

Level Measurement and Control

Any resource from **online experimentation@FEUP for all** might be accessed through <https://remotelab.fe.up.pt/>

Warnings:

This remote experiment interface works with the most common browsers. Live videos can have some problems with Internet Explorer or Edge browsers.

Access instructions

In order to access the remote experiment, the next steps might be followed:

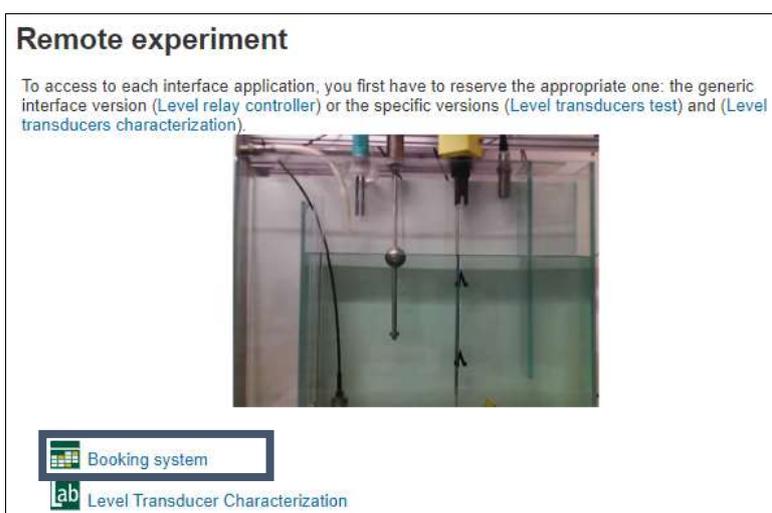
- Please, go to the link (<https://limserver.fe.up.pt/login/index.php>)
- and Log in using the provided credentials



The screenshot shows a login form with the following elements:

- Log in** (Title)
- Username field:
- Password field:
- Remember username
- Log in button

- Then, the experiment can be booked by selecting 'Booking system'



The screenshot shows the 'Remote experiment' interface with the following content:

- Remote experiment** (Title)
- Text: "To access to each interface application, you first have to reserve the appropriate one: the generic interface version (Level relay controller) or the specific versions (Level transducers test) and (Level transducers characterization)." (Note: the original text has a typo 'to' which has been corrected to 'to' in the transcription)
- Image of a laboratory setup for level measurement and control.
- Buttons: "Booking system" (highlighted with a blue border) and "Level Transducer Characterization" (with a 'lab' icon).

- Please, select the date, the experiment named 'Level Transducer Characterization' and select a free time slot for access the experiment. Then select 'book'.

How to use

Make a reservation

May 2021

Su	Mo	Tu	We	Th	Fr	Sa
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31	1	2	3	4	5

<Year <Month Month> Year>

Select a remote lab: Level Transducer Characterization

Select a practice: LMC-LTC

Availability 14-05-2021

00:00 - 00:30	06:00 - 06:30	12:00 - 12:30	18:00 - 18:30
00:30 - 01:00	06:30 - 07:00	12:30 - 13:00	18:30 - 19:00
01:00 - 01:30	07:00 - 07:30	13:00 - 13:30	19:00 - 19:30
01:30 - 02:00	07:30 - 08:00	13:30 - 14:00	19:30 - 20:00
02:00 - 02:30	08:00 - 08:30	14:00 - 14:30	20:00 - 20:30
02:30 - 03:00	08:30 - 09:00	14:30 - 15:00	20:30 - 21:00
03:00 - 03:30	09:00 - 09:30	15:00 - 15:30	21:00 - 21:30
03:30 - 04:00	09:30 - 10:00	15:30 - 16:00	21:30 - 22:00
04:00 - 04:30	10:00 - 10:30	16:00 - 16:30	22:00 - 22:30
04:30 - 05:00	10:30 - 11:00	16:30 - 17:00	22:30 - 23:00
05:00 - 05:30	11:00 - 11:30	17:00 - 17:30	23:00 - 23:30
05:30 - 06:00	11:30 - 12:00	17:30 - 18:00	23:30 - 00:00

Book

My bookings

- In 'My bookings', please access to the experiment during the selected time slot by clicking the remote experiment name
- The user interface shown below will be displayed

Level Transducers Characterization

Manual

Flow rate: Min Med Max

Filling Draining

Automatic Procedure

Start Stop

Status: Ready!

Live Video

Monitoring

A B C D E

Pick Points Reset Table

Data Table

Level [mm]	A [V]	B [V]	C [V]	D [V]	E [V]
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Voltage vs Level

Transducers Voltage [V]

Water Level [mm]

Save Data Reset System Informations

Interface features

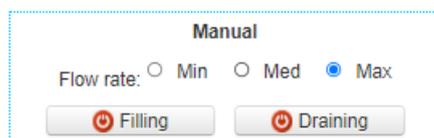
There are six sections in the interface allowing the following actions:

1. *Command* for actuation in either manual or automatic mode
2. *Status* for informing the experiment status
3. *Live video* for the remote experiment visualization
4. *Monitoring* for observing the progress of the level transducers output, the detectors' state and the water level measured
5. *Data table* and "selectable experimental transducers characteristic graphical"
6. *User actions*

Operation modes

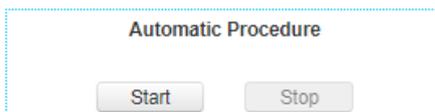
Manual mode

The *Manual mode* allows the user to get the on/off control of the pump by clicking (on/off) the *Filling* button. To drain valve actuation, click the *Draining* button. The user can select three distinct water flow rate.

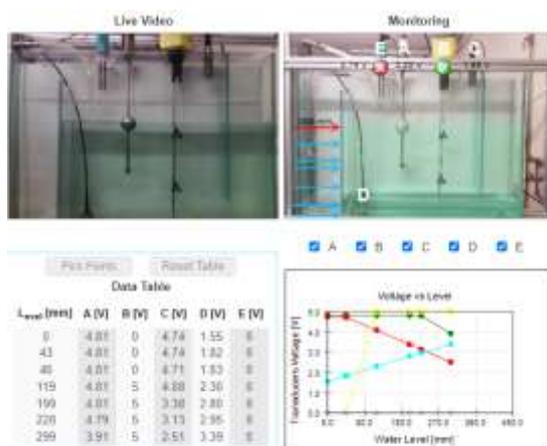


Automatic mode

The *Automatic procedure* allows the user to start the experiment by clicking *Start* button (the software will automatically perform the pre-established procedure).

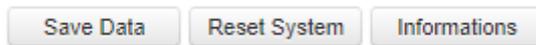


Both modes will introduce changes in the water level of the tank. The user interface provides each transducer output, the detectors' state and pretends to inform level values indicating different numerical values evolution of the water level. An example can be presented in the next picture.



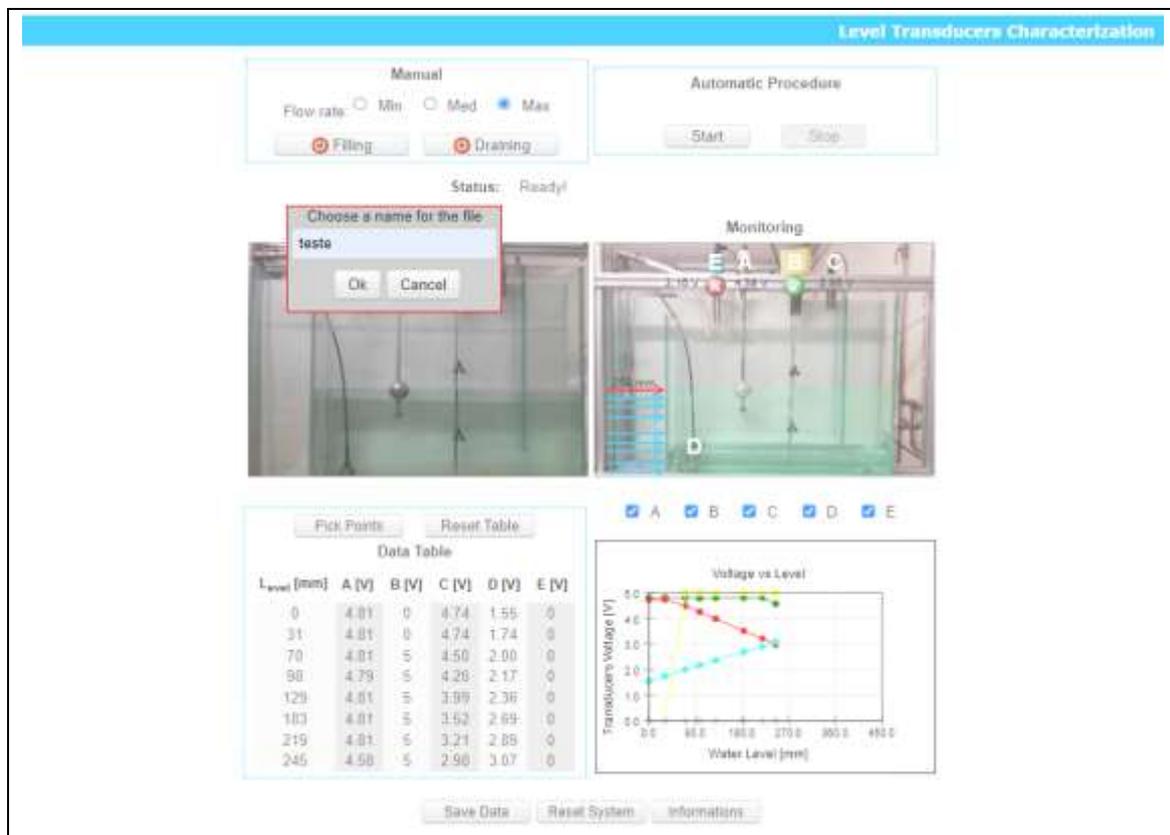
How to use

Bottom buttons



- The *Save Data* button allows the user to save test data from both the automatic operation or from the manual modes (when 'pick points' is pressed).
- The *Reset System* button is used to restart the system (reset is recommended whenever the experiment is to be performed).
- The *Information* button opens a new window with some relevant information about the setup (transducers and detectors description). If the browser blocks any pop-up windows it is necessary to allow it.

Save Data: After performed the automatic or manual mode test, the measured values can be saved in the Moodle Remote Experiments Platform file system with the user chosen file name.



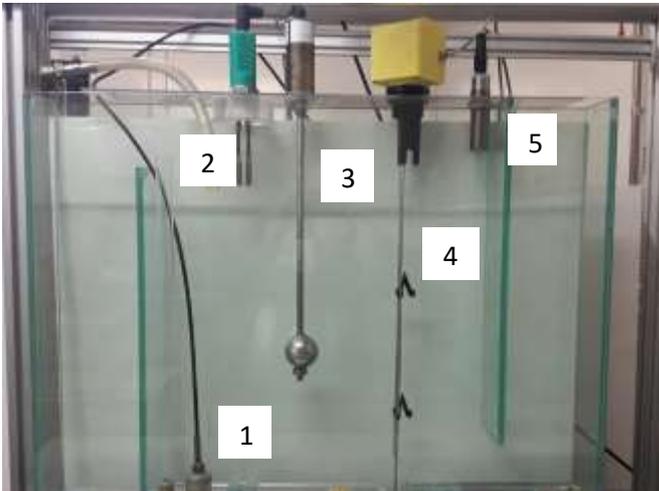
Level [mm]	A [V]	B [V]	C [V]	D [V]	E [V]
0	4.81	0	4.74	1.56	0
31	4.81	0	4.74	1.74	0
70	4.81	5	4.50	2.00	0
90	4.79	5	4.26	2.17	0
129	4.81	5	3.89	2.36	0
183	4.81	5	3.62	2.69	0
219	4.81	5	3.21	2.88	0
245	4.58	5	2.98	3.07	0

In the left menu *EJSAPP FILE BROWSER* the saved file can be accessed.



Suggested exercises

After the picture below, a few set of questions will address some experiment related questions.



1. Identify those that are transducers and those working as detectors, by using the corresponding numbers:

	Corresponding Numbers
Transducers	
Detectors	

2. Plot the characteristic (function) for **each transducer** for the experiment offered range (the range in which they have been working)
3. Determine each transducer sensitivity when integrated on this system (and its electronics) in the considered range.
4. Calculate the transducer's non-linearity for those with approximate linear response.
5. Annotate possible dead zones for each transducer.
6. Which procedure should have been used to determine the hysteresis of each detector?