

Session 1

No-Code Programming for Biology



- 1 Welcome!
- 2 Turn off your video and mute yourselves for now
- 3 Feel free to introduce yourselves in the chat
- 4 As we go along, ask any questions in the chat

No-Code Programming for Biology



Today's Session

17:00 Welcome!

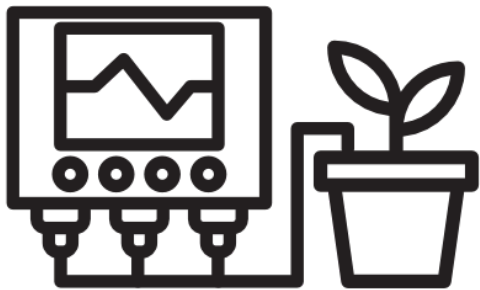
17:05 Lesson 1: Introduction

An introduction to the grove board, microcontrollers and the XOD IDE

17:30 Lesson 2: Getting Started (hands-on session)

Get started with using your board. We'll start with some simple tasks like flashing an LED, pressing a button and sounding a buzzer

18:25 Round-up



No-Code Programming for Biology



Before we Start

1 Downloaded the XOD Software

www.xod.io

2 Downloaded the No-Code Programming Beginner's Guide

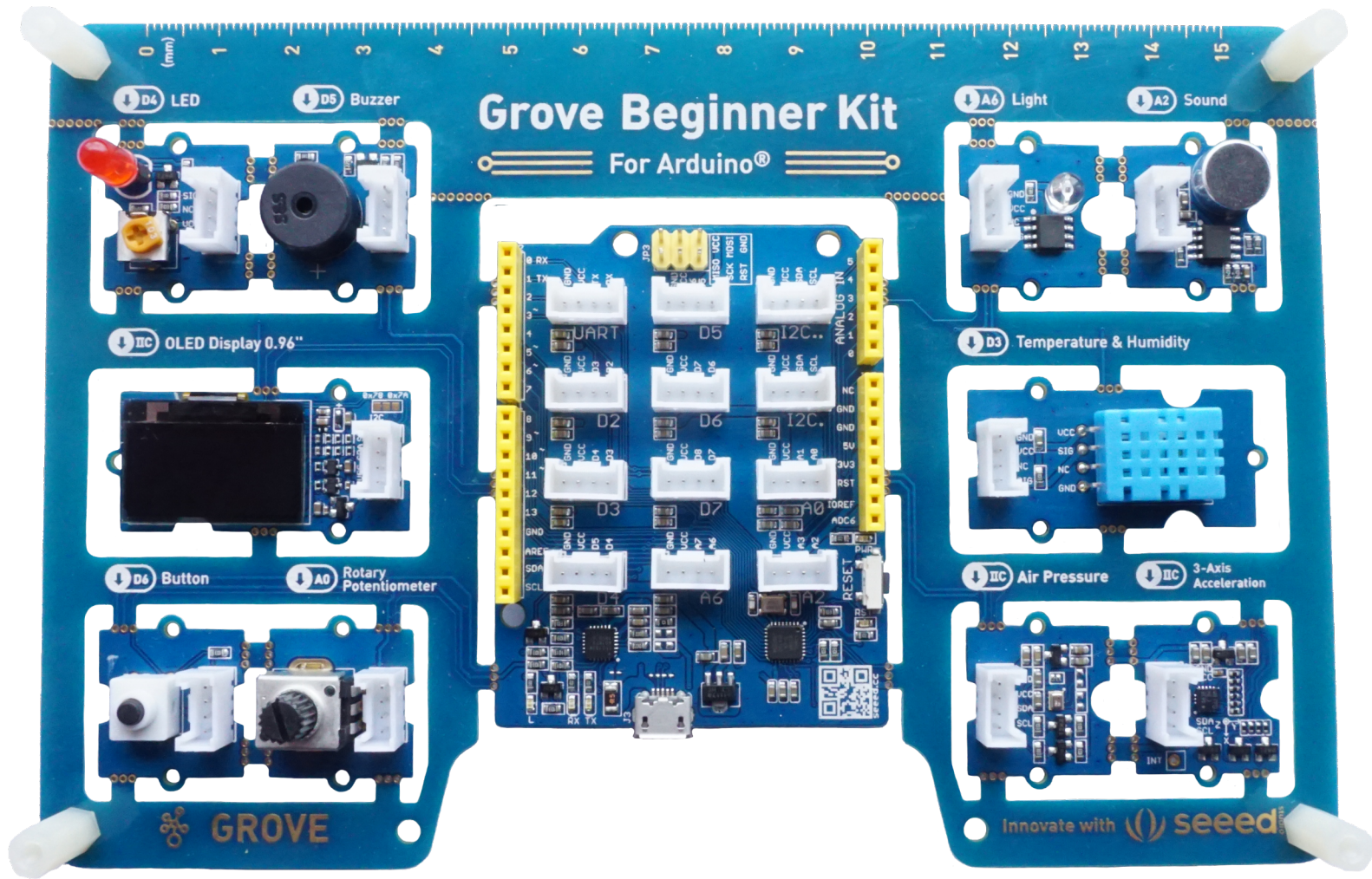
www.biomaker.org/nocode-programming-for-biology-handbook

3 Installed USB Drivers (if required)

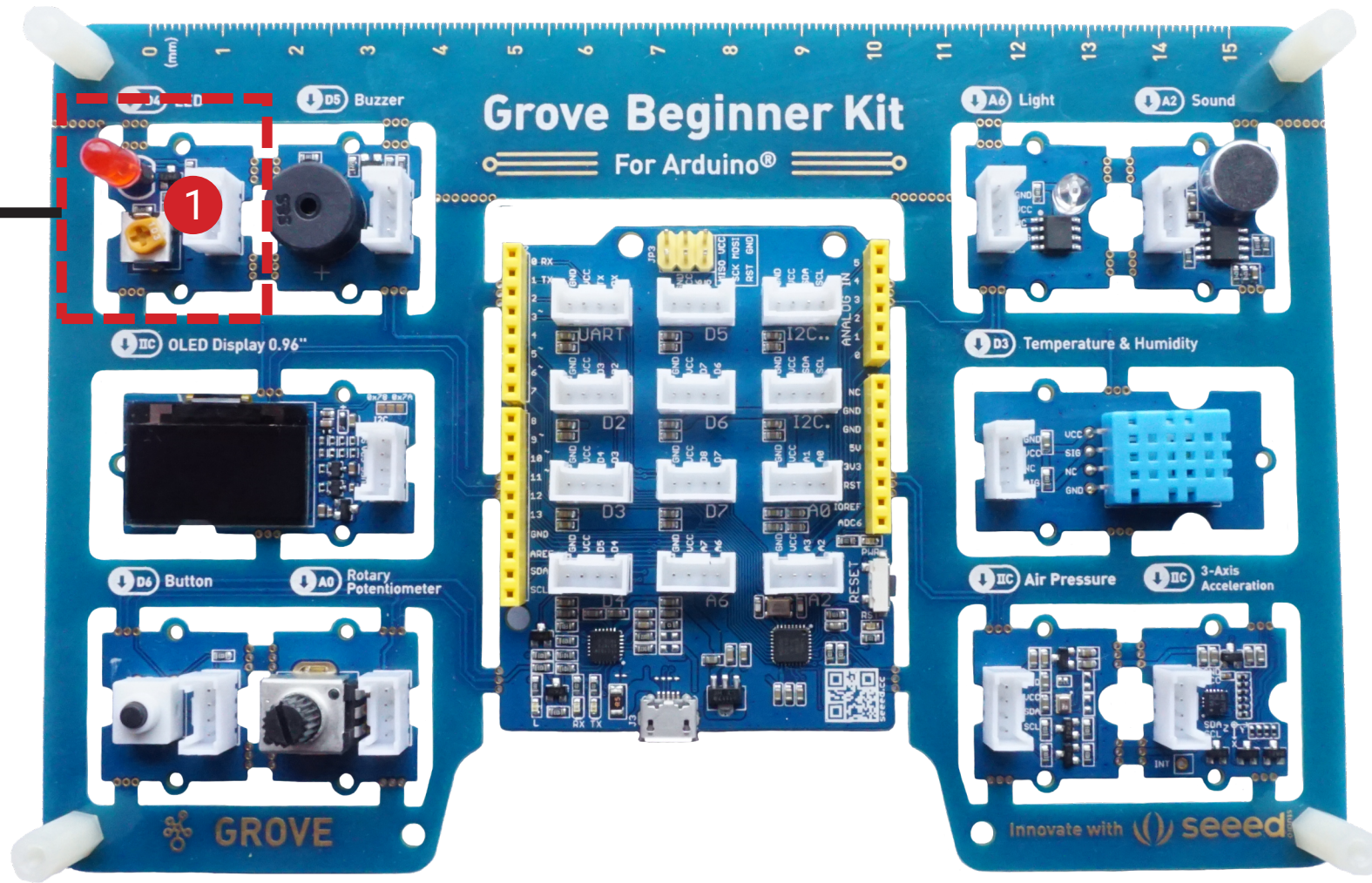
www.silabs.com/developers/usb-to-uart-bridge-vcp-drivers



The Starter Kit

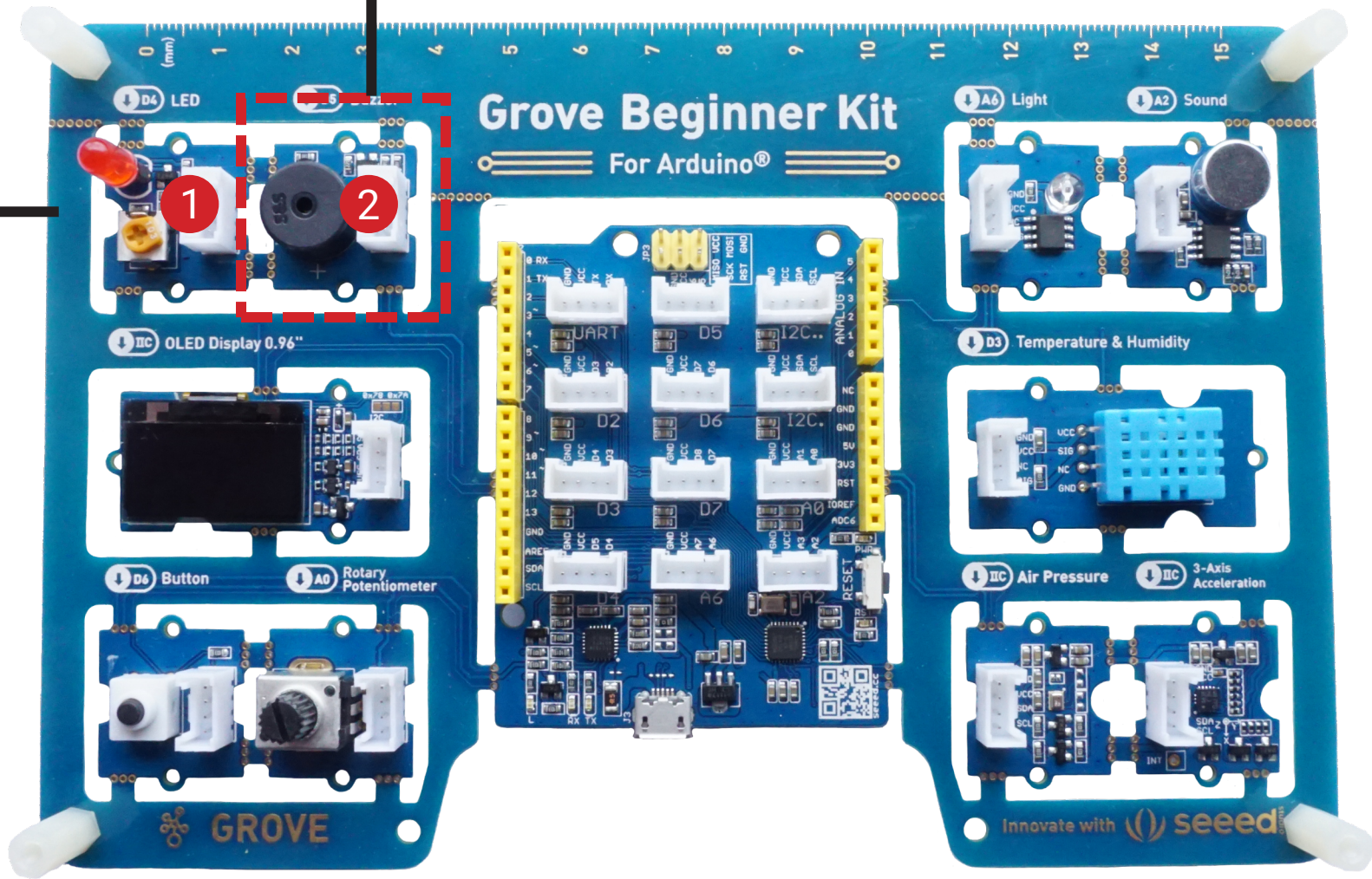


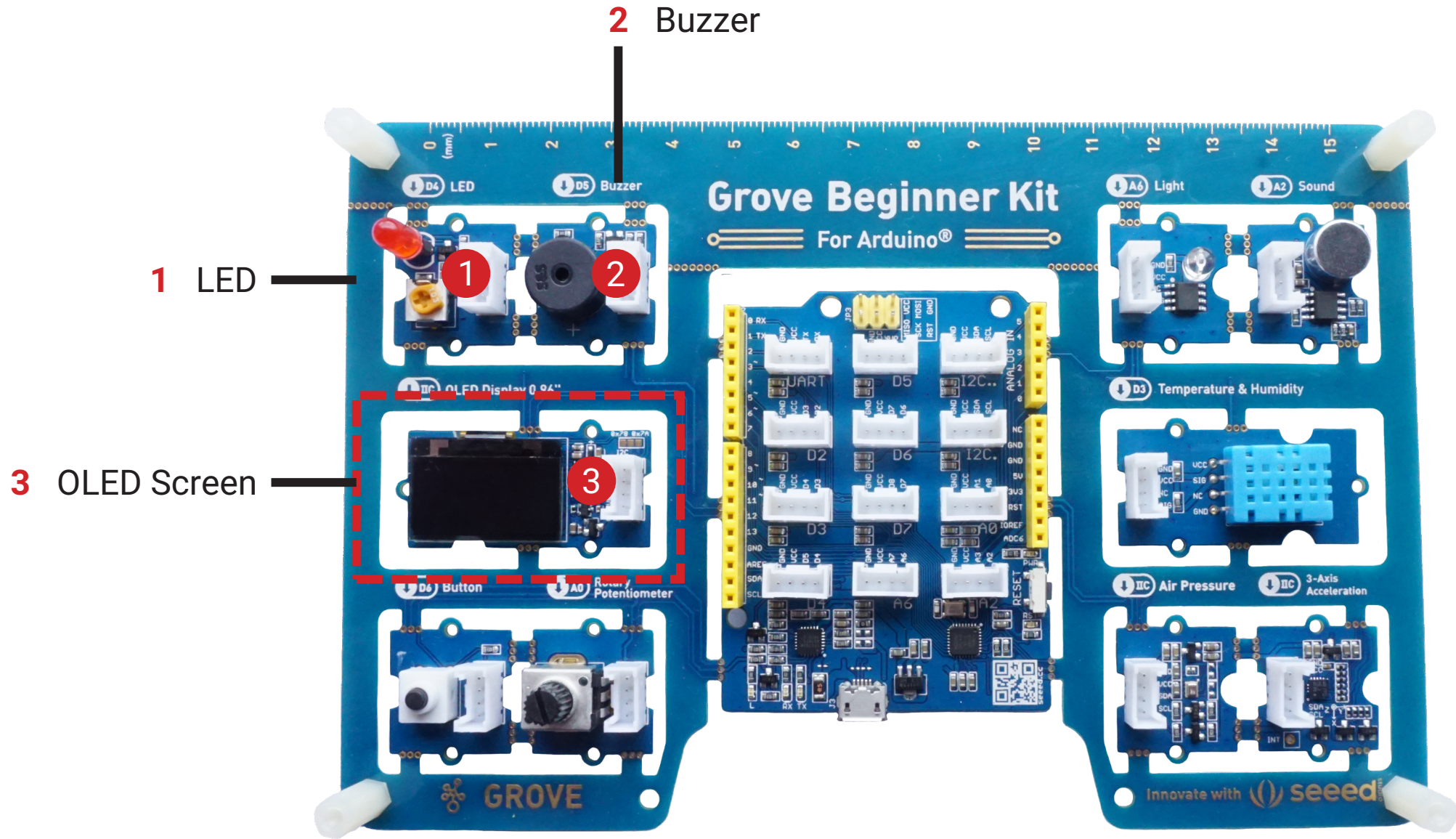
1 LED

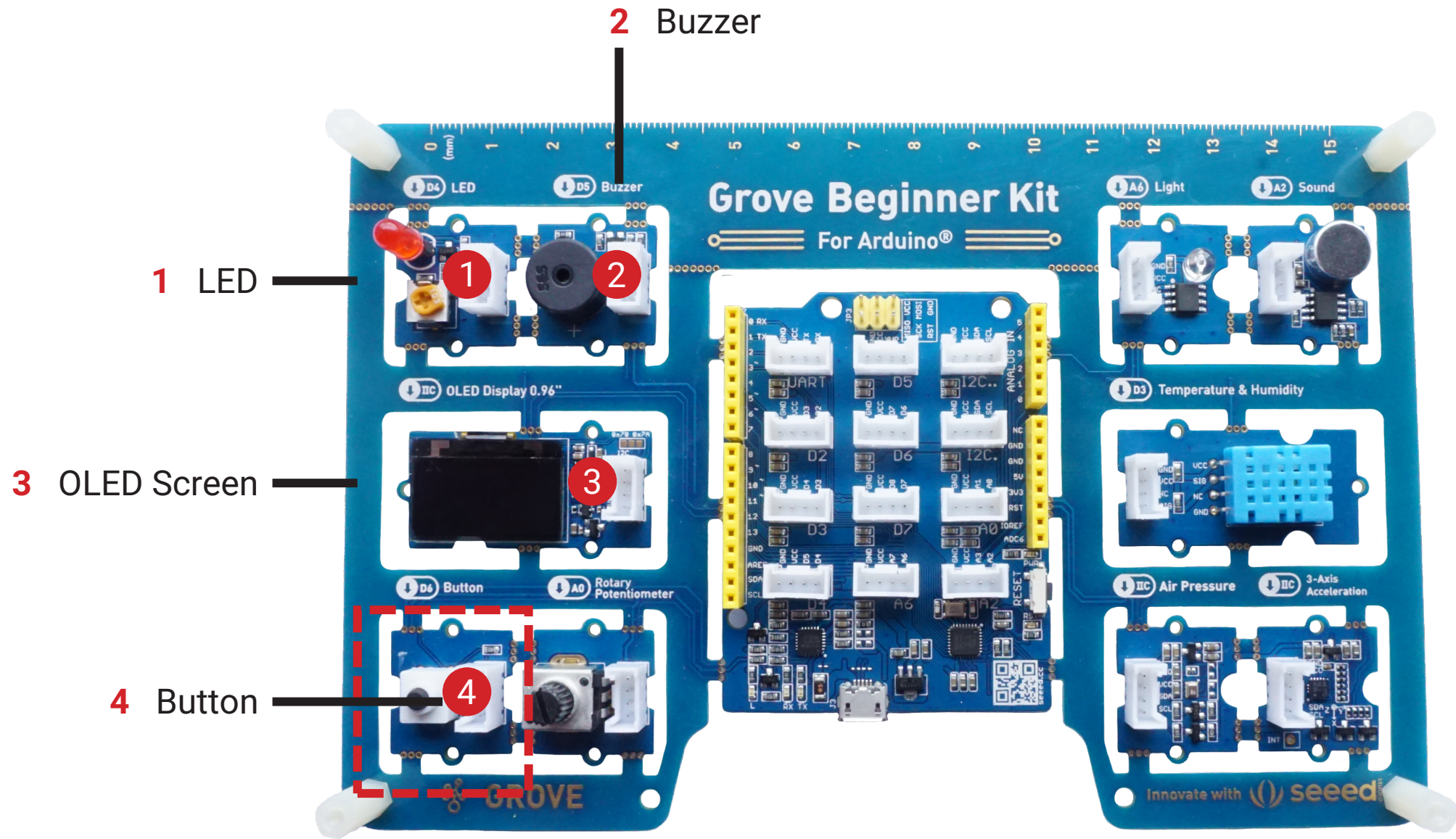


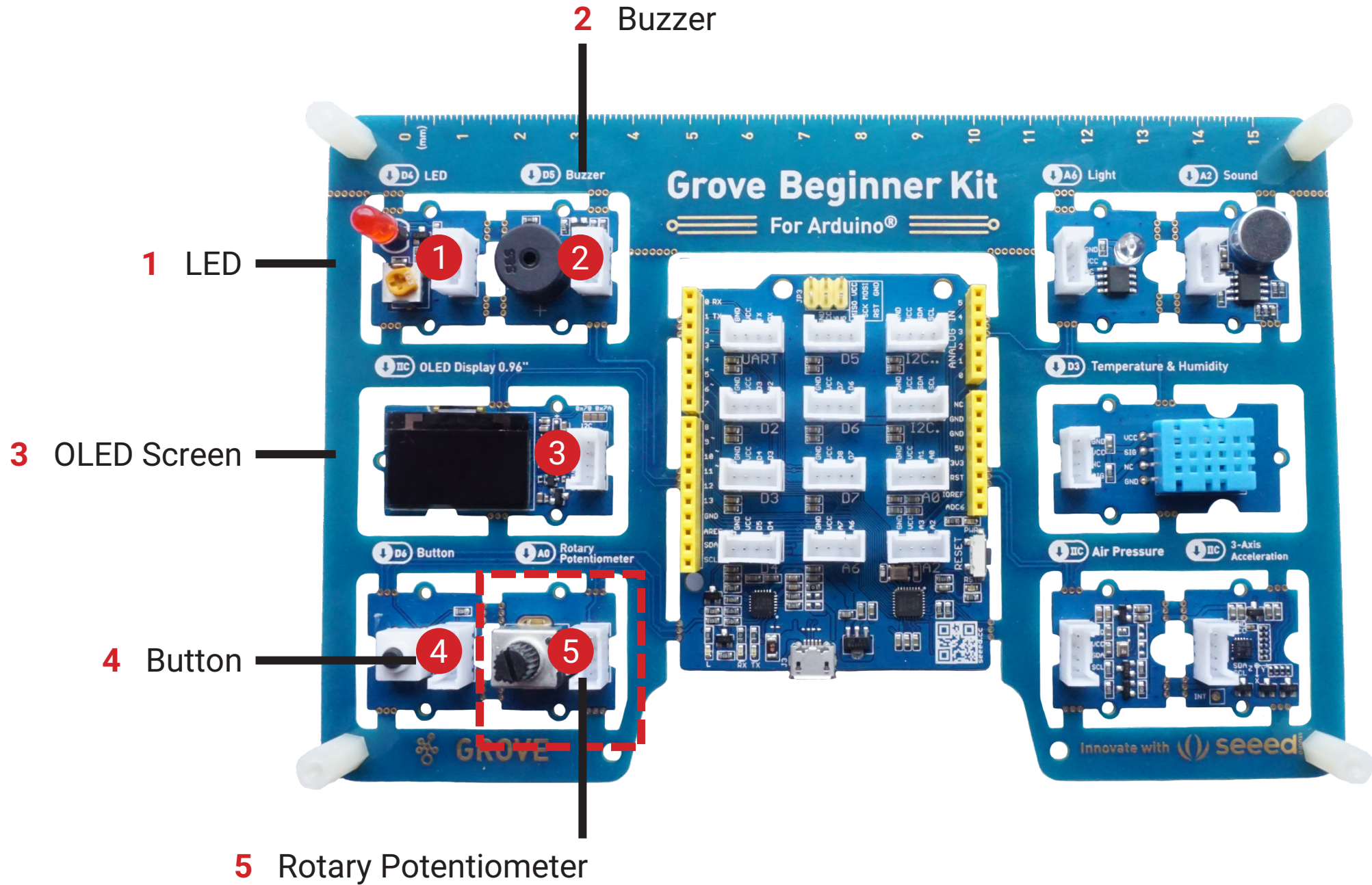
1 LED

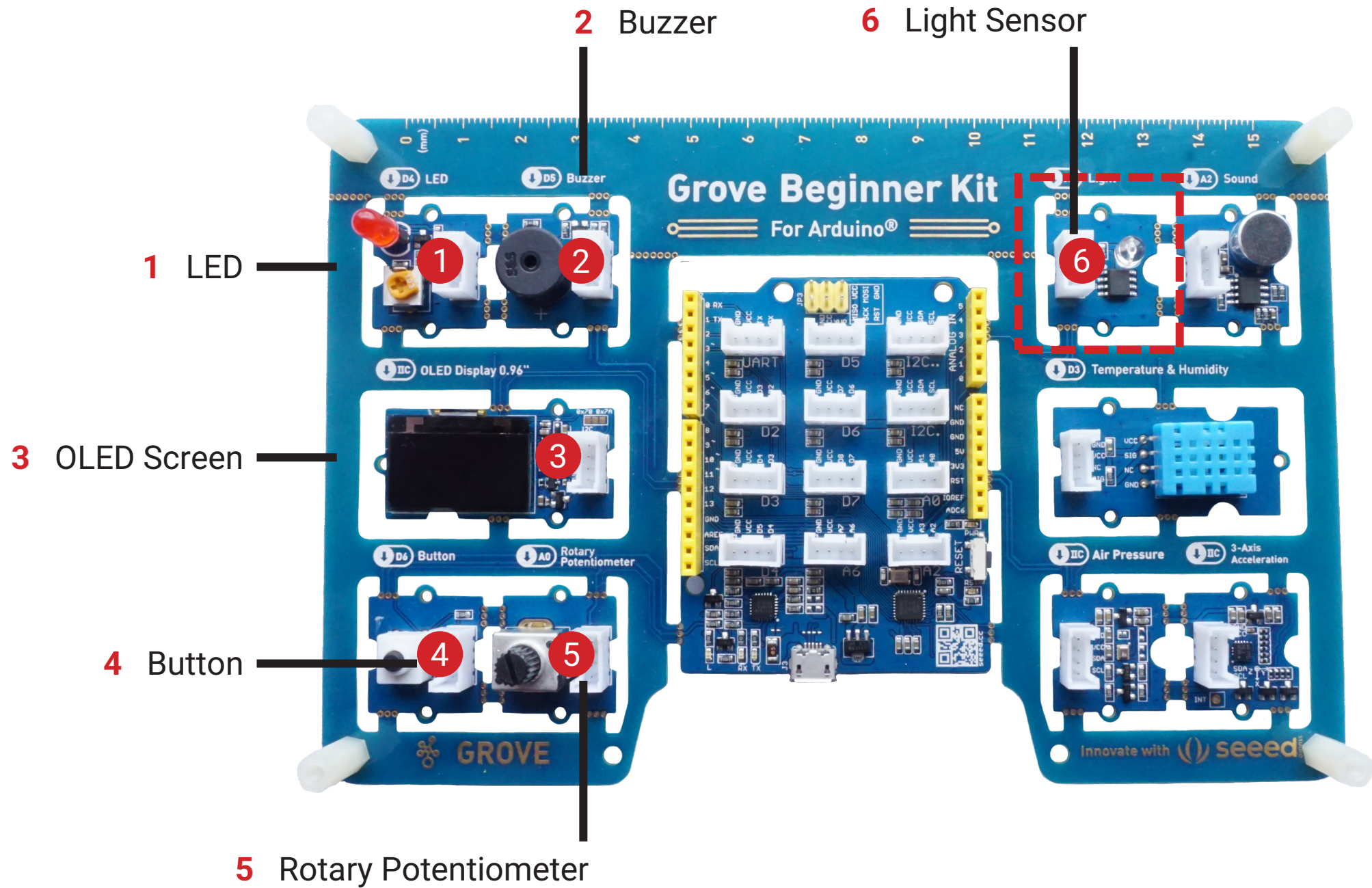
2 Buzzer

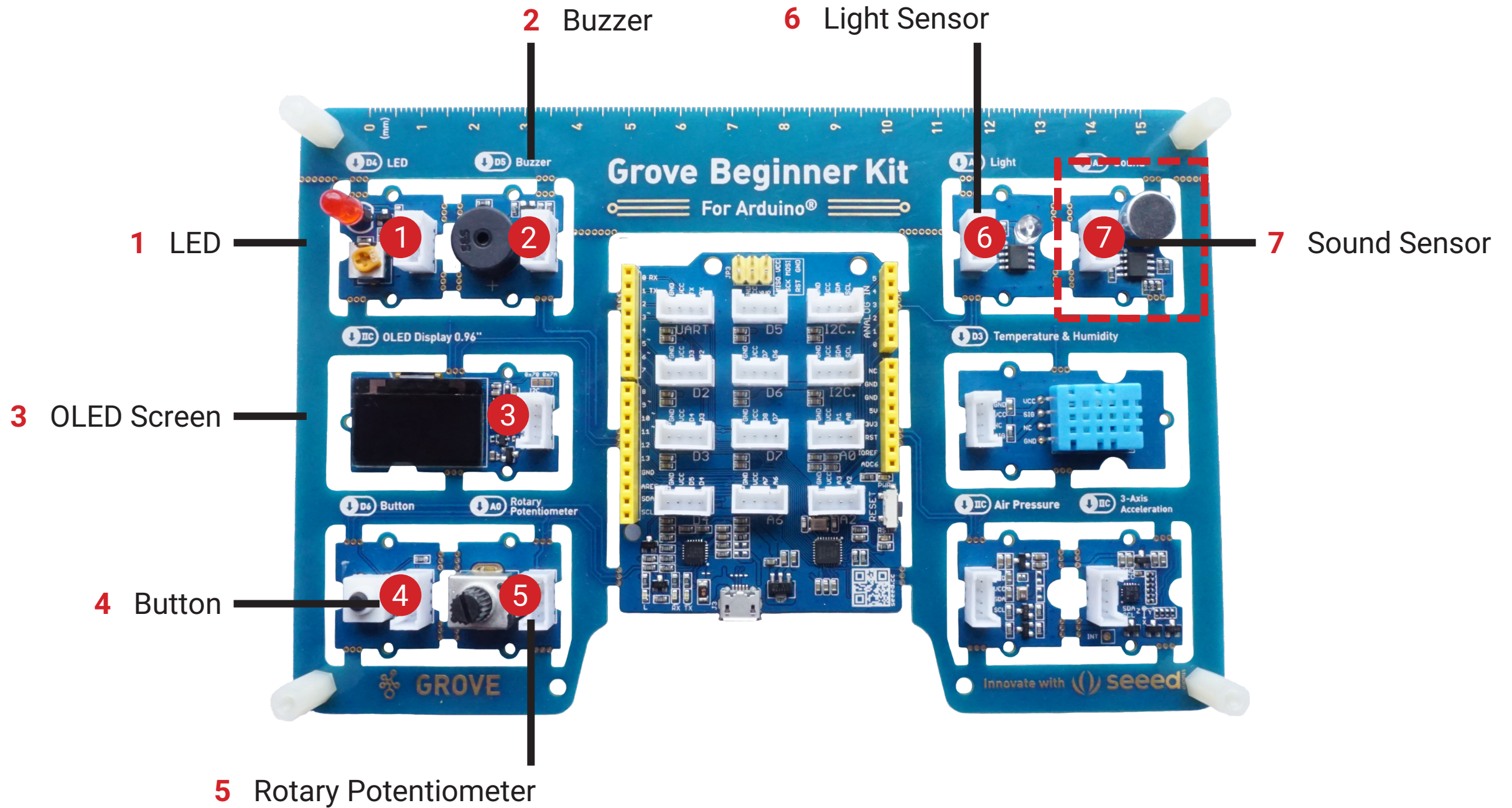


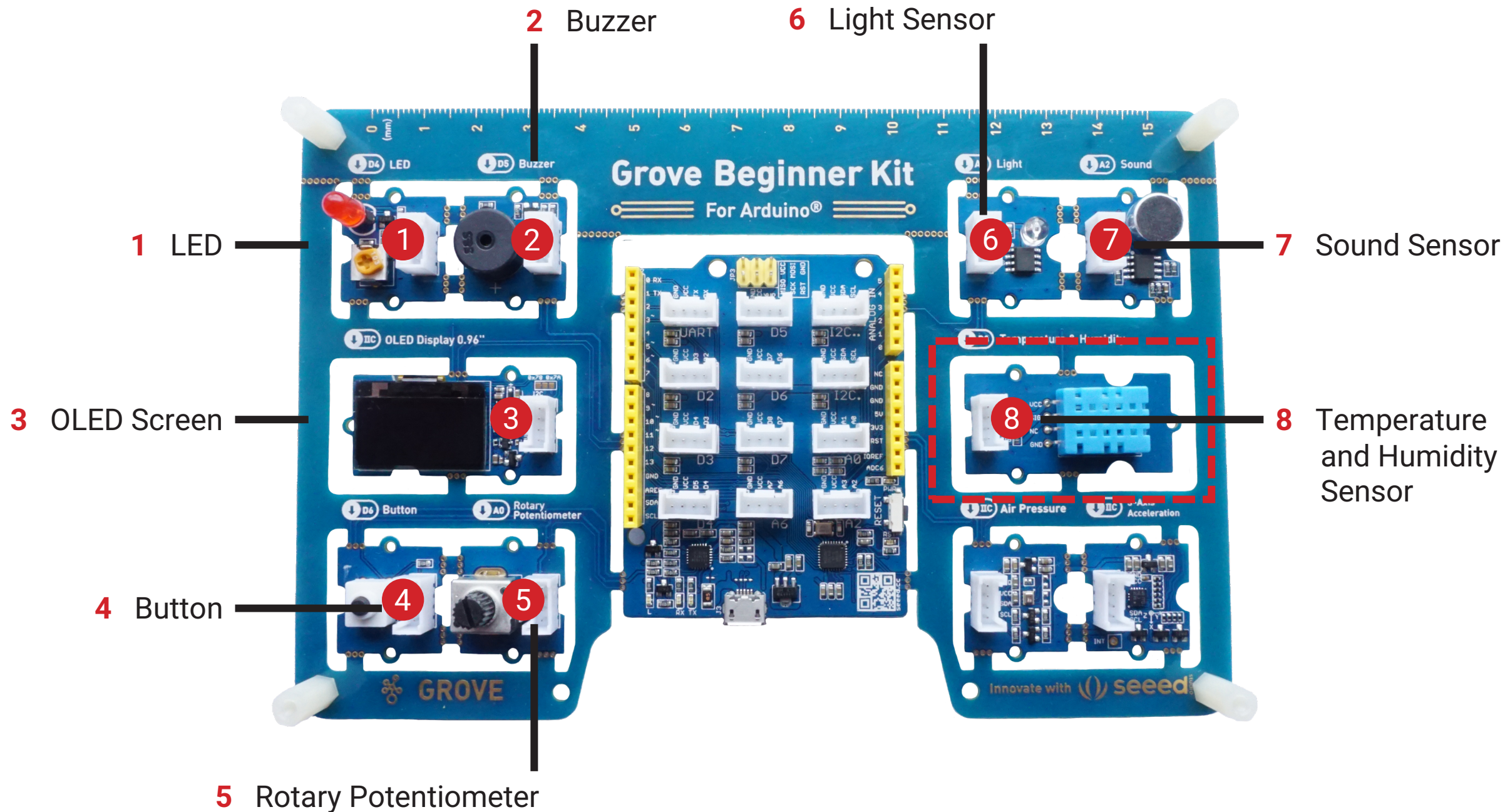


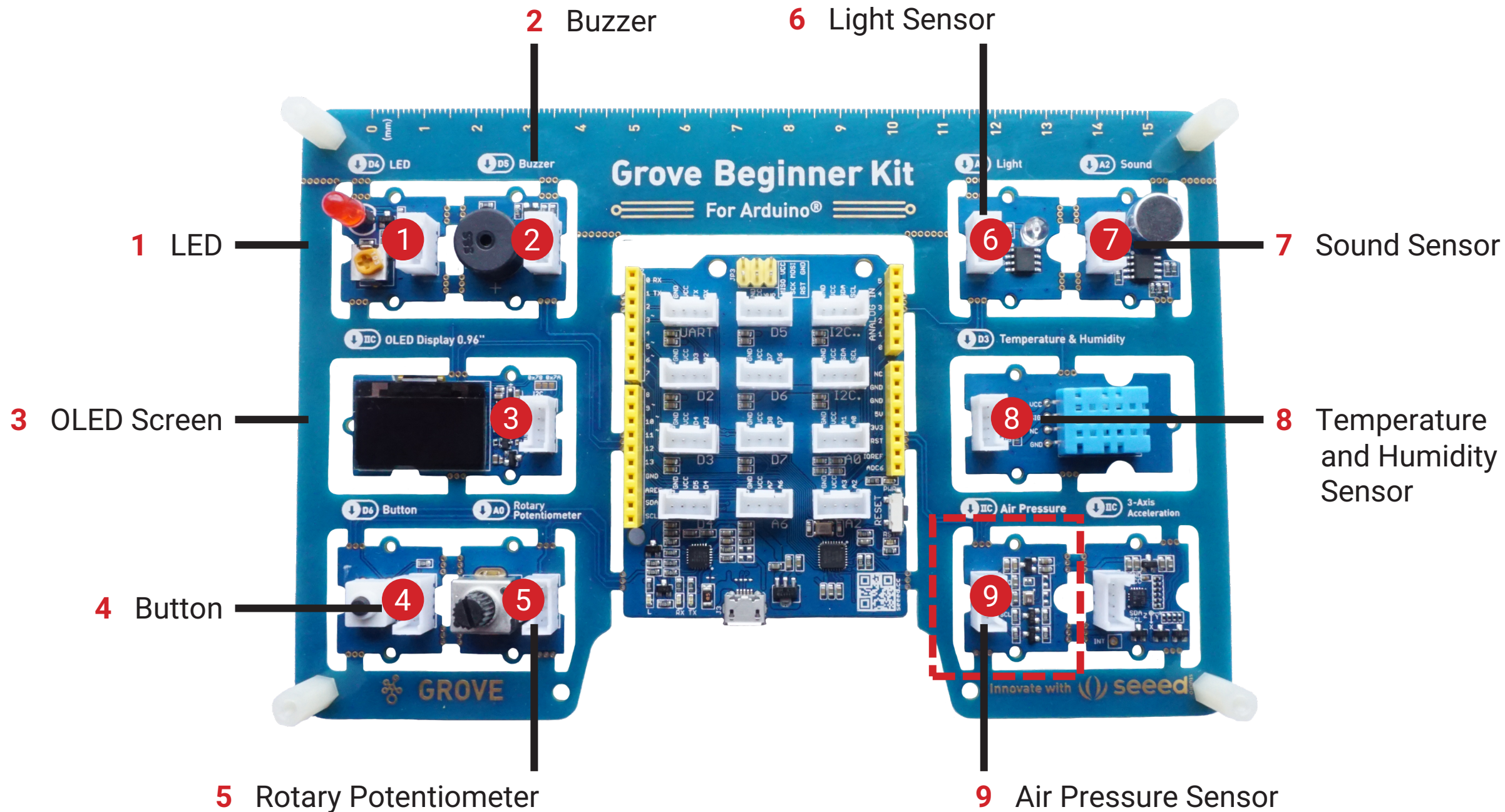


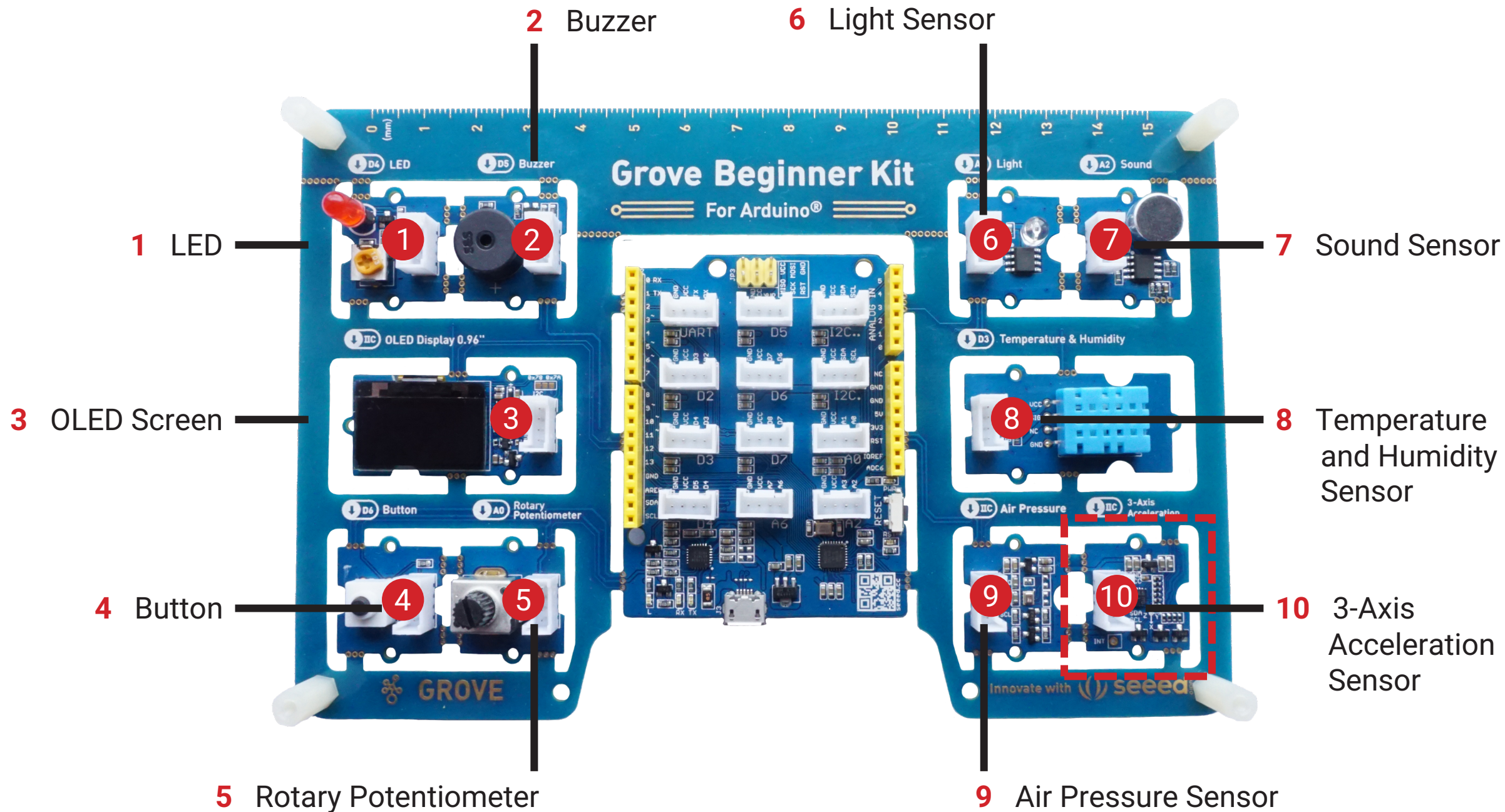












1 LED

2 Buzzer

6 Light Sensor

3 OLED Screen

7 Sound Sensor

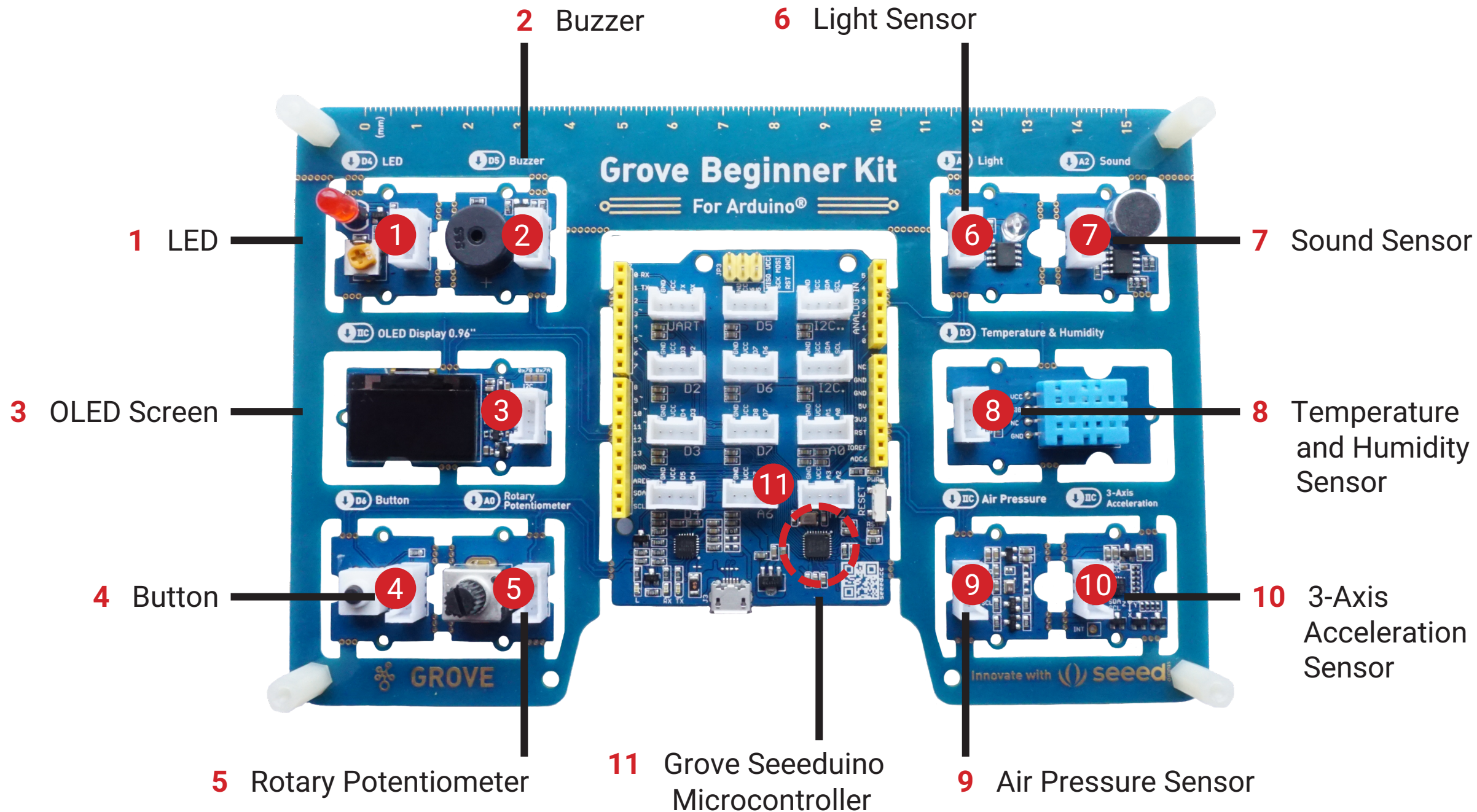
4 Button

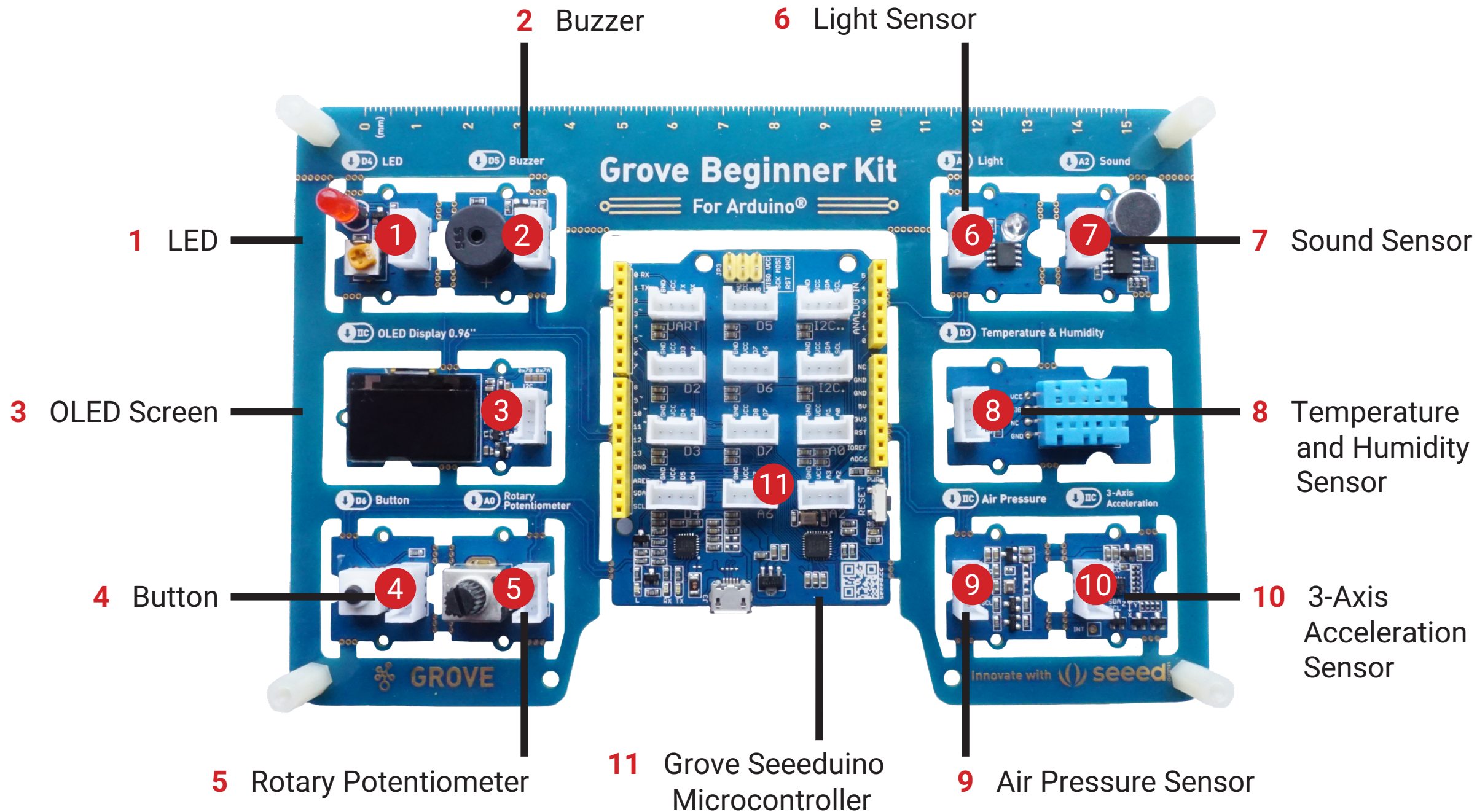
8 Temperature and Humidity Sensor

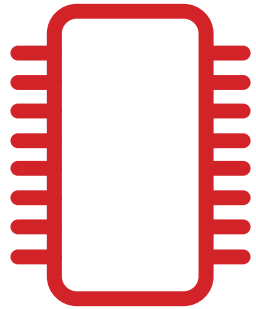
5 Rotary Potentiometer

9 Air Pressure Sensor

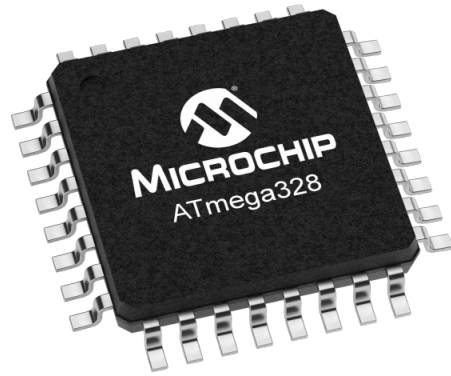
10 3-Axis Acceleration Sensor







The Microcontroller



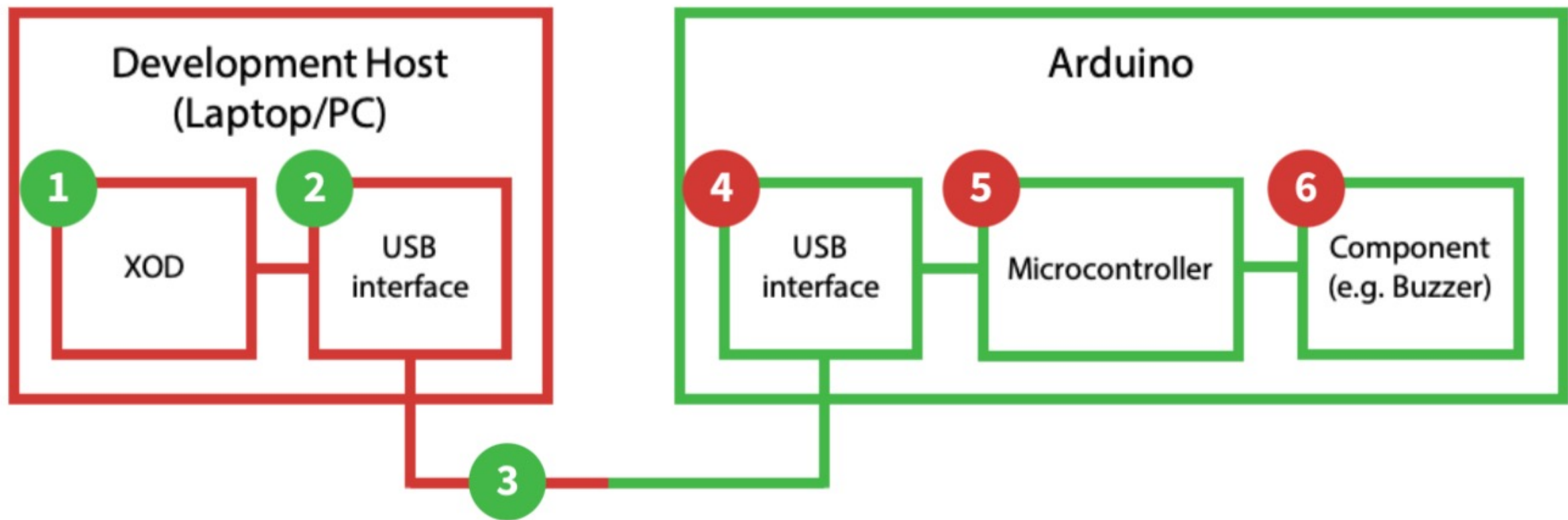
A0-A6 Analog

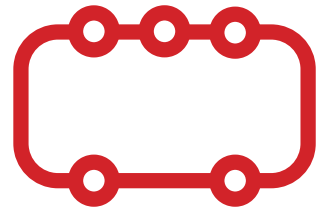
D0-D13 Digital

I2C I2C (require address)



PIN	DEVICE
A0	Rotary Potentiometer
A2	Sound Sensor
A6	Light Sensor
D3	Temperature and Humidity Sensor
D4	LED
D5	Buzzer
D6	Button
I2C (19h)	Three-Axis Accelerator
I2C (77h)	Air Pressure Sensor
I2C (3Ch)	OLED Screen





The XOD IDE

Project Browser

- welcome-to-xod
- 001-hello
- 002-simulate
- 003-inspector
- 004-patching

awgrover/adafuitneopixel

awgrover/conversions

bradzilla84/neopixel

bradzilla84/visi-genie-extra-library

cesars/0-all-examples

cesars/i2c-scanner

Inspector

clock

xod/core/clock

EN True

IVAL 1

RST Never

TICK pulse

Label

Description

Deployment

001-hello x

Welcome to XOD, Maker!

In XOD, we do not use text to code; we use visual objects instead.

This large gray area with boxes is your program. It's called a **patch**. Patches are like documents or source files in other systems.

Several related patches form a **project**. Currently you are working on a project named welcome-to-xod.

Exercise

Let's learn how to navigate a project.

1. On the left-hand side, you will find a list of patches grouped by a project or library name. The list is called a **Project Browser**. The first item in it is welcome-to-xod. Expand the project by clicking on it.
2. As you can see, the tutorial consists of many patches. Right now, you are in the patch 001-hello. The next chapter of the tutorial is in the patch 002-simulate. Double-click it, and let's meet there!

```
graph TD; clock[clock] -- TICK --> count[count]; count -- STEP --> watch[watch];
```

Web hints

If anything goes wrong or you have no idea what to do, we have [hints for every patch](#) on the web.

Quick Help

clock

xod/core/clock

Outputs pulses at regular intervals

Inputs:

EN **boolean**

Is the clock enabled, i.e. produces ticks? At the moment when set to true, starts counting from scratch.

IVAL **number**

Tick interval in seconds

RST **pulse**

Resets current count, restarts clock with new interval

Outputs:

TICK **pulse**

Pulses on each time interval end

1 Your Patch

001-hello

Project Browser

- welcome-to-xod
- 001-hello**
- 002-simulate
- 003-inspector
- 004-patching

Inspector

clock

xod/core/clock

EN True

IVAL 1

RST Never

TICK pulse

Label

Description

Deployment

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This large gray area with boxes is your program. It's called a **patch**. Patches are like documents or source files in other systems.

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Exercise

Let's learn how to navigate a project.

1. On the left-hand side, you will find a list of patches grouped by a project or library name. The list is called a **Project Browser**. The first item in it is `welcome-to-xod`. Expand the project by clicking on it.
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Tick interval in seconds

RST **pulse**

Resets current count, restarts clock with new interval

Outputs:

TICK **pulse**

Pulses on each time interval end

count

STEP INC RST

watch



New Patch Add Library

2 Project Browser: Buttons

1 Your Patch

The screenshot shows the XOD IDE interface. On the left is the **Project Browser** with a list of patches and projects. A red box highlights the top of the Project Browser, and a red circle with the number '2' is placed over the '001-hello' patch. The main workspace shows a patch named '001-hello' with a 'clock' block and a 'count' block. A red circle with the number '1' is placed over the 'clock' block. The 'clock' block has inputs EN (boolean), IVAL (number), and RST (pulse), and an output TICK (pulse). The 'count' block has inputs STEP (pulse), INC (pulse), and RST (pulse), and an output TICK (pulse). A 'watch' block is connected to the TICK output of the 'count' block. On the right is the **Inspector** for the 'clock' block, showing its inputs and outputs. Below the patch editor is an **Exercise** section with two steps: 1. On the left-hand side, you will find a list of patches grouped by a project or library name. The list is called a **Project Browser**. The first item in it is welcome-to-xod. Expand the project by clicking on it. 2. As you can see, the tutorial consists of many patches. Right now, you are in the patch 001-hello. The next chapter of the tutorial is in the patch 002-simulate. Double-click it, and let's meet there! Below the exercise is a **Web hints** section with a hand icon and the text: 'If anything goes wrong or you have no idea what to do, we have [hints for every patch](#) on the web.'



New Patch Add Library

2 Project Browser: Buttons

3 Project Browser: Project Patches

1 Your Patch

The screenshot shows the XOD interface with three red callouts: '2' points to the Project Browser buttons, '3' points to the project list, and '1' points to the patch diagram. The Project Browser on the left shows a tree view with 'welcome-to-xod' expanded to show patches '001-hello', '002-simulate', '003-inspector', and '004-patching'. The Inspector on the left shows the 'clock' patch with parameters: EN (True), IVAL (1), RST (Never), and TICK (pulse). The main workspace shows a patch diagram with a 'clock' patch connected to a 'count' patch, which is connected to a 'watch' patch. The 'clock' patch has inputs EN, IVAL, and RST, and an output TICK. The 'count' patch has inputs STEP, INC, and RST, and an output TICK. The 'watch' patch has an input TICK and an output pulse. The right sidebar shows the 'clock' patch details: EN (boolean), IVAL (number), RST (pulse), and TICK (pulse).



New Patch Add Library

2 Project Browser: Buttons

3 Project Browser: Project Patches

4 Project Browser: Libraries

1 Your Patch

The screenshot shows the XOD IDE interface. On the left is the Project Browser with a list of patches and libraries. A red dashed box highlights the library section, and a red circle '4' is next to it. The main workspace shows a patch editor with a 'clock' patch and a 'count' patch. A red circle '1' is next to the 'clock' patch. The right side shows the Patch Inspector for the 'clock' patch, with a red circle '2' next to the 'clock' title. A red circle '3' is next to the '001-hello' patch in the Project Browser. The interface includes a 'Welcome to XOD, Maker!' message, an 'Exercise' section, and a 'Web hints' section.

Project Browser

- welcome-to-xod
- 001-hello
- 002-simulate
- 003-inspector
- 004-patches
- awgrover/adafruitneopixel
- awgrover/convers
- bradzilla84/neopixel
- bradzilla84/visi-genie-extra-library
- cesars/0-all-examples
- cesars/i2c-scanner

Inspector

clock

xod/core/clock

EN True

IVAL 1

RST Never

TICK pulse

Label

Description

Deployment

Quick Help

clock

xod/core/clock

Outputs pulses at regular intervals

Inputs:

EN **boolean**

Is the clock enabled, i.e. produces ticks? At the moment when set to true, starts counting from scratch.

IVAL **number**

Tick interval in seconds

RST **pulse**

Resets current count, restarts clock with new interval

Outputs:

TICK **pulse**

Pulses on each time interval end

Web hints

If anything goes wrong or you have no idea what to do, we have [hints for every patch](#) on the web.



New Patch Add Library

1 Your Patch

2 Project Browser: Buttons

3 Project Browser: Project Patches

4 Project Browser: Libraries

5 Inspector

The screenshot shows the XOD IDE interface with several numbered callouts:

- 2**: Points to the top navigation bar containing icons for New Patch, Add Library, Filter, and Menu.
- 3**: Points to the Project Browser on the left, which lists various projects and patches. The '001-hello' patch is selected.
- 4**: Points to the Project Browser's library section, which lists various libraries like 'awgrover/adafruitneopixel' and 'cesars/i2c-scanner'.
- 5**: Points to the Inspector panel on the right, which displays the properties of the selected 'clock' patch, including EN (boolean), IVAL (number), RST (pulse), and TICK (pulse).

The central workspace displays a patch diagram with a 'clock' block connected to a 'count' block, which is connected to a 'watch' block. The 'clock' block has inputs for EN, IVAL, and RST, and an output for TICK. The 'count' block has inputs for STEP, INC, and RST, and an output for TICK. The 'watch' block has an input for TICK and an output for STEP.

The workspace also contains text instructions and an exercise section:

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Exercise

Let's learn how to navigate a project.

1. On the left-hand side, you will find a list of patches grouped by a project or library name. The list is called a **Project Browser**. The first item in it is `welcome-to-xod`. Expand the project by clicking on it.
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Web hints

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New Patch Add Library

1 Your Patch

2 Project Browser: Buttons

3 Project Browser: Project Patches

4 Project Browser: Libraries

5 Inspector

The screenshot shows the XOD Maker interface with several numbered callouts:

- 2**: Project Browser: Buttons - Points to the top navigation icons in the Project Browser.
- 3**: Project Browser: Project Patches - Points to the list of patches in the Project Browser.
- 4**: Project Browser: Libraries - Points to the library list in the Project Browser.
- 5**: Inspector - Points to the Inspector panel on the left side of the patch editor.
- 1**: Your Patch - Points to the main patch editor area.
- 6**: Quick Help - Points to the Quick Help panel on the right side of the patch editor.

The main patch editor area shows a patch named "clock" with inputs EN (boolean), IVAL (number), and RST (pulse), and outputs TICK (pulse). A "count" patch is connected to the TICK output of the "clock" patch. A "watch" patch is also connected to the TICK output of the "count" patch.

The Quick Help panel for the "clock" patch provides the following information:

- clock**
xod/core/clock
- Outputs pulses at regular intervals
- Inputs:
 - EN **boolean**
Is the clock enabled, i.e. produces ticks? At the moment when set to true, starts counting from scratch.
 - IVAL **number**
Tick interval in seconds
 - RST **pulse**
Resets current count, restarts clock with new interval
- Outputs:
 - TICK **pulse**
Pulses on each time interval end

6 Quick Help



New Patch Add Library

1 Your Patch

2 Project Browser: Buttons

3 Project Browser: Project Patches

4 Project Browser: Libraries

5 Inspector

The screenshot shows the XOD IDE interface with several numbered callouts:

- 1**: Points to the main workspace area containing a visual patch diagram with blocks like 'clock', 'count', and 'watch'.
- 2**: Points to the top navigation bar containing icons for 'New Patch' and 'Add Library'.
- 3**: Points to the 'Project Browser' on the left, showing a list of projects like 'welcome-to-xod' and '001-hello'.
- 4**: Points to the 'Inspector' on the left, showing configuration for the 'clock' patch, including inputs like 'EN', 'IVAL', 'RST', and 'TICK'.
- 5**: Points to the 'Inspector' on the left, showing the 'clock' patch details.
- 6**: Points to the 'Quick Help' panel on the right, displaying documentation for the 'clock' patch.
- 7**: Points to the 'Upload And Debug' buttons at the bottom right of the workspace.

6 Quick Help

Upload And Debug

7 Upload Buttons





New Patch Add Library

1 Your Patch

2 Project Browser: Buttons

3 Project Browser: Project Patches

4 Project Browser: Libraries

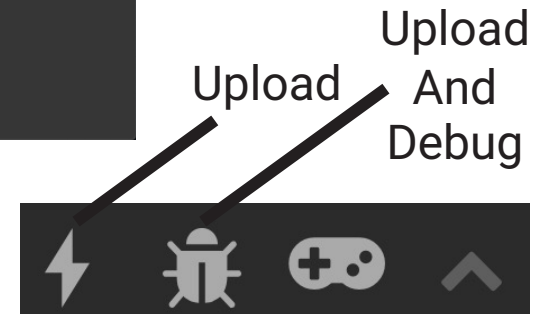
5 Inspector

The screenshot shows the XOD IDE interface with several numbered callouts:

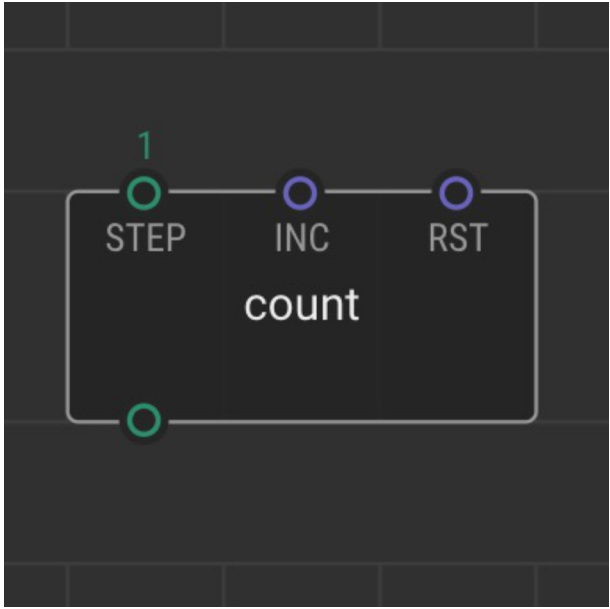
- 1**: Points to the main workspace area containing a visual patch diagram with blocks like 'clock', 'count', and 'watch'.
- 2**: Points to the top navigation bar containing icons for New Patch, Add Library, Filter, and Menu.
- 3**: Points to the Project Browser on the left, showing a list of projects like 'welcome-to-xod', '001-hello', '002-simulate', etc.
- 4**: Points to the Project Browser on the left, showing a list of libraries like 'awgrover/adafruitneopixel', 'awgrover/convers', etc.
- 5**: Points to the Inspector on the left, showing the configuration for the 'clock' patch, including inputs like EN (boolean), IVAL (number), RST (pulse), and TICK (pulse).
- 6**: Points to the Quick Help panel on the right, showing details for the 'clock' patch, including its location, outputs, and inputs.
- 7**: Points to the bottom right corner of the IDE, showing the 'Upload And Debug' button.

6 Quick Help

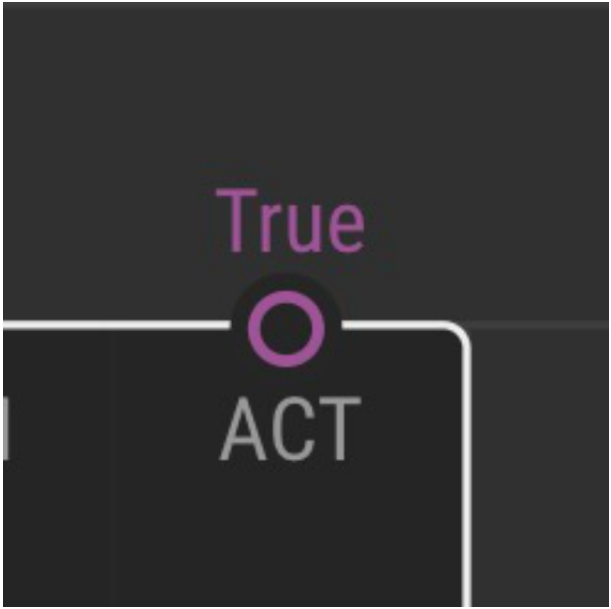
7 Upload Buttons



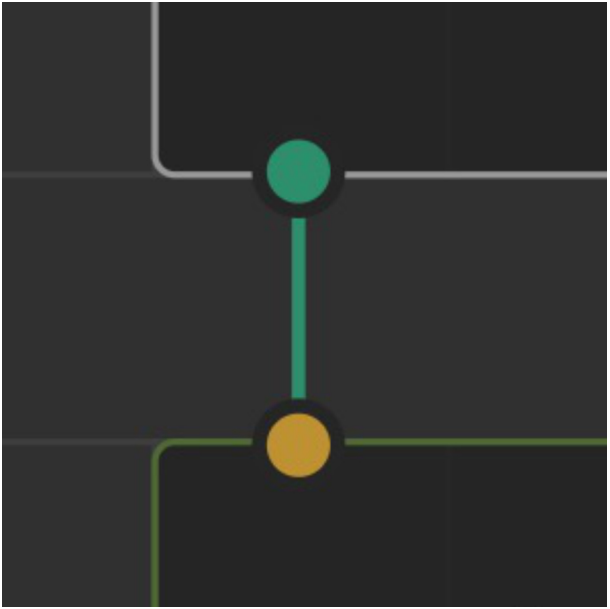
Nodes



Pins



Links



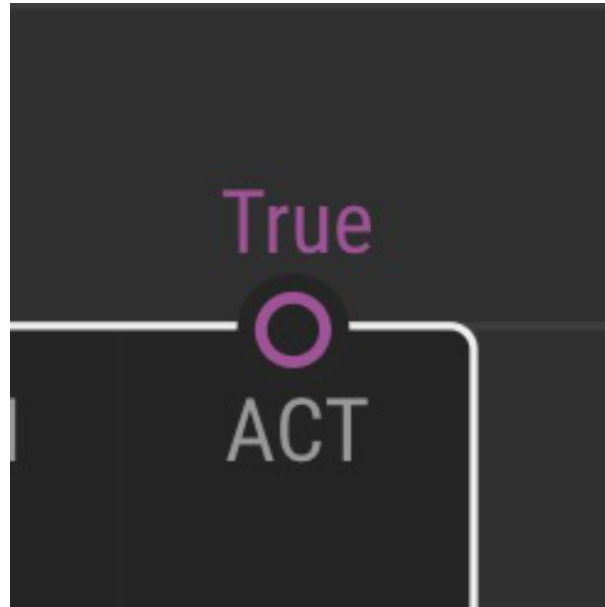
Pulse

String

Pins

Boolean

Port

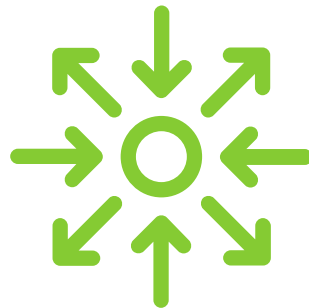


Number

Byte



Testing Your Board



Inputs and Outputs

Breakout Groups – 35min

- 1 Introduce yourselves
- 2 Work together and see if each of you can complete the tasks
- 3 Step-by-step instructions are in the Guide (**p20-29**)
- 4 Use the 'Ask for Help' button if necessary

Congratulations!

**You can now programme
an Arduino Board!**

Homework Challenge!

- 1 How can you expand on your simple programme?
- 2 Can you use the potentiometer to turn the buzzer on?
- 3 Can you make the buzzer turn on and the LED turn off when the button is pressed?
- 4 Can you get your light to flash?
- 5 Work through Lesson 3 in the Guide (**p32-45**)

Next Week

17:00 Welcome and Recap

17:05 Lesson 3: Explore XOD

Get to grips with some of the most useful nodes in XOD

17:25 Lesson 4: Building Devices (hands-on session)

Learn how to make your own XOD nodes and use the inbuilt OLED screen

17:55 Mini-Challenge (breakout groups)

What is the most interesting thing you can build with your Grove board

16:20 Round-up

Thank You

More info:

www.biomaker.org



Session 2

No-Code Programming for Biology



- 1 Welcome!
- 2 Turn off your video and mute yourselves for now
- 3 Feel free to introduce yourselves in the chat
- 4 As we go along, ask any questions in the chat

No-Code Programming for Biology



Today's Session

17:00 Welcome and Recap

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17:25 Lesson 4: Building Devices (hands-on session)

Learn how to make your own XOD nodes and use the inbuilt OLED screen

17:55 Mini-Challenge (breakout groups)

What is the most interesting thing you can build with your Grove board?

16:20 Round-up

Last Week's Session

- 1** The Grove Board (**p6-7**)
- 2** The Microcontroller (**p8-11**)
- 3** The XOD IDE (**p12-15**)
- 4** Turned the LED on using the button (**p20-25**)
- 5** Controlled the buzzer using the button and potentiometer (**p26-29**)

Project Browser

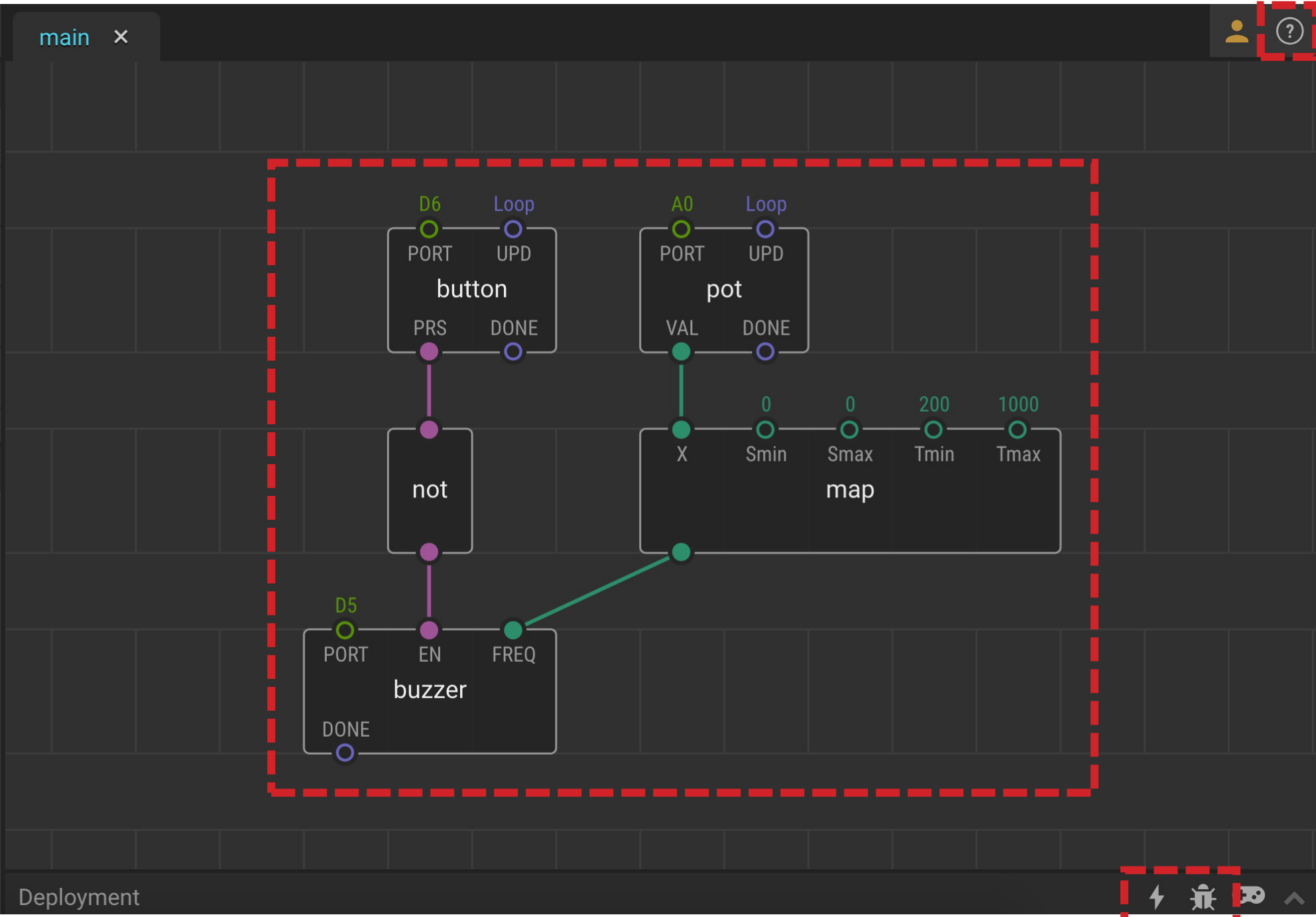
- My Project
- main
- awgrover/adafruitneopixel
- awgrover/conversions
- bradzilla84/neopixel
- bradzilla84/visi-genie-extra

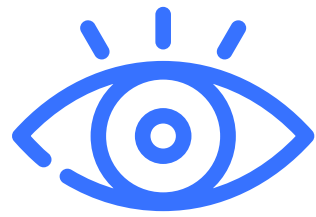
Inspector

main

Description

Deployment





Tweak and Watch Nodes

Boole

Pulse

String

Byte

Colour

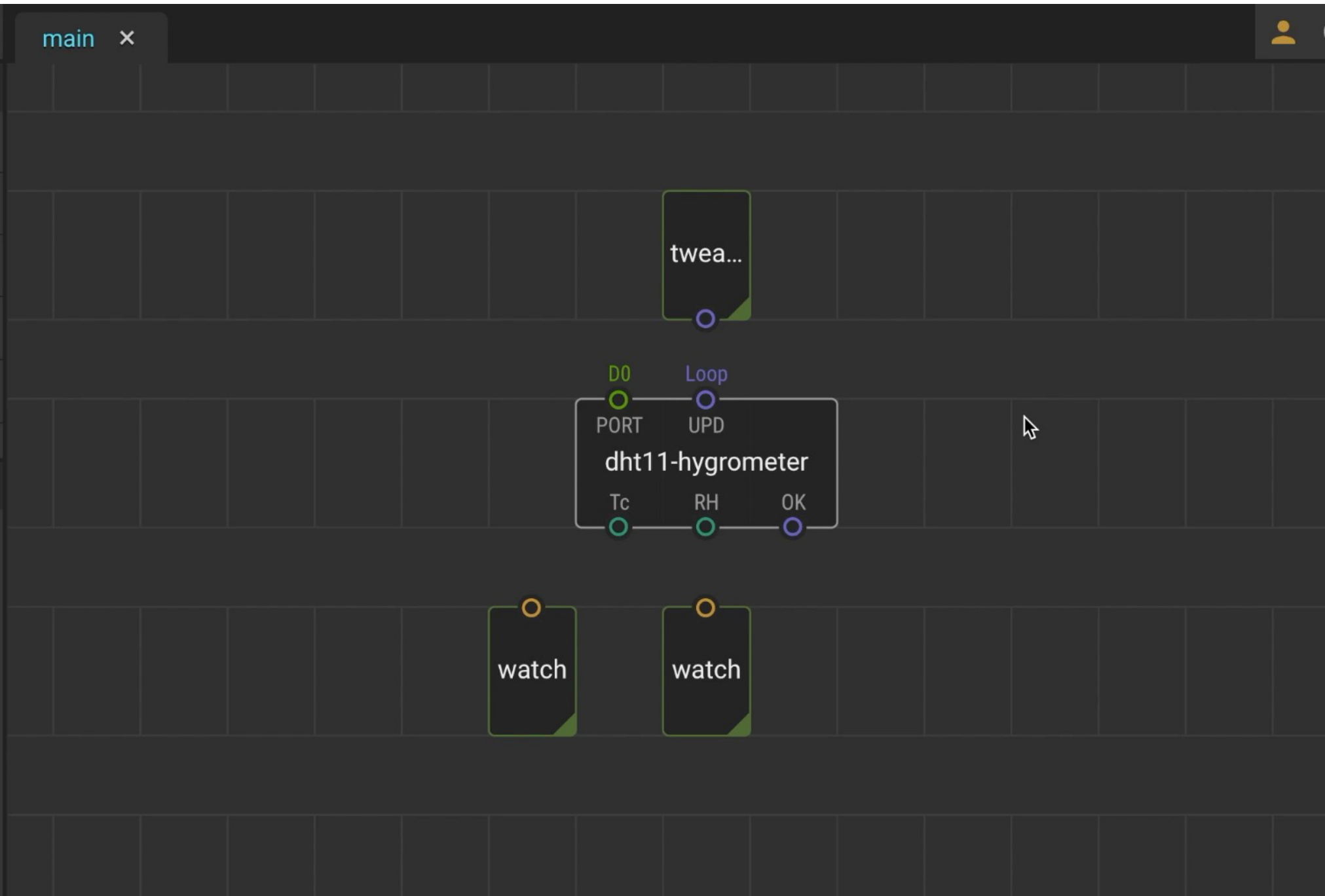
Num

watch



Project Browser

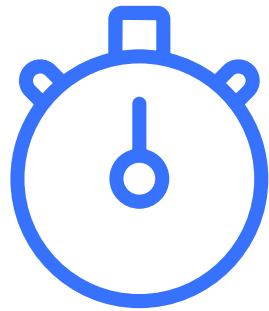
- My Project
- main
- awgrover/adafruitneopixel
- awgrover/conversions
- bradzilla84/neopixel
- bradzilla84/visi-genie-extra-...



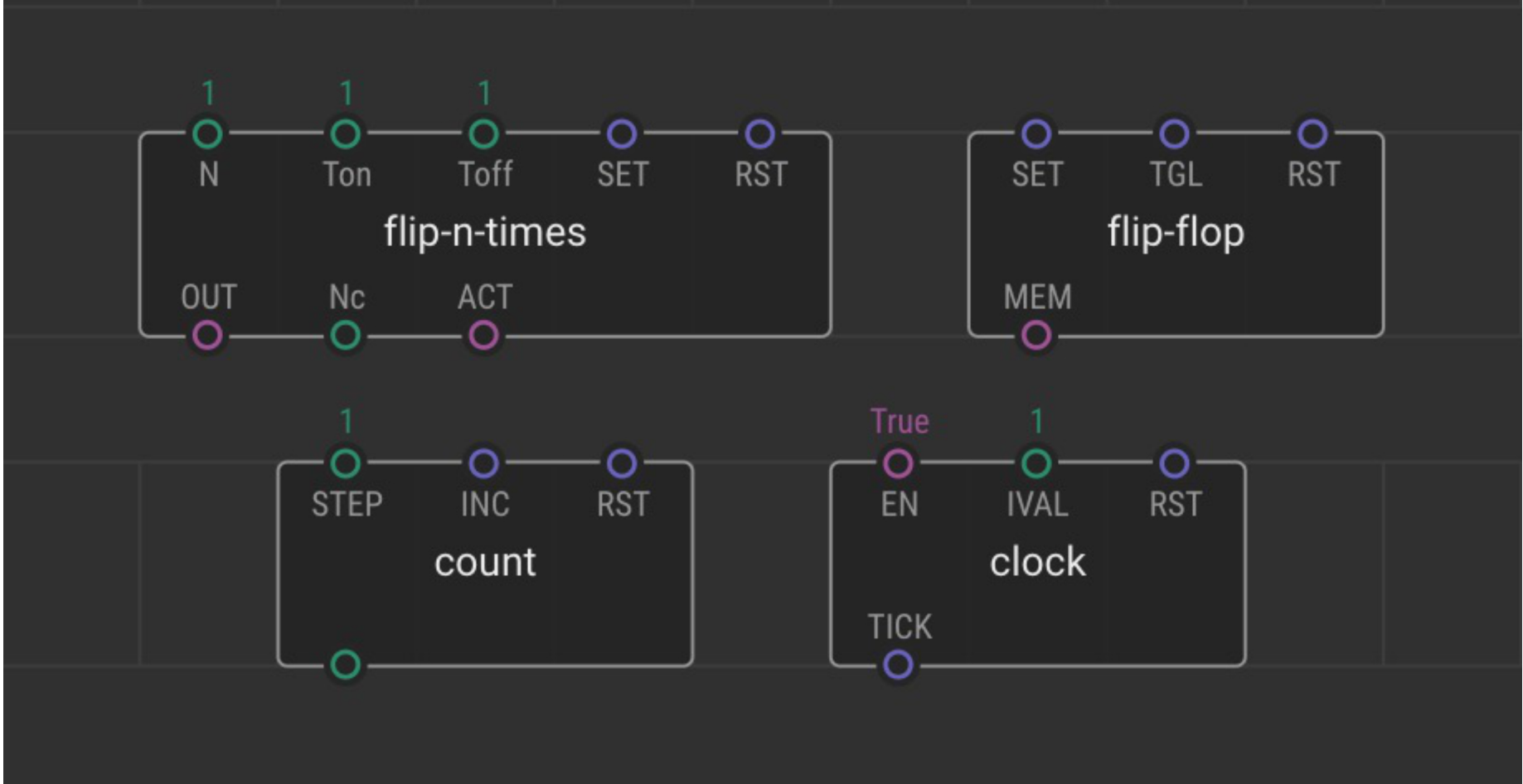
main

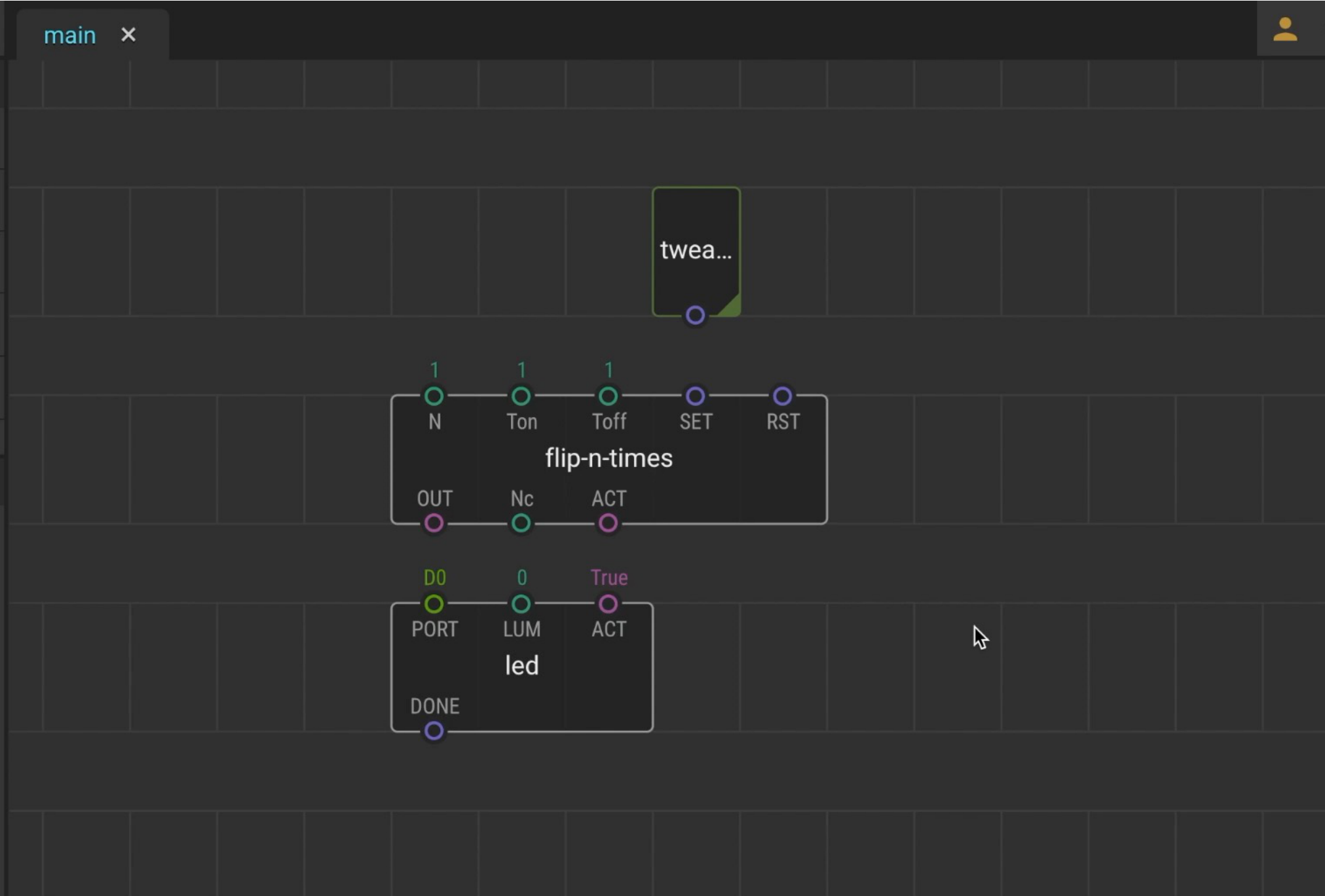
description

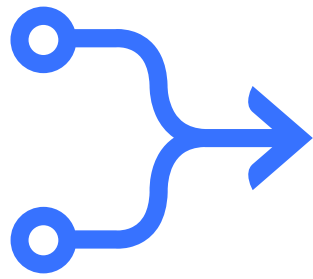
[Video Link](#)



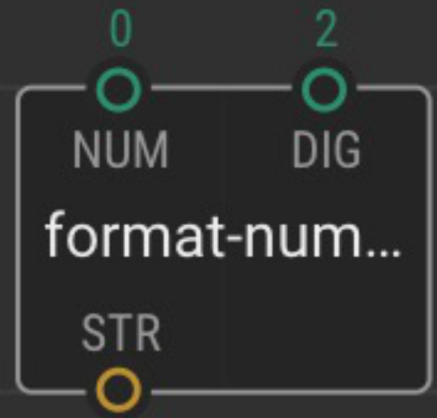
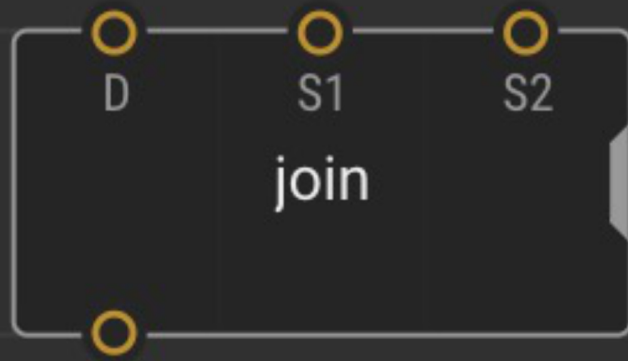
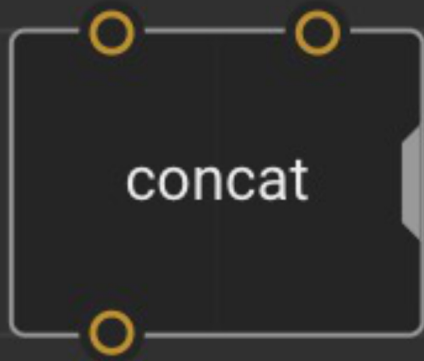
Flip, Clock and Count Nodes







Concat, Join and Format-Number Nodes

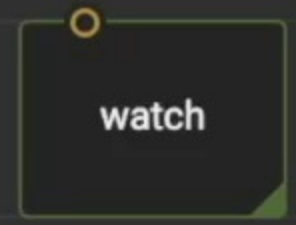
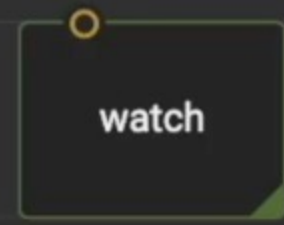
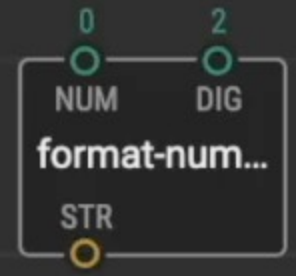
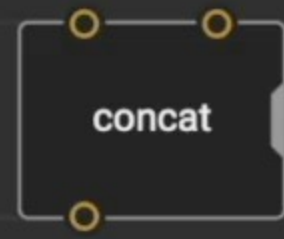


Project Browser

- My Project
 - main
- antoniorg/tcs34725
- awgrover/adafruitneopixel
- awgrover/conversions
 - data-to-pulse

Inspector

main x



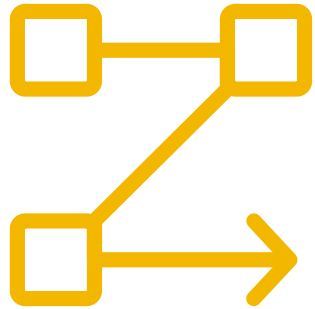
main

Description

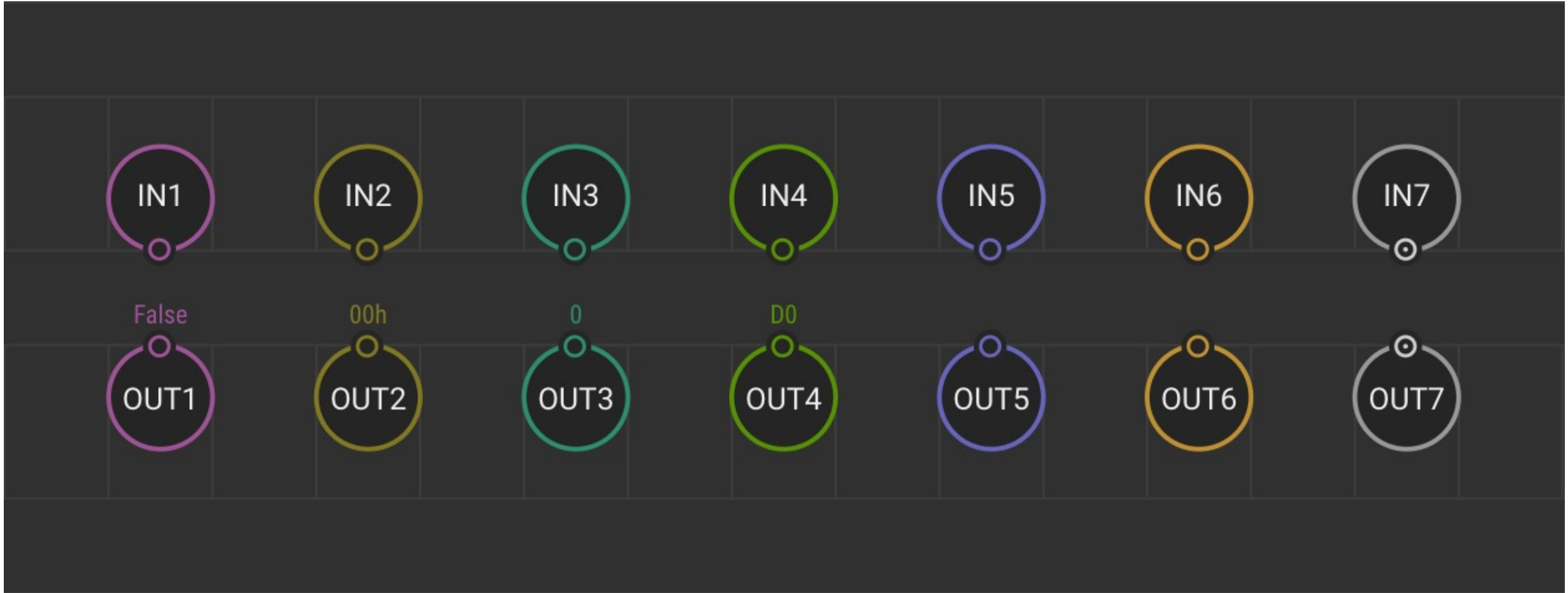
[Video Link](#)

Deployment





Creating New Nodes





The Challenge!

Breakout Rooms and Idea Session

- 1 Meet your new group and introduce yourselves
- 2 Work through Task 6 (p50-54)
- 3 Discuss ideas – what is the most interesting thing you can do with the OLED screen and other onboard devices?
- 4 Make a list – what things would you need to be able to make a device of your choice?

Thank You

More info:

www.biomaker.org

