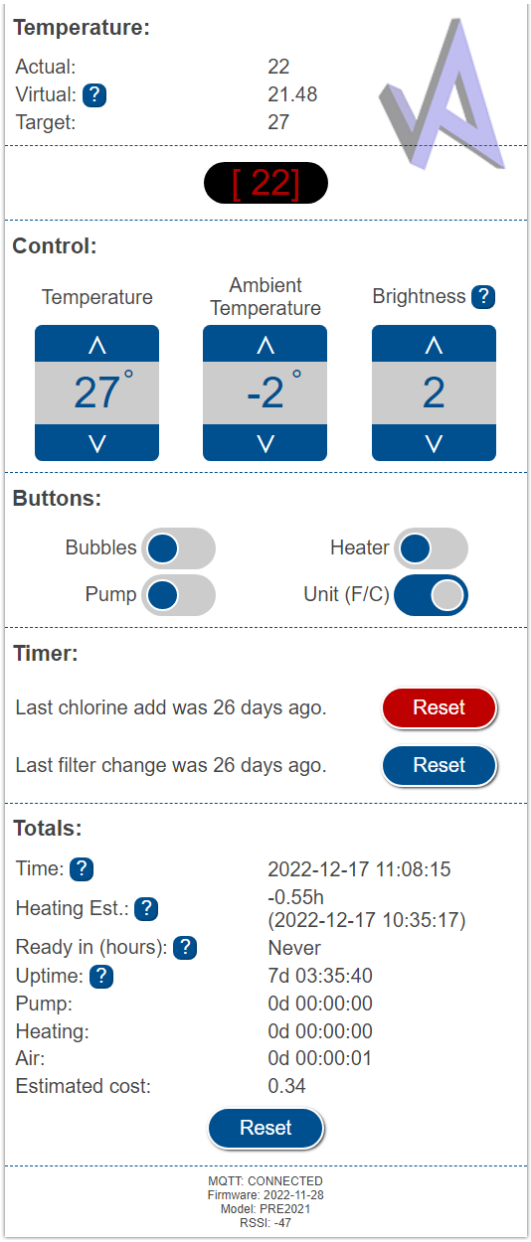
```
/** Other feats */
bool notify = false;
int notification_time = 32;
```

Change notify to true, and the display will beep and show time to next event at 32, 16, 8, 4, 2 and 1. Only for jets/bubbles/pump and heater.

Setting notification_time to something else will work the same way. Halving the remaining time as the next notification. If you for example set it to 100, it will beep at 100/50/25/12/6/3/1s before event.

As a side effect it will beep briefly at startup when the ESP restores the states.

10) Web interface



Main page (/index.html)

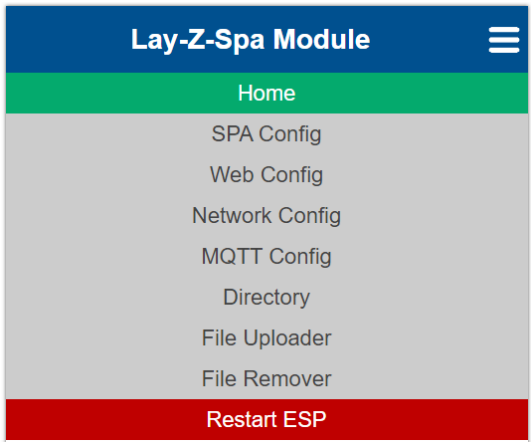
Main page shows information about the spa, like temperature, and elapsed time since last filter change, chlorine added and how long the pump has been running etc.

Press [Reset] restart the timer. These buttons will turn red when overdue.

Pressing the [Reset] button will reset the Totals times.

There is also a TTTT field in the latest version, that shows estimated time to target temperature. Negative values means time since diverting from target temperature.

MQTT status

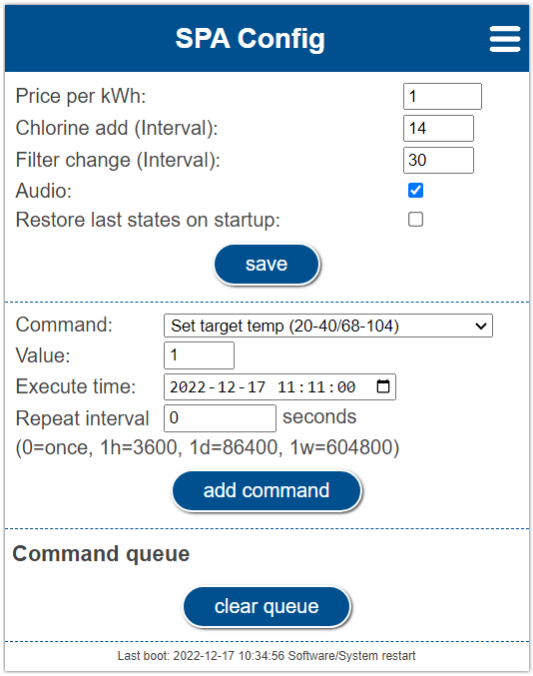


Clicking the menu button reveals other actions and pages.

Author: @torei

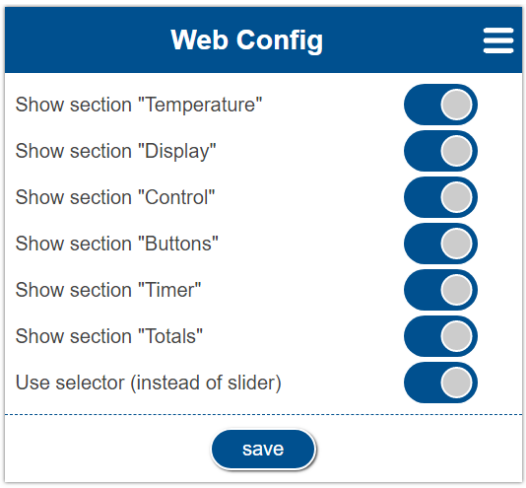
Use File Uploader to upload data files without erasing settings etc.

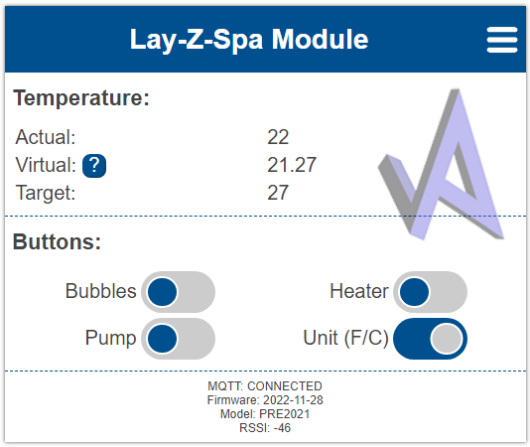
[Restart ESP] restarts the ESP 8266. Just in case you want to hear that lovely melody and read the greeting on the display again.



Schedule up to 10 actions. E.g. set target temp to 38, and turn on heater every Thursday and turn off pump every Sunday.

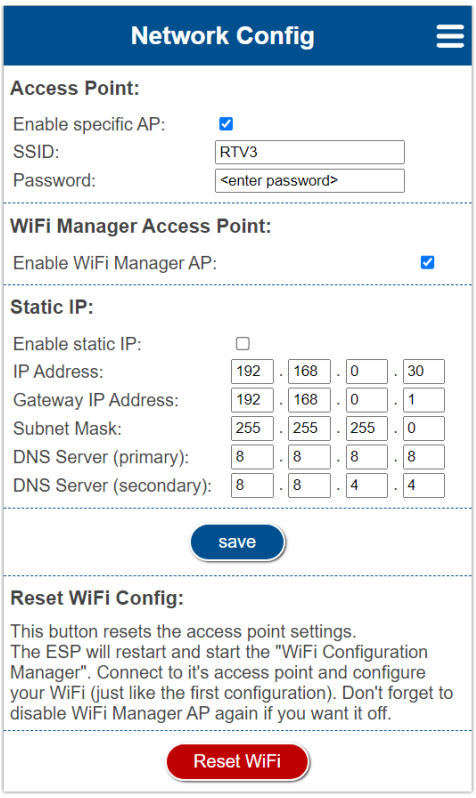
Set the daily energy meter to reset every midnight if using home automation.





With the Web Config you can create a compact Web UI like this.

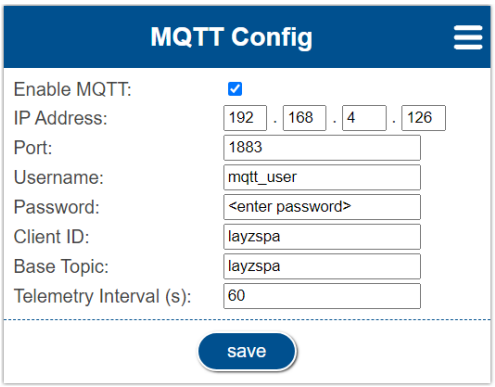
https://github.com/visualapproach/WiFi-remote-for-Bestway-Lay-Z-SPA
Last edited 2022-12-17 20:17



If you want to connect to another AP than you selected in the autoportal.

Advanced network settings.

Forget saved WiFi credentials.



Enter your MQTT broker IP and credentials.

Telemetry interval is how often messages are sent if no changes occur.

11) Connect

Unplug pump from mains!

Connect device to pump.

Close the display with the screws.

Turn on pump and enjoy.

12) Passwords and credentials

Take a look in the file config.h

13) Secret key combination

If you press the following button sequence on the display, the ESP will reset and forget the Wi-Fi settings:

POWER

LOCK

TIMER

POWER

14) Hardware test

Visit page http://layzspa.local/hwtestinfo.html for information. If you get zero errors you know that the device is working. Potential problems is bad cables or similar.

15) MQTT

This chapter is for advanced users. If you know what MQTT is, and have an MQTT broker, this is what you need to know:

There is two ways to enter your credentials. You can edit the “config.h” file before compiling and then you are done with it. Or you can go to the web interface and click on the MQTT link. If you save from the MQTT web page it will override config.h.

[base topic] is set from the web UI or in config.h

Device is publishing following topics:

[base topic]/Status	
[base topic]/MAC_Address	
[base topic]/MQTT_Connect_Count	
[base topic]/message	Payload is JSON string containing all states of the pump. Se next table
[base topic]/button	Plain text. Pretty name of the button being pressed on the pump display
[base topic]/times	Payload is JSON string containing uptime etc.
[base topic]/other	Payload is JSON string containing other info such as IP, RSSI, FW, MODEL etc
[base topic]/reboot_time	Plain text
[base topic]/reboot_reason	Plain text

Payload in /**message** is a JSON string with these key/value pairs:

KEY	VALUE
CONTENT	STATES (only used in websockets)
LCK	LOCKEDSTATE
PWR	POWERSTATE
UNT	UNITSTATE (0=F, 1=C)
AIR	BUBBLESSTATE
GRN	HEATGRNSTATE
RED	HEATREDSTATE
FLT	PUMPSTATE
TGT, TGTC, TGTF	TARGET TEMP
TMP, TMPC, TMPF	TEMPERATURE
CH1	CHAR1 DISPLAY'S FIRST CHARACTER ASCII code
CH2	CHAR2
CH3	CHAR3
HJT	JETSSTATE
ERR	ERROR (Only 4 wire)
GOD	GODMODE (ESP have control) (Only 4 wire)
VTM	VIRTUAL TEMPERATURE
VTF	VIRTUAL TEMPERATURE FIX (for debugging)
AMB, AMBC, AMBF	AMBIENT TEMPERATURE
BCC	Bad CIO checksum counter (the lower the better)(Only 4 wire)
BDC	Bad DSP checksum counter (Only 4 wire)

Device is subscribing to topic **layzspa/command**

Payload in **command** must be a JSON string with these key/value pairs:

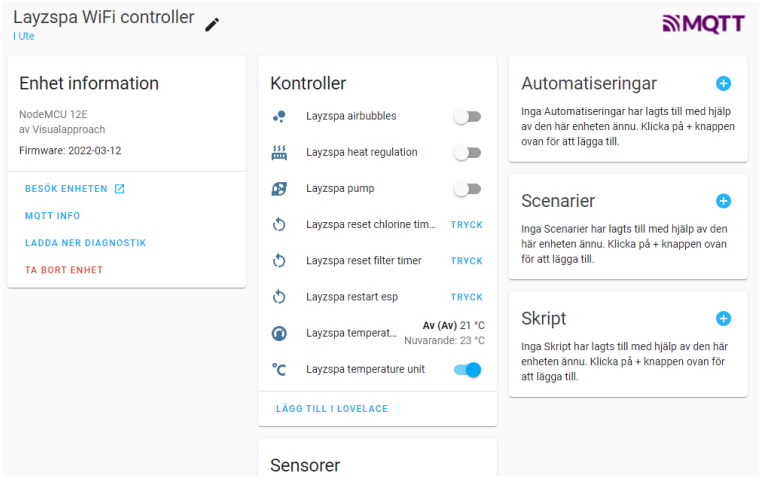
KEY	VALUE
CMD	INTEGER64, see next table
VALUE	INTEGER64
XTIME	INTEGER64, Execution time in UNIX TIMESTAMP or 0 for immediate action. (Seconds since 1970)
INTERVAL	INTEGER64, Repeat every Nth second INTEGER or 0 for NO REPEAT

Available commands (CMD) are

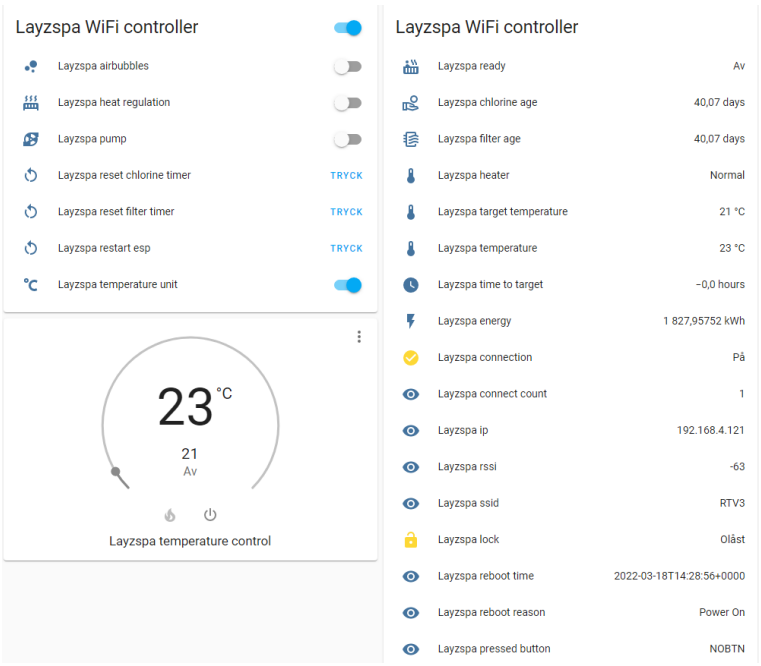
0	SETTARGET	20-40C / 68-104F
1	SETUNIT	0 for F, 1 for C
2	SETBUBBLES	0/1
3	SETHEATER	0/1
4	SETPUMP	0/1
5	RESETQ (clear command queue)	-
6	REBOOTESP	-
7	*GETTARGET*	*(internal use)*
8	RESETTIMES	Set all other timers to zero
9	RESETCLTIMER	Set chlorine age to zero
10	RESETFTIMER	Set filter age to zero
11	SETJETS	If equipped. 0/1
12	TAKECONTROL SETBRIGHTNESS	4 wire only 6 wire only. Sets display brightness 0-8
13	SETBEEP Internal cmd	6-wire only 0 – beeps once Not 0 – plays melody 4-wire only
14	SETAMBIENTF	Set the ambient temperature so virtual temperature and time to ready is accurate.
15	SETAMBIENTC	
16	RESETDAILY	Resets daily energy meter to 0

16) Homeassistant

From firmware version 2022-03-13 this device will register in HA by auto discovery when you connect to your MQTT broker. Go to configuration – devices – Layzspa WiFi controller and click on “add to lovelace”.



Lovelace panels:



The climate control and temperature sensors has its own unit conversion according to your general settings in HA. Switching unit only changes the pump display and the actual numbers sent over MQTT, but the lovelace translates to your preferred unit. After changing HA general unit you have to restart HA.

If you update firmware and get double entities, remove the device from HA interface and restart HA.

17) FAQ

https://github.com/visualapproach/WiFi-remote-for-Bestway-Lay-Z-SPA/discussions

- **Can I make my pump not turn off?**
  Yes, on the Config.html page, add a command in the commandqueue to be repeated daily. E.g. Set pump 1 every 86400 s

- **How do I connect to solar panels etc?**
  Uncomment the relevant code provided in main.cpp to write logic for aother pins. This needs some considerations. Some pins have special limitations.

- **Node red**
  There is a folder "Code/Nodered" which contains examples.

- **Homebridge**

  - homebridge-mqttthing: see this example: **MQTT Homebridge Integration** #109 (Thank you **@PierreBier**)
  - homebridge-mqtt: see this nice write-up by **@chrstnmr MQTT to homebridge (HomeKit) for bloody beginners** #106

- **Home Assistant**
  Device is auto discovered with a lot of entities in FW 2022-03-13 onwards.
  See this example: **Home Assistant Integration - Sample** #96

- **OpenHAB**
  @DandeMC provided this link: openhab whirpool

- **Prometheus**
  Support added by **@svanscho**. Data retrieved at layzspa.local/metrics

- **Does this project support my home automation system not mentioned here?**
  It supports all systems that can handle MQTT and JSON data. Possibly also over Web Sockets. All information about MQTT is provided in this document. How to implement it on your system – you need to seek advise by experts in your system.

- **Mqtt**
  Sends status to broker every 10 minutes (configurable via web gui), and when anything has changed.

- **My blue LED blinks, should I be worried?**
  It's just an LED. It has nothing to do with Wi-Fi!
  It blinks whenever that particular pin is toggled. Doesn't mean anything useful.

18) If you like this project, please buy me a coffee:

PayPal.me/TLandahl

Thank you!

https://github.com/visualapproach/WiFi-remote-for-Bestway-Lay-Z-SPA
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