

## Acceleration of Gravity

### EV3 program description

The program "10" determines the acceleration of gravity of a small metal ball by calculating the time between the opening of the arm and the ball's collision on a Touch Sensor. If the acceleration of gravity is greater than or equal to 8, the experiment has succeeded, and the measured drop time of the metal ball will be output on the Display.

Subsequently, the measured drop time can be used to calculate the acceleration of gravity.

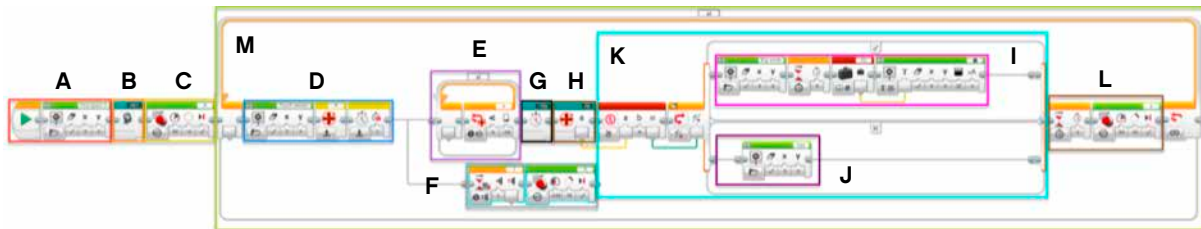
### Abbreviations used

- cl Calibration – close ball arm
- sl Start timer at defined opening angle
- ol Repeat measurement

- W Motor rotations
- S Time
- S2 Time difference

- INIT Close ball chamber
- TMS Calculate drop time
- FB Calculate acceleration of gravity

### Program summary



### Start program

Once the program has been started on the EV3 Brick, the program is started, once the ball is put in place, by pressing the Touch Sensor, and will execute repeatedly until the program is exited.

### Exit program

The program can only be exited using the Cancel button.

## Program Parts

### Program part A



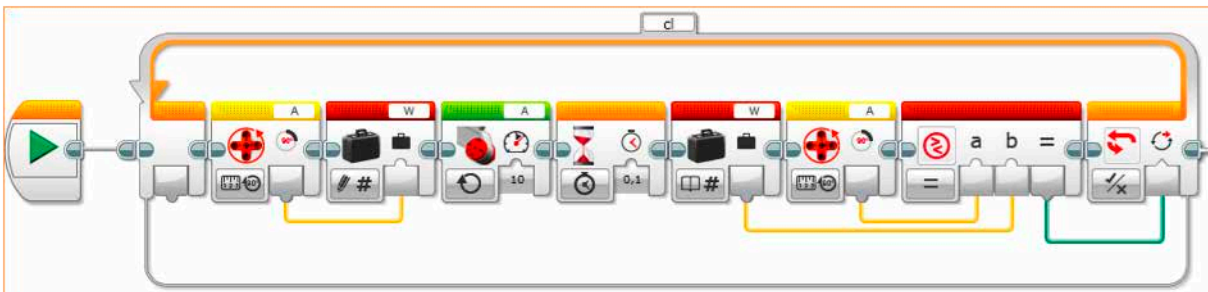
When the program is started, an hourglass is initially shown on the EV3 Brick Display.

### Program part B

The arm holding the ball is closed in a My Block.

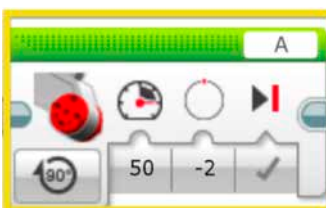


### My Block INIT



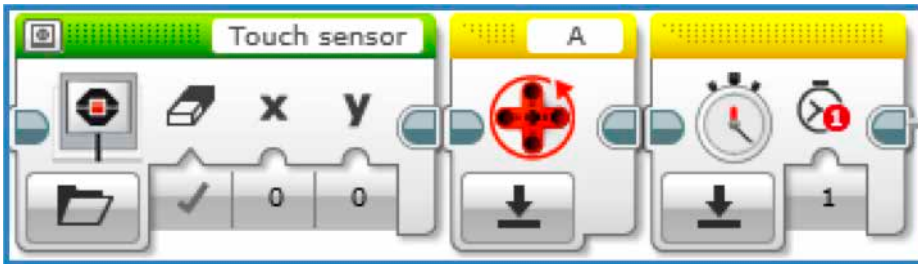
Motor rotation saved to variable W. After that the motor is turned by 10 degrees until it corresponds to the value in variable W. If W corresponds to the motor rotation, the ball arm is closed.

### Program part C



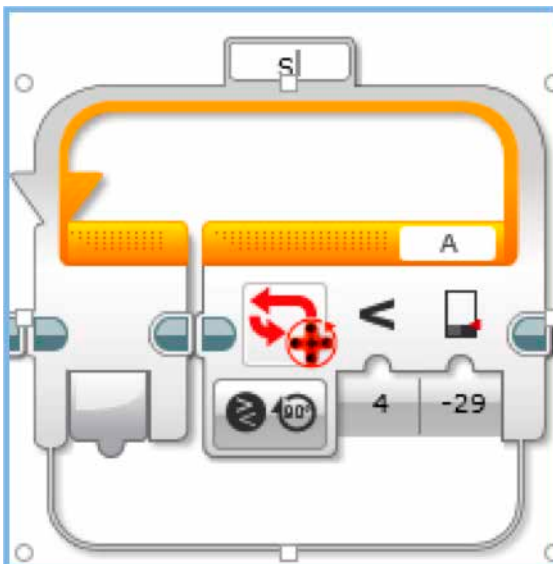
Open the arm that holds the ball.

### Program part D



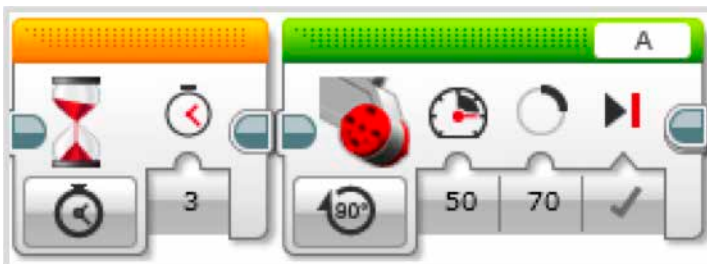
Display a Touch Sensor on the EV3 Brick Display, reset motor rotation and time measurement.

### Program part E



Wait until the opening angle of the ball arm is less than  $-29^\circ$ .

### Program part F

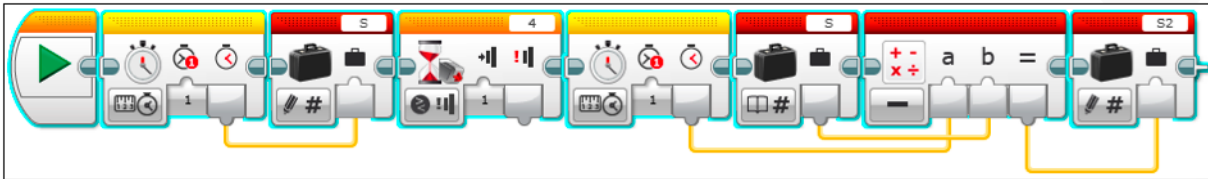


As soon as the Touch Sensor presses against Port 1, open the arm to  $70^\circ$ .

### Program part G



#### My Block TMS



In this block, the time until the Touch Sensor is actuated by the falling ball is measured. After that, the time the ball has been falling is determined.

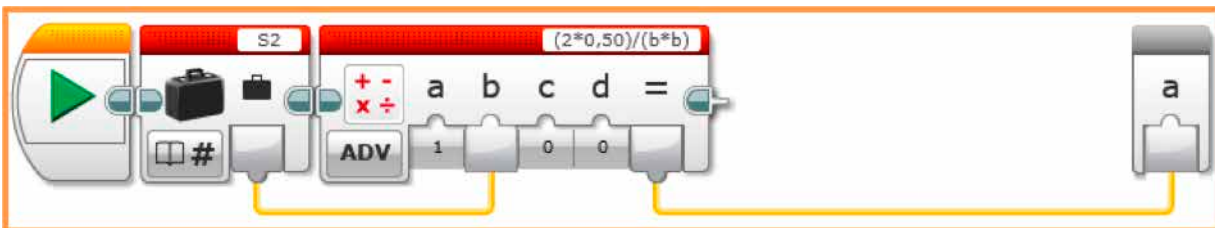
To do so, the following steps are performed:

- Measure time and save the value to variable S.
- As soon as the Touch Sensor actuates:
- Determine the time elapsed and calculate the difference.
- Save the drop time to variable S2.

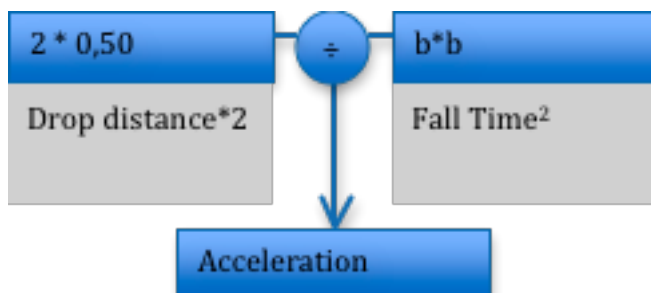
### Program part H



#### My Block FB



The following is calculated to determine the acceleration of gravity:



The acceleration of gravity is transferred to the main program in the form of interface a.

### Program part I



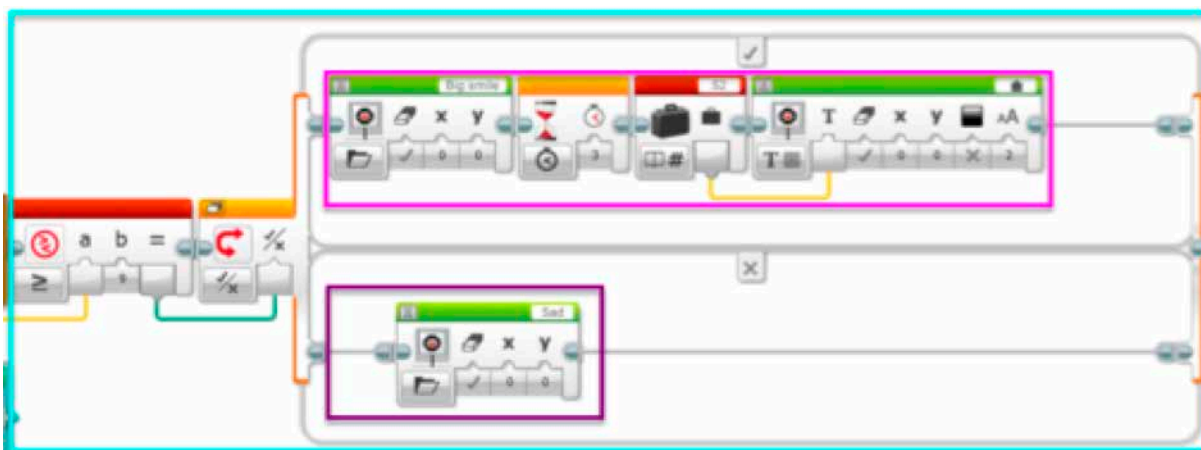
Output of a big smile (laughing face) on the EV3 Brick Display. The time is output on the display after 3 seconds.

### Program part J



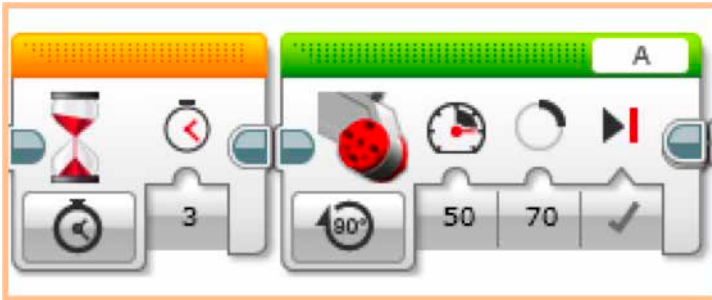
Display of sad face.

### Program part K



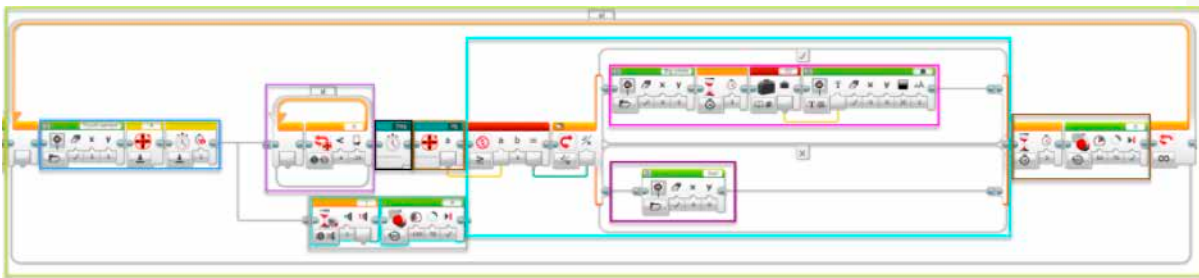
As soon as the acceleration of gravity determined in part H is greater than or equal to 8, a big smile as well as the drop time from part I are output on the EV3 Brick Display, or, if there's an error, a sad face from part J is displayed.

### Program part L



After 3 seconds, close the arm that held the ball by another 70 degrees.

### Program part M



Measurement of the acceleration of gravity and drop time is always performed in this loop.

To do so, the following steps are executed repeatedly:

- Program part D – Reset the Large Motor in number of rotations mode, and the timer
- Program part E – A loop that waits until the opening angle is less than -29.
- Program part F – When the Touch Sensor is pressed, the arm is opened back up to 70°. Parallel to program part E.
- Program part G – Determination of the rate of fall.
- Program part H – Determination of the acceleration of gravity for part K.
- Program part K – Output of a big smile as well as the drop time – or a sad face if the acceleration of gravity is less than or equal to 8.
- Program part L – Closing of the arm that holds the ball.