

Muscle Bio Activity Tracker – Designing an EMG Sensor

Case Study

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1. Overview

Short description: This **Case study** explores how an electromyography (EMG) measurement circuit can be used to detect and monitor the electrical activity generated by skeletal muscles. Surface electrodes capture low-amplitude bioelectrical signals, which are amplified and conditioned using amplification and band-pass filtering stages to produce a measurable EMG signal. Participants observe how muscle contraction and relaxation affect the acquired waveform and analyze the conditioned signal in real time. The **Analog Discovery Product Line** (AD 3 or AD Studio / Studio MAX, hereby **Device**) supplies power to the EMG circuit and simultaneously acquires the output signal for visualization and analysis using the oscilloscope.

Objectives

- Work with an instrumentation amplifier to amplify low-amplitude EMG signals captured from surface electrodes.
- Understand the purpose of a band-pass filter in EMG signal conditioning and how it helps isolate the useful muscle-activity frequency range.
- Explore the basic structure and operation of bio-signal acquisition circuits, including electrode sensing, amplification, filtering, and measurement.
- Acquire and observe conditioned EMG signals during muscle contraction and relaxation using the **Device** oscilloscope.

Software & Hardware Requirements

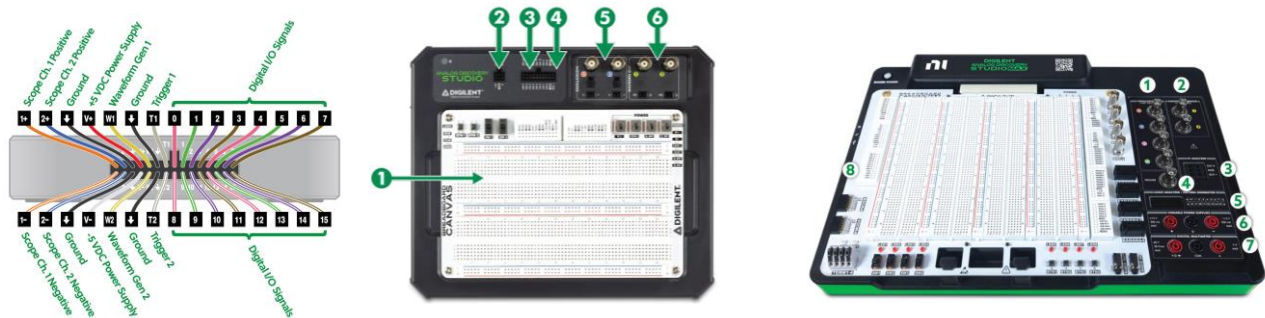
Software		Version
Diligent WaveForms (Runtime + SDK)		Latest (64-bit)
NI LabVIEW		2025 64-bit
WaveForms Toolkit for LabVIEW		Latest
Hardware		Quantity
Diligent Analog Discovery Product Line		
Option 1	Diligent Analog Discovery 3	1
Option 2	Diligent Analog Discovery Studio	1
Option 3	Diligent Analog Discovery Studio MAX	1
List of Components		Quantity
Canvas Breadboard		1
AD623 Instrumentation Amplifier		1
TL072 Operational Amplifier		1
EMG/ECG Surface Electrodes with Wires		3
Resistor, 1 MΩ		2
Resistor, 100 kΩ		2
Resistor, 33 kΩ		1
Resistor, 10 kΩ		2
Resistor, 330 Ω		1
Potentiometer, 20 kΩ		1
Ceramic Capacitor, 100 nF		2
Ceramic Capacitor, 10 nF		1
Electrolytic Capacitor, 10 μF		2
Electrolytic Capacitor, 220 μF		1
Jumper wires		-
BNC to BNC cable ¹		1
Banana to Banana cable ²		2

¹ BNC cable required only for the Analog Discovery Studio MAX.

² Banana cable required only for the Analog Discovery Studio MAX.

2. Hardware Setup

This section describes the **Digilent Analog Discovery Product Line** hardware setup for **Case studies**. Before assembling the measurement circuit, it is essential to understand the pinout and available connections of the **Devices**. **Figure 1** highlights the pinouts and instrumentations of the Digilent Analog Discovery product line.³



a. Analog Discovery 3

- Power Supplies
- Logic Analyzer and Pattern Generator
- Triggers
- Oscilloscope
- Waveform Generator

b. Analog Discovery Studio

1. Breadboard Canvas
2. Power Supplies
3. Logic Analyzer and Pattern Generator
4. Triggers
5. Oscilloscope
6. Waveform Generator

c. Analog Discovery Studio MAX

1. Oscilloscope
2. Waveform Generator
3. IV Analyzer
4. Trigger
5. Logic Analyzer and Pattern Generator
6. Variable Power Supplies
7. Digital Multimeter
8. Breadboard Canvas

Figure 1. Digilent Analog Discovery Products Pinout and Instrumentations

Table 1 provides a common reference for physical channels' names across the **Digilent Analog Discovery product line**. The **Case studies** are designed to work with all supported devices, so the generic channels' names shown in the first row are used consistently in all circuit diagrams and wiring instructions.

Table 2 provides a common reference for device names and instrument identifiers used in NI LabVIEW with the WaveForms Toolkit across the **Digilent Analog Discovery product line**. The Case studies are designed to work with all supported devices; therefore, the generic instruments and

³ For detailed electrical specifications, pin descriptions, and operating limits, always refer to the official datasheets of each device (Analog Discovery 3, Analog Discovery Studio, and Analog Discovery Studio MAX). The latest datasheets are available on the Digilent website:

- [Analog Discovery 3](#)
- [Analog Discovery Studio](#)
- [Analog Discovery Studio MAX](#)

channels identifiers shown in Table 2 are used consistently throughout the LabVIEW block diagrams and configuration steps.

Table 1. Physical Channels Mapping for Digilent Analog Discovery Devices.

<i>Channel Device</i>	<i>Scope Ch.1 Positive</i>	<i>Scope Ch.1 Negative</i>	<i>+Vs</i>	<i>-Vs</i>
AD 3	Scope Ch.1 Positive (Pin 1+)	Scope Ch.1 Negative (Pin 1-)	+VDC Power Supply (Pin V+)	-VDC Power Supply (Pin V-)
AD Studio ⁴	OSCILLOSCOPE 1 (Pin + or BNC Positive Cable)	OSCILLOSCOPE 1 (Pin - or BNC Negative Cable)	Pin V+	Pin V-
AD Studio MAX ⁴	OSCILLOSCOPE 1 (BNC Positive Cable)	OSCILLOSCOPE 1 (BNC Negative Cable)	Variable Power Supplies “+” Banana Connector	Variable Power Supplies “-” Banana Connector

Table 2. Device Names and Instruments Identifiers in NI LabVIEW (WaveForms Toolkit).

<i>Identifier Device</i>	<i>Device name</i>	<i>Scope Ch.1</i>	<i>Scope Ch.2</i>	<i>Positive PS Channel</i>	<i>Negative PS Channel</i>
AD 3	Discovery3	mso/1	mso/2	ps/+	ps/-
AD Studio ⁴	DiscoveryStudio				
AD Studio MAX ⁴	ADS_Max			ps/+V	ps/-V

⁴ For the Analog Discovery Studio and Analog Discovery Studio MAX, ensure the devices are powered by turning ON the main power switch before use.

3. Background Information

Electromyography (**EMG**) is a technique used to detect the small electrical potentials generated during skeletal muscle activation. In this **Case study**, three surface electrodes are used for signal acquisition. Two electrodes detect the differential bioelectrical signal produced by the muscle, while the third electrode provides the reference connection. Because surface EMG signals have relatively small amplitudes and are easily affected by interference and noise, the acquired signal must first be amplified and then filtered before it can be clearly measured using the **Device**.

The signal-conditioning circuit used in this Case study consists of two main stages: an instrumentation amplifier and an active band-pass filter with additional amplification.

3.1 Instrumentation Amplifier Stage

The first stage uses an **instrumentation amplifier** to amplify the small voltage difference measured between the two signal electrodes. Instrumentation amplifiers provide high input impedance and high common-mode rejection, making them suitable for measuring small differential signals in the presence of interference that may appear simultaneously on both inputs. The basic relationship between the differential input and output is:

$$V_{out1} = G_1(V_+ - V_-) + V_{REF}$$

where:

- V_+ - voltage measured by the positive electrode input (Electrode +);
- V_- - voltage measured by the negative electrode input (Electrode -);
- G_1 - instrumentation amplifier gain;
- V_{REF} - reference voltage of the amplifier.

In the implemented circuit, the instrumentation-amplifier gain is controlled using an external gain resistor (R_G). For the AD623 used in this Case study, the gain is determined by:

$$G_1 = 1 + \frac{100k\Omega}{R_G}$$

A **20 kΩ potentiometer** is used as the adjustable (R_G), allowing the first-stage amplification to be changed according to the amplitude of the acquired EMG signal.

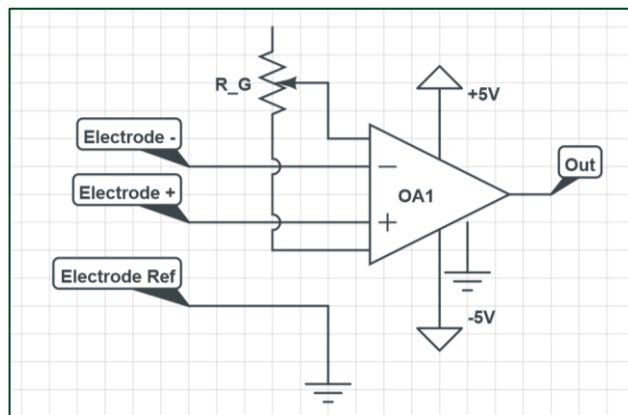


Figure 2. Instrumentation Amplifier Stage for EMG Signal Acquisition

The instrumentation amplifier therefore performs the initial amplification while rejecting a significant portion of the voltage that is common to both electrode inputs. The amplified signal is then passed to the second stage for frequency-selective filtering and additional amplification.

3.2 Active Band-Pass Filter and Second Amplification Stage

The second stage uses an operational amplifier together with resistor-capacitor networks to form an **active band-pass filter**. A band-pass filter combines a **high-pass filter (HPF)** and a **low-pass filter (LPF)** so that frequencies inside the selected range are amplified, while frequencies below and above the selected range are attenuated. The lower cutoff frequency of the implemented filter is determined by the high-pass RC network:

$$f_L = \frac{1}{2\pi R_{HP} C_{HP}}.$$

Using:

$$R_{HP} = 330\Omega \text{ and } C_{HP} = 220\mu F$$

the lower cutoff frequency is:

$$f_L = \frac{1}{2\pi(330)(220 \times 10^{-6})} \approx 2.2Hz.$$

The upper cutoff frequency is determined by the low-pass network:

$$f_H = \frac{1}{2\pi R_F C_{LP}}.$$

Using:

$$R_F = 33k\Omega \text{ and } C_{LP} = 10nF$$

the upper cutoff frequency is:

$$f_H = \frac{1}{2\pi(33 \times 10^3)(10 \times 10^{-9})} \approx 482Hz.$$

Therefore, the approximate passband of the implemented circuit is: $2.2Hz < f < 482Hz$.

The upper cutoff frequency is selected close to **500 Hz** because the useful frequency content of surface EMG signals is commonly considered to extend to approximately this region. Surface EMG acquisition is often performed using a band of approximately **20–500 Hz**, although the exact bandwidth depends on the application and measurement conditions. The lower cutoff of approximately **2.2 Hz** used in this educational circuit is intentionally wider than the approximately 20 Hz lower cutoff frequently used for dedicated surface-EMG processing. This allows slower bioelectrical variations to remain visible, although it also permits more low-frequency movement and electrode-related artifacts to pass through the circuit. The operational amplifier in the band-pass stage also provides additional amplification. For an inverting amplifier configuration, the passband voltage gain is approximately:

$$G_2 = -\frac{R_F}{R_{HP}} = -100.$$

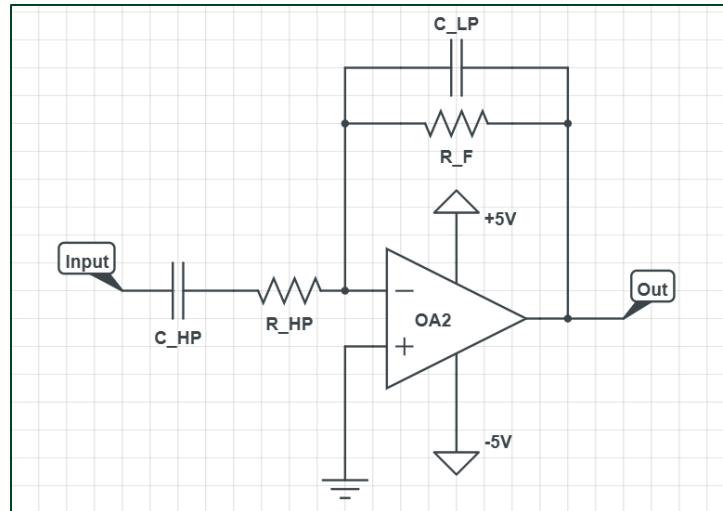


Figure 3. Active Band-Pass Filter and Second Amplification Stage

If the instrumentation amplifier is adjusted to approximately ($G_1 = 21$), the theoretical overall gain within the filter passband is approximately:

$$G_{TOTAL} = G_1 |G_2| \approx 2100$$

This high overall gain is required because the voltage detected by the surface electrodes is relatively small. In practice, the first-stage gain can be adjusted using the potentiometer to prevent the output signal from reaching the amplifier supply limits and becoming saturated.

3.3 Power-Supply Decoupling (optional)

Because the circuit contains high-gain analog amplification stages, noise and disturbances present on the power-supply lines can also appear in the measured signal. **Power-supply decoupling capacitors** are therefore connected between the supply rails and ground close to the amplifier supply pins.

The circuit uses small **100 nF ceramic capacitors** together with larger **10 μ F electrolytic capacitors**. The ceramic capacitors provide a low-impedance path for higher-frequency supply disturbances, while the larger electrolytic capacitors help stabilize slower supply-voltage variations. The AD623 manufacturer specifically recommends locating supply-decoupling capacitors close to the power pins and shows the use of 0.1 μ F ceramic and larger bulk capacitors for this purpose.

After amplification and filtering, the conditioned EMG signal is acquired using the **Device Oscilloscope**. During muscle relaxation, the measured signal amplitude is comparatively small. When the muscle is contracted, increased electrical activity produces a larger and more complex waveform. This allows participants to observe how differential amplification, frequency-selective filtering, and additional amplification are combined to transform a low-level bioelectrical signal into a signal suitable for visualization and analysis.

Important! When surface electrodes are connected to a person, the measurement arrangement must follow appropriate electrical-isolation and body-safety practices. Do not connect a body-connected circuit directly to non-isolated mains-referenced equipment.

4. Circuit Design – step by step instructions

4.1 Description

The measurement circuit is designed to acquire and condition low-amplitude **EMG bioelectrical signals** captured using three surface electrodes. **Electrode +** and **Electrode –** provide the differential muscle signal, while **Electrode Ref** provides the common reference for the measurement circuit.

At the input, two **100 kΩ resistors** (R_3 and R_5) and two **1 MΩ resistors** (R_4 and R_6) provide input current limiting and a defined bias path for the instrumentation amplifier inputs. The differential EMG signal is amplified by the **AD623 instrumentation amplifier**, while the **20 kΩ potentiometer** (R_G) allows the first-stage gain to be adjusted.

The amplified signal is then passed through an **active band-pass filter**. The high-pass section is formed by the **220 μF capacitor** (C_{HP}) and **330 Ω resistor** (R_{HP}), while the low-pass section is formed by the **33 kΩ feedback resistor** (R_F) and **10 nF capacitor** (C_{LP}) around the TL072 operational amplifier. The second stage therefore provides both frequency-selective filtering and additional amplification.

The circuit is powered using the Device **+Vs** and **–Vs** supplies. **100 nF ceramic capacitors** (C_1 and C_3) and **10 μF electrolytic capacitors** (C_2 and C_4) are connected to the supply rails for power-supply decoupling. At the output, the signal is AC-coupled through the **10 μF capacitor** (C_1) and biased using two **10 kΩ resistors** (R_1 and R_2) before being acquired by the **Device**.

The conditioned EMG output is monitored by connecting **Scope Ch.1 Positive** to the output measurement node and **Scope Ch.1 Negative** to **GND**.

Important! The pin numbers given in the following instructions correspond to the standard 8-pin AD623 and TL072 packages. Always verify the package orientation and pin configuration using the manufacturer datasheet before assembling the circuit.

Important! Refer to **Table 1** to determine the exact physical pin, connector, or cable that corresponds to each generic connection on the specific Digilent Analog Discovery device being used. The remaining rows in the table show how each generic channel maps the actual hardware connections for each device.

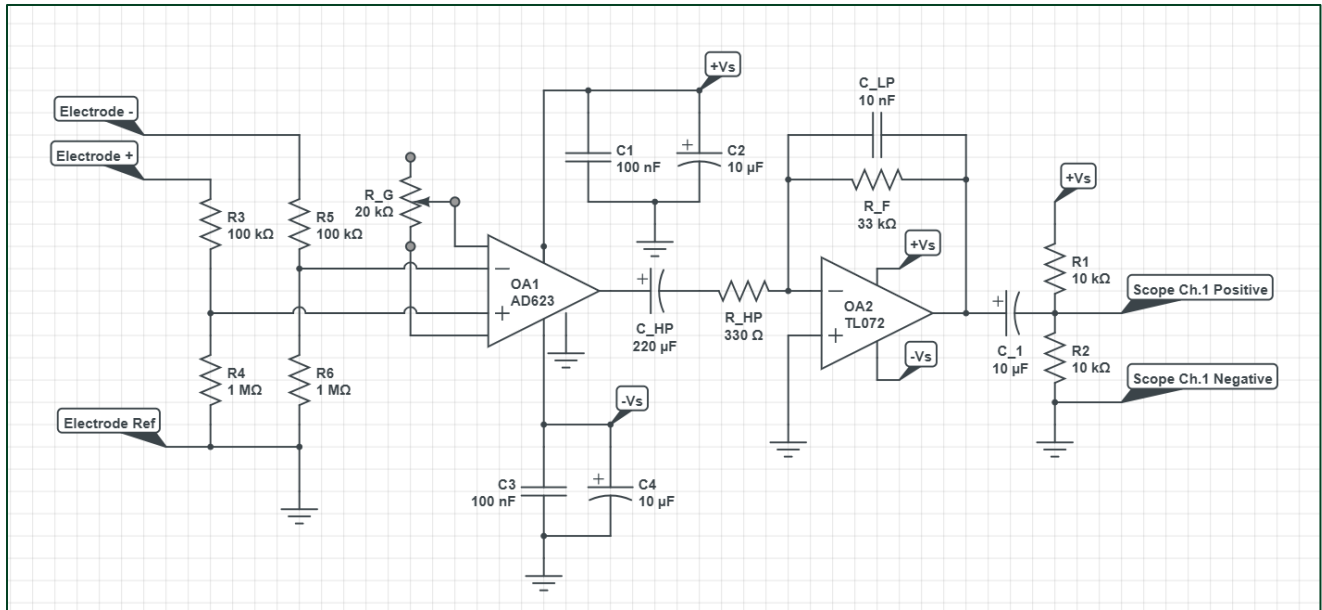


Figure 4. EMG Signal Amplification and Band-Pass Filtering Circuit for Device

Important! For the Analog Discovery 3 (AD 3), use the programmable positive power supply output and set it to +5V to power the microphone module.

For the Analog Discovery Studio and Analog Discovery Studio MAX, use the fixed +5V supply available on the Canvas board to power the microphone module.

4.2 Electrode Placement

Three surface electrodes are used to acquire the EMG signal. Electrode + and Electrode - are placed over the target forearm muscle, approximately along the direction of the muscle fibers, while Electrode Ref is positioned away from the main muscle activity on a relatively inactive or bony area. The skin should be clean and dry to improve signal quality and reduce artifacts.

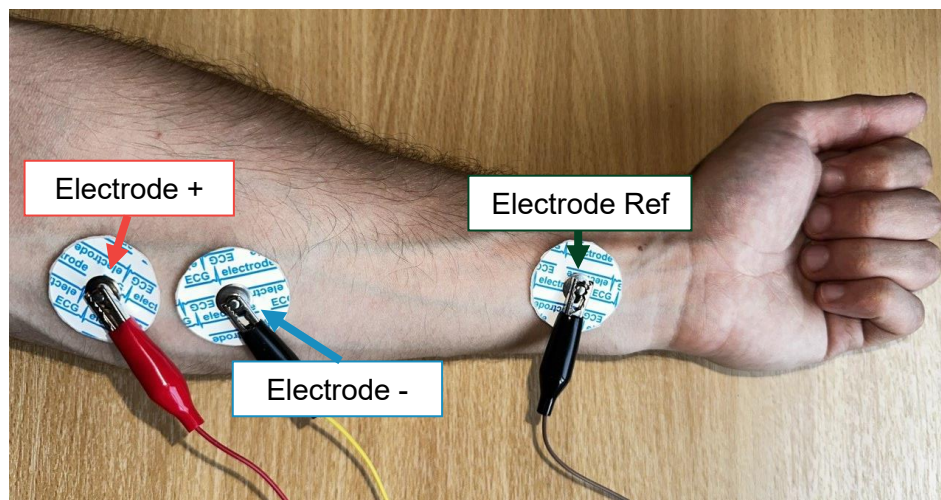


Figure 5. Surface Electrode Placement on the Forearm for EMG Signal Acquisition

4.3 Step by step instructions⁵

1. Place the **AD623 instrumentation amplifier** and **TL072 operational amplifier** on the **Canvas breadboard**⁶. Ensure that each IC is positioned across the center separation of the breadboard so that its pins are inserted into separate rows.
2. Connect **Electrode +** to one terminal of the **100 k Ω resistor (R_3)**.
3. Connect the other terminal of R_3 to **AD623 Pin 3 (+IN)**.
4. Connect the **1 M Ω resistor (R_4)** between the R_3 /AD623 Pin 3 junction and **GND**.
5. Connect **Electrode -** to one terminal of the **100 k Ω resistor (R_5)**.
6. Connect the other terminal of R_5 to **AD623 Pin 2 (-IN)**.
7. Connect the **1 M Ω resistor (R_6)** between the R_5 /AD623 Pin 2 junction and **GND**.
8. Connect **Electrode Ref** to the circuit **GND**.
9. Connect **AD623 Pin 7 (+V_S)** to the Device **+V_S** supply.
10. Connect **AD623 Pin 4 (-V_S)** to the Device **-V_S** supply.
11. Connect **AD623 Pin 5 (REF)** to **GND**.
12. Connect the **20 k Ω potentiometer (R_G)** between **AD623 Pin 1** and **Pin 8**. Use the potentiometer wiper and one outer terminal as the variable resistance, as shown in **Figure 4**.
13. Connect the **100 nF ceramic capacitor (C_1)** between **+V_S** and **GND**.
14. Connect the **10 μ F electrolytic capacitor (C_2)** in parallel with (C_1), with its positive terminal connected to **+V_S** and its negative terminal connected to **GND**.
15. Connect the **100 nF ceramic capacitor (C_3)** between **-V_S** and **GND**.
16. Connect the **10 μ F electrolytic capacitor (C_4)** between **-V_S** and **GND**, with its **positive terminal connected to GND** and its negative terminal connected to **-V_S**.

Note: Place the decoupling capacitors as close as practical to the amplifier power-supply connections.

17. Connect **AD623 Pin 6 (OUTPUT)** to the positive terminal of the **220 μ F capacitor (C_{HP})**.
18. Connect the other terminal of C_{HP} to the **330 Ω resistor (R_{HP})**.
19. Connect the other terminal of R_{HP} to **TL072 Pin 2 (1IN-)**.
20. Connect **TL072 Pin 3 (1IN+)** to **GND**.
21. Connect **TL072 Pin 8 (VCC+)** to the Device **+V_S** supply.
22. Connect **TL072 Pin 4 (VCC-)** to the Device **-V_S** supply.
23. Connect the **33 k Ω resistor (R_F)** between **TL072 Pin 1 (1OUT)** and **TL072 Pin 2 (1IN-)**.
24. Connect the **10 nF ceramic capacitor (C_{LP})** in parallel with (R_F), also between **TL072 Pin 1** and **Pin 2**.
25. Connect **TL072 Pin 1 (1OUT)** to the positive terminal of the **10 μ F output coupling capacitor (C_1)**, as shown in **Figure 4**.
26. Connect the other terminal of C_1 to the output measurement node.
27. Connect the **10 k Ω resistor (R_1)** between the Device **+V_S** supply and the output measurement node.
28. Connect the **10 k Ω resistor (R_2)** between the output measurement node and **GND**.

⁵ Given on Figure 4.

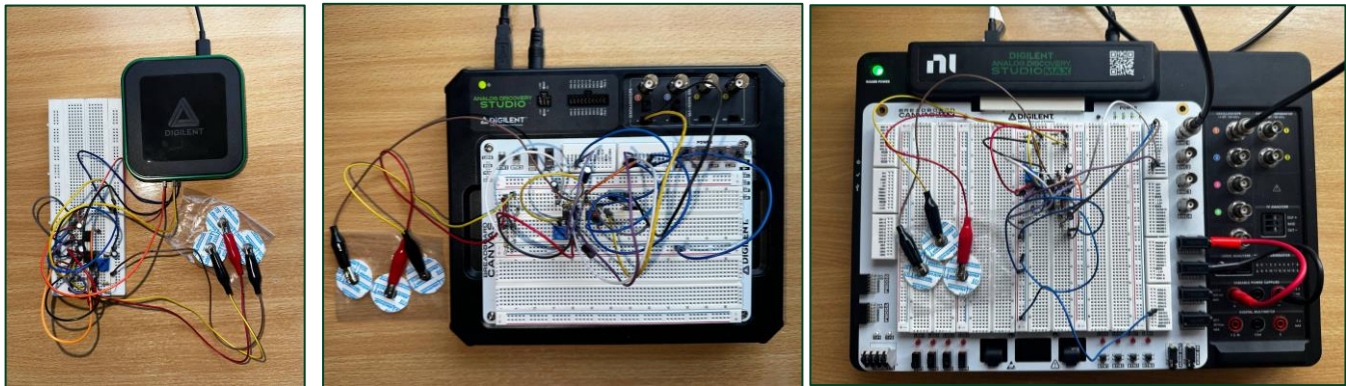
⁶ Use external breadboard in the case of Analog Discovery 3.

29. Connect **Scope Ch.1 Positive** to the junction of C_1 , R_1 and R_2 .
30. Connect **Scope Ch.1 Negative** to **GND** to provide the measurement reference.

Important! The TL072 contains two operational amplifiers. Figure 4 uses the first amplifier section (Pins 1, 2, and 3). Refer to the TL072 datasheet for the pin configuration.

4.4 Assembled Circuit

Figure 6 presents complete experimental circuits on different Digilent devices.



a. Analog Discovery 3

b. Analog Discovery Studio

c. Analog Discovery Studio MAX

Figure 6. Assembled circuits for different Devices

5. Software Setup - step by step instructions

5.1 Data Visualization and Analysis in WaveForms

Step 1. Launch WaveForms and connect the device

- 1.1. Connect the **Device** to the computer via USB.
- 1.2. Open the **Digilent WaveForms** software.
- 1.3. Verify that the device is detected and shown as *Currently Selected* in the **Device Manager** (Settings -> Device Manager).

Step 2. Configure the Power Supply in WaveForms

- 2.1. Open the **Supplies** instrument in **WaveForms**.
- 2.2. Enable the **Positive Supply (V+)** and set the output voltage to **+5.000 V DC**.
- 2.3. Enable the **Negative Supply (V-)** and set the output voltage to **-5.000 V DC**.
- 2.4. Enable the **Master Enable** switch to activate the power output.

The positive and negative supplies are required to power the instrumentation amplifier and active band-pass filter stages.

Figure 7 shows the configuration of the **Device** power supply using the Digilent WaveForms environment.

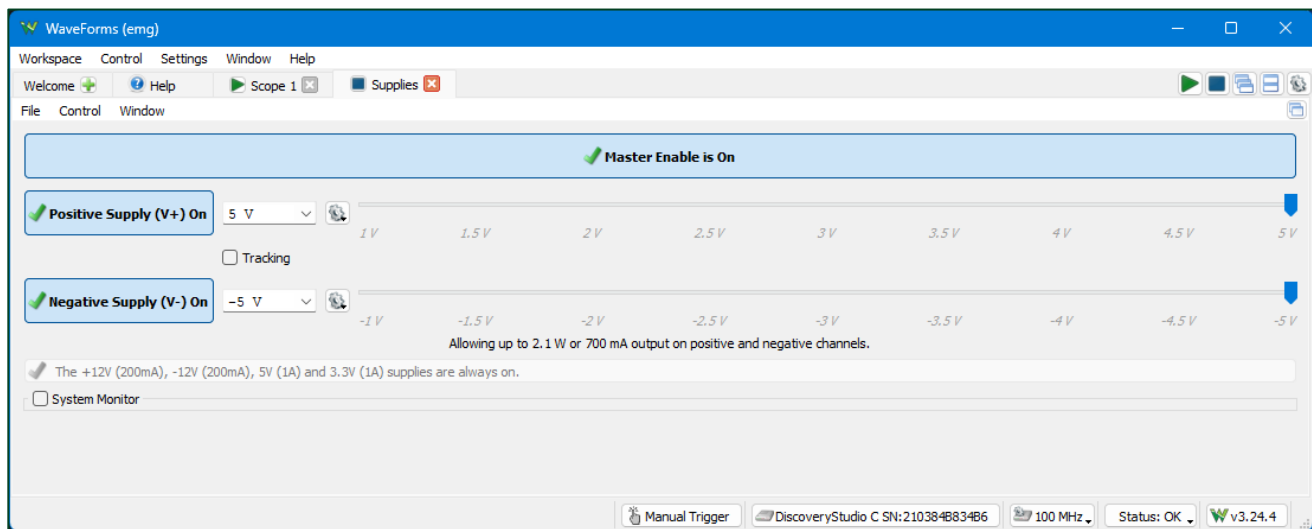


Figure 7. Positive and Negative Power Supply Configuration in WaveForms

Step 3. Generate and acquire an acoustic signal using the Oscilloscope⁷

- 3.1. Position the **three surface electrodes** on the forearm as described in **Section 4.2**.
- 3.2. Open the **Scope** instrument in **WaveForms**.
- 3.3. Enable **Channel 1**.
- 3.4. Adjust the vertical **Range** so that the EMG signal fits clearly on the screen. A starting value of approximately **1 V/div** can be used and adjusted if required.

⁷ In the case of AD Studio turn the V± switch on. In the case of AD Studio MAX turn Board Power on.

- 3.5. Adjust the **Time Base** to approximately **500 ms/div** to clearly observe changes in muscle activity.
- 3.6. Run the **Scope** and keep the target forearm muscle relaxed for several seconds to observe the baseline signal.
- 3.7. Contract the target muscle and observe the corresponding change in the amplitude and shape of the acquired EMG waveform.
- 3.8. Repeat the muscle contraction and relaxation several times to observe the difference between the two conditions.

Figure 8 shows an example of the conditioned EMG signal acquired using the Scope instrument in WaveForms. During muscle contraction, increased electrical muscle activity produces a larger and more complex waveform compared with the relaxed condition.

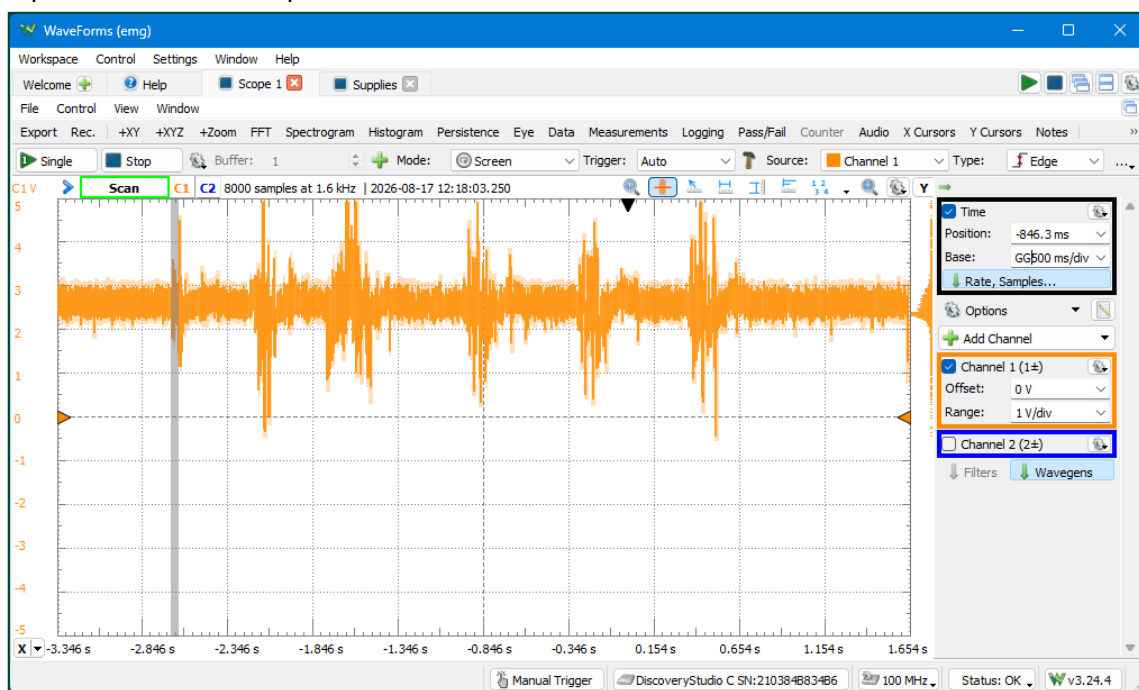


Figure 8. Conditioned EMG Signal Displayed in WaveForms

Step 4. Measure and compare the EMG signal

- 4.1. Click **Measurements** from the top toolbar and select **Add → Defined Measurements**.
- 4.2. Add the **Peak-to-Peak** measurement for **Channel 1** to observe changes in EMG signal amplitude.
- 4.3. Add the **RMS** measurement for **Channel 1** to obtain a quantitative measure of the signal level.
- 4.4. Observe and record the **Peak-to-Peak** and **RMS** values while the muscle is relaxed.
- 4.5. Contract the muscle and record the same measurements.
- 4.6. Compare the relaxed and contracted measurements to observe how muscle activation affects the acquired EMG signal.

- 4.7. If the waveform reaches the upper or lower measurement limits, stop the acquisition and reduce the instrumentation-amplifier gain using the R_G potentiometer before repeating the measurement.

Figure 9 illustrates the EMG waveform and corresponding measurements during muscle relaxation and contraction.

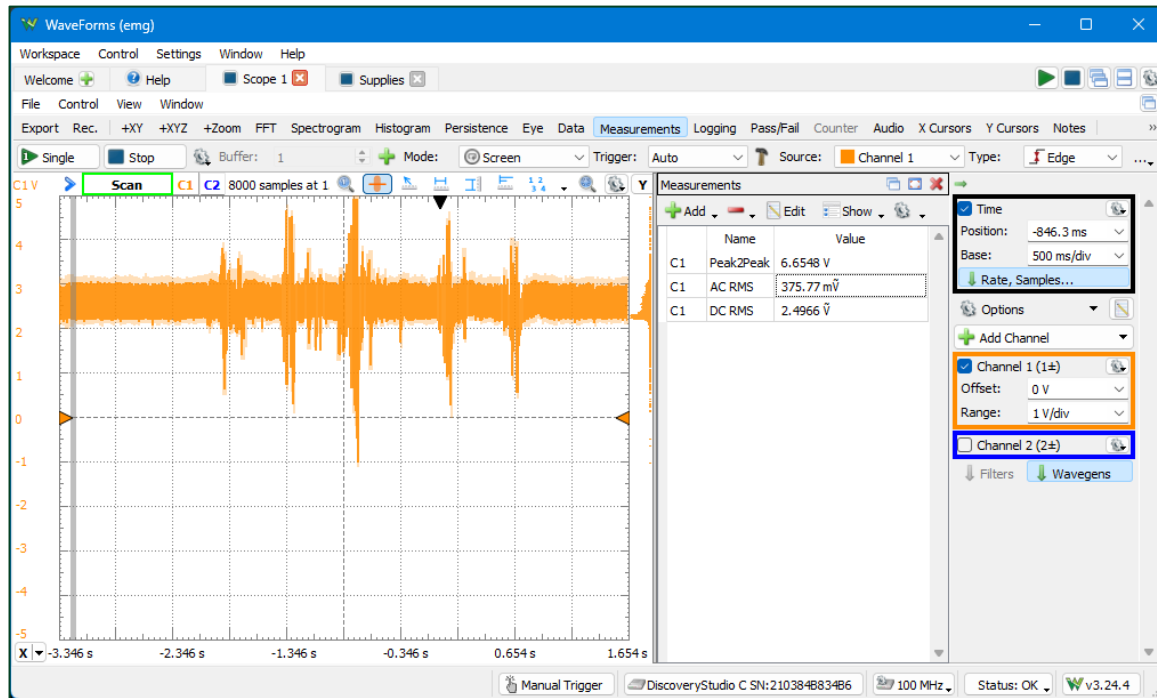


Figure 9. EMG Signal Measurements During Muscle Relaxation and Contraction

5.2 Data Visualization and Analysis Using NI LabVIEW WaveForms Toolkit

Step 1. Launch NI LabVIEW and connect the Device

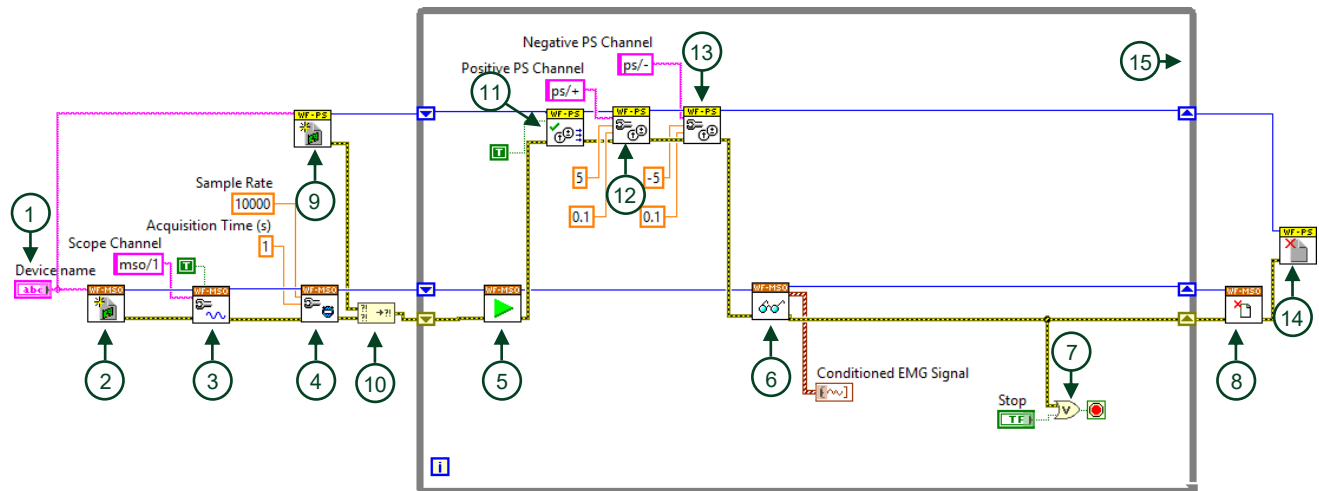
- 1.1. Connect the **Device** to the computer via USB.
- 1.2. Open **Digilent WaveForms** and verify that **Device** is detected and shown as *Currently Selected* in the **Device Manager** (Settings -> Device Manager), then close **Digilent WaveForms** software⁸.
- 1.3. Open the **NI LabVIEW** software.
- 1.4. Create a new NI LabVIEW VI (**File->New VI**)

Step 2. Create Block Diagram and Front Panel in NI LabVIEW

- 2.1. Modify the block diagram as shown in **Figure 10**.

⁸ Before running NI LabVIEW, please ensure that the Digilent WaveForms software is closed.

Figure 10. VI Block Diagram for Device



1. **Device Name** - specify the name of your **Device**. Use **Table 2** to determine the appropriate device name.
2. **WF-MSO Initialize** - initializes the oscilloscope instrument and establishes communication with the **Device**.
3. **WF-MSO Configure Analog Channel** - configures **Scope Ch.1** for analog EMG signal acquisition. Specify the appropriate **Scope Channel** according to **Table 2** and connect Enable Channel to a True constant.
4. **WF-MSO Configure Timing** - configures the timing parameters of the oscilloscope acquisition. Set the **Sample Rate** to **10,000 samples/s** and the **Acquisition Time** to **1 s**.
5. **WF-MSO Run** - starts the oscilloscope acquisition.
6. **WF-MSO Read** - transfers the acquired conditioned EMG signal from the **Device** to NI LabVIEW. Connect the **Analog Waveforms** output to the **Conditioned EMG Signal** graph to visualize the measured muscle activity in the time domain.
7. **OR** - allows the While Loop to stop either when the **Stop** button is pressed or automatically when an error occurs.
8. **WF-MSO Close** - closes the oscilloscope session and releases the associated **Device** resources.
9. **WF-PS Initialize** - initializes the programmable power supply.
10. **Merge Errors** - combines the error information from the oscilloscope and power-supply initialization paths into a common error path.
11. **WF-PS Enable All Outputs** - enables the programmable power-supply outputs. Specify the **Positive PS Channel** (ps/+) and **Negative PS Channel** (ps/-) and enable the required outputs.
12. **WF-PS Configure Voltage Outputs (+Vs)** - configures the positive supply used by the EMG signal-conditioning circuit. Set the output voltage to **+5 V** and the current limit to **0.1 A**.
13. **WF-PS Configure Voltage Outputs (-Vs)** - configures the negative supply used by the EMG signal-conditioning circuit. Set the output voltage to **-5 V** and the current limit to **0.1 A**.
14. **WF-PS Close** - closes the programmable power-supply session and resets the power-supply resources.

15. **While Loop** - enables continuous acquisition and visualization of the conditioned EMG signal. During each iteration, a new waveform is acquired from the **Device** and displayed on the **Conditioned EMG Signal** graph.

- 2.2. Modify the front panel shown in **Figure 11**. Inside **Device name** String Control write your corresponding **Device** name from **Table 2**.

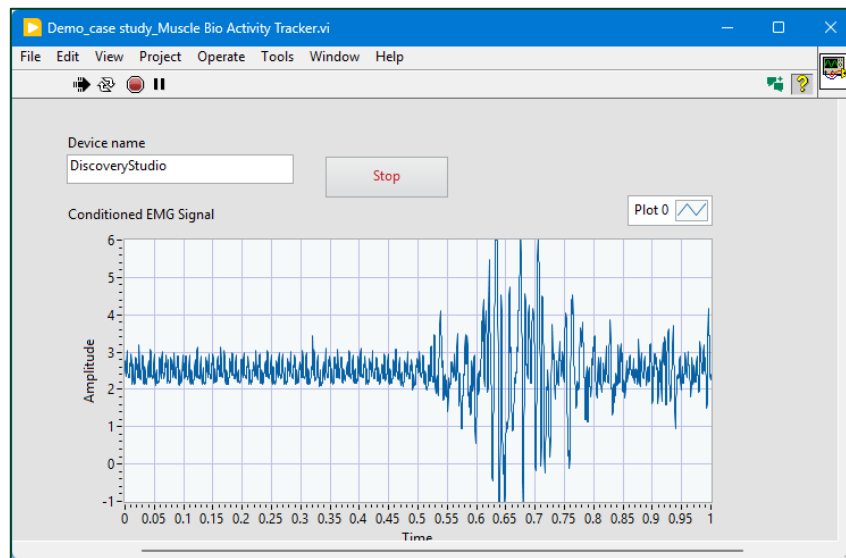


Figure 11. VI Front Panel

- 2.3. Save the VI.

Step 3. Run the code and perform measurements in LabVIEW

- 3.1. Run the code by clicking on the **Run button**.
- 3.2. Keep the forearm relaxed and observe the baseline signal on the **Conditioned EMG Signal** graph.
- 3.3. Flex the forearm muscle and observe the corresponding increase in the EMG signal amplitude.
- 3.4. Relax the muscle again and compare the waveform with the contracted condition.
- 3.5. Repeat the contraction and relaxation several times to observe the relationship between muscle activity and the measured EMG signal.