LOGBOOK WITHOUT PRETENSE

VOLUME 1

The Engine Runs

Tinkering, Cursing & the First Start

MAIK

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Logbook Without Pretense – Volume 1: The Engine Runs

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Chapter 1

The Purchase

Or: "Actually quite decent"

The listing had been online for three weeks.

"Motorboat, built 1985, freshly painted, technically flawless, berth optional."

That last word was important.

Boats without a berth are like cars without a parking spot.

Possible, but annoying.

The price was fair.

Not cheap.

Not overpriced.

Right in the middle between "bargain" and "something's off."

I called.

The seller sounded relaxed.

No pressure.

No excuses.

Just: "Come by, have a look."

That was a good sign.

Sellers who pressure you are selling problems.

Sellers who are relaxed are selling boats.

The difference is subtle, but important.

Saturday, 10 AM, dock 7.

The boat was there.

Calm.

Not particularly big.

Not particularly small.

Just: there.

Hull freshly painted, white, clean.

Below the waterline: flawless.

Above: "We'll do that later."

The deck had patina.

Not bad.

Just old.

Superstructure too.

Paint peeling in two spots.

"Cosmetic," I thought.

The seller arrived.

Mid-50s, jeans, polo shirt, boat shoes.

Looked like someone who knows boats.

"Glad you could make it. Want to come aboard?"

I nodded.

We climbed in.

Inside it was… okay.

Not modern.

Not fancy.

But clean.

Cushions had stains.

"Normal wear and tear," he said.

True.

Curtains were yellow.

From the sun.

Or from age.

Probably both.

Floor was linoleum.

Practical.

Ugly, but practical.

"Want to hear the engine?"

Of course I did.

He turned the key.

Starter whined.

Engine coughed.

Once.

Twice.

Then: a hum.

No sputtering.

No smoke.

No drama.

Just: on.

"Runs well, doesn't it?"

I nodded.

The engine ran.

Quiet, steady, no complaints.

Built in 1985, but sounded like new.

"Maintenance?"

"Oil every year. Filter too. That's all it needs."

I believed him.

We talked details.

Berth: can be taken over, doesn't have to be.

Papers: all there.

Inspection: valid for two more years.

Insurance: active.

"Why are you selling?"

"Not enough time. Boat sits more than it sails."

Honest answer.

No "have to sell because of a move" or "health reasons."

Just: no time.

Happens.

I looked around again.

Dashboard:

- Voltmeter (digital, shows 12.0V)
- Tachometer (analog, year of manufacture unknown)
- Depth gauge (digital, more recent)
- Fuel gauge (analog, shows 3/4)

Everything worked.

"Instruments running?"

"Everything. Except the GPS sometimes."

"Sometimes?"

"Takes its time. Then it works."

Okay.

The electrics.

I opened the hatch under the seat.

Fuse box.

Small, tidy.

10 fuses, labelled.

Well.

Almost labelled.

"Light," "Pump," "Engine," "Miscellaneous."

Miscellaneous.

Interesting word.

"What's Miscellaneous?"

He shrugged.

"GPS, I think. Or the outlet. One of the two."

I laughed.

He did too.

"It was like that when I bought it."

That sentence would come back to haunt me.

—

Cables.

Black, red, yellow, white, blue.

"Why so many colours?"

"Previous owners. Each had their own style."

Made sense.

Weird sense, but sense.

"But everything works?"

"Everything."

Good enough.

We went for a spin.

Engine ran.

Boat moved.

Straight, no pulling.

Rudder responded.

All good.

Back at the dock, I asked the question:

"What's the catch?"

He laughed.

"Deck needs doing. Superstructure too, if you want it looking nice. Inside is all old, but works."

Honest.

"Anything else?"

"Engine runs. Boat floats. Rest is cosmetic."

Sounded fair.

We agreed on the price.

No negotiation.

He wanted X.

I paid X.

Deal.

A week later I signed.

The boat was mine.

I stood on the dock, looked at it, and thought:

"This is going to be good."

That was in April.

In May I painted the deck.

In June the superstructure.

In July I went out alone for the first time.

Everything ran.

The engine anyway.

But the rest too.

Voltmeter showed 12.0V.

Fuel gauge showed 3/4.

GPS took its time, then worked.

Everything as described.

Everything worked.

And yet...

Something bugged me.

Not much.

Not dramatic.

But something was off.

Voltmeter showed 12.0V.

Always.

Whether the engine was running.

Whether shore power was connected.

Just: 12.0V.

Fuel gauge showed 3/4.

Even after 4 hours of driving.

Even after a week of sitting.

Always: 3/4.

GPS took 10 minutes.

Sometimes 15.

Once 30.

Why?

No idea.

—

In August someone at the dock asked:

"How much diesel do you have left?"

I looked at the fuel gauge.

3/4.

"About 150 litres?"

"About?"

"The gauge is... open to interpretation."

He laughed.

"Welcome to the club."

—

In September I filled up.

Full.

Tank holds 200 litres.

It took 180 litres.

The fuel gauge showed: 3/4.

Before: 3/4.

After: 3/4.

Right.

—

In October I connected the shore power.

Charge the battery.

Voltmeter: 12.0V.

After 12 hours: 12.0V.

After 24 hours: 12.0V.

Is the battery full now?

No idea.

Feels full.

Engine starts fine.

So: good?

In November I sat in the boat.

Heater on.

Ran.

One hour later: off.

Loose connection?

I wiggled the switch.

Heater: on.

Right.

In December I asked myself:

"Why do I actually know NOTHING about my boat?"

Voltmeter shows 12.0V.

But what does that mean?

Is the battery at 80%? 50%? 20%?

Fuel gauge shows 3/4.

But is that 150 litres? 120? 80?

Engine runs.

But how warm is it?

How much oil pressure?

How many hours on it?

I didn't know.

And that bugged me.

Not because the boat was bad.

The boat was good.

Better than most at the dock.

The engine ran.

The thing floated.

Everything worked.

But I didn't know WHAT was happening.

I GUESSED.

I ASSUMED.

I ESTIMATED.

But I didn't KNOW.

One evening in December I sat at home.

Laptop open.

YouTube.

"Boat electrics explained"

3 hours later I had 50 tabs open.

Voltmeters.

Shunts.

Battery monitoring.

ESP32.

Arduino.

Sensors.

The idea was born.

Slowly.

Creeping.

Dangerously.

"I could... digitise this."

The thought was there.

Small.

Innocent.

Naive.

"Just a little. LED lighting. Maybe a digital voltmeter."

Famous last words.

---

3 years later:

8 ESP32s installed.

Custom operating system.

Dashboard for everything.

Live data.

Navigation.

Controls.

All digital.

All networked.

All smart.

The engine?

Still running.

Unchanged.

Like day one.

But that came later.

Much later.

First I bought LEDs.

"I'll start small," I thought.

Spoiler: I didn't.

Chapter 2

The First Inspection

Archaeology below deck

January.

The boat sits at the dock.

Shore power connected, heater running (mostly), all quiet.

Time to REALLY look around.

Not superficially like during the purchase.

But: thoroughly.

I took a Saturday.

Toolbox, torch, notepad.

Plan: trace every cable.

Understand every instrument.

Map every fuse.

"How hard can it be?"

Dashboard.

Let's start at the top.

Left: Tachometer.

Analogue, with a needle, classic.

Looks like 1980s.

Probably is.

Function: Shows RPM.

Sometimes.

When it feels like it.

At 800 RPM the needle reads 1,000.

At 2,000 RPM it reads 2,400.

Inaccurate, but consistently inaccurate.

You get used to it.

Centre: Voltmeter.

Digital, 3 digits, red LEDs.

12.0

Always.

No matter what happens.

Engine on? 12.0

Engine off? 12.0

Shore power connected? 12.0

Battery half empty? Probably also 12.0

The thing is less a measuring device than an art installation.

Shows that power IS there.

How much?

Irrelevant.

Right: Depth gauge.

Digital, more recent, works.

Shows depth.

Correctly.

Reliably.

The only instrument I trust.

Far right: Fuel gauge.

Analogue, needle, scale from E to F.

Needle sits at 3/4.

For months.

Whether I fill up.

Whether I drive.

3/4.

Schrödinger's tank.

Is it full? Is it empty? Both at the same time?

You don't know until you run out and drift.

Below the dashboard: switches.

12 of them.

Toggle switches, old, plastic.

Half of them labelled.

"Light," "Pump," "Heater," "Nav."

The other half: mysteries.

Switch 7: Does what?

I flick it.

Nothing happens.

Again.

Nothing.

Okay.

Switch 8: Does what?

I flick it.

A light comes on.

Which light?

No idea.

Somewhere a light comes on.

I make a list:

```
Switch overview: 1. Light cabin       ✓ 2. Light exterior    ✓ 3. Bilge pump        ✓
4. Heater            ✓ (loose connection) 5. Navigation       ✓ (GPS) 6. ???
? 7. ???               ? (does nothing?) 8. Light ???         ? (something lights up)
9. ???               ? 10. Outlet           ✓ 11. ???              ? 12. ???
? (or reserve?)
```

50% success rate.

Good enough for daily use.

Fuse box.

Under the seat, port side.

Open the hatch.

10 fuses, 2 rows.

Top:

1. Light - 10A
2. Pump - 10A
3. Engine - 20A
4. Heater - 15A
5. Miscellaneous - 10A

Bottom:

6. Reserve - empty
7. Reserve - empty
8. GPS - 5A
9. ??? - 10A (installed, but for what?)
10. Reserve - empty

Miscellaneous.

My favourite word.

I trace the cables.

From the fuse box outward.

Black = negative.

Red = positive.

So far, so standard.

But then:

Yellow cables.

White cables.

Blue cables.

One green cable (lone wolf).

All going somewhere.

Where?

Good question.

I follow a yellow cable.

From the fuse box to the outlet.

Makes sense.

Why yellow?

Because previous owner #1 (circa 1995, I'm guessing) liked yellow.

Works though.

White cable.

From the fuse box to... the battery?

No.

To a SECOND battery.

Wait.

Two batteries?

I check.

Yes.

Two batteries.

One large (main battery, 100 Ah).

One small (GPS battery, 40 Ah).

The GPS has its own battery.

Why?

"It was like that when I bought it."

Presumably.

Blue cable.

From the fuse box to the bilge pump.

Why blue?

Because previous owner #3 (circa 2015, estimated) had blue.

Or because "bilge = water = blue"?

Creative logic.

But works.

Green cable.

Lone wolf.

Goes from... somewhere... to... somewhere else.

I trace it.

Starts at the fuse box (not connected).

Goes through the wall.

Ends... nowhere.

Cut off.

Insulated.

Waiting.

For what?

No idea.

Probably a project that never got finished.

I sit down.

Notepad full.

Drawings, arrows, question marks.

The electrical system is... organic.

Grown.

Over 40 years.

Four previous owners.

Each with their own style.

Layer 1 (1985): Original.

Black = negative.

Red = positive.

Simple, clear, works.

Main battery, engine, light, pump.

Base system.

Solid.

Layer 2 (1995): Previous owner #1.

"I need an outlet."

Yellow cable from the fuse box.

New fuse: "Miscellaneous."

Outlet installed.

Works.

Documentation?

"It was like that."

Layer 3 (2005): Previous owner #2.

"GPS would be nice."

Second battery installed (for whatever reason).

White cable routed.

GPS mounted.

Runs.

But: GPS takes 10 minutes to start.

Why?

Because the battery is half empty?

Because the GPS is old?

Both?

"It was like that."

Layer 4 (2015): Previous owner #3.

"Automatic bilge pump would be good."

Blue cable.

Float switch.

Pump runs automatically.

Works!

Except when it doesn't.

Sometimes it runs.

Sometimes it doesn't.

Loose connection in the float switch?

Probably.

"It was like that."

Layer 5 (2024): Me.

Staring at the masterpiece.

Understand half of it.

Guessing the other half.

Everything works.

Somehow.

But WHY it works?

Magic.

Or luck.

Or both.

I take a photo.

Fuse box, cables, everything.

Send it to a friend.

"Check out my boat."

Reply: "Mate. That's art."

Yes.

Modern art.

"Electrical Installation, mixed media, 1985–2024."

Would hang in a museum.

That evening I sit at home.

Laptop open.

Google: "Boat electrics tidy up"

First results:

- "Redo completely"
- "Professional boatyard"

- "Costs €5,000"

Second results:

- "DIY for beginners"
- Arduino
- ESP32
- Self-build

Interesting.

I click.

YouTube video: "Boat electrics with Arduino"

30 minutes later: 5 more videos.

"ESP32 battery monitor"

"MQTT for boats"

"DIY instrument display"

Rabbit hole.

---

2 hours later.

I look into my parts box.

Shopping list:

- ESP32 DevKit (already got one)
- Voltage divider (box, got it)
- Cables (€10)
- Resistors (€3)

Total: €26

"Just for testing," I think.

Checkout.

A week later the package arrives.

I unpack it.

ESP32. Old friend, new project.

"From today, you're the boat ESP."

---

3 years later:

8 ESP32s installed.

47 sensors.

3 hand-soldered PCBs.

Custom operating system.

Dashboard for everything.

The original electrics?

Still running.

Unchanged.

Layer 6 (my layer) is ON TOP.

Like a digital skin.

The old electrics stay.

As backup.

As a reminder.

As "it was like that."

The engine?

Still running.

Doesn't care about layers.

Doesn't care about ESP32s.

Only cares about diesel and ignition.

Runs.

As always.

But that came later.

Much later.

First I had to learn how boat electrics tick.

And that 12V at the dock isn't the same as 12V from a bench power supply.

Trial & error.

Lots of error.

Little trial.

But: it came together.

At the end of the day I sat in the boat.

Looked at the dashboard.

Voltmeter: 12.0V.

Fuel gauge: 3/4.

Tachometer: Something.

And thought:

"I'm rebuilding this."

Not because it's broken.

But because I can do it BETTER.

I think.

I hope.

I'll try.

The first step: LEDs.

How hard can it be?

Chapter 3

The First Summer

It works (sort of)

May.

The boat sits at the dock.

Freshly painted, clean, ready.

Me too.

Theoretically.

First trip out.

Alone.

No seller.

No previous owner.

Just me.

And the boat.

Exciting.

Bit scary.

But: exciting.

Checklist in my head:

1. Start engine
2. Cast off
3. Don't crash into other boats
4. Come back

Sounds simple.

It is.

Always.

Key in.

Turn.

Starter whines.

Engine coughs.

Once.

Twice.

Hum.

The engine runs.

First hurdle: cleared.

Voltmeter: 12.0V

Of course.

Fuel gauge: 3/4

Obviously.

Depth gauge: 2.3m

That's the only instrument I trust.

Cast off.

Slowly reverse.

Boat responds more sluggishly than expected.

But: responds.

Turn.

Forward.

Throttle up.

Engine hums louder.

Boat moves.

I'm driving a boat.

First time.

Alone.

Brilliant.

Out of the harbour.

Slowly.

5 knots.

Not because I have to.

But because I'm still cautious.

Other boats watching.

"Beginner," they're probably thinking.

True enough.

Open water.

Throttle up.

Engine pulls.

Boat accelerates.

Not spectacular.

Not fast.

But: moves.

I look at the dashboard.

RPM: Somewhere between 2,000 and 2,400.

Don't know exactly.

The needle is... creative.

Voltmeter: 12.0V

Still.

While driving too.

Interesting.

Fuel gauge: 3/4

After 30 minutes of driving.

Still 3/4.

Either the tank is massive.

Or the gauge is lying.

Probably the latter.

One hour later: back.

Docking.

Not perfect.

But no damage.

Good enough.

Engine off.

Voltmeter: 12.0V

Surprise.

I sit in the cockpit.

Beer open.

Grinning like an idiot.

First trip.

Alone.

Works.

Everything works.

Engine runs.

Boat drives.

I'm still alive.

Success.

June.

Routine sets in.

Every weekend out.

Sometimes alone.

Sometimes with friends.

Boat works.

Always.

Reliably.

Except for...

The heater.

Sometimes it runs.

Sometimes it doesn't.

No rule.

No logic.

Switch on: runs.

Next day, switch on: doesn't run.

Loose connection.

Probably.

I wiggle the switch.

Left.

Right.

In.

Out.

Heater: on.

Ah.

I learn: It's a feel switch.

You have to hold it JUST SO.

Not too firm.

Not too loose.

Just right.

Then it works.

—

Friend asks: "Why don't you fix it?"

"It works."

"But you have to wiggle."

"Yes. But then it works."

He shakes his head.

Me too.

But: heater runs.

Good enough.

—

July.

Hot.

Nobody needs a heater.

Problem solved.

Temporarily.

—

I go out.

Regularly.

Getting to know the boat.

How it responds.

How it feels.

What it likes.

What it doesn't.

Boat and I are becoming friends.

Slowly.

But surely.

Voltmeter shows 12.0V.

Always.

I get used to it.

It is what it is.

Engine running? → Good.

Engine off? → Also good.

As long as the thing turns over, everything's fine.

Probably.

Hopefully.

Most likely.

Fuel gauge shows 3/4.

Getting used to that too.

I drive by feel.

How long have I been out?

How much could be left?

Should I fill up?

Gut feeling.

Works.

So far.

—

August.

Longest trip yet: 6 hours.

There and back.

Engine runs the whole time.

No sputtering.

No overheating.

No drama.

Just: runs.

Built 1985, but runs like new.

Whatever the previous owner did — engine-wise he knew his stuff.

—

Fuel gauge at the end of the trip: 3/4.

Of course.

I fill up anyway.

To be safe.

It takes 120 litres.

Tank holds 200.

So: had 80 litres left.

Fuel gauge says: 3/4.

Mathematically that would be 150 litres.

Difference: 70 litres.

The gauge isn't just inaccurate.

It's creative.

—

Voltmeter after 6 hours of driving: 12.0V.

I laugh.

What else?

The thing isn't broken.

It's... optimistic.

Always shows "all good."

Whether it's true or not.

—

Evening at the dock.

Neighbour comes by.

"Nice boat."

"Thanks."

"Runs well?"

"Yes. Engine's great."

"And the rest?"

I hesitate.

"Works. Mostly. Somehow."

He laughs.

"Welcome to the boat owner club."

—

September.

First signs that I want more.

Not more boat.

More... knowledge.

—

I sit in the cockpit.

Looking at the voltmeter.

12.0V.

But WHAT does that mean?

Is the battery at 100%?

80%?

50%?

No idea.

Engine runs, so: good.

But I WANT to know.

Fuel gauge.

3/4.

Always 3/4.

How much is REALLY in there?

150 litres?

120?

80?

I could calculate.

Filled up: 200 litres full.

Driven: 3 hours.

Consumption: ~10 litres/hour.

Therefore: 170 litres left.

Or?

But that's guessing.

Estimating.

Hoping.

I don't want estimates.

I want data.

Numbers.

Facts.

I Google.

"Digital fuel gauge boat"

Results:

- Product 1: €450
- Product 2: €380
- Product 3: "On request"

Expensive.

"Digital voltmeter boat"

Results:

- Product 1: €120
- Product 2: €95
- Product 3: €89

Not cheap either.

For a display that shows a number.

I scroll further.

"DIY boat voltmeter"

Ah.

Interesting.

Forum post: "Self-build with Arduino for €15"

I click.

---

30 minutes later: 10 tabs open.

Arduino.

ESP32.

Voltage divider.

Resistors.

ADC.

Concepts I know from the workbench.

And: interesting for the boat.

I look at the voltmeter.

12.0V.

Then at the laptop.

"ESP32 voltmeter tutorial"

Video: 15 minutes.

I watch.

Understand most of it.

And that's enough.

To get curious.

Evening.

Beer open.

Boat sits quietly at the dock.

I think.

"Could I...?"

Voltmeter: €15 in parts.

Fuel gauge: €20 in parts.

Instead of €450 and €120.

And: I learn something.

And: I understand what's happening.

And: it's MINE.

—

The thought stays.

Sticks.

Grows.

"I could..."

—

October.

Cooler.

Boat gets used less.

More time to think.

And watch YouTube.

Dangerous.

—

I watch videos.

"Arduino for beginners"

"ESP32 tutorial"

"Boat electrics explained"

Hour after hour.

Tab after tab.

—

I take stock of the parts box.

All there.

Of course.

- LED strips (need to order, €12)
- Resistors (€3)
- ESP32 (€8)

"Finally a project again."

Famous last words.

November.

Boat in hibernation.

Shore power connected.

Heater runs (if you wiggle).

Time for projects.

I sit at home.

Laptop open.

Notepad beside me.

Sketch:

```
Voltmeter (digital): ESP32 → Voltage divider → Battery         → Display shows real
voltage  Cost: ~€20 Effort: ???
```

Looks doable.

Theoretically.

I order.

ESP32.

Resistors.

Cables.

Nudge the ESP32 with my nose.

Ordered: LED strips. €12. Rest I've already got.

"I'll start small."

LED lighting.

Then voltmeter.

Then... we'll see.

Package arrives.

I unpack.

ESP32.

Small.

Unassuming.

Doesn't look like much.

I hold it up.

"This is going to digitise my boat?"

Said out loud.

Sounds ridiculous.

But YouTube says: Yes.

I put the ESP32 on the table.

Next to it: boat photos.

Dashboard.

Voltmeter (12.0V).

Fuel gauge (3/4).

And think:

"This can be better."

The first summer was good.

Boat works.

Engine runs.

Everything floats.

But:

Voltmeter lies.

Fuel gauge fantasises.

Heater needs finesse.

I don't want estimates.

I want data.

Real data.

The plan:

Phase 1: LED lighting (can't be THAT hard)

Phase 2: Digital voltmeter (€15 instead of €120)

Phase 3: ... we'll see

Start small.

Scale up slowly.

Don't overdo it.

---

3 years later:

8 ESP32s installed.

47 sensors.

Custom operating system.

Dashboard for everything.

"Start small" I'd said.

Ha.

No.

But that came later.

Much later.

First I had to learn that LED + 12V direct = smoke.

Trial & error.

Lots of error.

Little trial.

But: it came together.

The first summer was the beginning.

From user to tinkerer.

From accepter to improver.

From "it works" to "it can be better."

December.

Boat sits still.

Cold.

Dark.

Engine off.

But:

At home, at the desk, the light is on.

ESP32 on the table.

Laptop beside it.

Tutorial on the screen.

"Install Arduino IDE"

I click.

Download.

The first step.

The boat doesn't know it yet.

But next summer will be different.

Digital.

Measurable.

Data-driven.

The engine?

Just keeps running.

As always.

Doesn't care about ESP32s.

Doesn't care about plans.

Runs.

And me?

I'm learning to code.

In December.

For a boat.

That actually works fine.

But could be better.

Because I want it to be.

Not because it has to be.

The first summer was good.

The second will be better.

I think.

I hope.

I'll try.

Chapter 4

The First Winter

Questions upon questions

—

—

December.

Cold.

Boat sits at the dock.

Hibernation.

Not mine.

—

Shore power connected.

Cable from the dock to the boat.

16 amps.

Should be enough.

For: battery charging, heater, lights.

Should.

—

I come on Saturday.

Step aboard.

Cold.

Very cold.

Heater not running.

—

Check the switch.

On.

Or so I thought.

I wiggle.

Left, right, in, out.

Nothing.

Again.

Nothing.

—

The loose connection is dead.

Not "needs finesse."

But: dead.

Contact gone.

Heater off.

Winter here.

Problem too.

—

Plan B: Electric heater.

Small, 500 watts.

Plug it into the outlet.

Boat has shore power, should work.

Plug in.

Heater… doesn't work.

Wait.

—

Check the fuse.

"Miscellaneous" (of course).

Out.

Blown.

New one in.

10A.

Heater on.

Works!

Five minutes later: off.

Fuse blown again.

---

500 watts.

12 volts.

Equals: 41 amps.

Fuse is 10A.

Maths says: won't work.

Reality confirms: won't work.

I'm sitting in a cold boat.

Learning Ohm's law.

The practical way.

Plan C: Bigger fuse.

20A.

In.

Heater on.

Works!

Ten minutes later: fuse is hot.

Very hot.

Smells funny.

Off.

I give up.

Boat stays cold.

Me too.

Go home.

Frustrated.

—

January.

Next visit.

Colder.

Even colder.

Boat frozen?

No.

But: cold.

—

Check the battery.

Voltmeter: 12.0V

Of course.

But IS the battery full?

No idea.

Shore power's been running for a month.

Should be full.

SHOULD.

—

I start the engine.

Test.

Turn the key.

Starter...

...turns heavy.

Engine coughs.

Twice.

Three times.

Then: hum.

Runs.

But: reluctantly.

Engine off.

Voltmeter: 12.0V

Was 12.0V before.

Is 12.0V now.

Helps me ZERO.

Is the battery now:

- At 100% (fully charged)?
- At 80% (okay)?
- At 50% (critical)?

Voltmeter says: "Yes."

Helpful.

I Google on my phone.

"12V battery state of charge"

Table:

```
12.6V = 100% 12.4V = 75% 12.2V = 50% 12.0V = 25% 11.8V = dead
```

Ah.

My battery is at 25%?

Or does the voltmeter show 12.0V because it always shows 12.0V?

Both possible.

No idea.

I go to the outlet.

Check the shore power connection.

Plug in: yes.

Power arriving: presumably.

LED on the charger lit: no.

Wait.

Check the charger.

Plug in.

LED off.

Look for a switch.

Find one.

Flip it.

LED: on.

Ah.

The charger was OFF.

For a month.

Shore power was arriving.

But not being used.

Battery wasn't charging.

Only discharging.

From the onboard electrics.

Which draw something.

Always.

Voltmeter: 12.0V

But really: probably 11.8V.

So: nearly empty.

No wonder the engine started hard.

I turn on the charger.

LED glows green.

"Charging."

Good.

I wait.

One hour.

Voltmeter after one hour: 12.0V

Of course.

Is the battery fuller now?

No idea.

Voltmeter says: same as before.

Helpful: zero.

I drive home.

Frustrated.

Cold.

Angry at a voltmeter.

That can't do its one job.

Namely: show voltage.

Correctly.

February.

Third visit.

Even colder.

But: prepared.

Multimeter in hand.

Multimeter on the battery.

Direct.

Measure.

12.4V.

Ah.

FINALLY a real number.

Voltmeter on the dashboard: 12.0V

Multimeter on the battery: 12.4V

Difference: 0.4V

The voltmeter isn't broken.

It's just... optimised.

For one number.

12.0.

Always.

I switch on the lights.

Multimeter: 12.3V (drops slightly)

Voltmeter: 12.0V (doesn't move)

I start the engine.

Multimeter: 14.1V (alternator charging!)

Voltmeter: 12.0V (couldn't care less)

The thing is hopeless.

It doesn't show voltage.

It shows "power exists."

Binary.

On or off.

12.0 = on.

Everything else: invisible.

I note:

```
Problems: 1. Voltmeter useless 2. Battery state unknown 3. Charger was off (switch!)
4. Heater dead 5. Fuses too small 6. Fuel gauge still lying 7. I know NOTHING
```

The list is depressing.

But:

Engine runs.

Still.

Despite a nearly empty battery.

Despite winter.

Despite everything.

The engine is the MVP.

Most Valuable Part.

Evening at home.

Laptop open.

YouTube.

"Boat electrics done right"

Video: 45 minutes.

I watch.

Learn.

Understand.

—

The guy in the video explains:

Voltmeter needs to go directly to the battery.

Not through fuses.

Not through switches.

Direct.

Then it shows real values.

—

My voltmeter?

Goes through 3 fuses.

2 switches.

And probably a relay.

No wonder it shows 12.0V.

It's measuring somewhere in the middle.

Where there's always 12.0V.

Because: battery has 12.4V.

Voltage drop: 0.4V.

Remainder: 12.0V.

Always.

—

I could rewire it.

Run a new cable.

Direct to the battery.

Would work.

Or:

I could build it NEW.

Digital.

With ESP32.

For €15.

Second video.

"DIY battery monitor with ESP32"

30 minutes.

Schematic.

Code.

Instructions.

Looks... doable.

I pause the video.

Screenshot.

Save.

"Project_Voltmeter.png"

Create folder: "Boat_Projects"

First file in it.

Third video.

"Boat heater repair"

The guy in the video:

"Loose connection? Replace the switch. €5. 10 minutes."

Sounds easy.

Probably is.

I note: "Buy switch"

Fourth video.

"Fuel gauge calibration"

40 minutes about resistors.

Sender in the tank.

Receiver on the dashboard.

Calibration.

Complicated.

Or:

"DIY fuel gauge with ultrasonic sensor"

€15 sensor.

Measures fill level.

ESP32 converts.

Display shows litres.

Precise.

Simple.

Better.

Tab 5, 6, 7...

"MQTT for boats"

"SignalK introduction"

"Node-RED dashboard"

Concepts.

Lots of concepts.

Understand half.

But: interesting.

—

I look at the clock.

23:47.

I've been watching YouTube for 3 hours.

Have 12 tabs open.

Notes on 3 pages.

Amazon basket: €87.

—

Buster comes padding in.

Lies down next to the desk.

Looks at me.

With that look.

That "You do know it's 11 PM?" look.

I know, Buster. I know.

But: 12 tabs open.

Amazon basket full.

Notes on 3 pages.

—

Pause.

Buster yawns.

Loudly.

Demonstratively.

Rolls over.

Falls asleep.

Mid-sentence.

Dogs have no appreciation for digitisation.

But honestly?

He's right.

It's late.

Buster snores.

Quietly.

Contentedly.

He has his bed.

I have 12 tabs.

To each their own happiness.

I think it over.

"No. You don't have to."

"But?"

"But I WANT to know."

I look at Buster.

Then at the screen.

He goes.

I stay.

YouTube keeps playing.

Tab 13: "ESP32 boat monitoring tutorial"

Tab 14: "Install Arduino IDE"

Tab 15: "How does I2C work"

Tab 16: "Connect OLED display"

Tab 17: "Calculate voltage divider"

Parts box inventory:

- ESP32 DevKit (already got one)
- Voltage divider (box, got it)
- OLED Display 0.96" (box, three of them)
- Resistors (whole drawer full)
- Breadboard (got it)
- Jumper cables (got them)
- USB cable (got it, ten of them)
- Ultrasonic sensor (€12, need to order that one)
- Temperature sensor DS18B20 (box, five of them)
- Current sensor INA219 (€18, order that too)
- ...

To order: €30. Rest: already here.

"Finally a project."

Sure.

I look at the list.

Then at the boat photo.

Dashboard.

Voltmeter: 12.0V (useless).

Fuel gauge: 3/4 (lying).

Then at the YouTube videos.

ESP32.

Small.

€8.

Can do everything.

The decision ripens.

Not suddenly.

Creeping.

Over weeks.

Over videos.

Over frustration.

Over the will to make it better.

March.

Boat still cold.

Me too.

But: prepared.

New switch bought: €5.

Installed: 10 minutes.

Heater runs: yes.

Without wiggling: yes.

Problem solved: yes.

That was easy.

Too easy.

Should have done it sooner.

But: done.

Heater works.

Boat gets warm.

Me too.

Better.

I sit in the warm boat.

Look at the dashboard.

Voltmeter: 12.0V

Fuel gauge: 3/4

And think:

"Next project: digital voltmeter."

Then: "Digital fuel gauge."

Then: "Everything digital."

The winter was frustrating.

Cold.

Full of questions without answers.

Voltmeter useless.

Battery unknown.

Heater dead.

But:

Now I know what I DON'T want:

Guessing.

Estimating.

Hoping.

"Works somehow."

I want data.

Real data.

Numbers.

Facts.

Knowing what's going on.

Not assuming.

ESP32 is at home.

On the desk.

Waiting.

Tutorials are bookmarked.

Code is downloaded.

Arduino IDE installed.

Ready.

The winter was the preparation.

The frustration.

The motivation.

The drive.

The summer will be the execution.

The first project.

LED lighting.

Then voltmeter.

Then... we'll see.

Start small.

(Ha. No.)

The engine?

Ran all winter.

Every time.

No drama.

Despite a nearly empty battery in January.

Despite the cold.

Despite everything.

I sit in the boat.

Heater running (finally).

Voltmeter shows 12.0V (useless).

Engine running (reliable).

And I think:

"Next winter will be different."

Digital.

Measurable.

Understandable.

But first: summer.

And the first project.

LEDs.

How hard can it be?

Spoiler:

Harder than expected.

Smoke included.

But: educational.

The first winter was tough.

Cold.

Frustrating.

Full of "I don't know."

The second winter will be better.

Warmer.

With data.

With knowledge.

With "I know exactly."

I think.

I hope.

I'll build it.

Chapter 5

The Idea

Or: "I can do this too!"

March.

At home.

Desk.

ESP32 lying there.

Small.

Unassuming.

€8.

Supposed to digitise my boat.

Doesn't look like it.

YouTube tutorial, video 1:

"ESP32 for absolute beginners"

Length: 22 minutes.

I press play.

The guy in the video explains:

ESP32 = mini computer.

WiFi, Bluetooth, 30 pins.

Programmable.

Can read sensors.

Can drive displays.

Can... everything.

For €8.

I look at the ESP32.

Then at the video.

Back to the ESP32.

"This thing does WiFi?"

Video says: Yes.

"And Bluetooth?"

Video says: Yes.

"For €8?"

Video says: Yes.

I'm impressed.

Video continues:

"Install Arduino IDE."

Pause.

I Google: "Arduino IDE download"

Click.

Download.

Install.

5 minutes later: done.

Open Arduino IDE.

Looks like... a code editor?

Menu at the top.

Empty file.

Cursor blinking.

I have no idea what I'm doing.

Video continues:

"Open Board Manager."

I click.

List appears.

"Install ESP32."

I search.

Find it.

Click Install.

Downloads.

Installs.

Done.

"Select board: ESP32 Dev Module"

I select.

"Select port: COM3"

I select COM3.

"Connect USB cable."

I connect.

ESP32 blinks briefly.

Alive.

Video shows code:

```
void setup() {   Serial.begin(115200);   Serial.println("Hello World!"); }  void
loop() {   delay(1000); }
```

I type it out.

Exactly like that.

Without understanding.

"Press upload."

I press.

Arduino IDE thinks.

"Connecting..."

"Uploading..."

"Done."

"Open Serial Monitor."

I open.

Black window.

Empty.

Then:

"Hello World!"

I stare at it.

A mini computer.

For €8.

Says "Hello World."

To me.

Over USB.

That's... cool.

Very cool.

I just wrote my first code.

Okay, typed it out.

But: works!

—

Video 2:

"Make an LED blink"

The classic.

Everyone starts with this.

—

Code:

```
void setup() {   pinMode(2, OUTPUT); }  void loop() {   digitalWrite(2, HIGH);
delay(1000);   digitalWrite(2, LOW);   delay(1000); }
```

I type.

Upload.

—

ESP32 has an internal LED.

Pin 2.

It blinks.

On.

Off.

On.

Off.

—

I just programmed an LED.

To blink.

With code.

That I wrote.

(Typed out.)

But still:

I'm a programmer now.

Feels like it.

Video 3:

"Connect an external LED"

Now it gets practical.

Get out the breadboard.

Get out an LED.

Get out a resistor (220 Ohm, says the video).

Get out jumper cables.

Video explains:

LED, resistor, breadboard. Got them. Standard stuff.

I can do this in my sleep.

Have been for years.

But:

Boat electrics are a different beast to the parts box.

Wiring:

ESP32 Pin 2 → Resistor → LED (+) → LED (-) → GND

Just like the video.

Hope: works.

Reality: ...

Upload code.

Same as before.

LED blinks!

External!

On the breadboard!

I've controlled hardware!

With software!

I lean back.

Grin.

That was easy.

Much easier than expected.

LED blinks.

I've understood it.

More or less.

Buster lifts his head.

Looks at the blinking light.

Blinking LED.

Buster watches.

LED blinks.

On. Off. On. Off.

On. Off. On. Off.

Buster tilts his head.

The way dogs do.

When their human does weird things.

What he doesn't know:

This is just the beginning.

Everything else is human stuff.

The LED keeps blinking.

"Yes."

Dogs are wise.

They know when to stop.

He goes.

LED keeps blinking.

Video 4:

"Measure voltage with ESP32"

NOW it gets relevant.

ESP32 has an ADC.

Analogue-to-digital converter.

Can measure voltage.

0–3.3V directly.

More: need a voltage divider.

Boat has 12V.

ESP32 tolerates 3.3V.

12V straight to the ADC? Obviously not. Not my first rodeo.

So: voltage divider.

Got everything I need.

Voltage divider:

Know this.

Calculated it a hundred times.

But: 12V boat battery is a different thing from a 5V bench power supply.

12V become 3.3V.

Maths.

Quick calculation:

```
Vout = Vin × (R2 / (R1 + R2))  For 12V → 3.3V: R1 = 100kΩ R2 = 38kΩ
```

I have:

- 100kΩ: Box. Three bags.
- 38kΩ: Not exactly, but 47kΩ works.

47kΩ gives 3.5V at the ADC.

Enough headroom.

Works.

Build on breadboard:

12V (power supply) → R1 (100kΩ) → R2 (47kΩ) → GND

Between R1 and R2: tap point

Tap → ESP32 Pin 34 (ADC)

Code:

```
void setup() {   Serial.begin(115200); }  void loop() {   int value = analogRead(34);
float voltage = value * (3.3 / 4095.0);   float battery = voltage * 4.0; // back-
calculation      Serial.print("Battery: ");   Serial.print(battery);
Serial.println(" V");      delay(1000); }
```

Upload.

Serial Monitor:

"Battery: 11.8 V"

Power supply shows: 12.0V

Difference: 0.2V

Inaccurate, but: CLOSE!

I stare at the number.

11.8V.

A real measurement.

From an €8 computer.

That I programmed.

That's...

That's exactly what I need!

For the boat!

Instead of the useless 12.0V voltmeter!

Real voltage!

Live!

Precise!

I take a photo.

Breadboard.

ESP32.

LED.

Resistors.

Cable chaos.

Serial Monitor: "Battery: 11.8 V"

Send it to a friend.

"Look, it works!"

Reply: "What is that?"

"ESP32. Measures voltage."

"For the boat?"

"Yes!"

"Cool. Can you really do that?"

"Just learned."

"Wow."

Yes.

Wow.

I'm surprised too.

Video 5:

"Connect an OLED display"

Now comes the display.

OLED 0.96 inch.

Small.

128×64 pixels.

I2C connection.

Just 4 wires:

- VCC (3.3V)
- GND
- SDA (data)
- SCL (clock)

Extend the breadboard:

Connect display.

ESP32 Pin 21 → SDA

ESP32 Pin 22 → SCL

VCC → 3.3V

GND → GND

Code:

Video has a library.

Adafruit_SSD1306.

Arduino IDE → Library Manager.

Search: "SSD1306"

Install.

Example code:

```
#include <Adafruit_SSD1306.h>  Adafruit_SSD1306 display(128, 64);  void setup()
{   display.begin(SSD1306_SWITCHCAPVCC, 0x3C);   display.clearDisplay();
display.setTextSize(2);   display.setTextColor(WHITE);   display.setCursor(0,0);
display.println("Hello");   display.println("Boat!");   display.display(); }  void
loop() { }
```

Upload.

Display:

Shows:

"Hello

Boat!"

In white.

On black.

Sharp.

Readable.

Perfect.

I combine them.

Voltage measurement + display.

Write code:

```
void loop() {   int value = analogRead(34);   float voltage = value * (3.3 / 4095.0);
float battery = voltage * 4.0;      display.clearDisplay();   display.setTextSize(2);
display.setCursor(0,0);   display.print("Batt:");   display.setCursor(0,20);
display.print(battery, 1);   display.print(" V");   display.display();
delay(500); }
```

Upload.

—

Display shows:

```
Batt: 11.8 V
```

Live.

Updates every 500ms.

I change the voltage on the power supply.

12.5V.

Display: "12.3 V"

It works!

LIVE!

—

I stare at it.

That's a working voltmeter.

For €15 in parts.

Digital.

Precise.

Live.

Self-built.

—

I make a video.

Show it:

- Breadboard with ESP32
- Display shows "12.3 V"
- I turn the power supply knob
- Voltage changes
- Display updates

- Live

Send video to a friend.

"LOOK AT THIS!"

Reply: "WTF! You built that?"

"Yes!"

"How many hours?"

"3."

"Mate."

"Yeah."

I look at the clock.

23:15.

I've been tinkering since 20:00.

3 hours.

5 videos watched.

Code written (typed out).

Hardware assembled.

Working voltmeter created.

For the boat:

Instead of €120 off-the-shelf voltmeter.

I now have:

€15 DIY voltmeter.

That I UNDERSTAND.

That I can CUSTOMISE.

That is MINE.

—

Buster stands up.

Stretches.

Comes over.

Sniffs the breadboard.

"Buster, NO. That's technology."

He doesn't care.

Sniffs again.

Lies down on my feet.

—

"Look, Buster. 12.3 volts!"

He yawns.

Classic.

—

Buster's already snoring again.

I look at the display.

Buster's right.

Time for bed.

—

Next day.

Saturday.

I get up.

First thought:

"To the boat. Test. NOW."

—

Pack the breadboard.

ESP32.

Display.

Resistors.

Cables.

Power supply.

Laptop.

Everything.

Off to the boat.

Start engine.

Runs.

Of course.

The engine doesn't care about my plans.

Just runs.

As always.

I set up.

In the cockpit.

Breadboard on the table.

ESP32 on USB power bank.

Voltage divider on the battery.

Direct.

No fuse.

No switch.

Nothing in between.

Direct.

Switch on the display.

Run the code.

Wait.

—

Display shows:

"Batt:

12.4 V"

Onboard voltmeter shows:

"12.0 V"

My multimeter shows:

12.4V.

—

My ESP32 is RIGHT!

The onboard voltmeter is LYING!

Proof delivered!

—

Engine on.

Alternator charging.

Display:

"Batt:

14.2 V"

Onboard voltmeter:

"12.0 V"

Completely ignores the fact that charging is happening.

—

My ESP32:

Shows it.

Live.

Precise.

14.2V.

Charging in progress.

Perfect.

I sit there.

Grinning.

Like an idiot.

Just completed my first boat project.

In 24 hours.

From idea to working prototype.

That's...

That's the moment.

The "I can do this!" moment.

The "This is becoming real!" moment.

The "No turning back now" moment.

I take photos.

Breadboard in the boat.

Display shows 14.2V.

Onboard voltmeter shows 12.0V.

The contrast.

Old vs. new.

1985 vs. 2024.

I know:

This is just the beginning.

Voltmeter is simple.

Fuel gauge is coming.

Temperature sensors are coming.

Dashboard is coming.

WiFi is coming.

Everything is coming.

But today:

Today I proved:

I can do this.

With €8 of hardware.

3 hours of YouTube.

And the will to make it better.

The engine runs.

As always.

Doesn't care about ESP32s.

Doesn't care about displays.

Just runs.

Reliably.

Since 1985.

But the rest?

The rest is going digital now.

Modern.

Measurable.

Understandable.

—

I pack up.

Take the breadboard home.

Develop further at home.

Then: install properly.

Fixed.

Permanent.

In the boat.

—

The first winter brought frustration.

Spring brought the solution.

Summer will bring the execution.

—

I drive home.

Breadboard beside me.

Display off.

But in my head:

It keeps running.

Showing data.

Voltage.

Temperature.

Tank.

Everything.

—

The next project:

LED lighting in the boat.

Properly.

With a switch.

Dimmable maybe?

How hard can it be?

(Spoiler: smoke incoming.)

But that comes later.

First: enjoy.

The success.

The working voltmeter.

The proof:

I can do this.

Chapter 6

The First Project

LED instead of light bulb

April.

Boat sits at the dock.

Me too.

With tools.

And a plan.

The plan:

Modernise the cabin lighting.

Old light bulb out.

LED in.

Simple.

Should work.

I have:

- LED strip (12V, warm white)
- Cable (red, black)
- Switch (new, no wiggle)
- Soldering iron
- Heat shrink tubing
- Optimism

Old light bulb:

5 watts.

Warm.

Inefficient.

But: working since 1985.

Getting replaced.

By progress.

LED strip:

3 watts.

Same brightness.

More efficient.

More modern.

Better.

Theoretically.

Step 1: Remove old lamp.

Loosen the screw.

Lamp comes down.

Two cables visible:

- Red
- Black

Classic.

Understandable.

Beautiful.

Step 2: Prepare LED strip.

Cut 20cm.

Strip the ends.

Solder cables on:

- Red to +
- Black to −

Heat shrink over it.

Heat gun.

Done.

Looks professional.

Feels professional.

I'm proud.

Step 3: Connect.

LED cable to boat cable.

Red to red.

Black to black.

Terminal block.

Tighten.

Step 4: Test.

Switch on.

LED lights up!

Bright!

Beautiful!

Perfect!

I lean back.

First project.

Successful.

In 30 minutes.

No problems.

No drama.

Just works.

I enjoy the moment.

For 5 minutes.

Then:

Do I smell something?

Odd.

Sweet.

Plastic?

I look around.

Where from?

LED strip.

Getting... warm?

Very warm.

Too warm.

I touch it.

"OUCH!"

Hot!

Very hot!

That's not normal!

Switch off.

Immediately.

LED off.

Heat remains.

Slowly cooling.

I look closer.

LED strip.

One LED is... brown.

Discoloured.

Others too.

Damn.

I check again.

Packaging of the LED strip:

"12V DC, 3W/m, warm white"

Boat has: 12V

Should fit.

But: doesn't.

I Google.

"LED strip getting hot"

Forum post:

"Too much current? Checked the power supply?"

I check.

Battery: 12.4V.

Engine running: 14.2V.

Ah.

—

Alternator running.

14.2V.

LED strip tolerates: 12V.

Difference: 2.2V.

Too much.

LED gets hot.

Dies slowly.

—

Google more:

"LED 12V overvoltage"

Solution: voltage regulator.

Or: buy 14V LEDs.

Or: put a resistor in series.

—

I don't have a voltage regulator.

No 14V LEDs.

But: resistors.

—

Second attempt.

Disconnect LED strip.

(The brown LED is done for, anyway.)

Find a resistor.

10 Ohm? 100 Ohm?

Which one?

—

Google: "Calculate resistor for LED"

Formula:

```
R = (Vin - Vled) / I  Vin = 14V (alternator) Vled = 12V (LED) Difference = 2V  I = 3W / 12V = 0.25A  R = 2V / 0.25A = 8 Ohm
```

I have: 10 Ohm.

Close enough.

Will work.

New LED strip.

20cm.

Solder resistor in series.

10 Ohm, 5 watt (important: power rating!).

Cable on.

Heat shrink.

Connect.

Again.

Terminal block.

Tighten.

Hope.

Switch on.

LED lights up.

I wait.

5 minutes.

10 minutes.

Touch:

Warm.

But not hot.

Resistor warm too.

But okay.

—

15 minutes:

LED lights up.

Not brown.

Not too hot.

Works!

—

Start engine.

Alternator at 14.2V.

LED keeps shining.

Evenly.

No hotter.

Resistor does its job.

—

Success!

On the second attempt!

Trial & error!

More error, less trial!

But: works!

—

I sit there.

Looking at the LED.

My first real boat project.

Small.

Just LEDs.

But: MINE.

Friend comes by.

"What are you doing?"

"Installed LEDs."

He looks.

"Looks good."

"Thanks. Was my second attempt."

"Second?"

"First one got too hot."

He laughs.

"Welcome to the DIY club."

We sit in the cockpit.

Beer open.

LED shining.

Friend asks:

"What's the next project?"

I think.

List in my head:

- ✅ LED lighting (done!)
- ☐ Install voltmeter (breadboard → permanent)
- ☐ Fuel gauge (ultrasonic sensor)
- ☐ Engine temperature
- ☐ Dashboard (permanent display)
- ☐ WiFi access
- ☐ ...

"Voltmeter. Permanent install."

"The breadboard one?"

"Yes."

"Permanently?"

"Yes."

"Can you do that?"

I hesitate.

"Don't know. But I'll try."

He nods.

"That's all it takes."

"What?"

"Trying. The rest follows."

He's right.

Evening.

Boat alone.

LED shining.

Warm.

Pleasant.

Self-built.

I think back:

3 months ago:

Knew nothing about ESP32.

Nothing about Arduino.

Nothing about LEDs and resistors.

Now:

Written code.

Built hardware.

Built a voltmeter (breadboard).

Installed LEDs (with mistakes, but successfully).

That's...

That's progress.

Real progress.

From "no idea" to "it works."

In 3 months.

The first project was small.

Just LEDs.

Just light.

But:

It was the proof.

Proof that I can do this.

That YouTube is enough.

That €8 of hardware is enough.

That willpower is enough.

The engine runs.

As always.

Doesn't care about LEDs.

Doesn't care about resistors.

Just runs.

Since 1985.

Unchanged.

Reliable.

But around it:

Things are changing.

LED instead of light bulb.

Digital instead of analogue.

Data instead of guessing.

Modern instead of old.

I switch off the LED.

Dark.

Boat sleeps.

Me too.

Satisfied.

Next day.

Sunday.

I come back.

With a new plan.

Voltmeter.

From breadboard to PCB.

Fixed.

Permanent.

Installed.

I have:

- Stripboard
- ESP32
- Resistors
- OLED display
- Case (3D printed, from a mate)
- Cables
- Soldering iron
- Courage

The plan:

Everything that works on the breadboard.

Transfer to PCB.

Solder permanently.

Into the case.

Install.

Done.

Reality:

Gets more complicated.

Much more complicated.

Soldering.

I'm not a soldering pro.

Looks like...

Mediocre.

But works.

Mostly.

—

ESP32 onto the board.

With pin headers.

(In case I need to swap it.)

Solder resistors.

100k and 47k.

Voltage divider.

—

OLED display.

4 pins.

VCC, GND, SDA, SCL.

Solder on.

Cable running out.

To the display.

—

2 hours later:

Board done.

Looks… handmade.

But: complete.

—

Test.

USB cable to ESP32.

Upload code.

Connect display.

Power on.

—

Display stays black.

Damn.

Check:

Cables right?

Yes.

Solder joints?

Look okay.

Code?

Same as before.

Multimeter out.

Continuity check.

VCC to display: no contact.

Ah.

Rework the solder joint.

More solder.

Better.

Test:

Continuity: yes!

Power on.

Display:

"Batt:

12.4 V"

YES!

Works!

Board into the case.

3D printed.

Black.

Professional.

Fits.

Almost.

ESP32 sticks out 2mm.

Lid won't close.

Dremel out.

Trim the lid.

2mm removed.

Try.

Fits!

Screw together.

Display on the outside.

Visible.

Cable out the back.

To the battery.

Install in the boat.

Dashboard.

Next to the old voltmeter.

The comparison.

Double-sided tape.

Holds.

For now.

Later: screws.

Route cables.

Through the wall.

To the battery.

Direct.

No fuse.

(Only measures, draws barely any current.)

Connect.

Plus to plus.

Minus to minus.

Power on.

Display glows.

In the boat.

Permanently installed.

Professional.

Self-built.

"Batt:

12.4 V"

Old voltmeter next to it:

"12.0 V"

The contrast remains.

Start engine.

New display:

"14.1 V"

Old display:

"12.0 V"

Completely ignores the alternator.

I sit there.

Looking at both.

Old and new.

Side by side.

The new one shows the truth.

The old one... shows something.

But the old one stays.

As backup.

As a reminder.

As "it was like that."

Friend comes by.

Sees the new display.

"Impressive. Looks professional."

"Thanks."

"How long did it take?"

"6 hours. Including mistakes."

"And cost?"

"€15."

"Mate."

He looks at the old voltmeter.

"And that one?"

"Stays. For comparison."

"Does it show correctly?"

"No."

"But it stays?"

"Yes."

He laughs.

"Typical boat."

We sit in the cockpit.

Two displays.

One shows 14.1V (true).

One shows 12.0V (false).

Both glow.

Both have their right to exist.

The first project was LEDs.

Small.

Simple.

But successful.

The second project was the voltmeter.

Bigger.

More complex.

But successful.

From breadboard to PCB.

From prototype to product.

From test to permanent.

The engine runs.

As always.

Doesn't care about displays.

Just runs.

14.1V alternator.

Since 1985.

Reliable.

But now I KNOW it.

14.1V.

Precise.

Live.

Measurable.

No longer:

"Engine's running, so it's fine."

But:

"Engine's running, charging at 14.1V, battery at 85%, everything perfect."

—

Data instead of assumptions.

Knowledge instead of guessing.

Measuring instead of estimating.

—

That's the difference.

Between "works" and "understanding."

Between "okay" and "optimal."

Between old and new.

—

I switch everything off.

LED off.

Display off (but stays live, barely draws current).

Engine off.

—

Boat sleeps.

But wakes up with data.

With information.

With knowledge.

—

The next project:

Fuel gauge.

Ultrasonic sensor.

Measures fill level.

Shows litres.

Precise.

Not "3/4" any more.

But "156 litres."

—

But that comes later.

First: enjoy.

Two successful projects.

LED: ✅

Voltmeter: ✅

—

From "no idea" to "2 successful projects."

In 4 months.

With YouTube.

With €8 of hardware.

With trial & error.

—

More error than trial.

But: error is learning.

Trial is trying.

Success is both together.

—

The first summer is coming.

With new LEDs.

With a new voltmeter.

With new knowledge.

—

And with the realisation:

I can do this.

Really.

Not just breadboard.

But: fixed. Permanent. In the boat.

That's just the beginning.

Voltmeter was small.

The vision is big.

Very big.

But more on that later.

First: be proud.

Of the LEDs.

Of the voltmeter.

Of myself.

The engine runs.

The LED shines.

The display shows data.

The boat is getting smart.

Slowly.

Project by project.

But it's happening.

Chapter 7

The Vision

Or: "I'm rebuilding the whole thing"

May.

Boat sits at the dock.

LED shining.

Voltmeter shows 12.4V.

Two successful projects.

Small.

But successful.

I sit in the cockpit.

Notepad on my lap.

Pen in hand.

Thinking.

"What's next?"

List:

```
✅ LED lighting ✅ Voltmeter (digital) ☐ Fuel gauge ☐ Engine temperature ☐ Oil pressure ▫ RPM (accurate) ▫ Diesel flow meter ▫ ...
```

The list grows.

Fast.

Each "☐" is a project.

Each project is:

- ESP32 (€8)

- Sensor (€5–20)
- Time (hours)
- Code
- Installation

Doable.

All doable.

—

But:

8 projects.

8 ESP32s.

8× programming.

8× installing.

Individually.

—

I look at the dashboard.

Voltmeter: new, digital.

Next to it: old voltmeter.

Next to that: tachometer (analogue).

Next to that: fuel gauge (lying).

Next to that: depth gauge (okay).

Next to that: 12 switches (half known).

—

All separate.

All on their own.

No connection.

No integration.

No system.

—

The idea forms.

Slowly.

Creeping.

"What if..."

"What if I brought ALL of this..."

"...together?"

One system.

One dashboard.

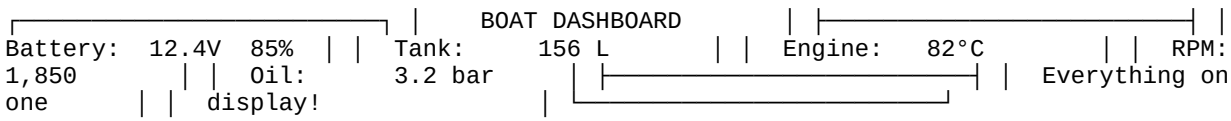
One display.

All the data.

Central.

Modern.

I sketch:



That would be...

That would be perfect.

I Google.

"Boat dashboard DIY"

"Marine display custom"

"ESP32 dashboard"

Results:

- SignalK server
- Node-RED dashboard
- Grafana
- Raspberry Pi as hub

Concepts.

Lots of concepts.

A video:

"Complete boat monitoring with Raspberry Pi"

45 minutes.

I watch.

The guy shows:

- Raspberry Pi (€50)
- Multiple ESP32s (€8 each)
- MQTT broker
- Node-RED
- Dashboard on tablet
- WiFi throughout the boat

All networked.

All data centralised.

Accessible from anywhere.

Phone.

Tablet.

Laptop.

That's...

That's exactly what I want!

Not 8 individual projects.

But:

ONE system.

For everything.

I pause the video.

Take screenshots.

Notes.

Components:

```
Hardware: - Raspberry Pi 4 (4GB): €60 - 5× ESP32: €0 (from the drawer) - Sensors:
~€100 - Cables, cases: €30 - Display (7" touch): €80  Software: - Raspbian OS: free -
Mosquitto MQTT: free - Node-RED: free - All open source!  Total: ~€310
```

I look at the number.

€310.

For a complete system.

Not individual projects.

But:

All integrated.

Centrally controlled.

Professional.

Raymarine equivalent:

Multifunction display: €1,500

Plus sensors: +€800

Plus installation: +€500

Total: €2,800

My system: €310.

Difference: €2,490.

And: I understand it.

Can customise it.

Extend it.

Repair it.

The decision is clear.

I'm building it.

Completely.

From the ground up.

But:

This is big.

Very big.

Not a "little project" any more.

But:

Complete digitisation.

I make a new list.

Not "projects."

But "phases."

```
PHASE 1: Foundation ▫ Raspberry Pi setup ▫ MQTT broker ▫ Install Node-RED ▫ Basic dashboard  PHASE 2: Sensors ▫ Battery monitoring (3× batteries) ▫ Tank level ▫ Engine data (temp, oil, RPM) ▫ Diesel flow  PHASE 3: Integration ▫ Connect all ESP32s ▫ Finalise dashboard ▫ WiFi access point ▫ Mobile access  PHASE 4: Extensions ▫ Heater control ▫ Bilge pump monitor ▫ GPS/Navigation ▫ Alerts & notifications
```

Four phases.

Many months.

But: doable.

I look at the old list.

8 individual projects.

Then at the new list.

1 big system.

The new list is better.

More thought-through.

More complete.

More right.

But also:

Bigger.

More time-consuming.

More expensive.

I calculate:

```
Time (estimated): - Phase 1: 20h - Phase 2: 40h - Phase 3: 30h - Phase 4: 50h  Total:
140h  At 5h/week: 28 weeks = 7 months
```

7 months.

Almost a year.

Until everything's done.

Cost:

```
Hardware: €310 Reserve (mistakes, replacements): €100 Tools (still to buy): €50
Total: €460
```

Not cheap.

But doable.

Spread over 7 months.

~€65/month.

—

I look at the boat.

Then at the list.

Back at the boat.

—

This is it.

This is THE idea.

Not "improve a little."

But:

"Rebuild completely."

—

Partner comes aboard.

Sees the notepad.

Sketches.

Lists.

Numbers.

—

"What are you planning?"

I show her.

Dashboard sketch.

Phase plan.

Cost overview.

—

She reads.

Silent.

Thinks.

—

"That's... big."

"Yes."

"And expensive."

"Not too bad. €460."

"Over how long?"

"7 months."

—

Pause.

"And all this... for data?"

"Yes."

"Do you need it?"

I think.

"No."

"But?"

"But I want it."

—

She smiles.

"You're crazy."

"Yes."

"But it's your boat."

"Our boat."

"Your project."

—

She looks at the sketch.

Dashboard.

All the data.

Central.

Modern.

"That looks... professional."

"It will be."

"Can you really do this?"

"Don't know. But I'll try."

She nods.

"Okay. But:"

"What?"

"Stick to the budget."

"Promise."

"And no new projects on the side."

"Promise."

"Finish first, then expand."

"Promise."

She leaves.

I stay.

With the list.

The vision.

The plan.

Evening.

At home.

Excel open.

Table 1: Budget

Component	Price	Status
Raspberry Pi 4	€60	▫
Sensor set	€100	▫
Cables & cases	€30	▫
Reserve	€100	▫
TOTAL	€460	

Looks doable.

Table 2: Timeline

Month	Phase	Cost
Jun	Phase 1: Setup	€90
Jul	Phase 2a: Batt	€50
Aug	Phase 2b: Tank	€40
Sep	Phase 2c: Engine	€80
Oct	Phase 3: WiFi	€50
Nov	Phase 4a: Heat	€60
Dec	Phase 4b: Rest	€90
	TOTAL	€460

7 months.

Order something every month.

One step closer every month.

By December: done.

I lean back.

This is it.

The plan.

The vision.

The project.

No longer:

"I'll build a voltmeter."

But:

"I'm digitising the entire boat."

That's...

That's insane.

Ambitious.

Big.

Maybe too big.

But:

I've built LEDs.

I've built a voltmeter.

I've written code.

I've soldered.

I've learned.

If I can do that...

I can do the rest.

One step at a time.

One project at a time.

One phase at a time.

I save the spreadsheet.

"Boat_Digitisation_Master_Plan.xlsx"

Sounds official.

It is.

I open Amazon.

Basket:

- Raspberry Pi 4 (4GB)
- Official power supply

- 32GB MicroSD
- Case with fan

Total: €89.

Phase 1.

Finger hovering over the "Order" button.

Hesitate.

This is the point of no return.

If I order now:

No going back.

Project is live.

7 months.

€460.

140 hours.

But:

I want this.

Really.

Not because it's necessary.

But because it's possible.

Click.

"Order."

Order placed.

Arriving: tomorrow.

It has begun.

The digitisation.

The transformation.

From "old boat" to "smart boat."

The engine runs.

As always.

Doesn't care about plans.

Doesn't care about Raspberry Pi.

Just runs.

Since 1985.

Unchanged.

Reliable.

But around it:

Everything changes.

Analogue becomes digital.

Old becomes new.

Guessing becomes knowing.

I look at the order confirmation.

Raspberry Pi 4.

Arriving tomorrow.

Then it begins.

Partner comes in.

"Did you order?"

"Yes."

"How much?"

"€89. First instalment."

She sighs.

"You're really doing this."

"Yes."

"Madness."

"Yes."

—

She smiles.

"Good luck."

"Thanks."

"And don't forget:"

"What?"

"Document it. For others."

"Why?"

"Because you need to show this."

—

Document.

Good idea.

Take photos.

Save code.

Write notes.

—

Maybe.

At some point.

When it's done.

A blog?

A guide?

A... book?

But that comes later.

Much later.

First: build.

Learn.

Do.

The vision is clear:

Complete boat digitisation system.

Central.

Integrated.

Modern.

The road is long:

7 months.

4 phases.

Countless hours.

Many mistakes.

Even more learning.

But:

I'm ready.

Built LEDs.

Built a voltmeter.

Proved: I can do this.

Now:

It gets big.

Really big.

The boat doesn't know it yet.

Sits quietly at the dock.

LED shining.

Voltmeter shows 12.4V.

Engine sleeping.

But soon:

Raspberry Pi.

Sensors everywhere.

Dashboard.

Data.

Knowledge.

From "works somehow"

To "I know exactly what's happening."

That's the vision.

That's the plan.

That's the project.

The engine runs.

Will always run.

Unchanged.

Reliable.

Since 1985.

But everything else?

Gets new.

Digital.

Modern.

Smart.

Next summer:

Boat with a system.

With data.

With knowledge.

No more guessing.

But knowing.

That's worth it.

€460.

140 hours.

7 months.

For certainty.

For knowledge.

For control.

And for the fun.

The fun of building.

Of learning.

Of understanding.

The boat works.

Has always worked.

Will always work.

But now:

It's getting smart.

Chapter 8

The Engine Runs

And everything else I'm digitising now

June.

Package on the table.

Raspberry Pi 4.

Phase 1 begins.

I think back.

To the beginning.

To the purchase.

To the boat.

---

14 months ago:

Bought a boat.

Well maintained.

Works.

Engine runs.

Everything floats.

Perfect.

But:

Voltmeter showed 12.0V.

Always.

Fuel gauge showed 3/4.

Always.

Knew nothing.

Guessed everything.

That bugged me.

Not much.

But enough.

First attempt:

Accept it.

"It works."

"Engine runs."

"That's enough."

Worked.

For a few months.

Until winter came.

And questions came.

"Is the battery full?"

No idea.

"How much diesel do I have?"

Estimate.

"Is the alternator charging?"

Probably.

That wasn't enough any more.

I wanted to know.

Not guess.

Know.

—

So:

YouTube.

50 tabs.

3 in the morning.

"ESP32 for boats"

—

Then:

Amazon.

€8.

"Just for testing."

Ha.

—

Then:

Breadboard.

LED blinks.

"Hello World!"

The first code.

The first success.

—

Then:

Voltage measurement.

11.8V.

Real.

Precise.

Digital.

Then:

First installation.

LED in the boat.

With smoke.

With mistakes.

With success.

Then:

Voltmeter.

Fixed.

Permanent.

Professional.

14.1V vs. 12.0V.

Proof delivered.

Then:

The vision.

Not just a voltmeter.

Everything.

Complete.

System.

And now:

Raspberry Pi.

Phase 1.

It begins.

—

14 months.

From "no idea"

To "I'm building a complete digitisation system."

—

That's...

That's a journey.

A learning journey.

A DIY journey.

An "I can do this!" journey.

—

What have I learned?

—

Lesson 1:
Prior knowledge helps.

Really.

Electronics experience saves weeks.

Every question has an answer.

But boat electrics still need learning.

The hard lessons come on the water.

—

Lesson 2:
Having your own parts is gold.

Full parts box means: start immediately.

No waiting for Amazon.

No budget stress.

Just do it.

Lesson 3:

Mistakes are normal.

LED gets hot? → Resistor.

Display stays black? → Solder joint.

Code crashes? → Serial Monitor.

Everything solvable.

Lesson 4:

Start small.

Blink an LED.

Then measure voltage.

Then display.

Then install.

Step by step.

Lesson 5:

Community helps.

Forums.

Reddit.

Discord.

Someone's had the problem before.

Always.

Lesson 6:

Documenting pays off.

Take photos.

Write notes.

Save code.

For later.

For others.

For myself.

But:

The most important lesson:

Lesson 7:
I can do this.

Really.

Without marine training.

Without a boat electrician's licence.

Just with:

- Willpower
- YouTube
- €8 of hardware
- Time

That's...

That's empowering.

Liberating.

Motivating.

I open the package.

Raspberry Pi 4.

Small.

Unassuming.

Will be the brain.

Next weeks:

Setup.

Learn Linux.

Install MQTT.

Learn Node-RED.

Build dashboard.

Next months:

Connect sensors.

Program ESP32s.

Integrate system.

Test.

Debug.

Finalise.

By December:

Done.

Complete.

Digitised.

That's the plan.

Will it work out?

No idea.

But I'll try.

The boat sits at the dock.

Knows nothing about plans.

LED shining.

Voltmeter shows 12.4V.

Engine sleeping.

But soon:

Dashboard.

Sensors.

Data.

Knowledge.

From analogue to digital.

From old to new.

From guessing to knowing.

That's the journey.

It begins now.

For real.

I look at the boat.

Then at the Raspberry Pi.

Back at the boat.

"This is where it starts."

Not as a repair.

Not as a necessity.

But as:

Improvement.

Modernisation.

Project.

Because I can.

Because I want to.

Because it's possible.

The engine runs.

Will run.

Always run.

Since 1985.

Until... who knows.

The engine needs nothing.

No ESP32.

No Raspberry Pi.

No dashboard.

Just runs.

Diesel in.

Ignition on.

Done.

But everything else?

That's getting an upgrade.

A massive upgrade.

That's the difference.

Between "works"

And "optimal."

Between "enough"

And "perfect."

Between "old"

And "modern."

The boat is good.

Has always been good.

Will always be good.

But:

Good isn't enough for me any more.

I want better.

Not because it's necessary.

But because it's possible.

That's the motivation.

The driving force.

The reason.

I unpack the Raspberry Pi.

Connect.

Boot.

Install.

The project begins.

Now.

Really.

The road is long.

7 months.

Many hours.

Many mistakes.

But:

I'm ready.

I've learned.

I have experience.

I have willpower.

And:

I have a boat.

That wants to get better.

That can get better.

That will get better.

The engine runs.

The keyboard types.

The journey begins.

Here ends Volume 1.

But the story continues.

In Volume 2.

And 3.

And 4.

And...

Because:

Digitisation has no end.

Only phases.

Projects.

Improvements.

The boat will never be "finished."

Will always be a project.

Will always be improvable.

But that's okay.

That's even good.

Because:

That's the fun.

That's the journey.

That's the hobby.

The engine runs.

And everything else?

I'm digitising it.

Now.

EPILOGUE

3 years later...

December 2027.

Boat sits at the dock.

Winter.

Cold.

Dashboard in the cockpit:

7" touchscreen.

Live data:

```
┌──────────────────────────────────┐ │    BOATOS v2.4                 │
├──────────────────────────────────┤ │  Battery 1:  13.8V   98%   │ │  Battery 2:  13.7V
96%   │ │  Battery 3:  12.9V   78%   │ │                              │ │  Diesel:
187 L   93%   │ │  Water:       78 L   52%   │ │                              │ │
Engine Temp:  OFF          │ │  Heater:      22.5°C  ON   │ │  Cabin:       21.8°C
│ │                                  │ │  Solar:         0 W        │ │  Consumption:  35 W
│ └──────────────────────────────────┘ │  WiFi:         Online      │ │  Clients:      2
│                                      └──────────────────────────────┘
```

All live.

All precise.

All digital.

---

8 ESP32s installed:

- ESP32 #1: Battery monitoring (3× batteries)
- ESP32 #2: Tank levels (diesel + water)
- ESP32 #3: Engine data (temp, oil, RPM)
- ESP32 #4: Solar & consumption
- ESP32 #5: Temperatures (5× sensors)
- ESP32 #6: Heater control
- ESP32 #7: Bilge pump & alarms
- ESP32 #8: Navigation & GPS

Raspberry Pi 4:

- MQTT broker (Mosquitto)
- Node-RED dashboard
- InfluxDB (data logging)
- Grafana (historical data)
- WiFi access point
- VPN access (Tailscale)

All networked.

All centralised.

All accessible:

- On the touchscreen in the boat
- On the phone (WiFi)
- From home (VPN)

Features:

- Live monitoring of all values
- Historical data (1 year)
- Alerts for critical values
- Heater control via app
- Automatic bilge pump
- Solar yield tracking
- Diesel consumption per trip

Total cost:

Hardware: €487 (€27 over budget)

Time: ~180h (40h over estimate)

Nerves: priceless

Success: 100%

The boat is smart.

Really smart.

Smarter than many new builds.

Friends come aboard.

See the dashboard.

"What the hell?"

"BoatOS."

"You built that?"

"Yes."

"Mate."

They tap the screen.

Switch between views.

Battery.

Tank.

Solar.

History.

"That's... professional."

"Thanks."

"How long did it take?"

"3 years. On and off."

"And cost?"

"€500."

"WHAT?"

—

I show the old dashboard.

Next to it.

Still there.

As backup.

—

Voltmeter: 12.0V (still)

Fuel gauge: 3/4 (still)

Tachometer: something (still)

—

"Why still there?"

"A reminder."

"Of what?"

"Where I came from."

—

They nod.

Understand.

—

The old system:

Worked.

Always worked.

Will work.

—

The new system:

Is better.

Much better.

But:

Stands on the shoulders of the old.

—

Without the old:

No new.

Without "works":

No "optimised."

—

The old stays.

As respect.

As backup.

As history.

—

I start the engine.

Test.

—

Starter turns.

Engine hums.

Runs.

—

Dashboard shows:

```
Engine Temp:  Cold start Oil Pressure: 3.8 bar   ✓ RPM:          850 Alternator:
14.2V     ✓
```

All live.

All precise.

—

Old voltmeter:

12.0V

Of course.

Never changed.

Never will.

—

Friend laughs.

"That old thing still shows 12.0?"

"Yup."

"And you keep it?"

"Yup."

"Why?"

—

I look at both displays.

Old and new.

Side by side.

—

"Because it reminds me."

"Of what?"

"That the engine runs."

—

Pause.

"Always?"

"Always."

—

"Since?"

"1985."

—

"And you digitised everything around it?"

"Yes."

—

"But the engine?"

"Just runs."

—

He nods.

Understands.

—

The engine:

Built 1985.

No electronics.

No sensors.

No computers.

—

Just:

Diesel.

Ignition.

Mechanics.

—

Running for 40 years.

Will keep running.

Always running.

—

Around it:

8 ESP32s.

1 Raspberry Pi.

47 sensors.

Countless lines of code.

All modern.

All digital.

All smart.

But the heart?

The heart is the engine.

1985.

Analogue.

Simple.

Reliable.

That's the irony.

The beauty.

The truth.

I digitise everything.

But the most important thing?

Doesn't need it.

Just runs.

The boat is smart now.

The dashboard is perfect.

The data is precise.

But:

Without the engine?

Without the heart from 1985?

None of it would matter.

The engine runs.

Has always run.

Will always run.

And that?

That's reassuring.

In a digitised world.

Where everything is complex.

Where everything is networked.

Where everything depends on software.

The engine runs.

Simply.

Without ifs or buts.

Since 1985.

That's the lesson.

The most important lesson.

After 3 years of digitisation.

—

Modern is good.

Digital is better.

Smart is great.

—

But:

Simple is unbeatable.

—

The engine runs.

The boat floats.

Everything else?

Is a bonus.

—

I look at the dashboard.

BoatOS v2.4.

3 years of work.

€500 in hardware.

180 hours of time.

—

And at the engine.

1985.

Unchanged.

Reliable.

—

Both have their place.

Both are important.

Both are right.

—

The new system shows me:

What's happening.

How much.

How well.

—

The old engine shows me:

That it runs.

Always runs.

Simply runs.

—

That's balance.

Modern and old.

Digital and analogue.

Smart and simple.

—

That's my boat.

2024 meets 1985.

ESP32 meets diesel.

Code meets mechanics.

—

And it works.

Everything works.

Better than ever.

—

The engine runs.

The dashboard glows.

The boat is ready.

For the next trip.

The next season.

The next improvement.

Because:

It's never finished.

Never will be.

But:

That's okay.

That's even good.

Because:

The journey is the destination.

Learning is the fun.

Building is the hobby.

And as long as the engine runs?

I can keep going.

Improving.

Digitising.

Forever.

END Volume 1

The story continues in:

Volume 2: Power Is Never Simple
Solar, batteries & the reality of self-sufficiency

Volume 3: Sensors & Monitoring
ESP32, MQTT & hardware for beginners

Volume 4–5: BoatOS
The complete system – from vision to reality

Volume 6: The Valve Heater
Frost protection, clamshell & why you can't buy this

Volume 7: The Auto-Sat
GPS, stepper motors & automatic satellite alignment

More volumes in the works...

"The engine runs."

Always.

⚓

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Open Source & Free Materials:
github.com/bigbrainlabs/logbuch-ohne-pose

"*The engine runs.*"
Always.