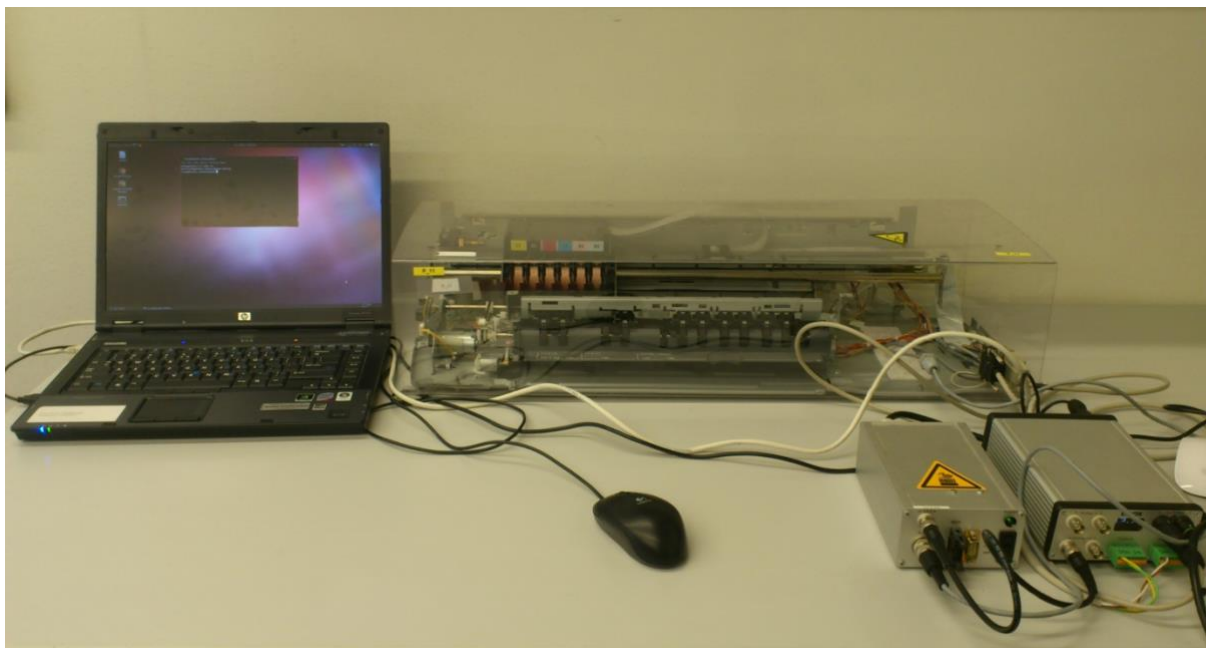


# Advanced Motion Control 4CM60

## ILC experiments



*Experimental Setup*

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# Performing experiments

## Perform the following steps to start experimenting

1. Inspect all connections; do you understand which wires serve what purpose? If you are unsure, ask the assistant. Make sure the amplifier is turned on (black switch).
2. Start Ubuntu (boot / reboot, select Ubuntu). When prompted for login information use the following:  
Username: **ebox**  
Password: **ebox123**
3. Copy all your files to a local directory on the laptop, e.g., /home/ebox/Desktop (working from the USB drive is problematic). **Do not forget to remove all files afterwards.**
4. Open a terminal and navigate to the local file directory, see also the FAQ. Set file permissions by opening a terminal (via the terminal icon in the upper left corner or CTRL+ALT+T), and enter
  - **sudo su** [enter]
  - **chmod 777 \*** [enter]See also the FAQ.
5. Start Matlab with super user rights: open a (new) terminal and enter
  - **sudo su** [enter]
  - **matlab&** [enter].
6. The experiments can be started using **ExpILC.m**.
7. Make sure that the amplifier is turned on prior to experimenting, and turn it off when completely finished. **NEVER** turn on the amplifier if you have already started the experiment and noticed the amplifier was turned off (doing so can result in a collision of the carriage with the sides of the printer, damaging the mechanics). Cancel the experiment first, then turn on the amplifier and then restart the experiment.
8. When finished:
  - turn off the amplifier,
  - copy the files to your USB,
  - **safely remove the USB** using the eject button in the file explorer *Places*,
  - **remove your files from the local drive**, and
  - shutdown the laptop.

In case of problems, first consult the FAQ (see below)!

## Safety measures

- Turn off the amplifier in case of unexpected behavior of the experimental setup.
- The experiments can be stopped by pressing **CTRL+C** repeatedly in the Matlab command window.

# Frequently Asked Questions (FAQ)

Before sending an e-mail, please read the FAQ and recall the lecture about the experimental setup.

## Simulations

- Use Matlab\Simulink R2011b or above with the Control Systems Toolbox installed, and install ShapeIt. The ShapeIt toolbox can be found at:  
[http://cstwiki.wtb.tue.nl/index.php?title=Home\\_of\\_ShapeIt](http://cstwiki.wtb.tue.nl/index.php?title=Home_of_ShapeIt)  
and the FAQ at  
[http://cstwiki.wtb.tue.nl/index.php?title=FAQ\\_of\\_shapeit](http://cstwiki.wtb.tue.nl/index.php?title=FAQ_of_shapeit)
- S-Function 'dlowpass2' or similar does not exist: install ShapeIt and make sure all required compiled files are available.
  - For 64-bit Windows platform, a C compiler is not supplied with MATLAB. A suitable compiler is Microsoft Windows SDK 7.1  
<http://www.microsoft.com/en-us/download/details.aspx?id=8279>  
Alternatively, install Matlab 32-bit or use Ubuntu.
  - On 32-bit Windows, the lcc C compiler is installed along with MATLAB.
  - On Linux, no C compiler is supplied with MATLAB, but the GNU compiler (gcc) is included with Ebox.
  - On the Mac, no C compiler is supplied with MATLAB. If you use products that require one, Apple's development environment for OS X (Xcode) is available in the Mac App Store.
- Error on number of parameters in 'dlowpass2': install the latest version of ShapeIt.
- Initialization commands cannot be evaluated. Install Simulink version 7.8 or above (Matlab R2011b or above).
- The "LTI system variable" parameter of the LTI block must be set to a valid LTI model. Install Simulink version 7.8 or above (Matlab R2011b or above).

## Experiments

- The experiments won't start. Always start Matlab as super user (**sudo su**).
- The experiments are started, but the print head won't move. Make sure the carriage has pressed the homing button on the left. If not, manually help the carriage push the button.
- If you make any changes to the Simulink model, rebuild the model (**CTRL+B**) (no spaces are allowed in the full path to the Simulink model).
- A warning about '**permission denied**' is displayed in the Matlab terminal when I want to run the experiments. Your files do not have the correct **permissions**. Make sure that all the files have been copied to the hard drive (i.e. you are not running from a USB stick) and perform the following steps:
  1. Open a terminal
  2. **sudo su** [enter]
  3. **cd** "location files" [enter] (navigate to the folder that hold your files)
  4. **chmod 777 \*** [enter]
  5. **ls -la** [enter] this lists all files in the folder. All files should have a green font. If not, the files are most likely not on the hard drive.
  6. Close the terminal.

## Ubuntu

- Terminal commands:
  - **cd ..** - go one folder up
  - **cd foldername** - navigate to folder
  - **ls** - list all files and all folders
  - **ls -la** - list all files and all folders with details
  - Use '**tab**' to complete folder or filename when typed only first part.
  - Copy/paste: **CTRL+SHIFT+C** / **CTRL+SHIFT+V**

- Windows folders: The host drive can be found at **/host**. Other drives can be found in **/media** (e.g. **/media/PROGRAMS**).
- Killing a process: If your laptop or an application (like Matlab) stops reacting you can try the following to kill the process giving problems:
  - Open a new terminal.
  - Type **sudo su** (superuser) to get the sufficient rights.
  - Type **ps -aux** or **ps -e** (get a list of all processes and ID). You can also use the command **top** to get a list of the processes using the most CPU time. Find the ID of the process you want to kill.
  - Type **kill -9 <process id>**.

Alternatively if you know the process name you can use the **pkill** command. So to kill Matlab use **pkill matlab**.

## Resetting the Ethernet index number

Ubuntu assigns a number to every network device, e.g., **eth0** or **eth2** etc. This index must be 0 in order for the ILC experiments to function. The number can be inspected and reset by performing the following steps:

1. Open a terminal.
2. **sudo su** [enter] (get super user rights)
3. **ifconfig** [enter] (list network interfaces)

If the Ethernet interface is not listed as “**eth0**”, perform the following:

1. In the same terminal: **cd /etc/udev/rules.d** [enter].
2. **rm \*** [enter]
3. Reboot the computer.

In case you are not running a freshly installed Ebox Ubuntu image, run the following script in Matlab after rebooting: **changeeth(0)**. Be sure to start Matlab with super user rights. This script updates the Ethernet numbering in the existing Simulink files provided with the Ebox image.

## Wireless network

The wireless network can be setup by clicking the Wi-Fi sign (quarter pie) on the right top of your screen. Use the following settings for **tue-wpa2**:

- Security: WPA & WPA2 Enterprise
- Authentication: Protected EAP (PEAP)
- Anonymous identity: <empty >
- CA certificate: /usr/share/ca-certificates/mozilla/GTE\_CyberTrust\_Global\_Root.crt
- Inner authentication: MSCHAPv2
- Username: <your s-number, e.g. s123456>
- Password: <corresponding password>

## Activating Matlab

In the current installation, a pre-installed version of a Matlab license is present which should be removed. If you encounter a problem with the license for Matlab: remove all license files. You can do so by entering **sudo rm -f /usr/local/matlab2011b/licenses/license\_ubuntu\_284992\_R2011b.lic** in the terminal. The version of Matlab installed on Ubuntu needs to be activated. To do so, start Matlab from a terminal window with **sudo su** followed by **matlab&**. Select the activation using internet. You have to login using your own Matlab Mathworks account. This should be registered to your @student.tue.nl email. You have created your password at the activation of your account. If you have not yet created a Mathworks account, please do so before joining the experiment sessions. After logging in you have to enter the activation key present on your desktop in the .txt file containing **stud** in the file name. **After entering the activation key, you have to keep the username at root, do not change this to your s-number!**