STEP MOTOR BURETTE 061
USER'S GUIDE
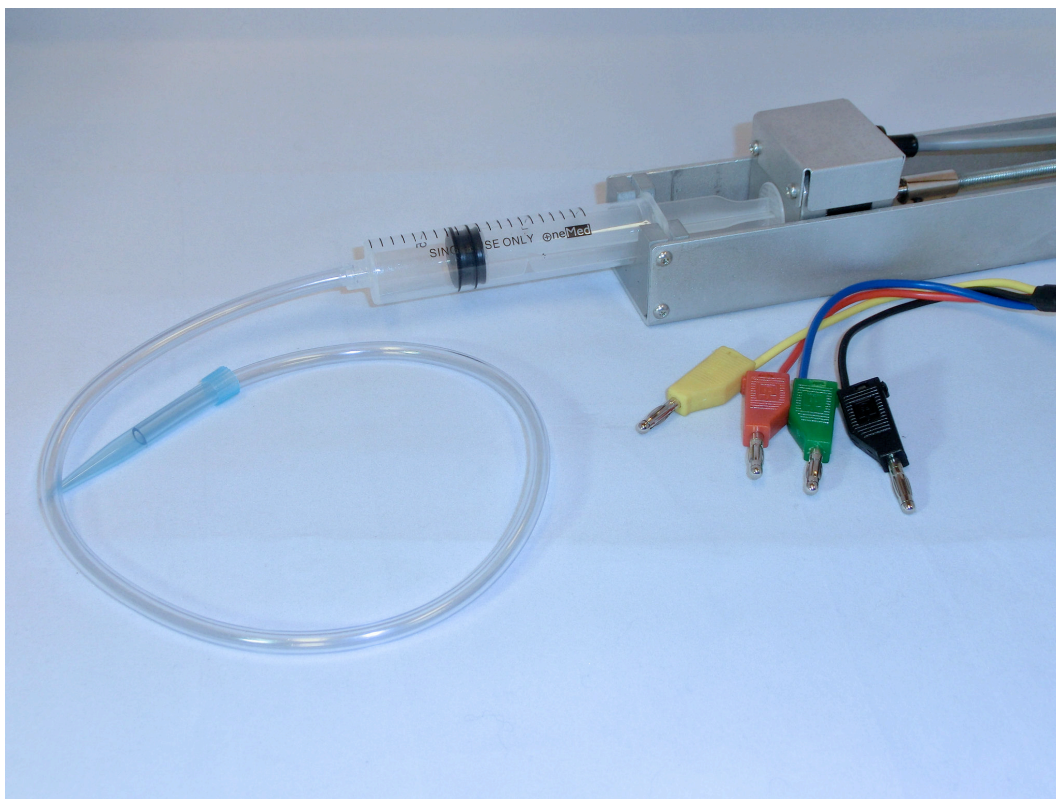
CENTRE FOR MICROCOMPUTER APPLICATIONS

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Short description

The step motor burette, called also Titrator, is a cheap, accurate, dosage device that can be used to control a process of adding a titrant in titration experiments. It can be connected to control outputs of CMA CoachLab II/II$^+$ interface.

The Titrator is delivered with a 20-ml syringe, 40-cm plastic tube and micro-pipette. The volume of a droplet from the delivered pipette is 0.02 ml.

The Step motor burette is supported by the CMA Coach 6 software. The unique combination of measuring and control facilities of Coach allows automation of the titration process. The step motor burette connected to the interface outputs is used to add titrant and the pH sensor connected to an interface input is used to measure pH values. A Coach control program controls the step motor of the burette.

Connecting the Step motor burette to CoachLab II/II+

Four wires of the Titrator are connected to four lower outputs of the CoachLab II/II+ in the following way:

- A1 - Yellow
- A2 - Black
- B1- Red
- B2 - Green
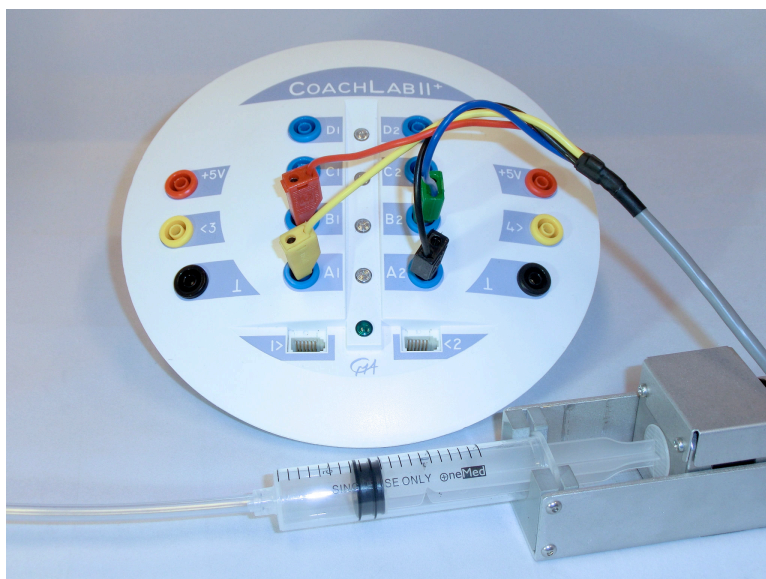
Inserting the syringe

- Lift the block with the spindle. Let the guide block turn by hitting it a few times at the edge until it is about 3 cm away from the nut.
- Place the block back.
- Fill the syringe (with plastic tube) up to 22 ml (a little bit more than the scale division shows). Remove the air from the syringe.
- Place the syringe in the Titrator and plug the plastic tube in the pipette.
- Turn the spindle until the syringe is fixed and droplets start to come out of the tube.

Calibration

With the following method, the number of steps per millimeter can be determined:
- Connect CoachLab II/II+ interface to the computer.
- Open the Coach 6 activity 'Calibration of CMA step-motor burette'.
- Fill the syringe with water.
- Control the presence of a droplet on the pipette. Remove the droplet.
- Weigh an empty glass (100 mL) and place it under the pipette.
- Click the Start button to execute the program and start the Titrator.
- Stop the Titrator when 6500 steps are made.
- Determine the mass of the water in the glass. This determines the volume of the water.
- Read the exact number of steps (S) from the graph (option: *Scan*).
- The calibration factor is S/V (in steps/ml). Write down this value.
- Repeat the calibration a few times and determine the average calibration factor. A typical value for the delivered syringe is 660 [±2] steps/ml. The program can be used also to empty the syringe in 5-ml portions. This gives you an indication of the reproducibility over the whole range of the syringe. In all tests the error margin was less then 0.5 %.

Performing a titration

It is recommended to use a magnetic stirrer (with stirring bar) and a small beaker (maximum 100-ml). The quality of the equivalence point strongly depends on the mixing of the solutions during the titration. For best results reduce the volume in the reaction vessel as much as possible (<40 ml) and stir thoroughly.

Use utility clamps to suspend a pH electrode and pipette on a ring stand. Situate the pH electrode in the solution and adjust its position toward the outside of the beaker so that the stirring bar does not strike it. The sensor should stay in permanent contact with the solution.

- Connect the CoachLab II/II$^+$ interface to the computer and start Coach 6. Check whether the mains adapter is set to 12 V (only for adjustable adapters).
- Select the Coach activity 'Acid-base titration with CMA burette'.
- Click the P-button to see the list with commands and the program.
- Fill in the calibration value of [steps/ml] found during the calibration. If the program doesn't contain the calibration factor then the value of 660 steps/ml is taken.
- Create a program.
- Click the green Start button to execute the program.

Example:

Titrate (10; Fast)
Titrate (2.5; Slow)
Titrate (2.5; Medium)
MotorBack(15)

This program moves the syringe so that the liquid is added: first 1 ml fast, then 2.5 ml slow and at the end 2.5 ml with medium speed (in this example it is known that the equivalence point is reached when 11.2 ml of liquid is added). At the end the motor returns to its starting position.

The results of the titration
of 0.1 M of acetic acid
with 0.1 M of NaOH.
The acetic acid is lightly polluted
with sulfuric acid.
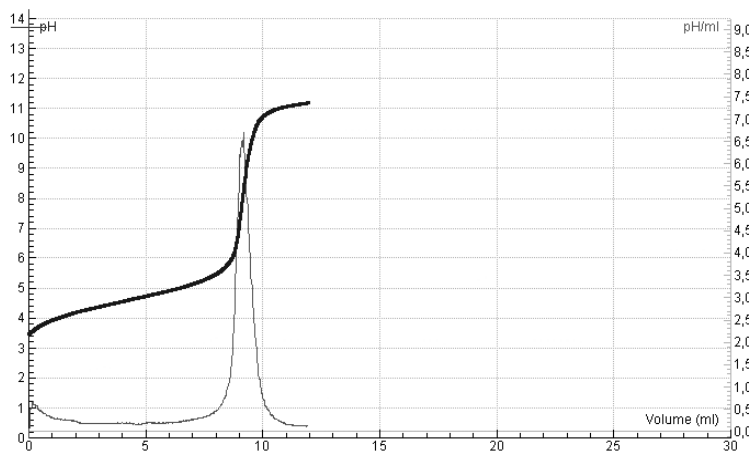
Problems during
quick titration

If the steps follow each other too quickly, 'hiccups' may occur as soon as the syringe is pressed. This problem appears sometimes when the command Titrate (…;Fast) is used. For slow titration (Titrate (…;Slow)) the step motor burette should function properly. If fast titration is required anyway, increase the Waiting time between the steps. This is only possible in the Author mode of Coach 6.

- Start the Coach activity 'Acid-base titration with CMA burette'.
- Click the Program window.
- Place the mouse cursor on the bottom line off the title bar until it changes its shape.
- Drag the top edge down to open the Titrator procedure editor.
- Increase the value of the variable WaitingTime (for instance into 0.005)
- Drag the edge back to close the editor window.
- Save the activity.
- Check if the Titrate (…;Fast) command works correctly after these changes.
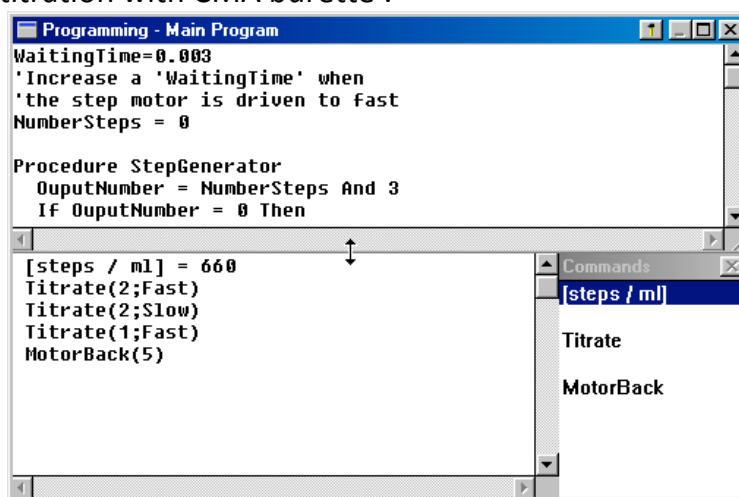
Warranty:

The Step Motor Burette 061 is warranted to be free from defects in materials and workmanship for a period of 12 months from the date of purchase provided that it has been used under normal laboratory conditions. This warranty does not apply if the sensor has been damaged by accident or misuse.

Note: This product is to be used for educational purposes only. It is not appropriate for industrial, medical, research, or commercial applications.

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