# SmartSpoil Compact Device – Technical & Assembly Manual

## 1. Physical Assembly (Technician)

Step 1: Print the enclosure using the 'compact\_enclosure\_hollow.scad' file in OpenSCAD and export to STL. Print using PLA or a biodegradable material.
Step 2: Solder the ESP32-PICO-D4, gas sensor, LED, and voltage regulator on the compact PCB.
Step 3: Mount the battery holder on the back of the PCB and insert the CR2032 cell.
Step 4: Slide the PCB into the enclosure. Ensure the LED and gas sensor align with the case cutouts.
Step 5: Close the case using biodegradable adhesive or snap-lock design.

## 2. Firmware Flashing Guide (Engineer)

Step 1: Install Arduino IDE from https://www.arduino.cc/en/software.
Step 2: Install the ESP32 board definitions via Boards Manager using: https://github.com/espressif/arduino-esp32.
Step 3: Connect your ESP32 via USB.
Step 4: Open 'Compact\_Device\_Firmware.ino'.
Step 5: Select the board as ESP32 Dev Module and correct COM port.
Step 6: Click Upload.

## 3. Sensor Calibration Procedure

Step 1: Open the terminal and run 'sensor\_calibration\_script.py'.
Step 2: Place the device in a clean, ventilated environment for 30 seconds.
Step 3: Observe average baseline values. Store the value for comparison during spoilage detection.

## 4. Technician Manual

Tasks: physical assembly, battery replacement, packaging the unit, LED function checks.
No reprogramming required. Use BLE to check functionality via app.

## 5. Engineer Manual

Tasks: flashing firmware, modifying sensor thresholds, maintaining calibration code, integrating new sensors or BLE configurations.
Ensure compliance with BLE UUIDs, and log device events via UART during development.