



Automating my home using **KNX**



Hallo!

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Requirements

- Should be wired
- Must meet the WAF
- Safe and stable
- Understandable



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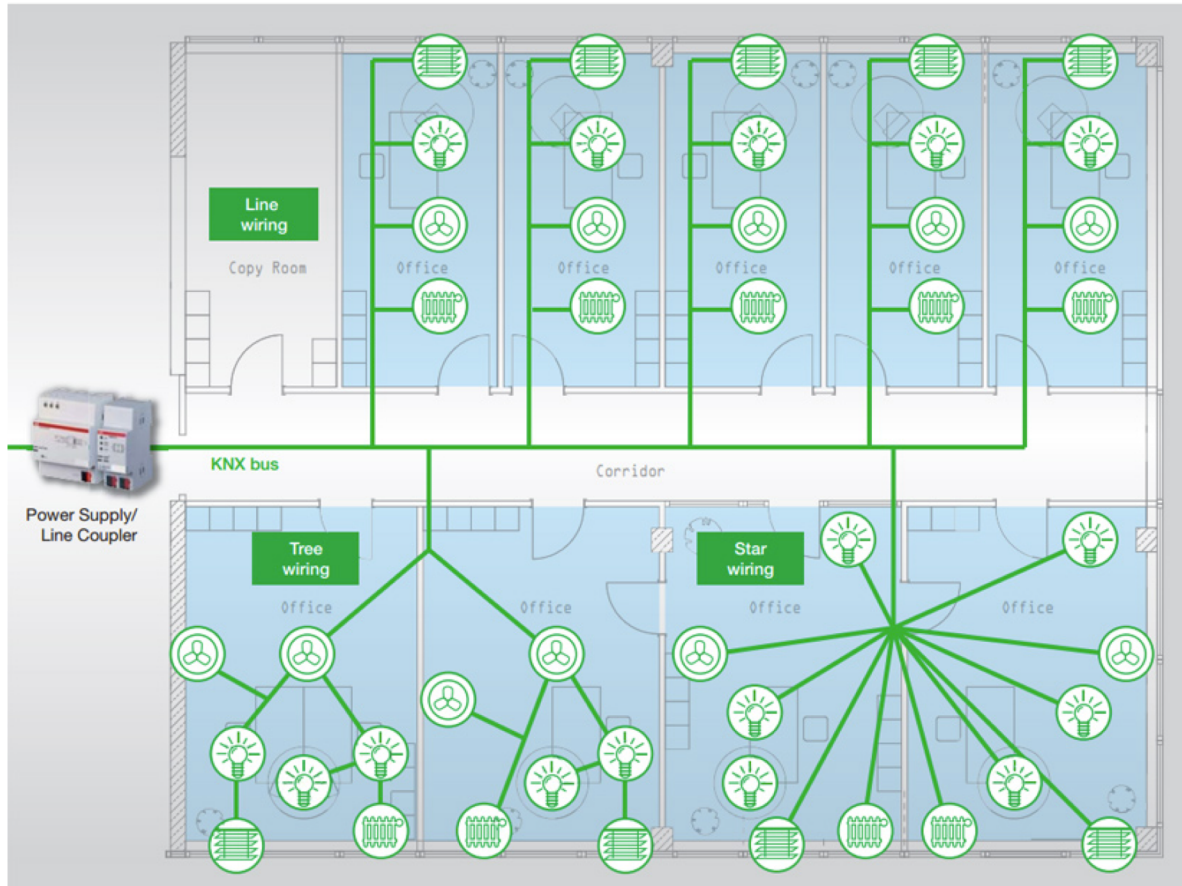
About KNX



A bit of history

- Open standard (ISO/IEC 14543)
 - ~400 manufacturers
- European Installation Bus (EIB)
- Around since 1990
- Twisted pair, RF or IP
- Decentral







ETS5™ - Test

ETS Edit Workplace Commissioning Diagnostics Apps Window

Close Project Undo Redo Reports Workplace Catalogs Diagnostics

Buildings

Add Buildings | Delete Download | Help Highlight Changes Default Parameters Grant Customer Access

Buildings

- Dynamic Folders
 - Test
 - Office
 - 1.1.1 STC-640.01 Bus power supply with dia...
 - 1.1.2 SCN-IP100.02 IP Router with email fun...
 - 1.1.3 SCN-IP100.02 IP Router
 - 1.1.4 Universal interface 6-fold
 - 1.1.5 AKK-02UP.03 Switch Actuator 2fold, fl...
 - 2.1.1 6-Channel Universal Interfaces with Se...
 - Universal Interface
 - 1: Switch - Switch value
 - 2: Value - Value for switch
 - 3: Switch - Switch value
 - 4: Value - Value for switch

2.1.1 6-Channel Universal Interfaces with Sensors > Universal Interface > Channel 0

Configuration Enabled

Function Switch LED output

Channel 0

Channel 1

Channel 2

Channel 3

Channel 4

Channel 5

Associations Parameter

Group Addresses

Add Main Groups | Delete Download | Info Reset Unload Print Search

Group Addresses	Object	Device	Sending	Data Type	C	R	W	T	U	Product	Program	Le
Dynamic Folders	0: System time - System time	2.1.1 6-Channel Universal Inter... S		date time	C	-	W	-	-	6-Channel Universa... 6-Channel Universal Interfaces with...	8 b	
0 Plank	4: Date / Time - Send current date...	1.1.2 SCN-IP100.02 IP Router w... S		date time	C	R	-	T	-	SCN-IP100.02 IP Ro... IP Interface/Router Email and Time s...	8 b	
0/0 Links												
	0/0/1 Switch A											
	0/0/2 Switch B											
	0/0/3 Time											
	0/0/4 Temperature											

Associations

MDT KNX IP Router (10.0.0.58:3671) | 1.1 New line | 0: System time - System time | Last used workspace

Properties

Find and Replace

Workspaces

Todo Items

Pending Operations

Active History

Clear History

- 2.1.1 6-Channel Universal Interfaces with Sensors
 - Download(App): Finished
- 2.1.1 6-Channel Universal Interfaces with Sensors
 - Download(App): Finished
- 2.1.1 6-Channel Universal Interfaces with Sensors
 - The device does not respond in appropriate time.
 - Download(App): Failed
- 2.0.1 6-Channel Universal Interfaces with Sensors
 - The device does not respond in appropriate time.
 - Download(App): Failed
- 2.0.1 6-Channel Universal Interfaces with Sensors
 - Writing to a memory block failed.
 - Download(App): Failed
- 2.0.1 6-Channel Universal Interfaces with Sensors
 - Download(All): Canceled

Undo History

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KNX Protocol



Characteristics

- Communication at 9600bps
- Telegram length
 - Standard: 23 bytes
 - Extended: 263 bytes

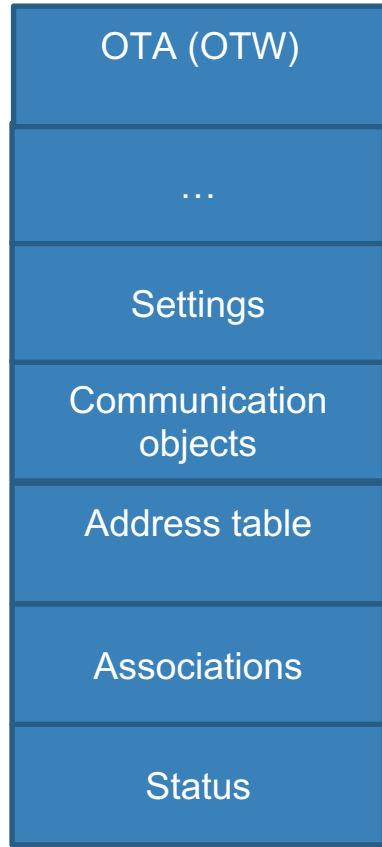


Anatomy

- Communication objects
- Memory
- Properties



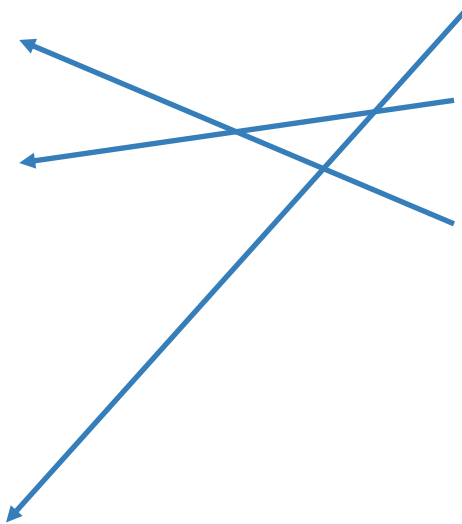
0xFFFF



0x0000

Properties:

- Programming mode
- Serial number
- Run status
- Mask version
- Version
- Address offsets
- ...





System models

- BCU1
- BCU2
- **System 7**
- System B

Up to 255 communication objects and 65KiB of memory.



Addressing (1)

- Every device has a physical address:
 - Example: 3.3.1
- Communication objects communicate using group address:
 - Example: 5/1/2 (3-level), 32/1 (2-level)



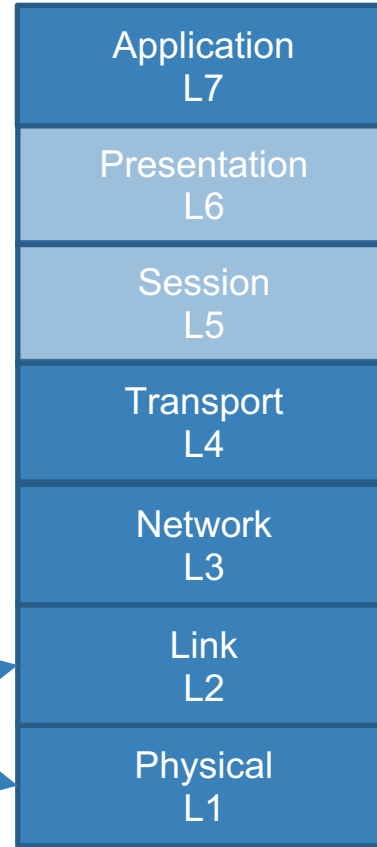
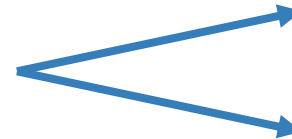
Addressing (2)

- If I toggle a switch, the switch will send an update of the communication object that represents the switch's state.
- It will transmit a telegram that is group-address.
- Interested parties (e.g. light bulb) will respond to that by updating its state (turn light on).



KNX is OSI-based

Transceiver



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Implementation



I'm not the first

- KARDUINO
- KONNEKTING
- SelfBus
- Wildfire KNX Stack



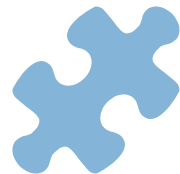
Features

- Not bound to specific hardware
- 'Complete'
- Emulation of System 7
- LGPL

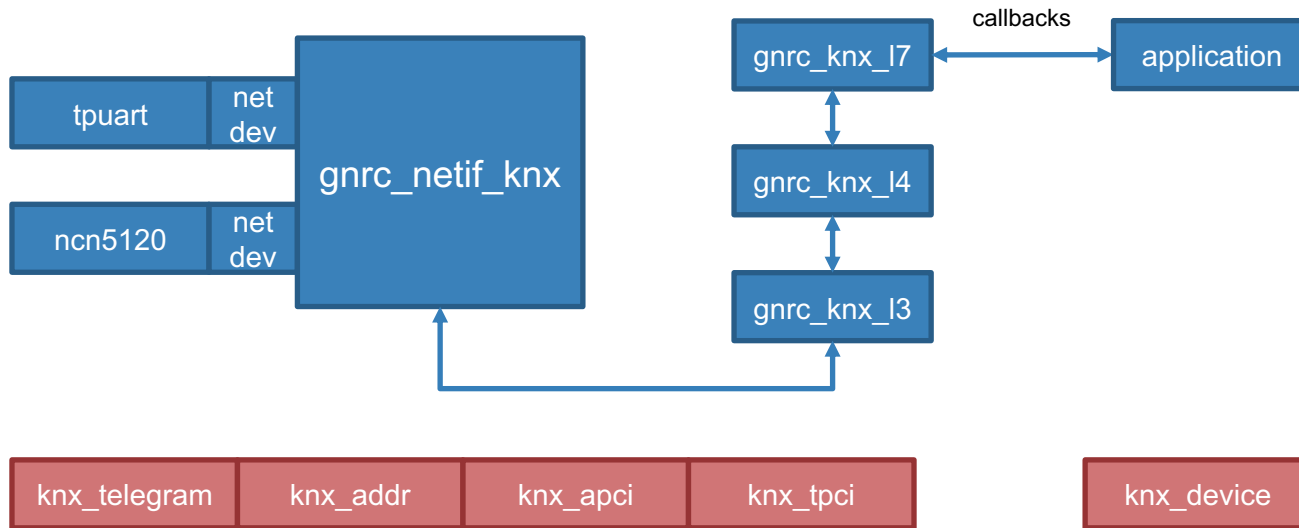


Warning

- I never used GNRC before
- I never implemented a network stack before



Architecture





Design choices

- Device drivers without netdev
- KNX library not coupled to GNRC



A feature branch is available

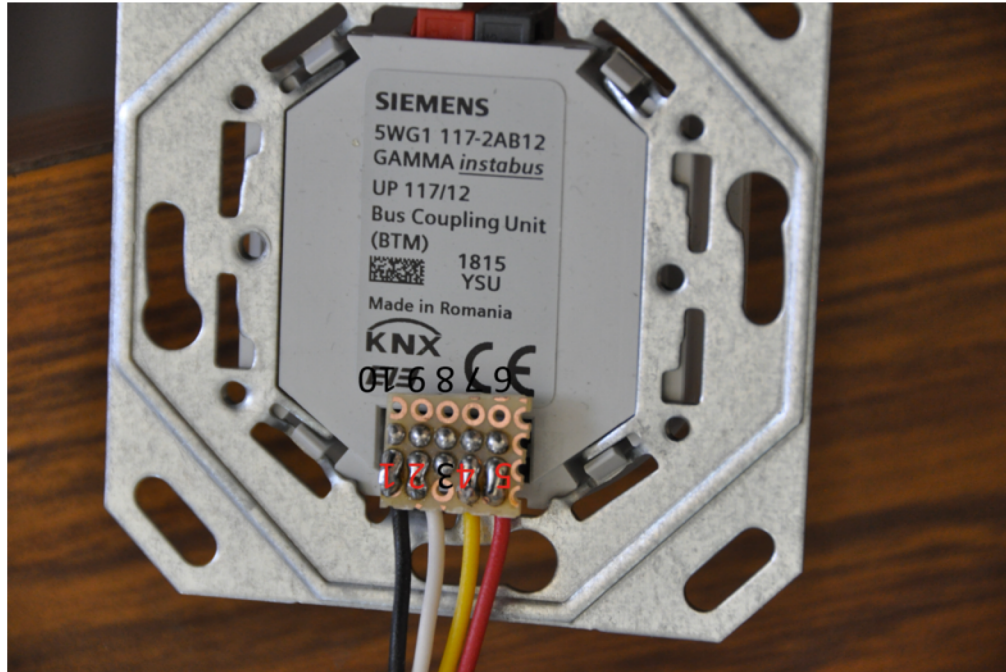
<https://github.com/basilfx/RIOT/tree/feature/knx>

Check out `examples/gnrc_knx_device`. Note that this branch can be unstable, and will be forced-pushed to.



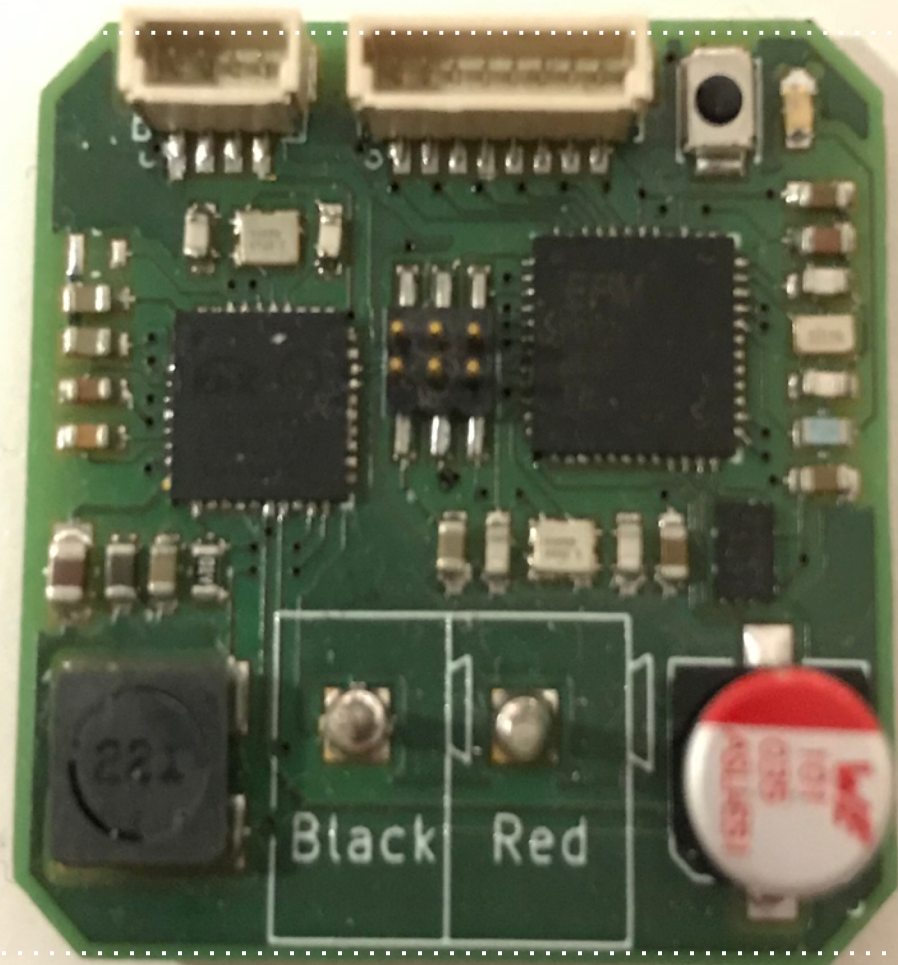
Getting started

- MCU with 8E1 UART support (Kinetis or EFM32)
- Transceiver (or a BCU like the SIEMENS 5WG1117-2AB12)
- Basic KNX stuff: router, PSU, actors



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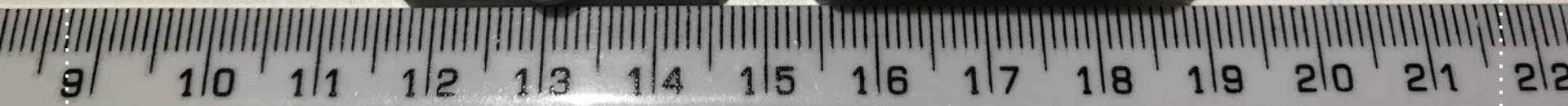
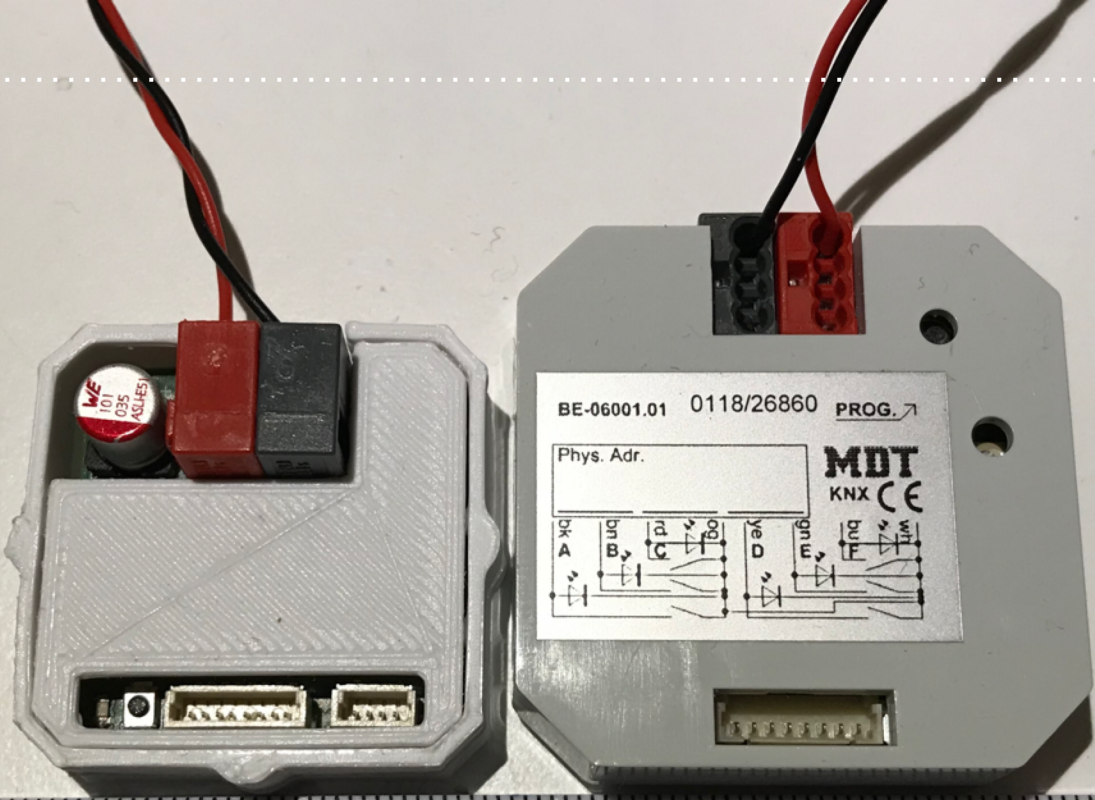
My custom board



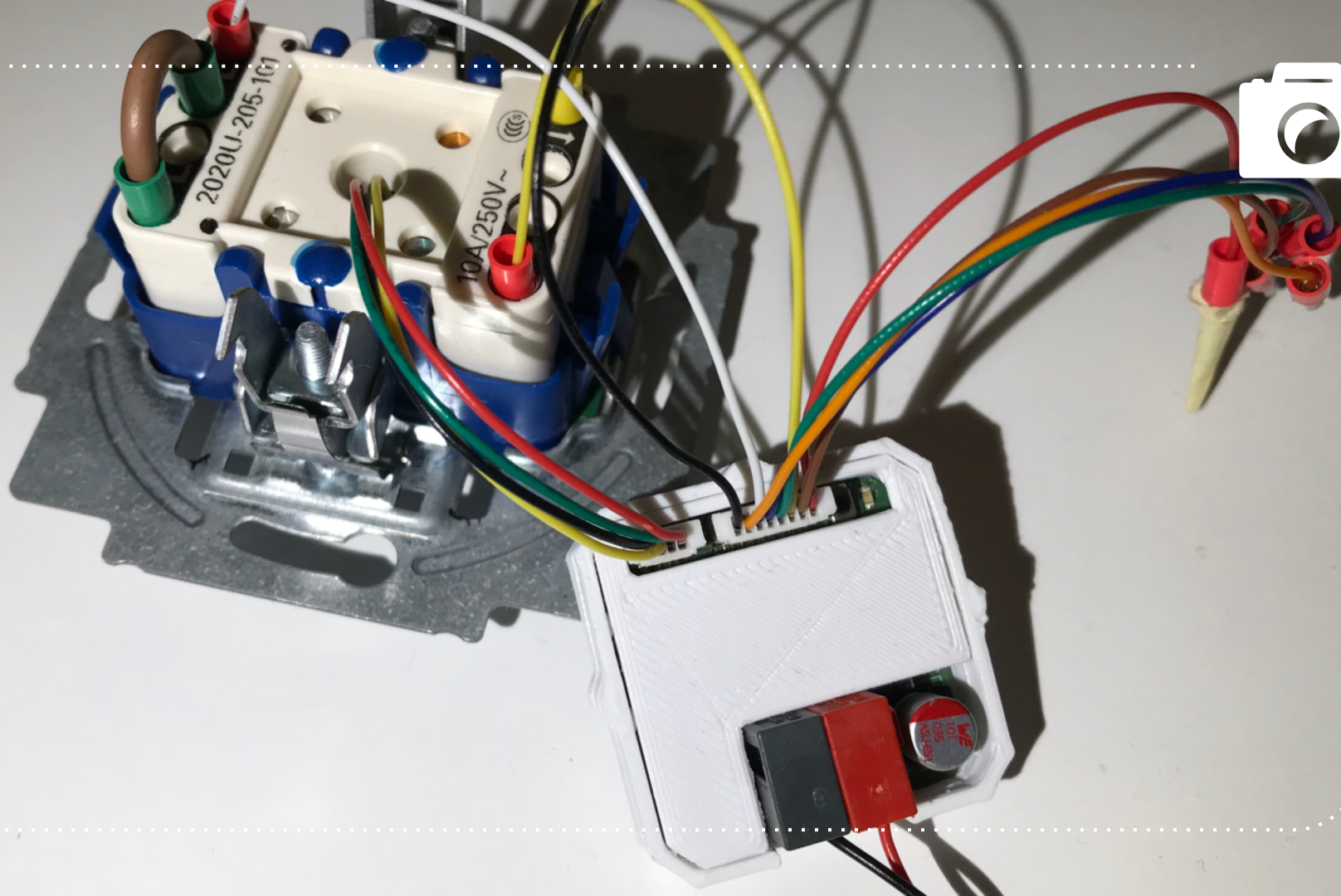


Specs

- Silicon Labs EFM32PG12B
 - 40MHz Cortex M4
 - 1MiB Flash
 - 256 KiB RAM
- OnSemi NCN5120/NCN5121
- I2C and GPIO









BOM

- ~20 Euro for components
- ~3 Euro for PCB
- ~1 Euro for 3D printed case (externally)

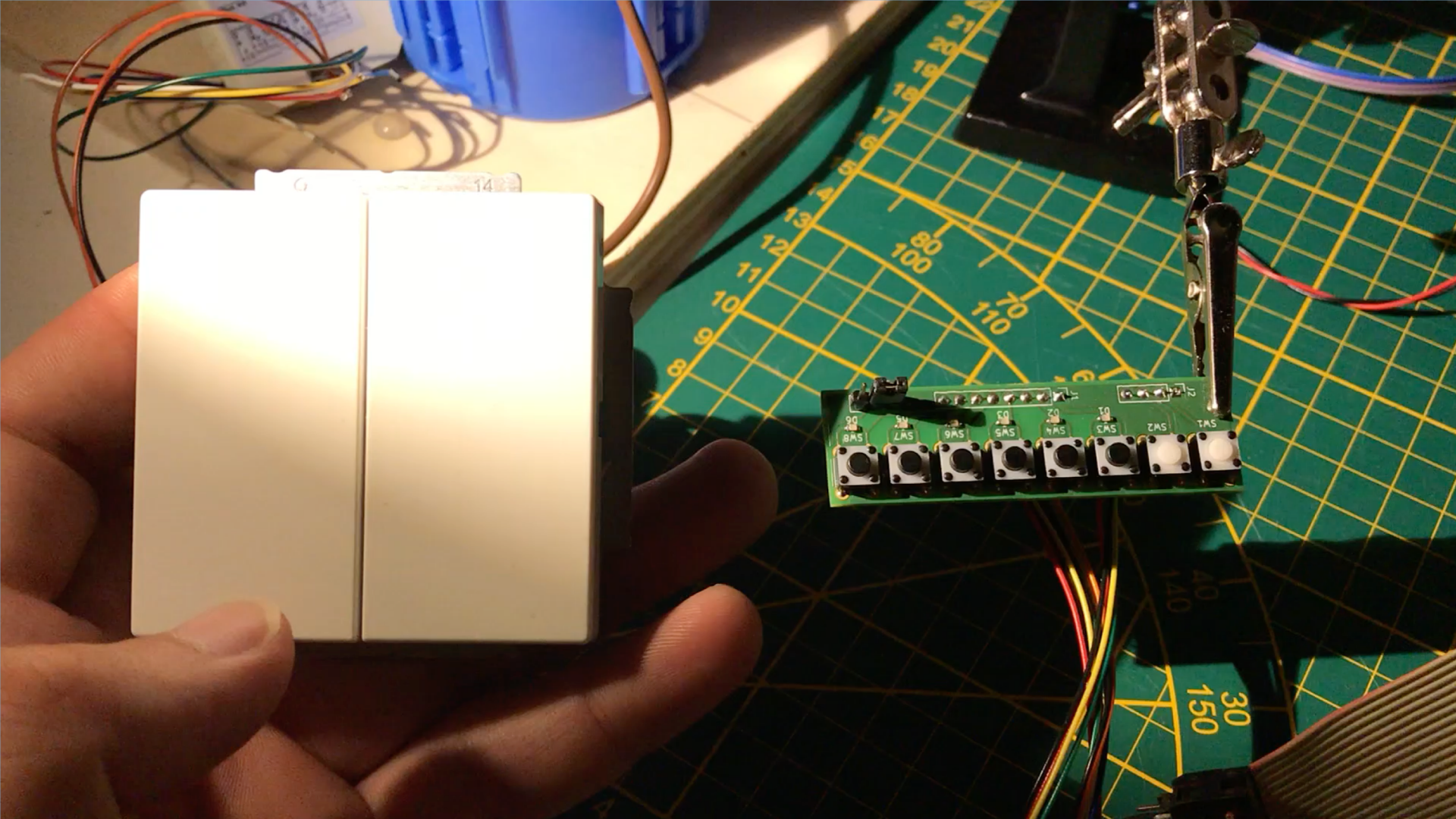
5

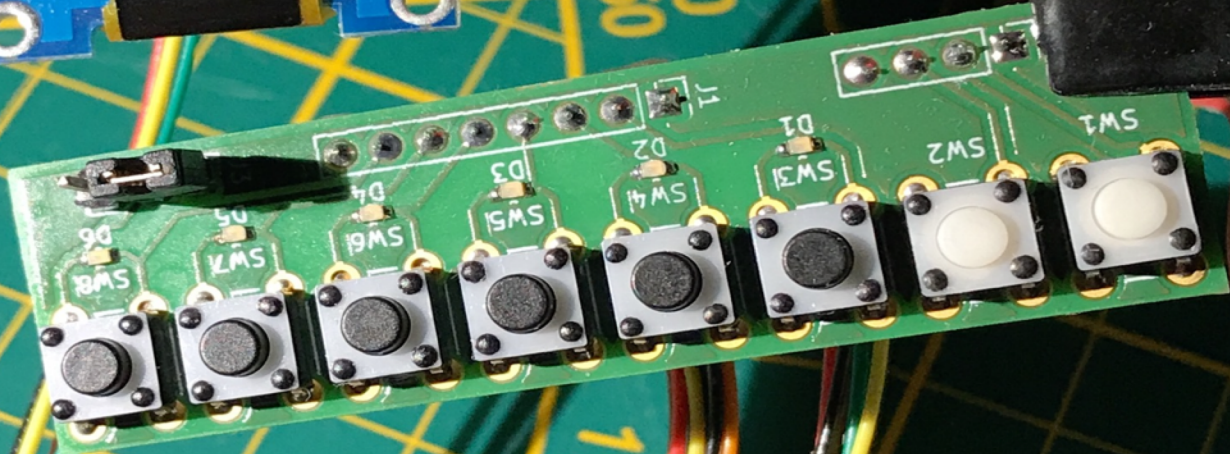
Whats next?



What Works

- The hardware
- Two device drivers
- L3/L4/L7
- 200+ (unit) tests
- Programming via ETS5







TODO

- Thorough review of code
- Contribute to RIOT
- Finish examples
- OTA (or actually, OTW)

- And soldering 20 more boards before next week...



Future

- Separation of L7 and device emulation code
- Memory optimization



Thanks!

Any questions?