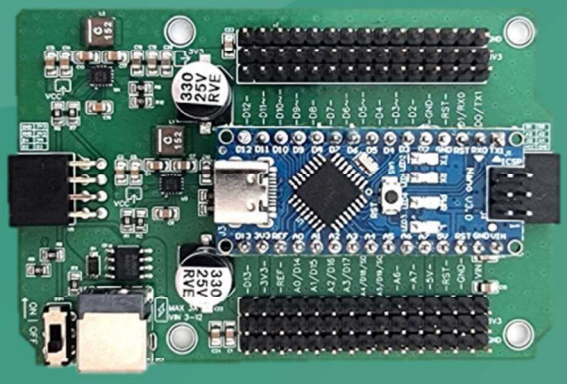
Leaphy

Electronics

&

Easybloqs

Manual



Leaphy Shield - Introduction

How does this book work?

In this booklet you will find lessons to learn how to work with the Leaphy Delphy and Murphy shield. By completing the assignments, you will automatically learn how to work with Leaphy electronics. In this way you can get off to a great start in the world of robots and technology!

Problem solved!

The Leaphy shields and robots do not always do what you want it to do. That's why you can learn so much from it. So: Go and give it a try. Feel free to make mistakes and carry on!

Arduino technology

On both the Leaphy shields you can attach a small computer called 'Nano'. This computer is part of the Arduino family and very widely used by techies all over the world. Together with the Leaphy shield you can easily learn how to work with computers. Work with it carefully, and you will enjoy it for a long time.

And now: let's get to work... Enjoy!

The Leaphy team

Delphy and Murphy Design: Bas de Graaf, review Ite
Lesson Material - concept and elaboration: Olivier van Beekum en Roeland Smith

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1 – Leaphy Nano computer

Leaphy robots all work with the Arduino nano or uno computers.
This chapter discusses the basic principles of Arduino.

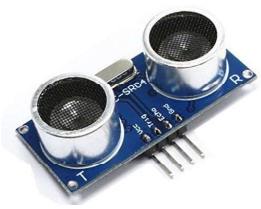
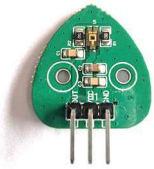
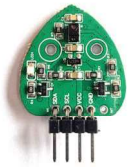
1.1 Arduino –Gateway to learning electronics

Quick and easy experiments with modern electronics. Easy and attractive for designers, artists and other creative thinkers. Technology that does not create a high barrier, but rather throws open the door. That was the goal of the group of Italian technicians who, under the leadership of Massimo Banzi, developed the Arduino mini-computer. The Arduino is now used all over the world, both at home by young hobbyists and by professionals in laboratories. Mission accomplished!

1.2 Feel and do - the basic principle of the Arduino

The Arduino computer itself has no keyboard and no screen. However, you can connect all kinds of electronics parts to it. This is easily done by connecting jumper wires onto the right pins. The electronics components can be divided into two groups:

Group 1 – (Examples of) sensors These are the senses of the Arduino and give way for robots to sense the world. There are many different sensors available. For example, there are sensors for measuring distance, light, color and movement and so on.

Group 2 – (Examples of) actuators These are the means by which the Arduino itself can come into action: servo motor, TT motors and LED lights for example.



1 – Leaphy and Nano computer

1.3 Linear Code

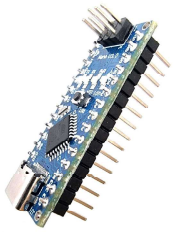
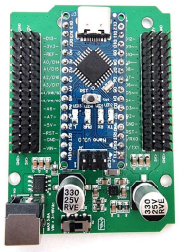
With the sensors and actuators, the Arduino can execute a computer program: the so-called linear code. This code is created with the free Arduino software IDE on a regular PC or laptop and put on the Arduino with a USB cable. A few examples of programs are: a light goes on when it gets dark, a buzzer buzzes when movement is detected, a Leaphy robot drives faster towards the light.

1.4 Leaphy Easybloqs Software

Program code is easy to type; that's not just for computer geeks. However, typing code takes a lot of time: a comma or a parenthesis is quickly forgotten. That's why Leaphy uses code blocks. This way you quickly get to the core of robotics: smart building and logical thinking and a lot of trial and error.

1.5 A robot asks for more – the shield

An Arduino computer can easily control LED lights, servo motors and Oleds. However, a robot has somewhat heavier motors and the Arduino computer itself is not robust enough for that. That is why in robotics a so-called *shield* is often used. The shield is a kind of extension of the Arduino computer: it has the same connection points for the sensors and the actuators as can be found on the computer, or even a little more. In the picture below, these are the black raised pins. Also clearly visible is the silver connector an additional connection point on the shield: for attaching the battery holder. When the Arduino gives a signal, the shield transfers the power from the batteries to the motors, without burdening the Arduino. The Arduino does the thinking, the shield does the heavy lifting.

Arduino Nano	*Shield*	*Nano on the shield*
		

1.6 Plus and minus

Sensors and actuators have multiple pins. Two pins are always used for the power supply: the plus and the minus. Different designations are used interchangeably for this. It's useful to know these. They are shown in this diagram:

Plus	Minus
+	-
V5 of V3	G
V of Vcc	GND
VMS	Ground

1.7 Input and Output

In addition to the power pins, there are also other pins; these are used to retrieve information from the sensors or to send commands to the actuators. Some of these pins are numbered. With this number you can include them in your code. Each information pin can be set as INPUT or OUTPUT with a command in the software. Do you want to create a project with a lot of sensors? Then you need a lot of INPUT pins. Do you have a lot of actuators? Then you set more pins as OUTPUT. So the Arduino is very flexible in this.

Before you can read more about the possibilities with these pins below, it is good to know that a number of pins are already in use on the Shield when used on the Leaphy Original or Leaphy Flitz. It is therefore not advisable to use them for additional sensors.

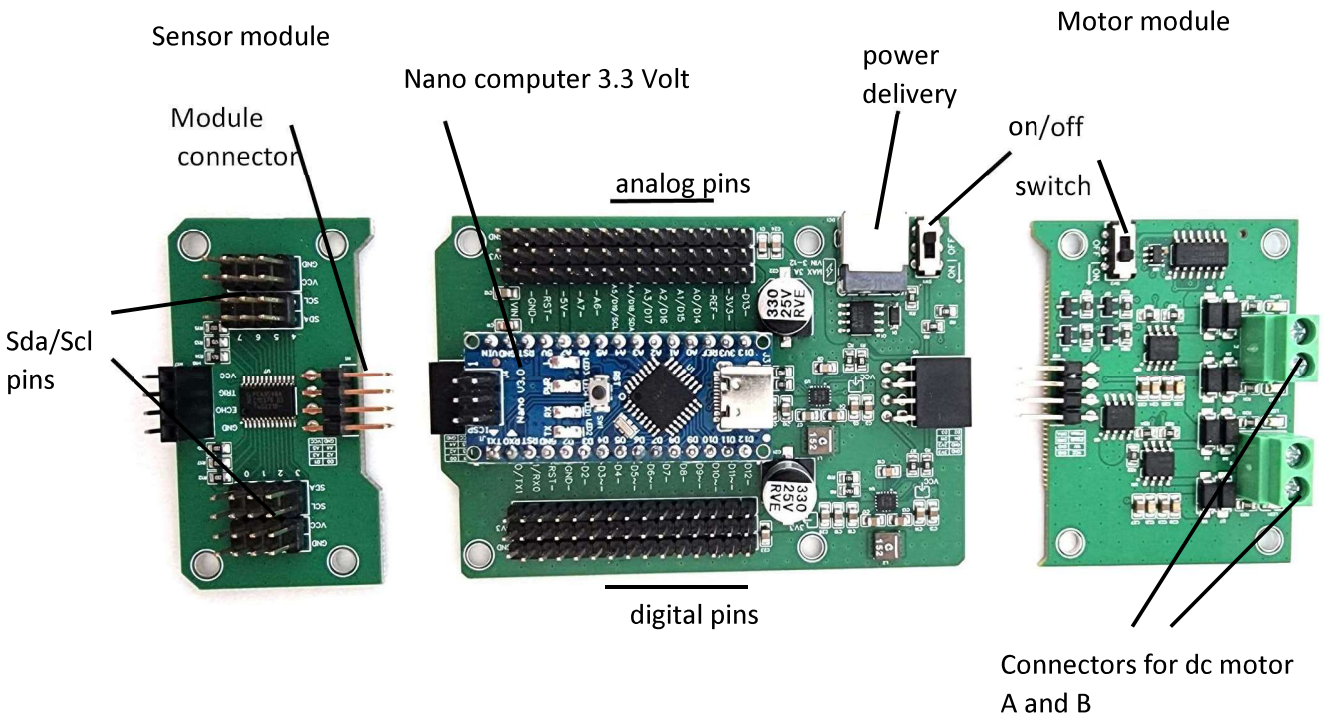
1.8 Two Leaphy shields, Murphy and Delphy what are the differences?

All Leaphy robots make use of either the Leaphy Murphy shield or the Leaphy Delphy shield. The Leaphy Flitz robot uses the Leaphy Delphy shield which is only suited for the regular 5v Nano computer. Leaphy Delphy output pins are always 5 volts. None regular nano like the rp2040 or ESP32 modelsuse 3.3 volts and can therefor not be used on the Leaphy Delphy shields without the risk of malfunctioning.

The Leaphy original robot makes use of the Leaphy Murphy shield which is suited for all Nano computers (regular, nano ESP32 and nano rp2040). Leaphy Murphy has two connectors on each side for connecting sensor modules and motor modules. The Leaphy Murphy output pins are 3,3 volts. Leaphy Delphy shields do not have these connectors for sensor and/or motor modules. These can be connected however making use of the regular connector pins on each side of the Nano computer.

The layout of the output pins are similar between both Delphy and Murphy shields and follow the lay out of the regular nano computer. All output pins are backed by a Gnd and Vcc pins. This makes connecting sensors and actuators very easy. Pin layouts for both Leaphy original as Leaphy Flitz are indicated in the next section.

1 Leaphy Shield - Murphy

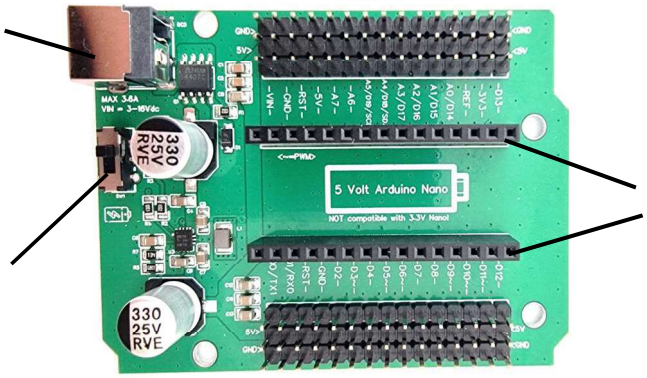


Pin layout for Leaphy Original

	D13		D12	
x	3V3		D11	*~ | PWMB
x	REF		D10	
Line L	A0/ D14		D9	~
Line R	A1/ D15		D8	Gnd
ECHO	A2 / D16		D7	B
TRIG	A3 / D17		D6	~ | G
I2C SDA	A4 / D18 / SDA		D5	R
I2C SCL	A5 / D19 / SCL		D4	~ | DIRB
Encoder L	A6		D3	~ | PWMA
Encoder R	A7		D2	DIRA
x	5V		GND	x
x	RST		RST	x
x	GND		D1 /RX0	
x	VIN		D0 / TX1	

	Sensor Module
	Available
	Motor Module
	Actuator

1 Leaphy Shield – Delphy



Pin Lay out for Leaphy Flitz

	D13		D12	
x	3V3		D11	~ | B
x	REF		D10	~ | G
Light	A0/ D14		D9	~ | R
	A1/ D15		D8	Gnd
	A2 / D16		D7	
	A3 / D17		D6	
	A4 / D18 / SDA		D5	
	A5 / D19 / SCL		D4	
	A6		D3	Servo
	A7		D2	IR
x	5V		GND	x
x	RST		RST	x
x	GND		D1 /RX0	
x	VIN		D0 / TX1	

	Sensor Module
	Available
	Actuator Module
	Actuator

1.9 **Digital pins-** The digital pin can only process two messages as INPUT: there is a signal or there is no signal. In code language: 1 (HIGH) or 0 (LOW). If you set such a digital pin with a 'reading block' to the 'INPUT mode', it will wait in the LOW position until the sensor emits a power signal: HIGH! You use this for your program. In the Leaphy software, you use the Digipin reading block: this lets the Arduino know that you want to read a digital pin.

1.10 Digital pin – Output (normal)

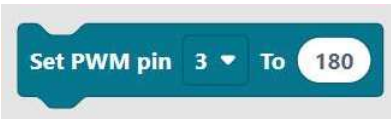
For example, in OUTPUT mode, the digital pin can turn on an LED light with the code 'true' (power ON) and turn it off again with the code 'false' (power off).

1.11 Digital pin – Output (PWM Function)

Sometimes turning actuators on and off digitally is too inaccurate. For example, a LED light that is completely on is far too bright. Or an engine is running way too fast. The digital pins 3, 5, 6, 9, 10 and 11 therefore also have a PWM function: Pulse Width Modulation. In this case, the power is not on continuously, but is sent out in short bursts: on-off-on-off-on-off-on-off. So it's digital, but very fast. This prevents the actuator from operating at full power. The light is a little less bright, the engine runs a little less hard. You can recognize these pins on the Arduino by this symbol: **~**

With the Leaphy Software command blocks, the motors and the three-color LED of the Leaphy Original are controlled with these PWM pins by default. Values between 0 and 255 are used for this. (If you enter 256, that's another 0 for the Arduino.)

The Leaphy command blocks also include a special block for sending PWM values via digital pins, where you can determine the PIN number yourself: **~** 3, **~** 5, **~** 6, **~** 9, **~** 10 or **~** 11. (Note: some pins are already in use for LED and motors. You can overrule that, but then those functions won't work properly anymore.)



2 – Actuators

2.1 – DC motors

For the Leaphy Original two TT motors are used to provide power for the wheels. These motors can only be connected to the nano via the motor module on the Leaphy Murphy shield.

The red wire is connected to '+' (Motor A or motor B) the black wire is connected to the '-' (Motor A or motor B).

2.2 – Servo motors

The are 4 types of servo's you can use, there is the regular servo for 180 degrees movements. Microservo's which are similar to the regular servo but much smaller. Rotating servo's for moving wheels and linear servo's for forward and backward movements.

All servo's can be connected to the digital pins, D0 to D19.

2.3 – I2C actuators

I2C actuators like the oled screen make use of the I2C communication protocol and should be connected to the Sda and Scl pins. There is only room for one I2C actuator or sensor on the nano. If you need to connect multiple sensors or actuators that make use of Sda and Scl pins you can use the I2C module. With this module up to 8 I2C sensors or actuators can be connected.

2 Leaphy original – Wheel motors

2.4 Wheel motors

The wheel motors of the Leaphy Original consist of two parts. The iron part is a DC motor. If the wires touch the iron, it can cause a short circuit. The yellow part is a gear mechanism that slows down the rapid rotation of the motor to speeds suitable for wheel movement. The yellow mechanism is loosely slid over the motor and can be slid off after removing the transparent plastic sleeve. Swapping the wires causes the motor to turn in the other direction.

The shield uses a total of four digital pins to control the two motors. Via pin D3, the Arduino tells the shield how much PWM power needs to be sent to the connection points of motor A. This sets the *speed* of that motor. Pin D11 does the same for engine B. Changing the direction of travel is also done by software. Pin D2 is used for motor A. If this pin is set to 1 (HIGH), the current goes one way and so does the motor. If the pin is set to 0 (LOW), the poles will switch and the motor will turn in the opposite direction. Pin D4 does the same for engine B. In the Leaphy Easybloqs software, all these code commands are hidden behind simple command blocks:

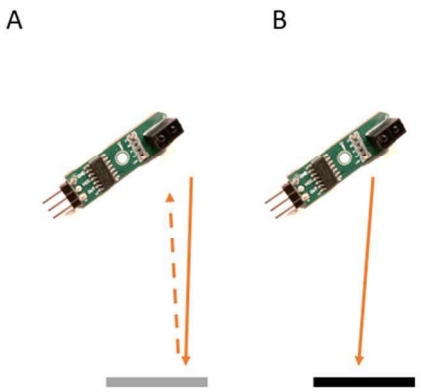
Using the Leaphy command blocks *'set digipin'* and *set 'pwm pin'* can also be used to control the engines:

3 – Three types of sensors

3.1 – Digital sensors

Digital sensors work like a switch in which the measured value is either 0 or 1. A good example are infrared sensors that measure the amount of reflected infrared light. For digital sensors one can use digital pin D0 to D19.

Assignment: Identify the 3 different types of sensors described below. Try to look for clues by looking at the amount and types of pins as shown on the sensor itself.



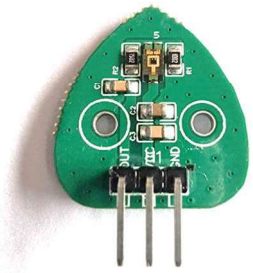
A. Emitted light, value=1
B. No emitted light, value=0

3.2 – Analogous sensors

Analogous sensors measure a value between 0 and 1023. Analogous sensors can be programmed using the 'read anapin' block. For analogous sensors one can use the analogous pins A0 to A7.

On the right you see the analogous light sensor which enables detection of the amount of light.

Assignment: Look up the analogous pins A0 to A7 on the Leaphy shield.

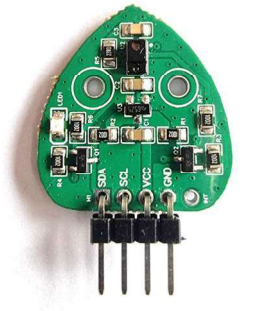


3.3 – I2C sensors

I2C is a serial communication protocol that allows multiple devices to talk to each other using only two pins: Sda and Scl. Here you see the ambient light sensor for detecting movement and color.

Sda :transfer of data takes place through this pin, Scl: serial clock carries the clock signal. Its main purpose is to synchronize the operations of a digital system and follows in time to coordinate its sequence of actions.

Assignment: Try to find the Sda and Scl pins on your Leaphy shield.



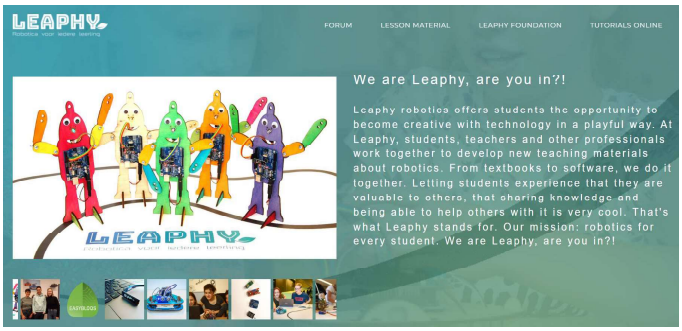
4 – Programming Software

Congratulations! You have just started to embark on a great journey and explore the world of programming. In this level, we'll explain how to get started.

4.1– Building

You can learn how to put the nano and Delphy shield together with the help of instructional videos on the Leaphy website.

Assignment: Look up the instructional videos for the Leaphy Delphy shield on Leaphyfoundation.com.



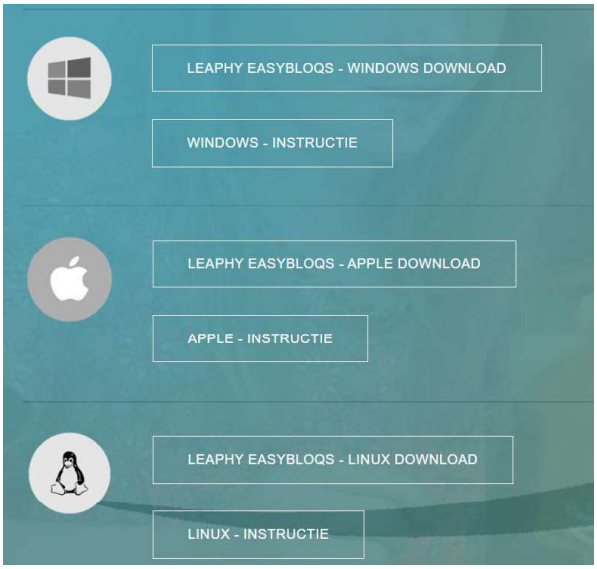
4.2–Installing Leaphy Easybloqs

To program your Leaphy development board, all you need is a computer with WiFi and USB port.

You can use our webbased programming software which you can find on leaphyeasybloqs.com. Or go to Leaphyfoundation.com to find a downloadable version of the program.

Do you use leaphyeasybloqs online together with a Windows computer? Then do not forget to also install the drivers, which you can find under 'More' in the top menu.

Assignment: make sure you can use the Leaphy programming software (online or installed) on your own computer.



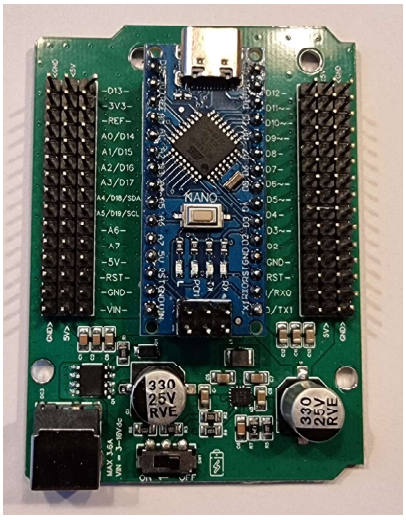
5 – Connections: RGB led

The Leaphy shield contains 3 different rows of pins on each side of the nano computer. The most outer pins are the Gnd pins (Ground or minus), the middle row are Vcc (Voltage or plus) and the inner row are the Out pins (data pins). Please take care, there are multiple ways to connect sensors, motors and Led lights, what is shown here is just one example of how to connect and program the various electronic parts.

5.1 – shield and nano

The nano computer is attached to the Leaphy shield as shown in this picture on the right. The shield connects the nano to the rows of pins on the left and right of the development board. In this way you can easily connect sensors and lights to it.

Assignment: Find out which 3 different types of pins there are on the shield.



5.2 – Connecting the RGB led

There are various ways to connect an RGB light to the shield. An easy way to connect the RGB led is shown in the diagram below. You will need a 4 pin jumperwire to make this connection.

On the back of the light are the signs:

Gnd	Ground
R	Red
G	Green
B	Blue

Assigment: Connect the RGB light using the diagram shown here.

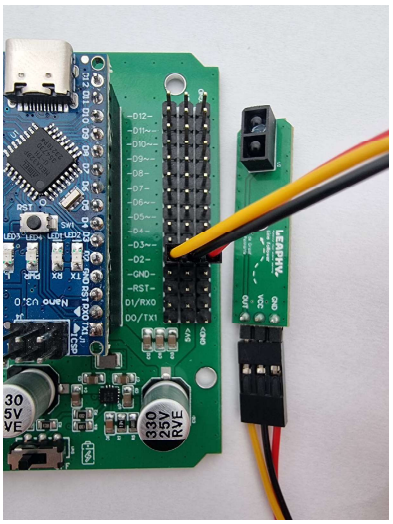
RGB-Led	Delphy shield
Gnd	D8
R (Red)	D11
G (Green)	D10
B (Blue)	D9

6 – Connections: IR sensor

6.1 – IR sensor connection

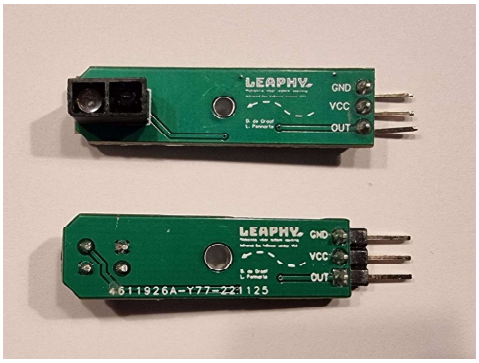
Many of the sensors we use have 3 types of pins: Gnd, Vcc and Out. These fit on the pins of the Shield. The out pins for sensors have numbers that start with a D (Digital) or A (Analog).

Digital pins only measure 0 or 1, analogous pins can make measurements between 0 and 1023. Furthermore there is one set of Sda/Scl pins that are used by a particular group of sensors.



6.2 Assignment: Check that the wires of the IR sensor are connected as shown in the right diagram. The out pin of the sensor on D2 (digital pin 2) of the shield, Vcc on 5V (middle row of pins of the shield) and Gnd on the outer row of pins on the shield. You can also use the schedule on the right or the photograph from the previous 6.1 section.

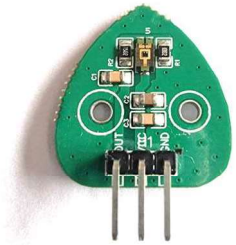
IR sensor	Delphy shield
Gnd	Gnd
Vcc	5V
Out	D2



7 – Connections: light sensor

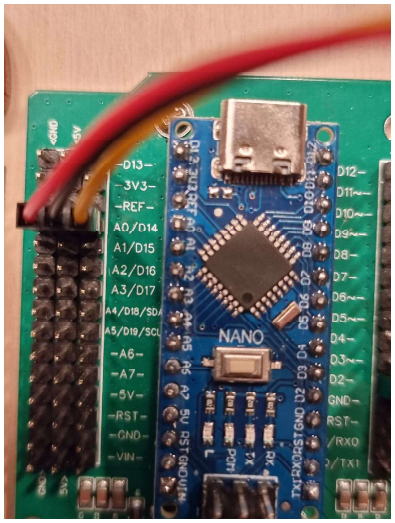
7.1 –Light Sensor Connection

In the picture on the right and the diagram below you can see how to connect the light sensor. The light sensor has three pins ‘out’ for data output (a number between 0-1023 depending on the amount of light) In the middle Vcc (3,3-5v) and next to this a Gnd pin.



7.2 – Light sensor connection

Here is a picture of the connection of the wires of the light sensor to the computer. The out pin of the light sensor is put on pin A0 of the shield. Vcc of the light sensor pin is connected to the 5v pin of the shield. The Gnd pin of the sensor is connected to the pin belonging to the outer row on the shield.



7.3 – Light sensor diagram

The wires of the light sensor are connected according to the diagram on the right.

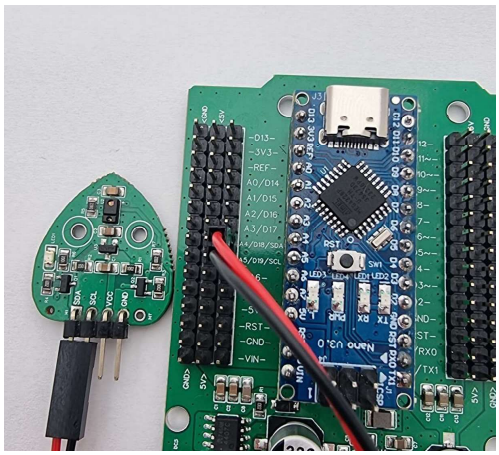
Light sensor	Delphy shield
Gnd	Gnd
Vcc	5V
Out	A0

8 – Connections: ambient light sensor

8.1 –Ambient Light Sensor Connection

In the picture on the right and the diagram below you can see how to connect the ambient light sensor. This sensor makes use of I2C for communication with the nano computer. For this the sensor makes use of Sda and Scl pins next to the Gnd and Vcc pins.

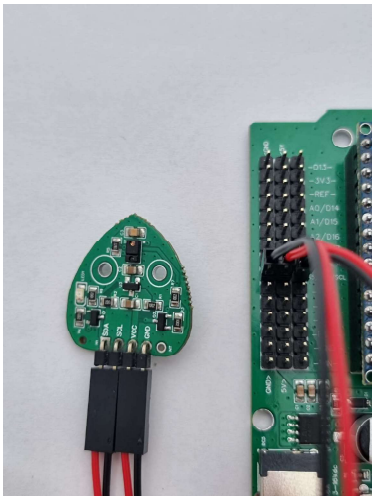
First connect the Sda and Scl pins of the sensor to the Sda and Scl pins of the shield using a 2pin jumperwire.



8.2 –Ambient Light Sensor Connection

Next connect the Gnd and Vcc pin of the sensor to the shield.

As you can see the nano computer has one Sda and one Scl pin and so one can connect only one ambient light sensor. For connecting more ambient light sensors there is an I2C extension board.



8.3 –Ambient Light Sensor Connection

The wires of the ambient light sensor are connected according to the diagram on the right.

Ambient light sensor	Delphy Shield
Sda	Sda
Scl	Scl
Vcc	5V
Gnd	Gnd

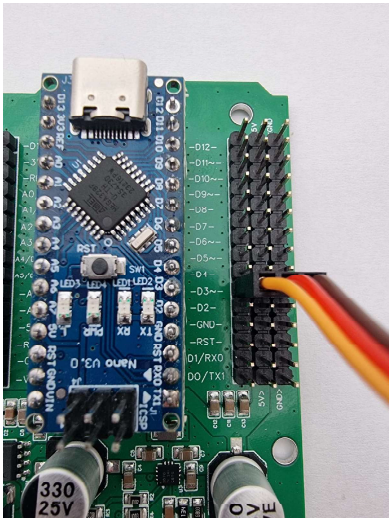
9 – Connections: servo motor

9.1 –Servo Connection

Normally servo's are motors that can move between 0 and 180 degrees. Servo's have 3 wires, one Vcc (red), one Ground (brown) and one control wire (yellow/orange). Servo's can be connected to all digital pins D0 to D19 on both the Leaphy Delphy and Murphy shield.

9.2 – Servo connection

Here is a picture of the connection of the wires of the servo to the computer. The out pin of the servo (yellow wire) is on digital pin 3 of the shield. Vcc of the servo (Red wire) is connected to the 5v pin of the shield. The Gnd wire (Brown) of the servo is connected to the pin belonging to the outer row on the shield.



9.3 – Servo motor diagram

The wires of servo are connected according to the diagram on the right.

Servo motor	Delphy shield
Brown	Gnd
Red	5V
Yellow	D3

10 – Programming

The Leaphy shields can be programmed with 'Leaphy Easybloqs', the block code of the Leaphy Software. In this level you will learn more about that.

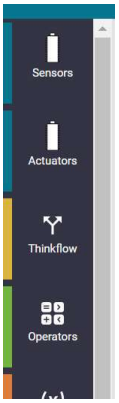
10.1 – Choose Leaphy Arduino nano

Start the Easybloqs program in your web browser via www.leaphyeasybloqs.com and click on the Arduino nano image.

10.2 – Different groups of programming blocks

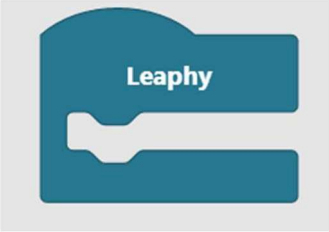
On the left side of your screen, you will see different groups of programming blocks.

The dark green Leaphy blocks at the very top are all action blocks which can give a call to action. Led Red, Green and/or Blue on and off, reading digital pins or analogous pins. With the 'show' blocks, you can show the values that a sensor transmits to the computer. More on this later.



10.3 – Leaphy block

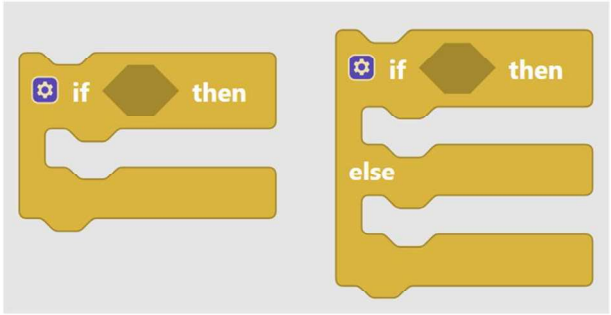
Programming is done by stacking the different blocks on top of each other in the right order. Please note! Only blocks that are between the 'Leaphy' block are sent to the nano computer.



10 – Programming

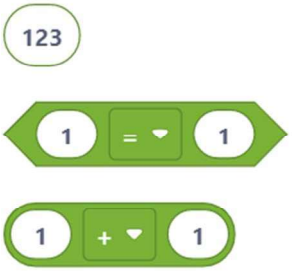
Level 10.4 – Yellow Thinking Step Blocks

The yellow thinking step blocks tell you when, how often and for how long the nano computer has to do something. In the empty spaces between the words IF and THEN you can put blocks with 'situations'. You will also use the repeat forever block a lot.



10.5 – Green Number Blocks

You use these blocks to compare, a value is less than < or larger than > or equal to = the value that the sensor measures.



10.6 – Orange Variable Blocks

The orange variable blocks are special because you can give them a name yourself. These blocks are like trays in which the nano computer stores numbers or even a calculation. So you can give each container its own name.

10.7 – Custom Blocks

With the light blue subprogram blocks you can merge a program you have created into 1 block. Very useful when you are going to make longer programs.

10 – Stacking Blocks

Now that everything is properly connected, you can create your first program in this level and learn how to get it on the nano computer.

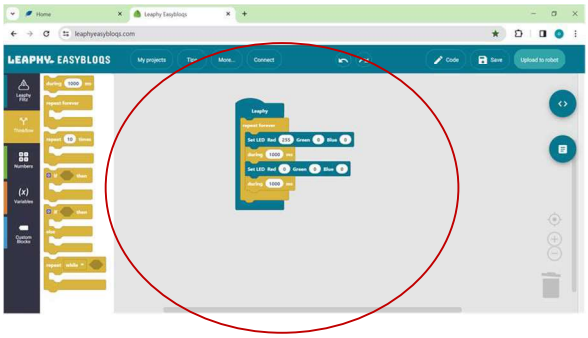
10.8 – Programming

All the separate parts of the program have been explained, but how do you make a program?

On the left side of the screen are the different groups. Click on the group you need command blocks from. You always start with the blue-green starting block 'Leaphy', which is already present.

10.9 – Build

Drag the individual command blocks to the center of the screen. This is the programming field, this is where you build your program. You do this by stacking the different blocks in a logical order on top of each other and in between the Leaphy block.



10.10 – Repeat and Wait

Put a 'Repeat forever' block around each program.
Otherwise, the nano computer will only do everything once for a split second.

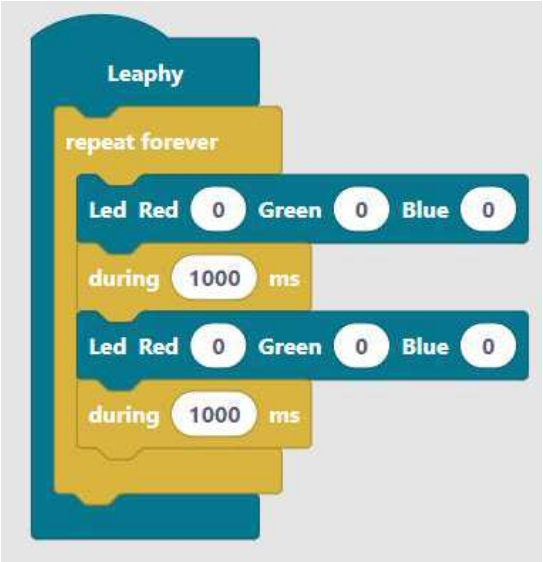
Use waiting blocks. The green LED light in the example on the right will turn on for such a short time that you won't see it. Then it goes to red again. Which block do you have to add to see the green light?

10 – Blink

10.11 – changing colors

Now that you have mastered the basics of programming the Leaphy shield we can move to our first programming assignment

Assignment: Program your shield so the the LED light will blink red. Build the sketch as shown here and finish it.

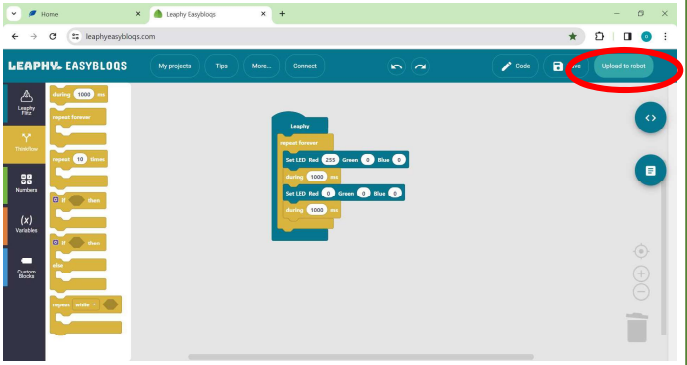


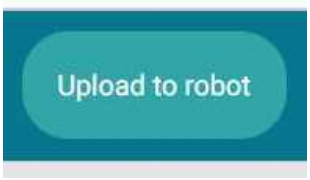
10.12 – Upload

Finished stacking? Then you can now upload the program to your nano. But how do you do that? It's easy:

> Connect the nano computer to your laptop with the USB cable.> Click on the 'Upload to robot' button and you're done! If all goes well, the Led light will now come on after a few seconds.

Assignment: what messages do you see in between on your screen?



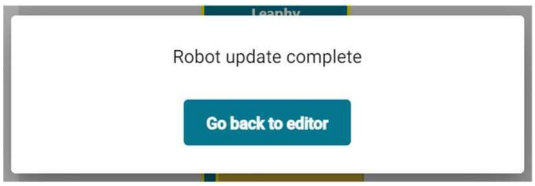


10 – Test & Save

10.13 – Testing

Often you have to wait a while uploading a sketch but hopefully you will get this message at the bottom of your screen: 'upload completed'. Congratulations, you've now put your first program on the nano!

Assignment: How many colors can you make? Yes exactly, all! Mixing colours with light! Try making purple or even pink.



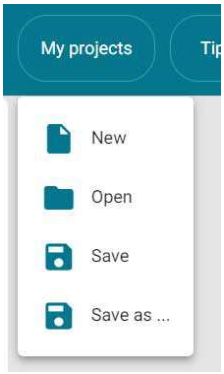
10.14 – Save

Some programs take a lot of time to make, and sometimes you want to save them to use again later. Here 's how to save a sketch:

>Go to 'my projects' at the top left of the text bar

>Go to 'save as' and save your file

>You can also open it in this screen, via 'open'

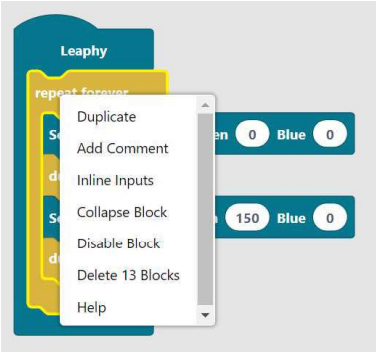


10.15 – Add Comments

When you share a program with others, it is sometimes useful to add comments to the command blocks. This can be done in the following way:

> Move the arrow over the command pad and press the right mouse button

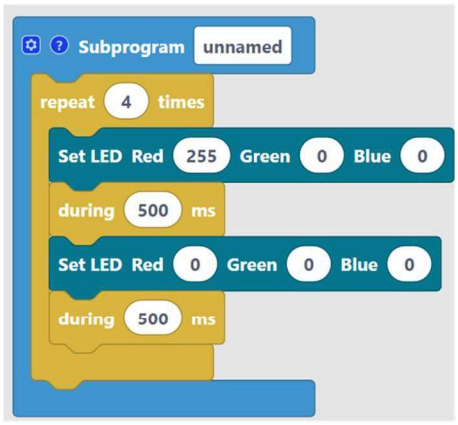
>Click on 'comment' and start writing!



10 – Subprograms

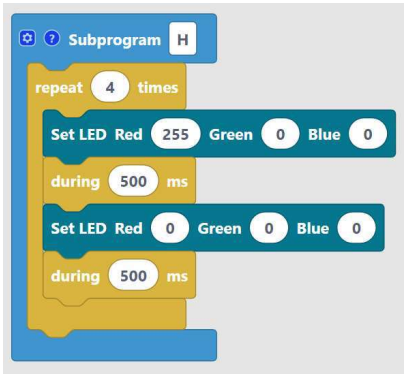
10.16 – Subprogram block

Some sketches can become very long. To keep things clear you can fold long sketches into one block using a ‘subprogram’. Shown here is an example of the morse code for the letter H, (blink four times) which is folded into a subprogram block.



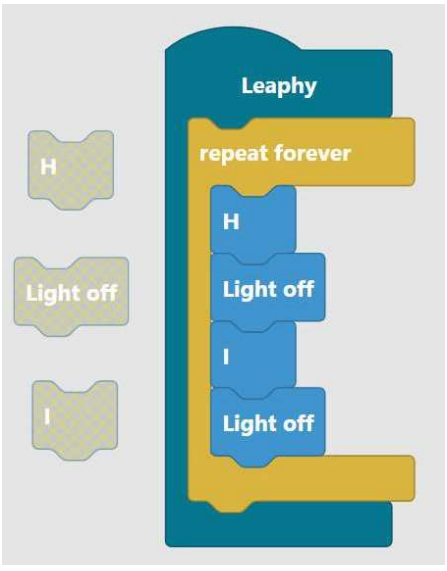
10.17 – Make a letter

At the top right, you can give the block a name, for example 'letter H'



10.18 – Whole Alphabet

Now a new block will appear with your code 'in it'. You can do this for every sketch. In the example given here a morse code for the word ‘HI’ was made using subprogram blocks.



11 – Digital sensors: the IR Sensor

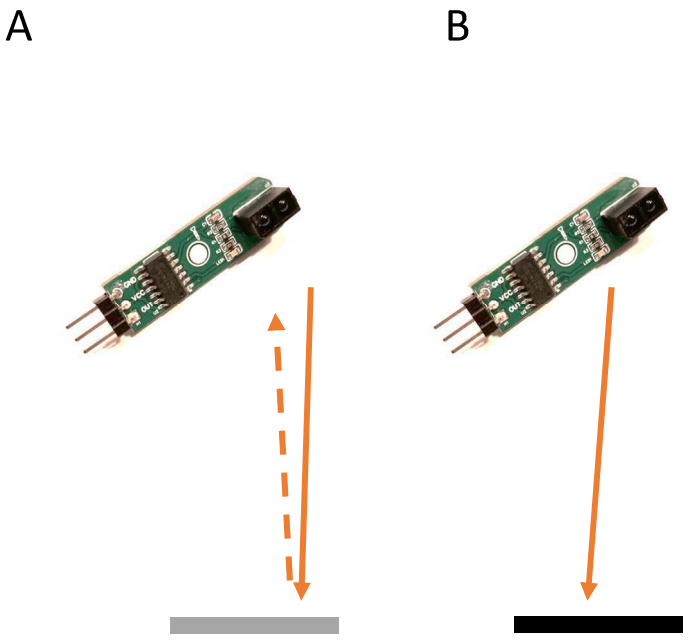
To know and to perceive what is happening around us, people have senses such as eyes and ears. Leaphy robots can also perceive the environment with senses, which we call 'sensors'. In the next chapters we will discuss the three different kind of sensors and how to program these.

Level 11.1 – How does the IR sensor work?
If you look closely, the infrared (IR) sensor has two 'lights' on the end, one black and one white.

The white light emits invisible (infrared) light. If that falls on a surface, the light bounces back to the black light a bit. That black light is actually not a light but a receiver.

The receiver only sends a signal to the nano computer when there is reflected infrared light.

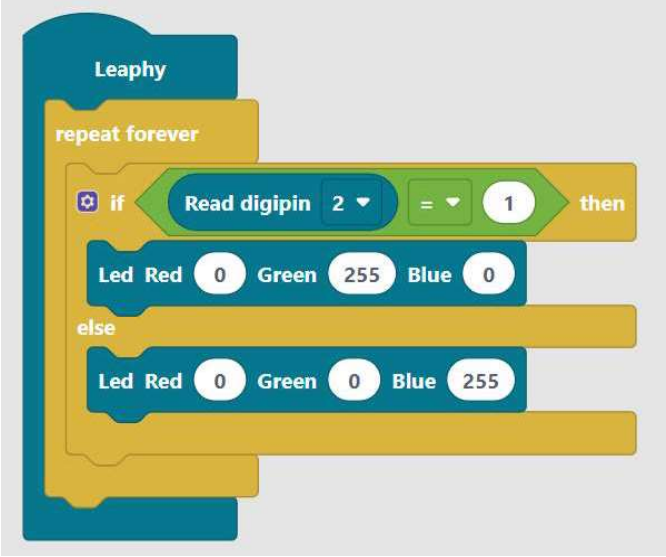
So the IR sensor can only measure two things, there is reflected light: the value is 1 or there is no reflected light: the value is 0. This sensor is there for a digital sensor.



A. Emitted light, value=1
B. No emitted light, value=0

Assignment: create the program on the right and test whether your IR sensor works. Beware you need a white background in order for the sensor to detect enough reflected light. What color does the light turn when you hold a piece of white paper near the sensor?
Caution: daylight can confuse the sensor. Then close the curtain!

Assignment: Can you program the sensor in such a way that the light turns red without changing the blue blocks?



12 – Analogous sensors: the light sensor

In addition to the IR sensor there is also the light sensor. The light sensor works completely differently than the IR sensor. In this level you will learn how the light sensor is different from the IR sensor and how to program it, read on!

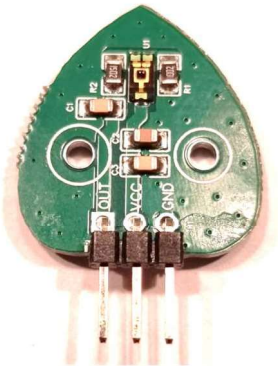
12.1 – What do we measure?

The light sensor measures light intensity. In other words, the light sensor measures how much light is in the environment.

The sensor gives this amount of light a number between 0 and 1023 and returns this to the nano computer. On the right you can see what those values roughly mean.

Digital & Analog

This is different from the IR sensor, which only works with 0 or 1. The IR sensor is therefore a sensor that is 'digital'. The light sensor gives 1024 different values, which is called analogue.

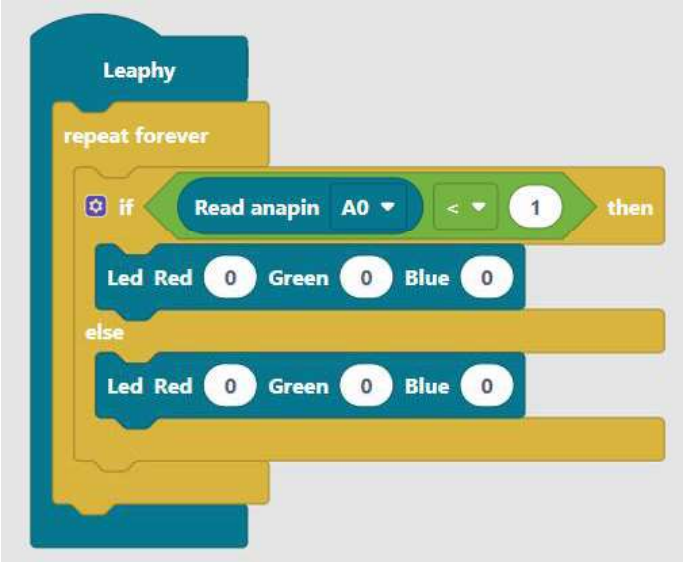


Completely dark	*50*
Living room by day	*500*
Daylight clouded	*800*
Daylight sunny	*900*
Torch light close by	*1000*

Assignment: Make connected LED change color when it gets dark. Start with the program as shown on the right and enter the values for LED yourself.

Assignment: Try to find out which value you need to enter for the light sensor. You can use the diagram above as a starting point.

Assignment: Can you also make the LED blink in the dark?



13 – I2C sensors: Ambient light Sensor

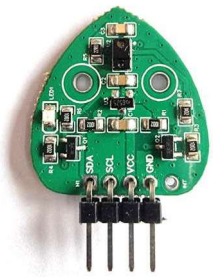
The ambient light sensor can measure both color and movement. In this chapter you can learn how to program the sensor to both measure color or movement using the different programming blocks.

Level 13.1 – Ambient light sensor: two in one

The ambient sensor can measure Red, Green and Blue light (RGB). When measuring color the sensor gives a number to each color between 0 and 255 for the amount of light in the environment.

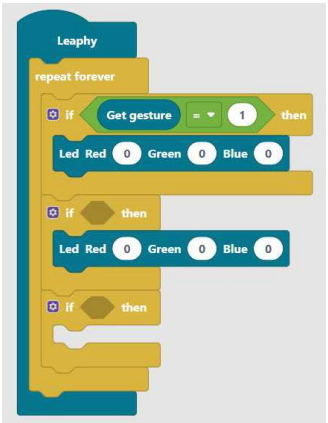
Clk and Sda sensors: Clock and Data

The ambient light sensor makes use of the Sda and Clk pins on the Arduino computer. You can connect these at the Clk and Sda denoted pins found on the shield.



Assignment: Make the LED change color when the ambient sensor detect movement. Start with the program as shown on the right and enter the values for the sensor and LED yourself.

Movement	Output number sensor
Up	0
Down	1
Left	2
Right	3



Assignment: Can you also make the LED show the color the ambient sensor detects?

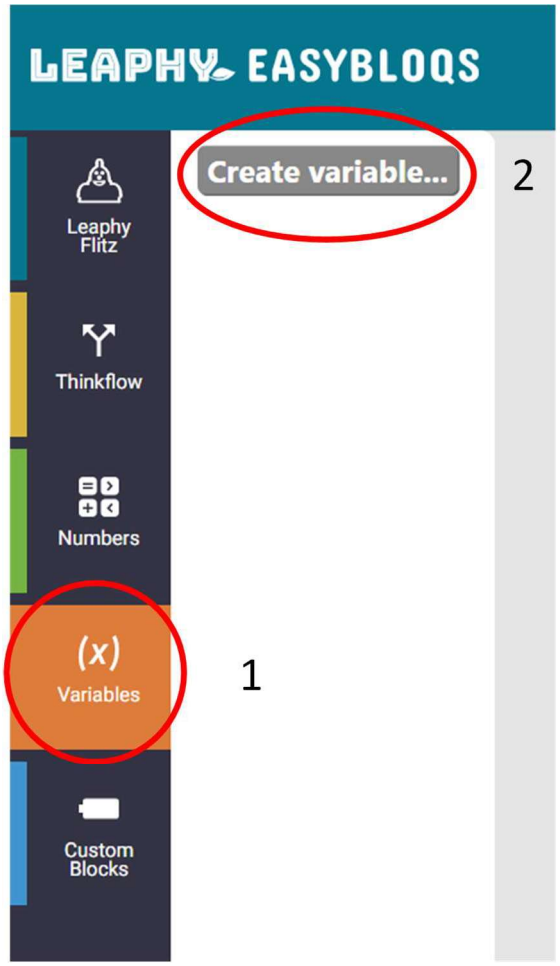
14 – Variables

14.1 – Blue or green?

You can use the RGB light connected to the Leaphy Delphy as a color die. The nano computer can generate random numbers. You can use those numbers to turn the colors of the RGB led on and off.

Assignment: Create a variable. You can do this with the orange blocks, just take a good look at the pictures on the right. Click on 'create variable' and name your variable: 'Color choice'. Now 3 new orange blocks will appear as shown on the right.

.

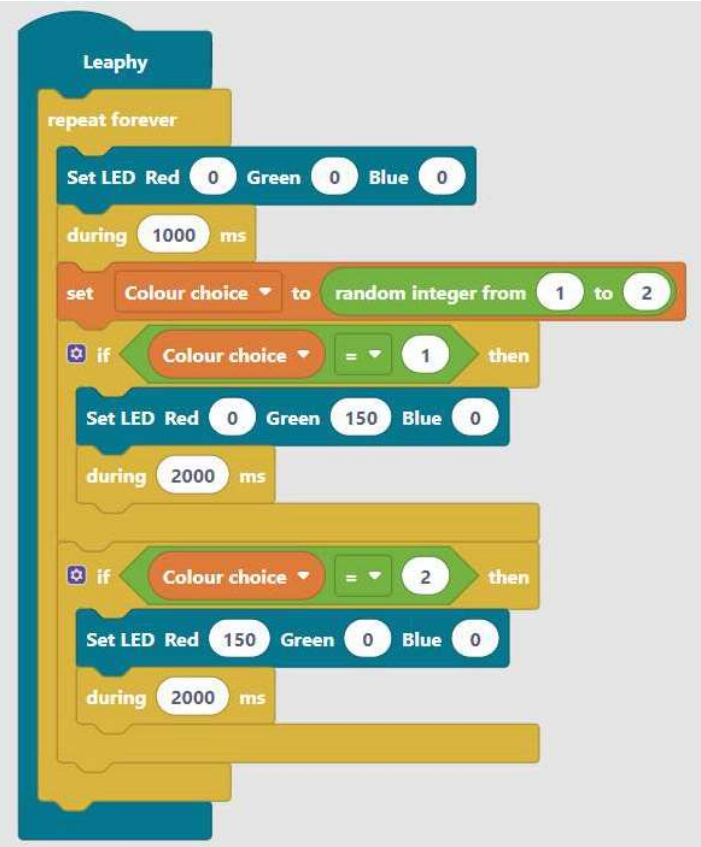


14 – Variables

Assignment: Now make the program on the right that rolls the dice between two colors. You can see that at the top the lights are turned off every time. Just try what happens if you don't.

Assignment: Can you roll the dice with three colors? Give it a try!

.

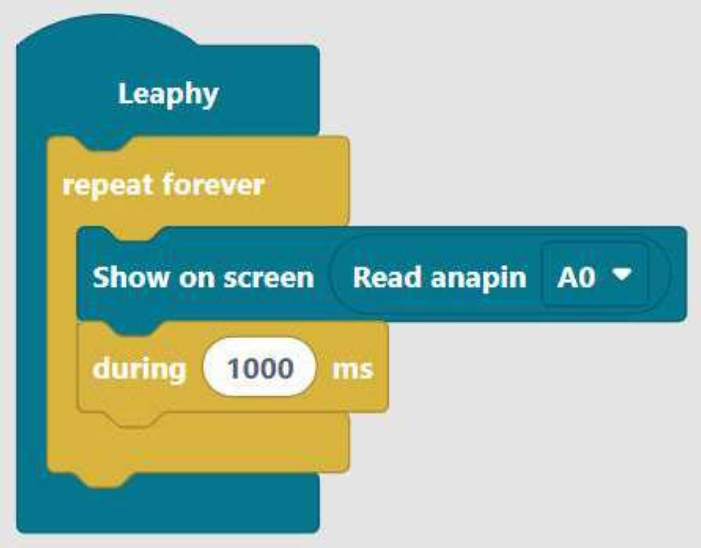


15 – Measurement on your screen

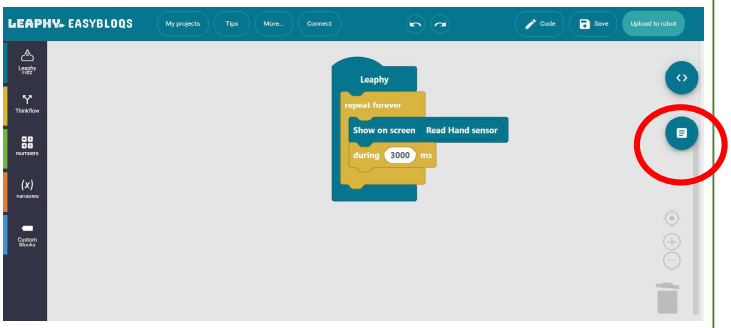
15.1 – To measure is to know?

You can show the values that are measured by the various sensors. In this example we will use the light sensor. How? Use the 'Show on screen' block. You can find this block in the group of actuators.

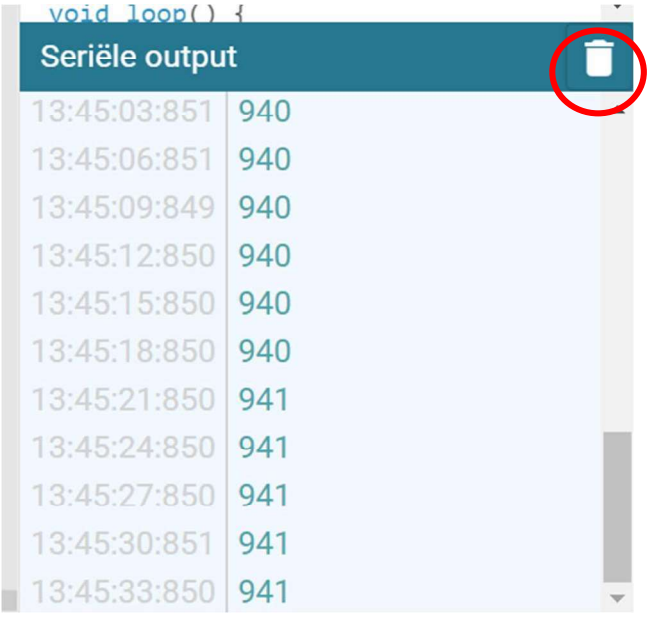
Assignment: Create the program as shown on the right and upload it to the nano.



Assignment now measure the amount of light at different places in the room. You can do this by clicking on the script button as indicated on the right. Now you can see the values that the nano measures with the light sensor at the bottom right of the screen.



By clicking on the trash can icon, the nano starts measuring again. Where is there more light, by the window or inside by the light?



16 – Servo motor

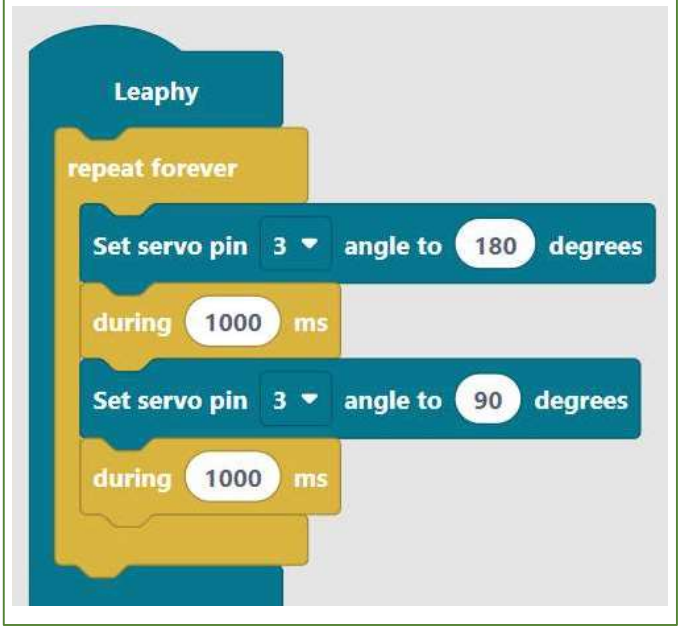
In this chapter we are going to learn how to program the servo motor. Using a servo motor enables you to make movements between 0 and 180 degrees. How? Just read on!

16.1 – Moving servo

To move the servo arm, you can use the command block servo arm. By default, this is on pin 2 while our arm is attached to pin 3. So you have to adjust this and set the 'Set servo pin' to 3.

Assignment: With the program on the right you can make the servo swing.

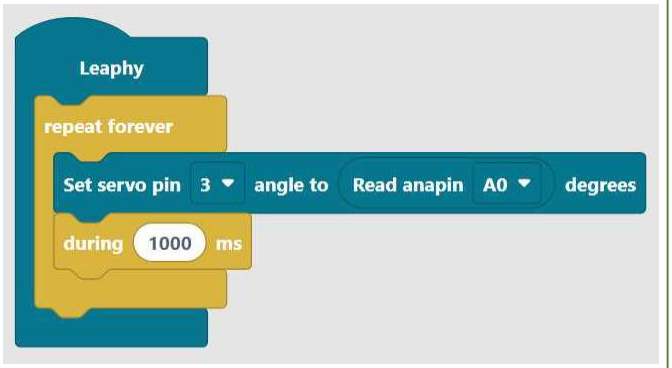
Assignment: Can you also think of a program where the servo only swings when you hold your finger near the infrared sensor? Think of the 'if then different' command block



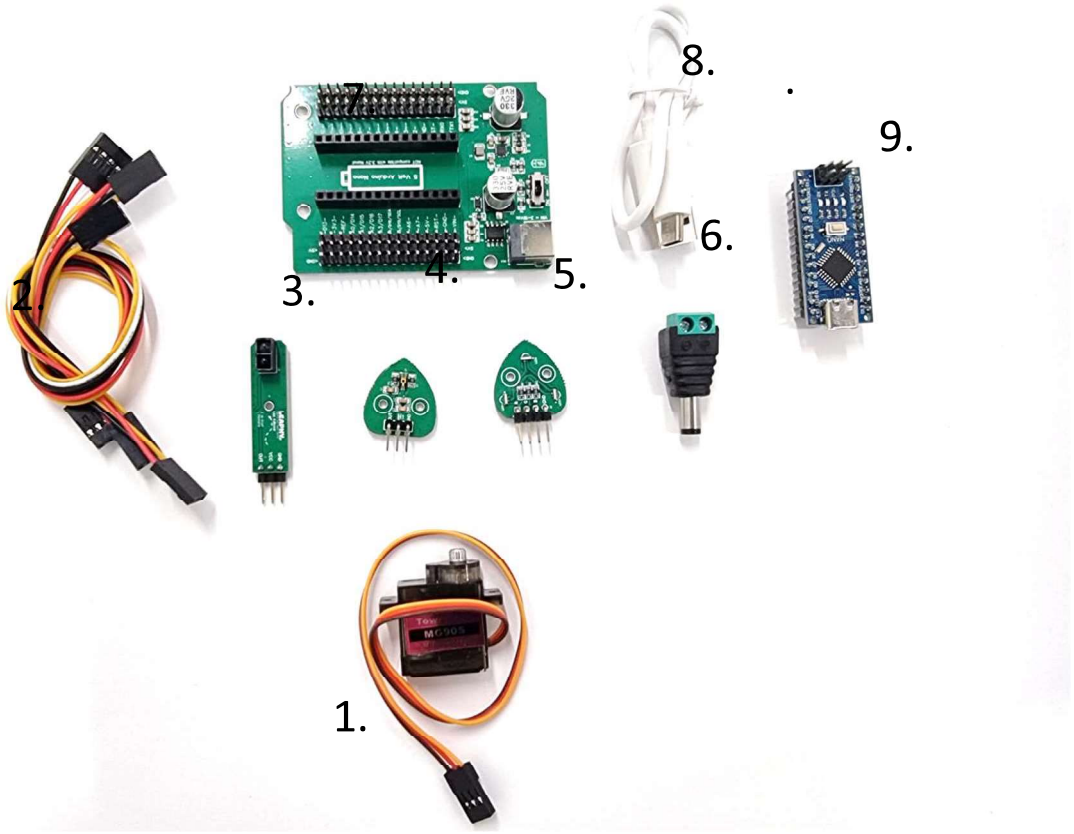
16.2 – Servo as a light meter

By using the read A0 sensor block together with the servo block you can program the nano computer as a light meter

Assignment: Recreate the program on the right and upload it to your nano computer. What happens to the arm when you hold the nano near the window?



Delphy kit contents



1. Servo metal gears
2. Jumper wores (2x 3pin and 1x 4 pin
3. Infrared sensor
4. Light sensor
5. Tri Led
6. Battery adapter
7. Delphy shield
8. USB-C wire
9. Regular Nano

Leaphy – next Chapter?

So that was it, wasn't it? Have you got the hang of it and are you ready for the next level? Then take a look at our robots on Leaphyfoundation.com. Or maybeyou want to design your own robot, check out our Youtube channel for the latest tutorials and stay in touch!

Have you come up with something new for the Leaphy foundation? Let us know by sending an email to contact@leaphy.nl or post a message on our forum on Leaphy.nl

The Leaphy Team

The Leaphy Foundation is supported by: