From the box to a live muscle signal in six steps

The same steps work for ECG, EOG and EEG: only the jumper and the electrode positions change.

1 Gather the parts

EasyEXG, an Arduino (UNO, Nano or UNO R4), 3 jumper wires, a 3-lead snap cable with a 3.5 mm plug, 3 gel electrodes and a USB cable.

2 Set JP1

Leave JP1 open (221×) for this first EMG test. Bridge it with solder later for ECG or EEG (1 048×).

3 Wire J3

Arduino unplugged: GND → GND, VCC → 5V (or 3.3V), OUT → A0. VREF stays unconnected.

4 Upload the sketch

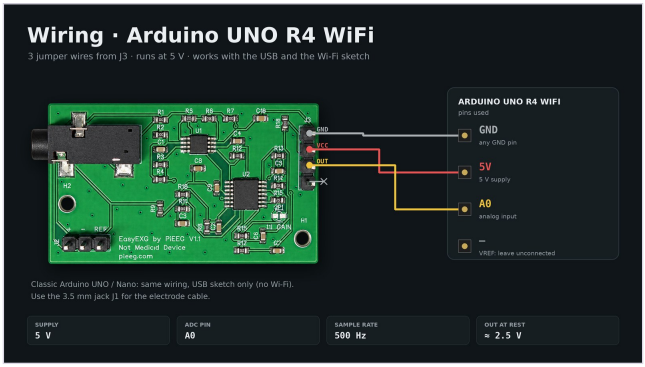
Open Arduino/EasyEXG_Arduino.ino, choose board and port, click Upload. It samples A0 at 500 Hz.

5 Place the electrodes

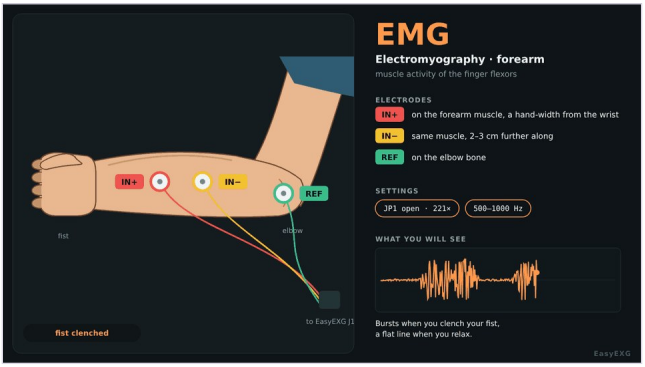
Clean the skin. IN+ (Tip) on the forearm muscle, IN− (Ring) 2–3 cm further along, REF (Sleeve) on the elbow. Plug into J1.

6 Read the signal

Unplug the laptop charger. Tools → Serial Plotter at 115200 baud. Clench your fist: bursts on the signal, the envelope rises.



Step 3: J3 to an Arduino UNO R4 WiFi



Step 5: EMG placement on the forearm

01 WHAT YOU SHOULD SEE

Test	Serial Plotter
Relax the arm	Both traces close to flat
Clench your fist	Bursts on the blue trace (signal); the yellow trace (envelope) rises
Relax again	Both traces go flat

NOT A MEDICAL DEVICE

EasyEXG has not been certified by any regulator for use with the human body. It is a tool for research, education and engineering. It has no patient isolation circuitry: full isolation from the mains depends entirely on running from a battery. The DRL current is limited to about 13 µA by design, but that does not protect against a mains fault.

02 SAFETY RULES

- **Battery only:** while electrodes are on a person, EasyEXG and everything cabled to it run from a 5 V power bank or a laptop on battery with the charger unplugged.
- **Upload off the person:** connect to a mains-powered computer only to upload, with no electrodes on anyone.
- **No mains connection:** no wall charger, desk power supply, mains-powered monitor or computer while recording.
- **No diagnosis:** do not use EasyEXG to diagnose, monitor or treat any medical condition.
- **Implanted devices:** not on a person with a pacemaker or other implanted electronic device without a physician's approval.
- **Skin:** clean, intact skin only. Stop if the skin becomes irritated; remove gel electrodes gently.
- **Exposed electronics:** no case: handle by the edges, use anti-static precautions, keep liquids away.

03 POWER WHILE RECORDING

Setup	Electrodes on?	Why
MCU + EasyEXG on a 5 V power bank, Wi-Fi to the PC	Safe	No cable path to the mains
USB to a laptop on battery (charger unplugged)	Safe	The laptop is not connected to the mains
USB to a laptop with the charger plugged in	Never	Links the person to the mains through the charger
USB to a desktop computer	Never	Desktops are always mains-powered
MCU on a wall charger	Never	Connects the person to the mains through the electrodes

04 GOOD PRACTICE

- Charge the power bank and the laptop before the session, never during it.
- Check every cable before each session. An adult or supervisor checks the setup when students use it.
- Use fresh disposable electrodes for each person.

05 SIGNAL

Problem	Fix
Flat line	Check OUT → A0, VCC and GND. Push the plug fully into J1. Electrodes on clean skin.
Stuck at top or bottom	Input too big for the gain: open JP1 (221×) for EMG / EOG. Wait 10–20 s for the high-pass to settle.
Rest not near the middle	OUT should rest at VCC/2 (≈ 512 of 1023 on 10-bit). Check VCC, GND, and that J1 and J2 aren't both used.
Strong 50/60 Hz hum	Check REF first (clean, firm, bony spot). Battery only, away from chargers, short cable, notch at mains frequency.
Signal upside down	IN+ and IN− swapped: swap the electrodes or invert in software.
Big swings when moving	Electrode or cable movement: sit still, tape the cable down, fresh electrodes.
No ECG heartbeat	Bridge JP1 (1 048×). Left chest, right chest, REF on the right lower abdomen.
No alpha on EEG	Bridge JP1. Eyes closed ≥ 10 s, relax the face. Filter 8–12 Hz. 14-bit ADC on the UNO R4.
EMG bursts too small	IN+ and IN− over the muscle belly, 2–3 cm apart along the fibres. Sample at 1000 Hz.
µV wrong by ≈ 4.7×	Viewer Gain doesn't match JP1 (221 vs 1048).
ESP32 values clipped	VCC must be 3.3 V on an ESP32, and VREF = 3.3 in the viewer.

06 UPLOADING, WI-FI AND VIEWER

Problem	Fix
No port in Tools → Port	Try another USB cable (some only charge) or USB socket.
Upload fails: port busy	Close the Serial Monitor / Plotter and any Python viewer, then upload again.
"This sketch needs a Wi-Fi board"	The Wi-Fi sketch builds only for UNO R4 WiFi, ESP32 and ESP8266.
Serial Monitor shows only dots	Wrong Wi-Fi name / password, or a 5 GHz-only network. Use 2.4 GHz.
Board makes an "EasyEXG" network	Set USE_ACCESS_POINT 0 and upload again.
Viewer: "No data yet"	PC and board on the same Wi-Fi; guest networks often block devices. Allow Python on Private and Public networks.
Viewer can't find the board	Type the Board IP from the Serial Monitor into "Board IP" (or --host).
Far fewer than 500 samples/s	Weak Wi-Fi: move closer to the router or use mode 1 (own network).

IS IT THE BOARD OR THE SETUP?

Unplug the electrode cable: OUT should sit quietly at VCC/2. Then short IN+, IN− and REF together on J2: the signal should stay near zero with only a little noise. If it does, the board is fine and the noise comes from the electrodes or the environment. Still stuck: Discord, GitHub issues, or pieeg@pieeg.com.