

DATA LOGGER APP

for fx-CG50

QUICK START GUIDE



LEARNING BY DOING - THE CMA WAY

<https://cma-science.nl>

Data Logger App Quick Start Guide ver.1.0

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CMA

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I. INTRODUCTION

In cooperation with Casio CMA has developed the Data Logger application for CASIO fx-CG50 Graphical Calculators. This is a menu-driven calculator program designed to support data collection with the CLAB data logger. It allows:

- configuring experiments,
- communicating with CLAB,
- graphing and analyzing the collected data,
- exporting data into Lists and a csv file,
- defining and managing experiment setups.

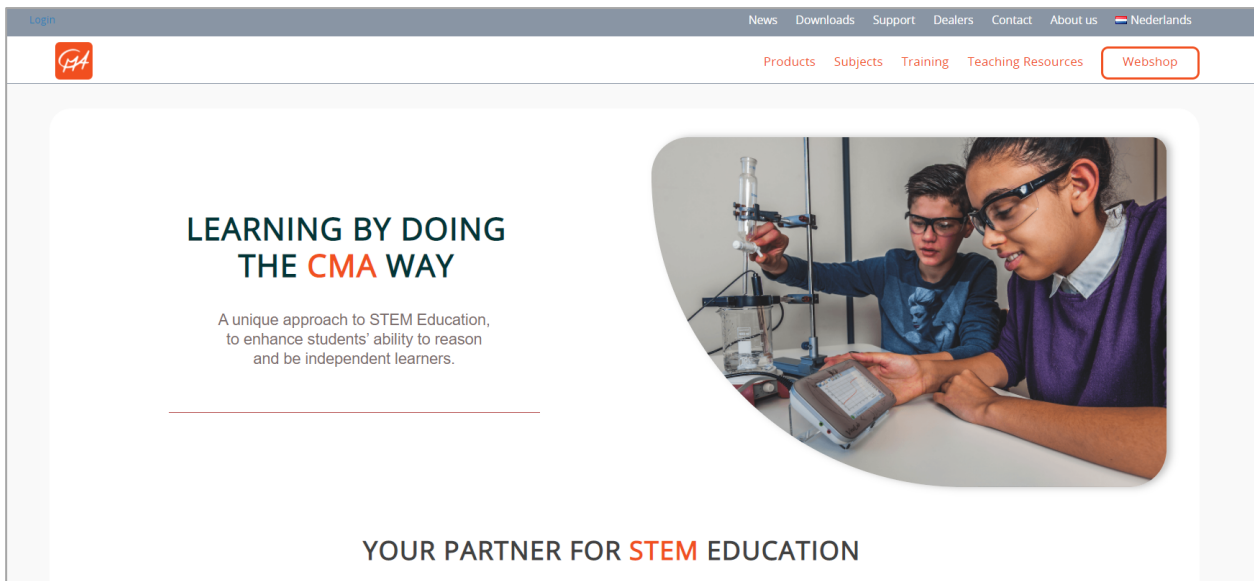
The purpose of this Quick Start Guide is to help you to get started to use the Data Logger app and perform simple measurements with CLAB and basic sensors. Detailed tutorials will guide you through basic functionalities. Each written tutorial is enriched with a video that demonstrates the described steps.

The following tutorials are available:

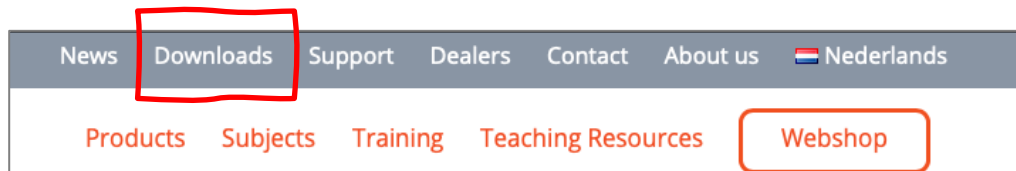
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II. GETTING AND INSTALLING THE APP

1. Go to the CMA website at <https://cma-science.nl>.



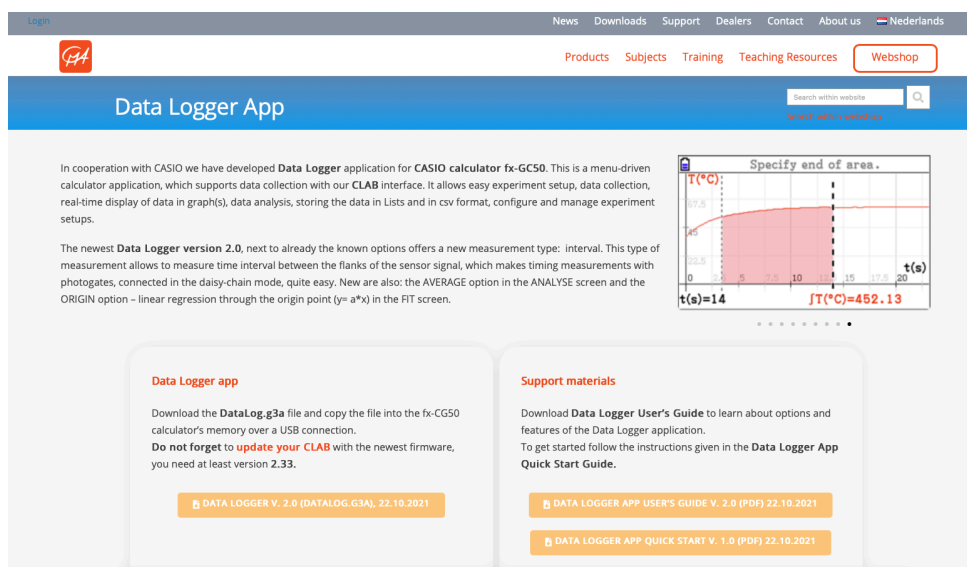
2. Go to the **Downloads** section.



3. Choose **MORE INFO** next to **Data Logger App for Casio fx-CG50**.



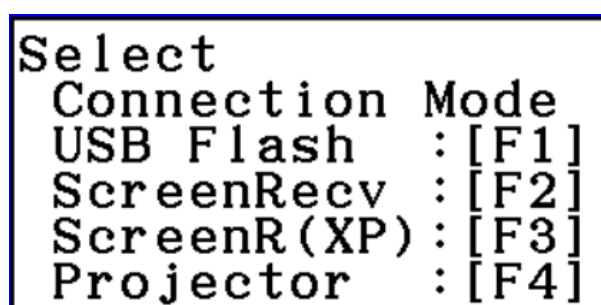
4. Download the app via the button Data Logger (**datalog.g3a file**). You might also download the Data Logger App User's Guide and Quick Start Guide.



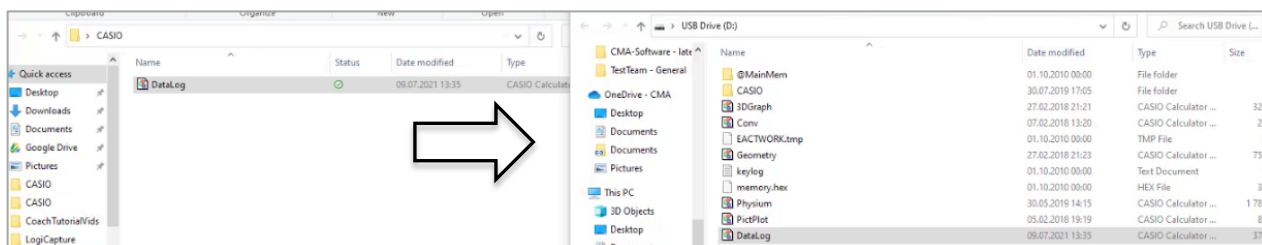
5. Connect your fx-CG50 to the computer via USB.



6. Press [F1] to enable file transfer.



7. Copy the downloaded **DataLog.G3A** file saved on your computer to the calculator's root folder.



8. Unmount the calculator from your computer (eject Casio MassStorage Device and disconnect your calculator).



9. Before you start Data Logger App you may reset the calculator's memory. Press [MENU], select [SYSTEM], select [F5: Reset], select [F2: Main Memory], confirm with [F1: YES].

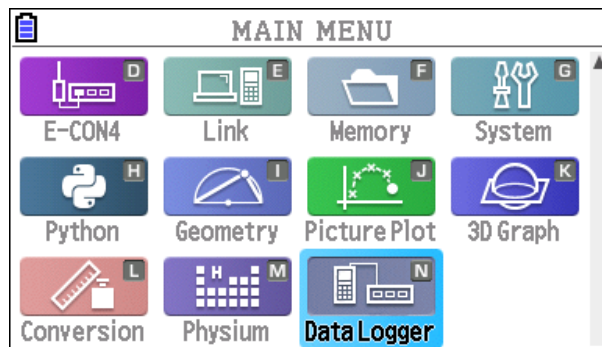


The video *Getting and installing the Data Logger App* demonstrates the steps of this tutorial.



II. CONNECTING CLAB AND SENSORS

1. Turn your fx-CG50 on and in the Main Menu select **Data Logger**.

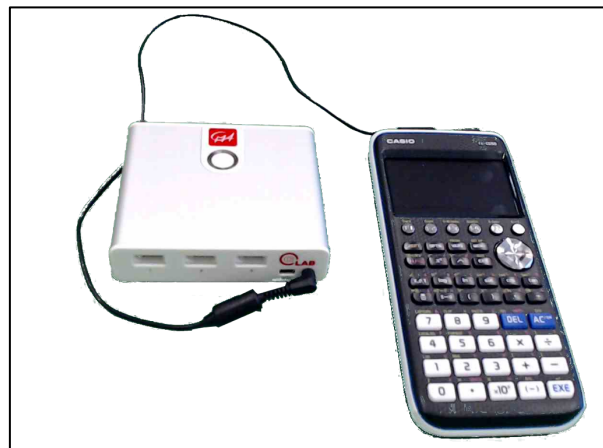


2. As long as CLAB is not connected to your calculator the app displays **CLAB disconnected**.

Note: This message appears always when there is a problem in communication between CLAB and the calculator.



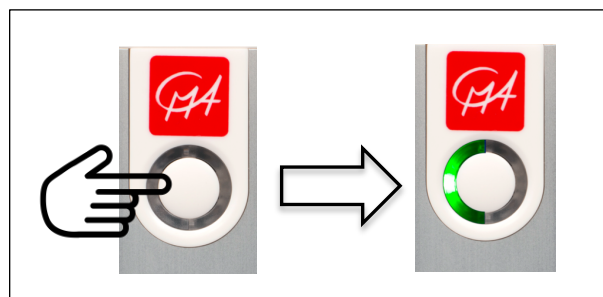
3. Connect your calculator and CLAB using the cable with 3-pin jack connectors (SB-62). Make sure that both plugs of your cable are fully inserted in the communication ports.



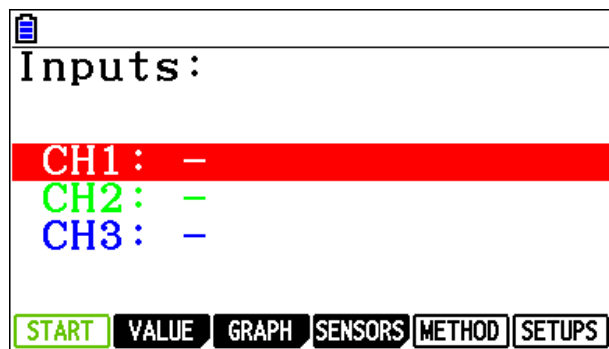
4. Press the CLAB Power button to turn CLAB on. The left LED blinks red and turns green when the device is ready.

Note: To be able to work with Data Logger App the CLAB firmware has to be updated.

To update your CLAB go to the CMA website, download and install the latest version of the CLAB Update program. Then install the newest firmware on your CLAB.



5. When the communication between CLAB and the fx-CG50 calculator is established properly then the HOME screen shows the status of CLAB's inputs.

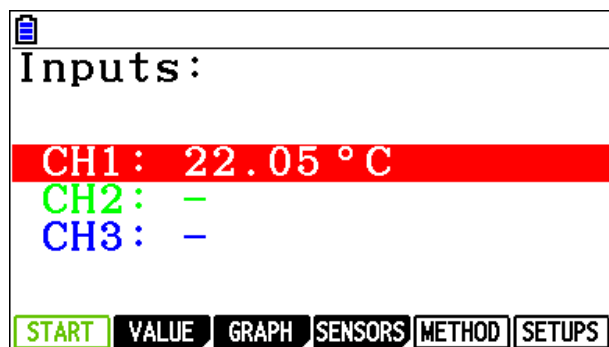


6. Use CLAB's BT connectors to plug in sensors. CLAB automatically detects the connected sensors. Sensors, which are not identified, have to be setup manually. See Tutorial *Working with Sensors* for more details.

If you want to measure with the internal accelerometer you have to enable the accelerometer channels. See Tutorial *Using the internal accelerometer* to see how to do it.



7. The Home screen now shows the current value measured by the connected sensor(s).

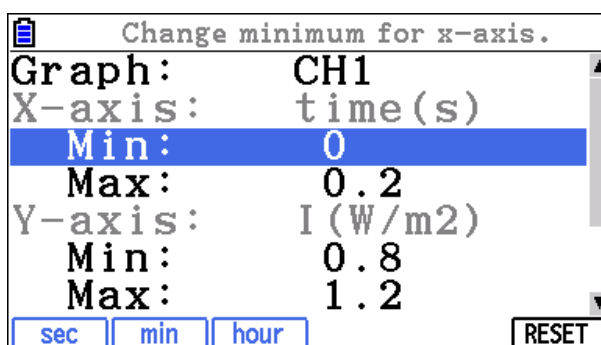
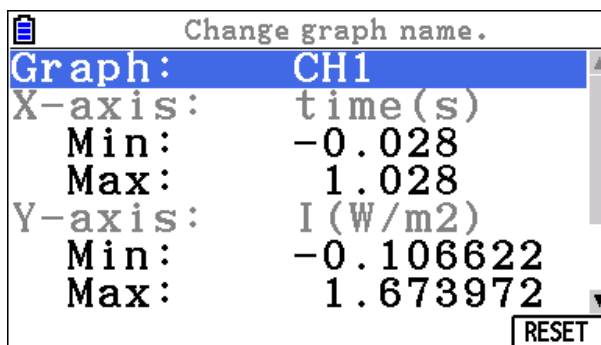
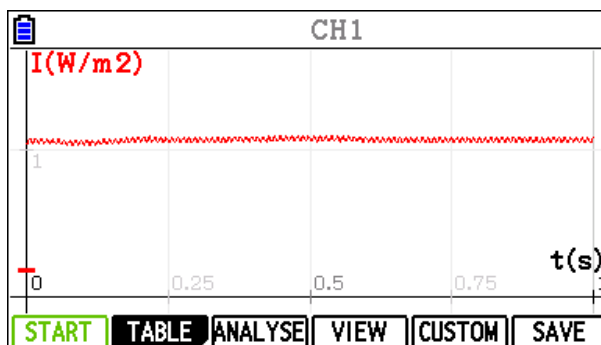
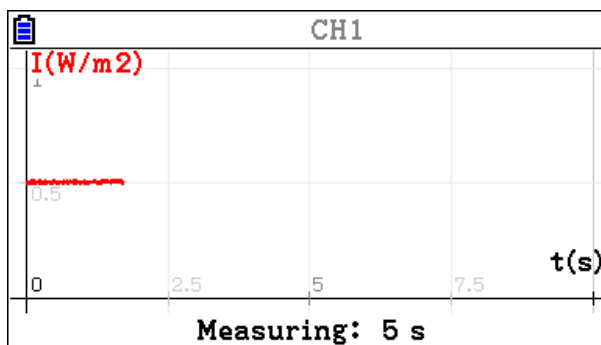
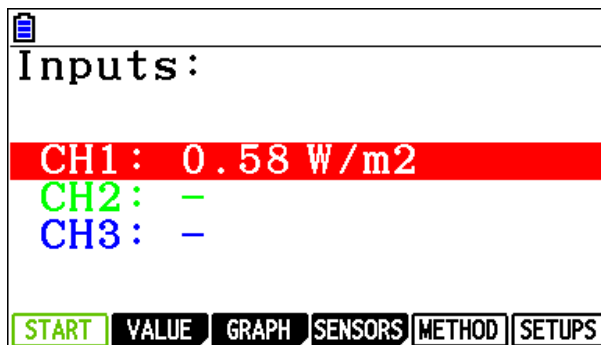


The video *Connecting CLAB and sensors* demonstrates the steps of this tutorial.



III. MEASUREMENT AND REVIEWING RESULTS

1. Prepare your sensor for measurement and press **[F1]** to start collecting data. The measurement is executed according to the selected method and its measurement settings. To learn how to setup the measurement see the tutorial *Measurement settings*.
2. Conduct your experiment. The app displays the graph during the measurement.
3. After the measurement is finished you may like to adjust your graph. Press **[F4]** to view and change the graph settings.
4. Adjust the viewing window.
5. Press **[EXIT]** to go back.

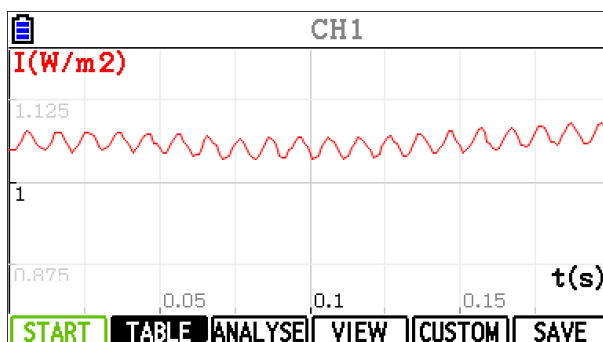


6. The graph will be adjusted according to the new settings.

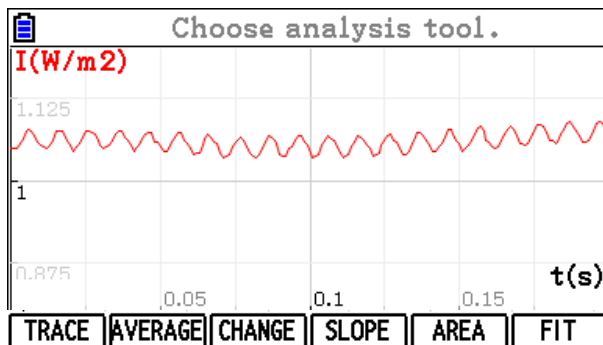
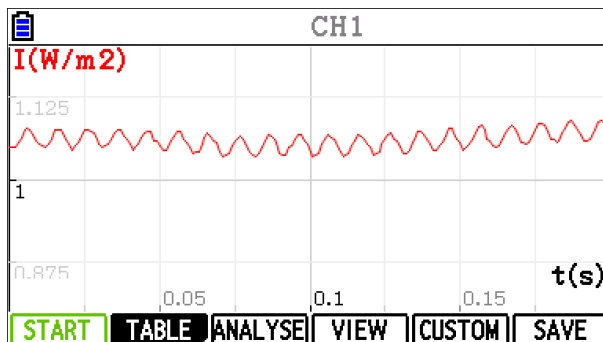
7. Press **[F2]** to view the data in a table. Use the cursor keys to navigate the table.

8. Press **[F2]** to go back to graph view.

9. Press **[F3]** to use data analysis tools. Choose a tool with **[F1]** - **[F6]** keys. Detailed explanation of all analysis tools can be found in the Data Logger App User's Guide.



	t(s)	I(W/m ²)
1	0	1.05
2	0.001	1.05
3	0.002	1.05
4	0.003	1.06
5	0.004	1.06
6	0.005	1.07
7	0.006	1.08
8	0.007	1.07



This tutorial presents only time-based measurement. For descriptions of manual measurement, time interval measurements or measurements with CLAB standalone consult the Data Logger App User's Guide.



The video *Measurement and reviewing results* demonstrates the steps of this tutorial.



IV. USING CLAB'S INTERNAL ACCELEROMETER

CLAB has a built-in 3-axis Accelerometer, which measures acceleration in 3 ranges: $\pm 20 \text{ m/s}^2$, $\pm 40 \text{ m/s}^2$ and $\pm 80 \text{ m/s}^2$ in the x, y and z directions.

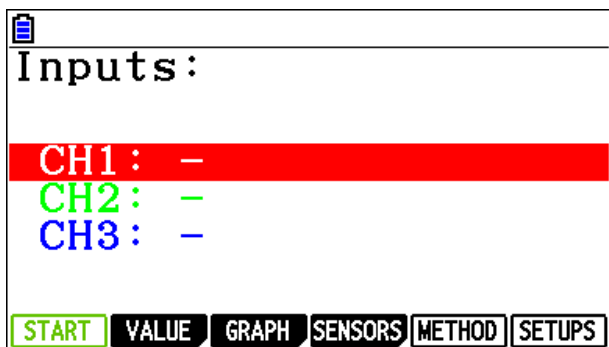
Holding the CLAB in the shown position should give the following values of the component accelerations:

- x-component $\approx 0 \text{ m/s}^2$
- y-component $\approx 0 \text{ m/s}^2$
- z-component $\approx -9.81 \text{ m/s}^2$.

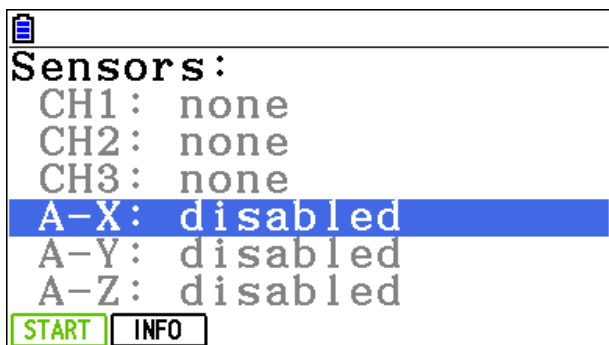
Follow the steps below to enable and measure with the internal accelerometer.



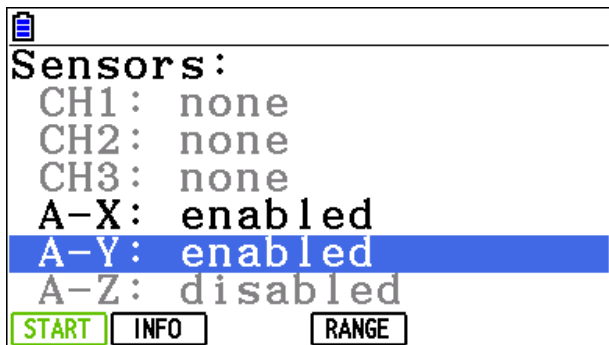
1. On the Home screen press **[F4]** to enter Sensors Setup.



2. Use the cursors and the **[EXE]** keys to enable accelerometer.



3. Press **[EXIT]** to return to the Home screen.

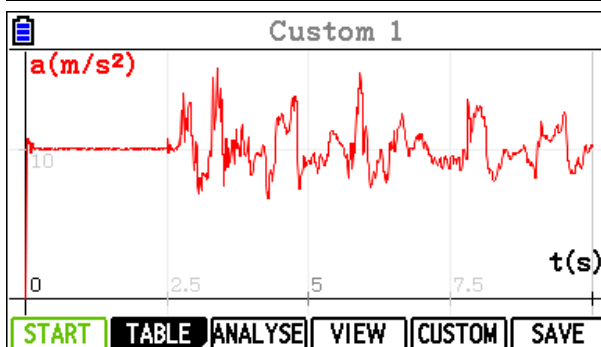
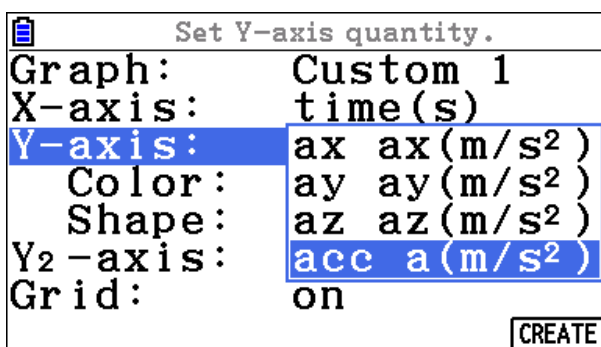
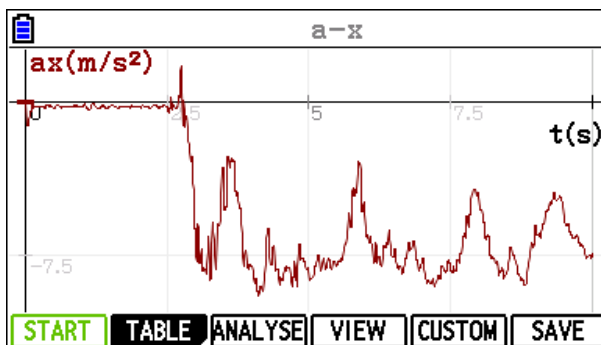
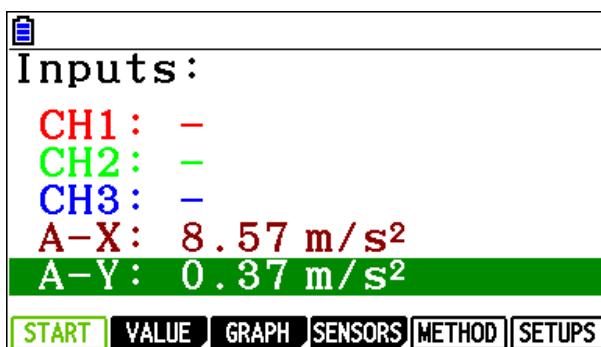


4. The accelerometer detects local gravity. Press **[F1]** to start the measurement. Perform your experiment.

5. The app displays the graph during the measurement. Use the **[UP]** and **[DOWN]** cursor keys to scroll between $a_x(t)$, $a_y(t)$ and $a_z(t)$ graphs. After the measurement is finished you can create a custom graph of resulting acceleration $a(t)$. Press **[F4]** to open the settings of the custom graph.

6. Define the graph settings, for the Y-axis select **acc a (m/s^2)**. Press **[F6]** to create the new graph.

7. A new graph $a(t)$ is added. Use the **[UP]** and **[DOWN]** cursor keys to scroll between graphs.



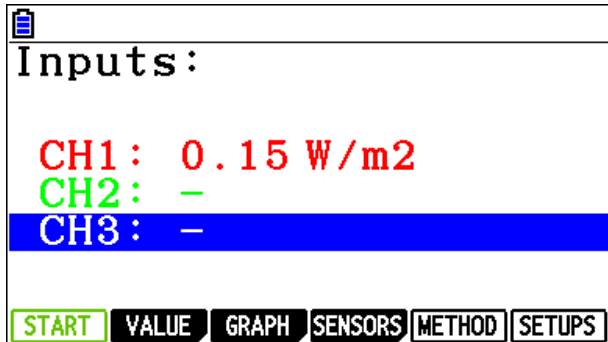
The video *Using CLAB's internal accelerometer* demonstrates the steps of this tutorial.



V. MODIFYING MEASUREMENT SETTINGS OF TIME-BASED MEASUREMENT

This tutorial shows you how to modify the settings of time-based measurement. In such measurement, data are collected at regular time intervals according to the given sampling frequency. A measurement is finished when its duration time has elapsed. Most measurements are of this type.

1. On the Home screen press **[F5]** to setup your measurement method.

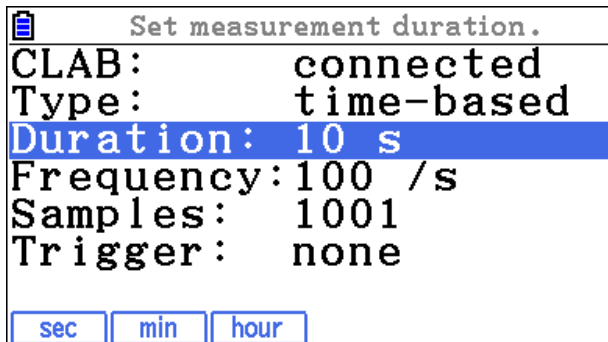


Inputs:

CH1: 0.15 W/m2
CH2: -
CH3: -

[START] [VALUE] [GRAPH] [SENSORS] [METHOD] [SETUPS]

2. Scroll to Duration. Use the **[F1]** - **[F3]** keys to select the time unit for measurement duration.

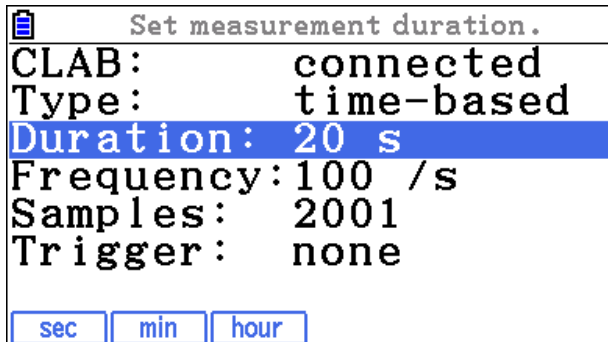


Set measurement duration.

CLAB: connected
Type: time-based
Duration: 10 s
Frequency: 100 /s
Samples: 1001
Trigger: none

[sec] [min] [hour]

3. Use numbers and **[EXE]** keys to change the duration.

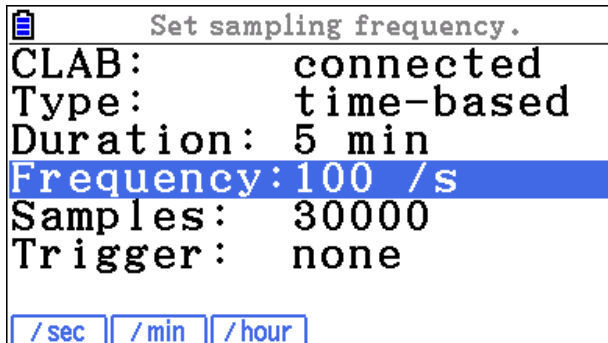


Set measurement duration.

CLAB: connected
Type: time-based
Duration: 20 s
Frequency: 100 /s
Samples: 2001
Trigger: none

[sec] [min] [hour]

4. In a similar way enter the sampling frequency.



Set sampling frequency.

CLAB: connected
Type: time-based
Duration: 5 min
Frequency: 100 /s
Samples: 30000
Trigger: none

[/sec] [/min] [/hour]

5. Based on the duration and frequency, the number of samples will be adjusted automatically. Press **[EXIT]** to leave the Method menu.

Set sampling frequency.	
CLAB:	connected
Type:	time-based
Duration:	5 min
Frequency:	5 /min
Samples:	25
Trigger:	none
/sec /min /hour	

For defining setting of other measurement methods consult the Data Logger App User's Guide.



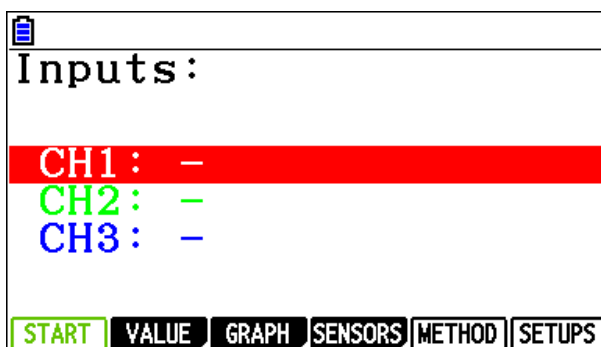
The video *Modifying measurement settings* demonstrates the steps of this tutorial.



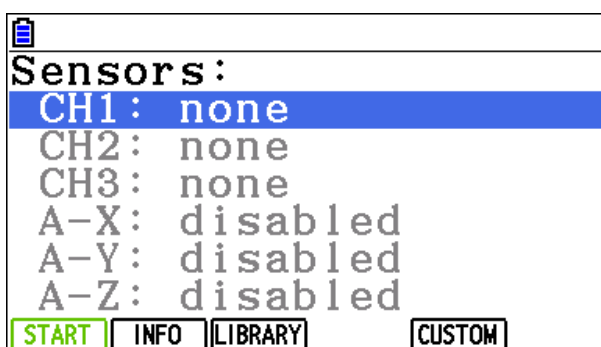
VI. SETTING UP SENSORS MANUALLY

Some sensors will not be automatically identified when connected to CLAB. These are: older type of sensors, sensors whose EEPROM memory cannot be read, and sensors with EEPROM memory which draw too much power e.g., Force sensors BT42i or 0663. Such sensors have to be setup up manually.

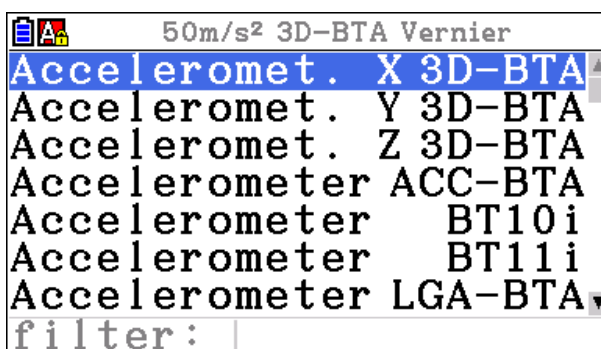
1. Connect a sensor. When there are no live readings press **[F4]** to setup the sensor manually.



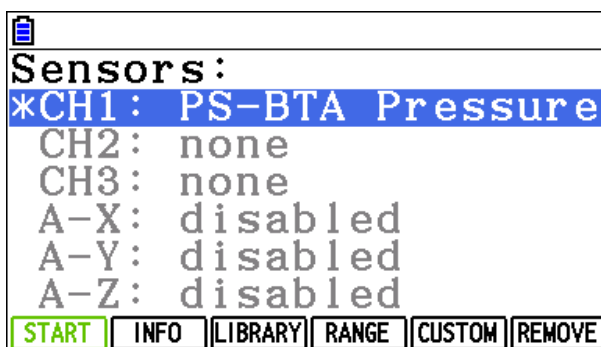
2. Press **[F3]** to open Sensor Library.



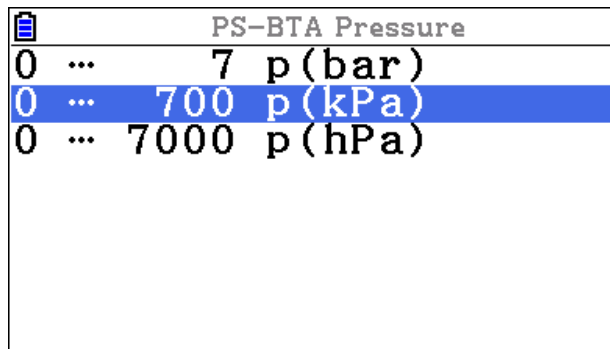
3. Use the **[UP]** and **[DOWN]** cursor keys to scroll and select a desired sensor. Press the **[EXE]** key to select the sensor.



4. Press **[F4]** to choose a sensor range.



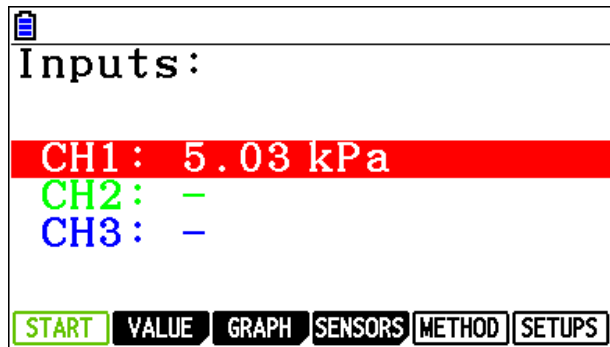
5. Choose a range from the list.



PS-BTA Pressure

0	...	7	p(bar)
0	...	700	p(kPa)
0	...	7000	p(hPa)

6. Return to the Home screen with [Exit].



Inputs:

CH1: 5.03 kPa

CH2: -

CH3: -

START VALUE GRAPH SENSORS METHOD SETUPS



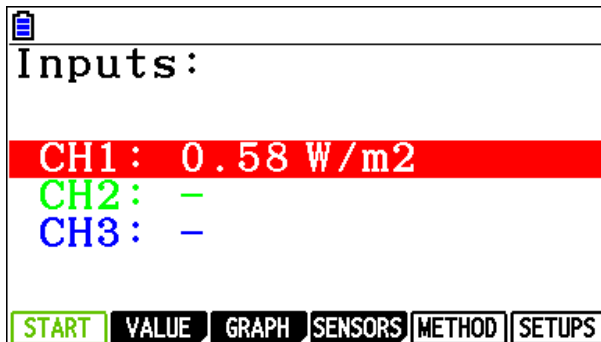
The video *Setting up sensors manually* demonstrates the steps of this tutorial.



VII. WORKING WITH SETUPS

Setups let you store experiment settings for later use. A Setup stores channel configuration, sensors settings, method settings and graphs settings. The predefined Setup can be opened and the experiment can be started directly.

1. Setup your experiment: connect sensors, select measurement method and its settings, setup graphs. When you are ready, press **[F6]** on the Home screen to access Setups.



Inputs:

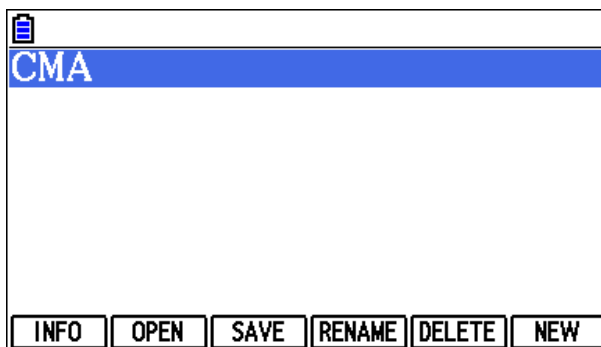
CH1: 0.58 W/m2

CH2: -

CH3: -

START VALUE GRAPH SENSORS METHOD SETUPS

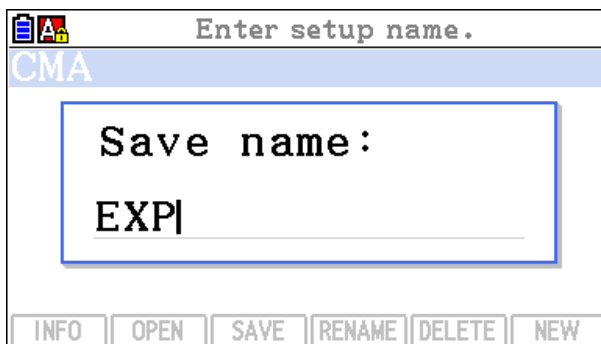
2. Press **[F3]** to save current setup; all the current settings will be stored.



CMA

INFO OPEN SAVE RENAME DELETE NEW

3. Type in a name for the new setup.



Enter setup name.

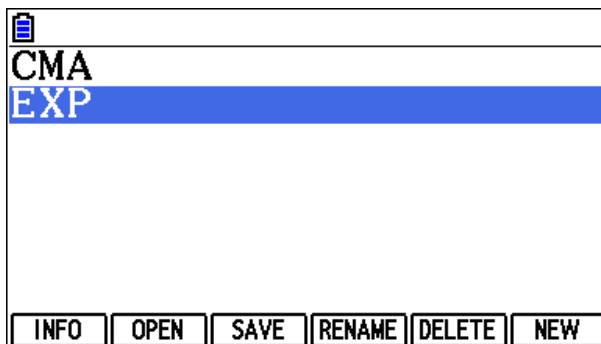
CMA

Save name:

EXP

INFO OPEN SAVE RENAME DELETE NEW

4. The saved setup is added to the list of available setups.



CMA

EXP

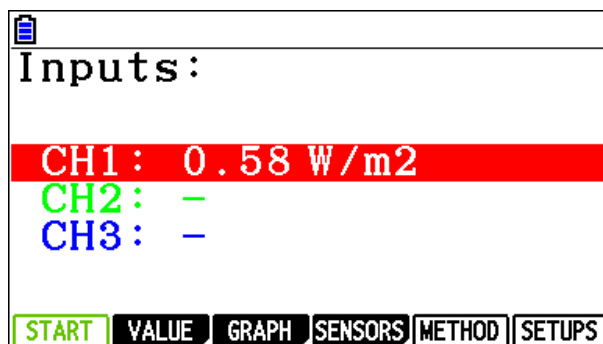
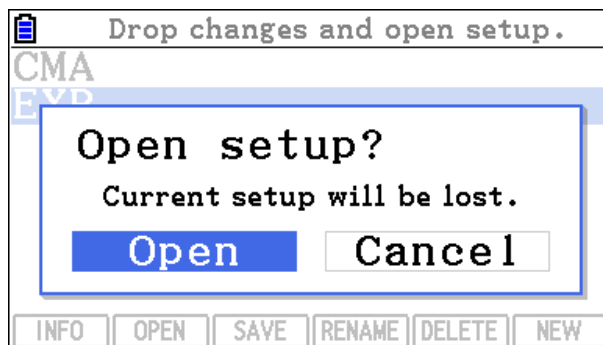
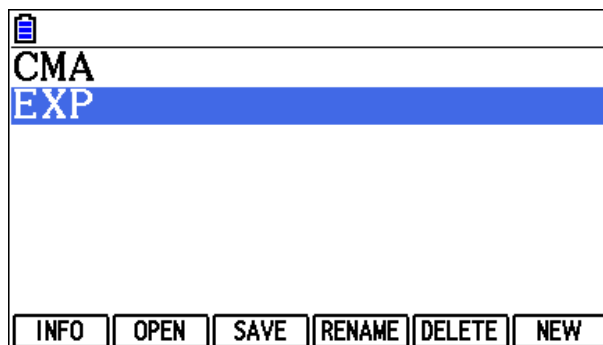
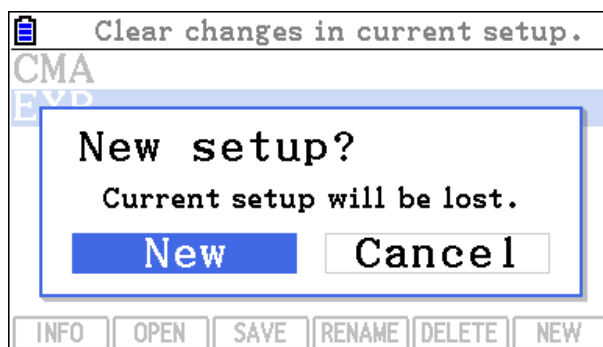
INFO OPEN SAVE RENAME DELETE NEW

5. If you want restore default experiment settings press **[F6]** again. Confirm removal of current custom settings.

6. To load a setup first press **[F6]** on the Home screen to access the setups and then press **[F2]** to open the desired setup.

7. Confirm your choice. The loaded setup will overwrite the existing settings.

8. The experiment settings will be loaded, and you can start your experiment.



The video *Working with setups* demonstrates the steps of this tutorial.



VII. EXAMPLES OF EXPERIMENTS

Some functionalities of the Data Logger app are presented in the short videos showing examples of experiments with basic sensors. You can find the detailed description of these experiments in the provided Experiments descriptions.

Newton's law of cooling

This video is an example of an experiment in which the **temperature sensor** is used. It shows how to setup a time-based measurement and how to use the analysis tools Change and Fit.



Induced emf

This video is an example of an experiment in which the **voltage sensor** is used. It shows how to setup a time-based measurement with the countdown triggering and how to use the analysis tool Area.



Polarization of light

This video is an example of an experiment in which the **light sensor** is used. It shows how to setup and execute a manual measurement. It also shows how to save the resulting data in a .csv file.



Sound waves

This video is an example of an experiment in which the **sound sensor** is used. It shows how to setup a fast time-based measurement and how to use the analysis tool Fit (SINE).



Graphing motion

This video is an example of an experiment in which the **motion detector** is used. It shows how to set up the time-based measurement and how to use the analysis tools Slope and Fit (LINE).

