

Reference

Source code references, build configuration, hardware datasheet pointers, useful commands and the pre-deployment checklist. If you made it till here, you a true G.Ⓢ

Source Code References

Main Application

File	Purpose
src/sensor_board/main.c	Main entry point, MainTask, sensor loop, packet handlers

Sensor and Actuator Drivers

Component	Location
IMU	components/sensor_board/imu/imu_sensor.h / .c
pH	components/sensor_board/ph/ph_sensor.h / .c
Load Cell (HX711)	components/sensor_board/load_cell/load_cell_sensor.h / .c
Pressure (FSR)	components/sensor_board/pressure/pressure_sensor.h / .c
Flow Sensor	components/sensor_board/sampling/flow_sensor/flow_sensor.h / .c
Pump	components/sensor_board/sampling/pump/pump.h / .c
Utilities	components/sensor_board/sensor_basics/sensor_basics.h / .c

Shared Components

Component	Location
Networking (LwIP glue, UDP)	components/common/networking/
Network addresses and port	components/common/networking_constants/ip_mac_constants.h
Packet dispatcher	components/common/packet_dispatcher/
Protobuf encode/decode helpers	components/common/pb_message/

Result codes and TRY macro	components/common/result/
Logging	components/common/logging/

Protobuf Definitions

Message definitions (PBEnvelope, SensorBoardPHInfo, SensorBoardIMUInfo, SensorBoardLoadCellInfo, SensorBoardPressureInfo, SensorBoardFlowSensorInfo, SensorBoardPumpInfo, SensorBoardDiagnostics) live in the **ERC-Protobufs** git submodule and are compiled to C by nanopb during the PlatformIO build. If the build cannot find the .pb.h headers, initialize the submodule:

```
git submodule update --init ERC-Protobufs
```

Build Configuration

File	Purpose
platformio.ini	Build configuration for all boards (env:sensor_board for this one)
components/sensor_board/firmware/firmware.ioc	CubeMX device configuration
components/sensor_board/STM32H753XX_FLASH.ld	Linker script

Development Workflow

Useful Commands (PlatformIO CLI)

Check this out for compiling code and more about project structure- [Project Structure](#)

```
# Build the sensor board firmware
pio run -e sensor_board

# Flash to the Nucleo board
pio run -e sensor_board -t upload

# Serial monitor (115200 baud)
pio device monitor -b 115200
```

```
# Run the unit tests
pio test -e sensor_board
```

Development Cycle

1. Change peripherals in CubeMX (firmware.ioc), regenerate with Keep User Code
2. Implement or update the driver in components/sensor_board/
3. Build and run unit tests on the host
4. Flash, watch the serial log, verify the per-sensor status lines
5. Enable sendUDP and verify packets on the network

Hardware References

Device	Model	Protocol	Note
Microcontroller	STM32H753ZI (NUCLEO-H753ZI)	n/a	ARM Cortex-M7, 480 MHz capable (running at 64 MHz), 2 MB Flash; ST STM32H7 reference manual
Ethernet PHY	LAN8742	RMII	10/100 Mbps auto-negotiation
pH	DFRobot SEN0161	Analog ADC	40-sample averaging, 5 V board (scale output below 3.3 V)
IMU	Xsens Avior	I2C1 (PB8/PB9), Xbus	Address 0x6B, 100 Hz; driver untested on hardware (mtidocs.xsens.com)
Load Cell ADC	HX711 (×2)	GPIO bit-bang	24-bit, channel A gain 128
Pressure	FSR pads (×2)	Analog ADC	Compile gated, needs ADC in CubeMX
Flow	FM-PS2216	GPIO EXTI pulses	40 to 150 ml/min, 5.5 pulses/ml
Pump	Grothen 12 V DC mini peristaltic	PWM (TIM3 CH3)	Single MOSFET, unidirectional, open loop

Network Quick Reference

Item	Value
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Board IP	192.168.0.111 (static, no DHCP)
Destination (sample board)	192.168.0.222
UDP port	1500
Netmask / Gateway	255.255.255.0 / 192.168.0.1

Quick Reference Checklist

Before Deployment

- ERC-Protobufs submodule initialized, firmware builds clean
- All connected sensors responding (OPERATING | OK in the log)
- Network IP/MAC configured and sendUDP enabled
- Calibration set for pH (offset/slope) and load cells (tare/scale)
- Serial monitor showing sensor data at 115200 baud
- Heap usage healthy (well above the 4096 byte critical threshold)
- UDP packets reaching 192.168.0.222:1500 and decoding as PBEnvelope

Monitoring in Production

- Watch per-sensor state/status codes in the log lines
- Monitor the free heap trend printed each loop
- Verify data ranges match expectations (pH 0-14, flow below 150 ml/min)
- Track error rates per sensor and pump/flow cross-check warnings

Hope you had fun.☺ End of documentation for the Sensor Board.

May The Force Be With You or Live Long and Prosper, depending on what you like.... but remember the Dark Side always has cooler toys

The Sensor Board is the coolest board ~ Mybrosky

Revision #8

Created 2026-04-14 16:08:14 UTC by Shishir Nambiar

Updated 2026-07-08 14:49:55 UTC by Shishir Nambiar