# F Demo set quick start guide

This quick start guide is Appendix F of the Bachelor Thesis Report: Lauper, JR (2020): "Robots Collective Behavior Demos. Using Embedded Programming with E-Pucks vers.1 (dsPIC) and Sound". https://github.com/jrlauper/jrl_epuck/blob/master/Lauper%20(2020).%20E-pucks.%20Report.pdf .

This short guide is intended for users who have at their disposal a group of e-puck robots already flashed with the .hex file[1] corresponding to the demo set described in Table 1, p.iii. It briefly presents the steps required to launch one of the programs of the set.

**(1)** Check the charge of the batteries you are going to use.
The easiest way to do it is to fully charge the batteries before use.

**(2)** Insert the battery in each robot.
To manipulate the robots safely:

- Do not grasp them by their circular bumper: this one detaches easily from the robot body;
- Instead, grasp them directly from the front and back of their transparent body with forefinger and thumb: this allows a good grip without any risk of damaging the different sensors (see Figure F.1).

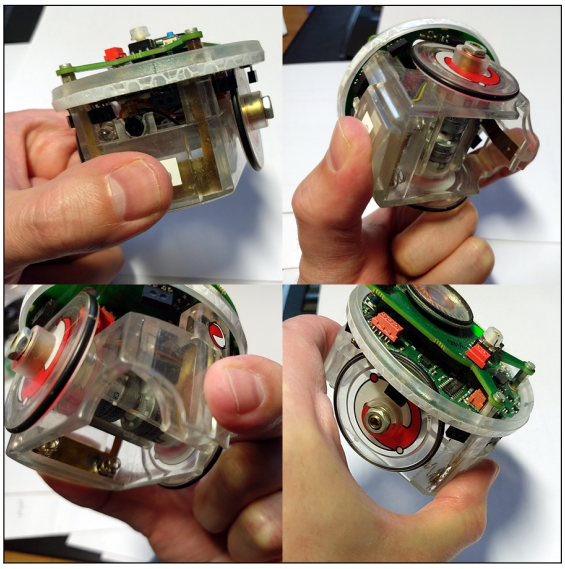


**Figure F.1:** Series of photos showing how to grasp the e-puck securely.
The best way is to grasp the transparent body of the e-puck with forefinger and thumb. Contrary to what we tend to do spontaneously, don't grab the e-puck by the bumper, which detaches very easily. Be careful not to touch the camera with your finger on the front part of the robot body.

[1] https://github.com/jrlauper/jrl_epuck/blob/master/jr_demo/jr_demo.X/dist/default/production/jr_demo.X.production.hex

**(3)** Locate the following two components on the upper robot support (where the speaker is located) (see Figure F.2).

- the reset button;
- the small white manual selector (approximatively 5 [mm] diameter).
  - On it, position 0 is usually indicated by a black marker line.
  - If not: when in front of the robot, it is located at 9 o'clock
  - To increase the position value: clockwise.

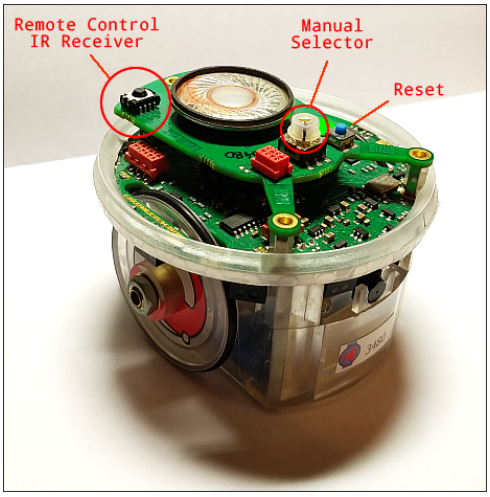



**Figure F.2:** Position of the remote control IR receiver on the e-puck

At this point, it all depends on whether or not you use a remote control to control the robots. The use of a remote control is highly recommended if possible because it makes everything much easier, from choosing the program to launching the robots.

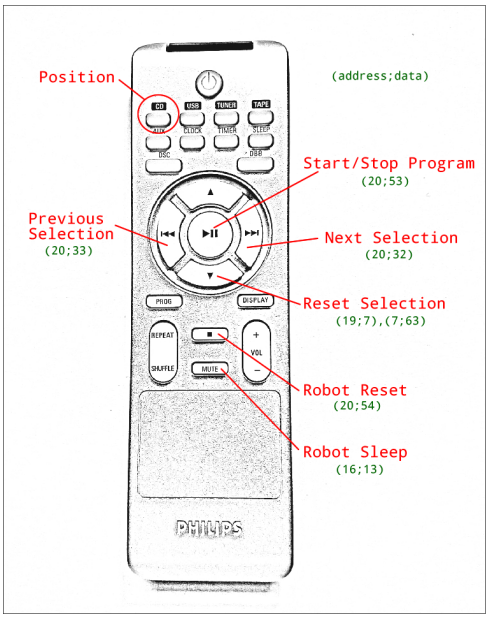



**Figure F.3:** Sketch of the remote control we used in our experiments with the couple (address;data) assigned to the buttons used. The "CD" position must be chosen because, on this remote control, the same button can send different signals in other modes such as "tuner" or "tape".

## F.1 Using a remote control

- From now on, "[button]" refers to a button on the remote control.
- Requirement: the robots have been flashed with a version of the demo set adapted to the remote control you are using. To see how to adapt the demo set code to a specific remote control, see section C.3.

**(1)** On the robot, set the white manual selector to position 14.
To do it, start from position 0 and go back 2 notches (clockwise).

**(2)** Place the robots at least 4-5 [cm] away from each other and from any object (e.g. the arena walls). This is necessary for the calibration of the IR sensors.

**(3)** Switch on the robots without taking care of what they are doing (if the selector is on position 14, they shouldn't move: they will just beep and light shortly).

**(4)** When all the robots are quiet, without making any noise in the room,
press [Robot Reset] on the remote control to calibrate all the robots at the same time.
Wait for the calibration phases to complete – this lasts 8 [s]. The phases are:

- IR proximity sensors calibration;
- micros volume calibration; and
- battery level display.

(see Figure F.4, p.132).

If all the robots do not reset at the same time, try operating the remote control from a slightly different angle.

**(5)** Use [Next Selection] and [Previous Selection] to select the program to play.
The led scheme of Figure F.5 (p.132) shows which program is selected on a robot.

If the program selected according to the leds is not the same on each robot:

- Press [Reset Selection] (and not [Robot Reset]): this allows you to set all robots selection to zero without performing a complete reset with all the calibration phases.
- Then start again using the remote control with a slightly different angle.

Repeat until you find the right angle such that all robots react at the same time and the same program is selected on each one.

**(6)** With the right angle, start the program by pressing [Start/Stop Program].

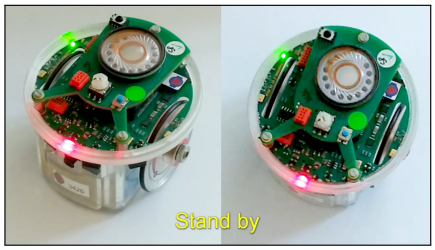
$***$ *Program running* $***$

**(7)** Stop the program by pressing [Start/Stop Program] again.

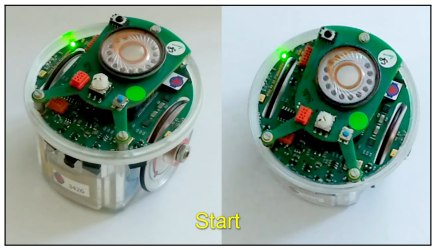
Warning: sometimes the stop is not immediate and the robots have to complete a cycle before stopping.

**(8)** To select another program without switching off the robots: go back to (2).

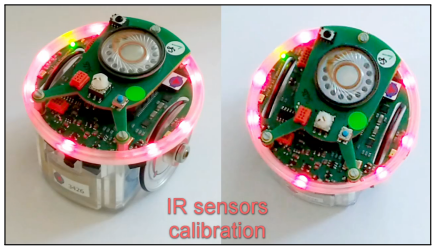
Warning: resetting and new calibration is important between program change as some variables need to be reset to zero.



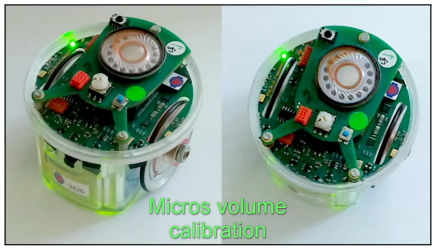

**(a)** Stand by



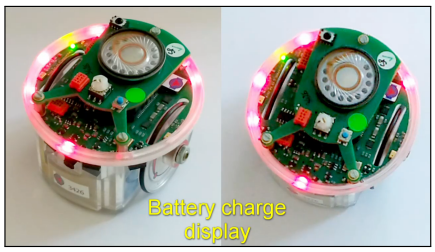

**(b)** Initialization start (e.g. after a reset)



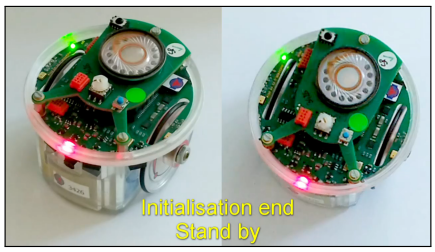

**(c)** IR proximity sensors calibration




**(d)** Micros volume calibration




**(e)** Battery charge display




**(f)** Initialization end. Back to stand by.

**Figure F.4:** Demo initialization phase stages.
The photos are taken from the following video: `https://youtu.be/fx46Hbjesd4`

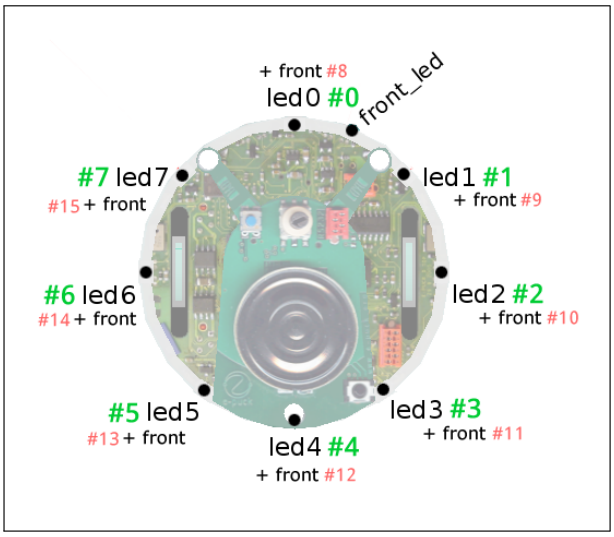



**Figure F.5:** Remote control leds-selectors correspondence.
#5 = manual selector position number 5.

### Special procedure for swarm coherence programs (programs 0 to 3)

Due to power issue, some robots reset themselves during the coherence programs and need to be restarted manually (see subsection 5.3.5 for details about this issue). To counter this problem, for these programs and these programs only, the robots no longer respond to the remote control when the program is running. However, they respond again after any automatic resets caused by power issue. Thus, thanks to the remote control, you can remotely restart a robot that has reset itself, allowing the demo to keep on satisfactorily.

To restart a robot after such an automatic reset: while the other robots keep on running, for the robot at stake, choose the relevant program with the remote control and launch it.

In practice, the fact that automatic resets and subsequent calibrations occur when there may be noise around the robot at stake and perhaps objects in its 4 [cm] (simply because the other robots are still running) do not pose significant problems for the coherence programs.

## F.2 Using manual selector only (without remote control)

**(1)** Select the desired program with the white manual selector.

**(2)** If necessary: raise the robots so that their wheels do not touch the ground.

Indeed, some demos require the robots to be moved after calibrations.

**(3)** Place the robots at least 4-5 [cm] away from each other and from any object (e.g. the arena walls). This is necessary for the calibration of the IR sensors.

**(4)** Without making any noise in the room, and one after the other, switch them on and wait for the calibration phases to complete – this last 8[s]. The phases are:

- IR proximity sensors calibration;
- micros volume calibration; and
- battery level display.

(see Figure F.4, p.132).

**(5)** Place the robots in the desired locations with their wheels on the ground.

$***\ Program\ running\ ***$

**(6)** To stop the program, switch off the robots one after the other.

**(7)** To change programs without turning off the robots:

- start again at (1).
- in (4), instead of switching them on, just press the reset button.

*
* *

# Complete list of the programs included in the demo set

| Arena | # robots (suggested) | | | File | Function | Demo link |
|---|---|---|---|---|---|---|
| | | | Initialization | main.c | | https://youtu.be/fx46Hbjesd4 |
| 180x140cm | 2 - 15+ (9 - 11) | 0 | Swarm Coherence Algo. Alpha threshold 6-1 (cycles of 50) | run_alpha_algo.c/h | run_alpha_algo_from_to(6,1,50) | https://youtu.be/PN_FrZWih0Q |
| " | " | 1 | Swarm Coherence Algo. Alpha threshold 5 | " | run_alpha_algo(5) | https://youtu.be/n0Ww2lsuaYE |
| " | " | 2 | Swarm Coherence Algo. Alpha threshold 3 | " | run_alpha_algo(3) | " |
| " | " | 3 | Swarm Coherence Algo. Alpha threshold 1 | " | run_alpha_algo(1) | " |
| 140x70cm | 1 - 5+ (5) | 4 | Collective Heap Buliding."Swiss XP" | runbraitenberg_mod3.c/h | run_braitenberg_swiss_EL() | https://youtu.be/AevML_FSlEM |
| | 2 - 15+ | 5 | Synchronicity through Beep Sounds. "Chirping" | run_chirping.c/h | run_chirping() | https://youtu.be/I6GSagp46zs |
| To choose | 1 - 15+ | 6 | Braitenberg Explorer | runbraitenberg_mod3.c/h | run_braitenberg_explorer() | https://youtu.be/yz6ijhXEd9Y |
| " | " | 7 | Braitenberg Explorer/Lover | " | run_braitenberg_explorer_and_lover() | https://youtu.be/iLH2aBzI9MI |
| | 1 | 8 | IR Piano & Full Sound Demo (paper) | e_freq_sound.c/h | freq_ir_piano_C_to_C1() | https://youtu.be/VEd9eDacvss |
| | " | | | " | freq_video_full_demo() | https://youtu.be/udtJUNvuzgM |
| | 1 | 9 | Robot Guiding by Whistling (GCTronic) | runfftlistener.c/h | run_fft_listener() | https://youtu.be/uaQSAEbv7jI |
| | 1 - 15+ | 10 | Rotating toward Hand Clapping (GCTronic) | runlocatesound.c/h | run_locatesound() | https://youtu.be/zhrk4egCTJU |
| To choose | 1 - 15+ | 11 | Rotating toward Light | runbraitenberg_mod3.c/h | run_light_lover() | https://youtu.be/kJHteD2_1GQ |
| " | " | 12 | Explorer & Light Follower | " | run_moving_light_lover(true) | https://youtu.be/uTkaBSoXj2o |
| | 1 | 13 | Simon Game: via Proximity Sensors or Whistling | run_simon.c/h | run_simon() | https://youtu.be/mGj8a8Cdw6Y |
| | | 14 | Selector corresponding to IR Remote Control use | | | |
| | | 15+ | Battery Charge Display | | | |

**Table 1:** Full list of programs included in the demonstration set
Full playlist: `https://www.youtube.com/playlist?list=PLrscHgSUZPdr38tirAsB4_4Q93khKP9Rv`
Github: `https://github.com/jrlauper/jrl_epuck/tree/master/jr_demo`
"(GCTronic)": the code comes from GCTronic demos with slights mods
(more precisely programs 2 and 9 in complete demo 2: see section D.2).
"15+": 15 and beyond.