User manual for GUI of Robot Denso measurement:

Graphical User Interface for EM signal measurement with Robot Denso 6axes/5axes + Oscilloscope TELEDYNE Lecroy HDO6034 (control + measure + save data)

Details:

Robot drivers' installation

Required tools:

1. Python 3.10 (developed in 3.10.11)
2. The packages:

   In "Command Prompt": add the commands:

   'pip install PyQt5

   pip install pyserial

   pip install pywin32 or pypiwin32 if the first one doesn't work

   pip install pyvisa

   pip install visa'

   to install the packages such as:

   PyQt5

   pyserial

   PyVISA

   pywin32

- The softwares :
  - RobX_1.28.20.1027.exe (KEOLABS software for libraries)
  - activedsoinstaller.exe
  - IviSharedComponents_300.exe
  - lecroyscope.3.2.9.0-x64.msi
  - visa530runtime.exe
  - wavestudioinstaller64_8.7.0.5.exe for the 5 axes (driver serial):
    - UC232A_Windows_Setup.exe for the 6 axes (Denso software for controlling their robots requires a license):

    - WINCAPS III v3.64.2 or to download from the website (requires a license to install))
    - ORiN2 in WINCAPS III (register a license in ORiN2/CaoConfig)
    - Visual Studio Code

Additionally, the tool requires a static IP on the PC port. For this :

- Find "panneau de controle" in Windows
- Go to "réseau et internet"
- "Réseau et centre de partage"
- "changer les options d'adaptateur"
- Right click "Ethernet", NOT ‘WIFI’
- Click "propriétés"
- Click "Protocol Internet Version 4 (TCP/IPv4)"
- Click "propriétés"
- Select "utiliser l'addresse ip suivante"
- Enter "192.168.30.33" (for example) in the field of "addresse ip" and "255.255.255.0" in the field of "masque sous réseau"
- Note: Robot IP is ‘192.168.30.34’ – defined in the Robot

Usage

The DENSO 6-axis robot can be manually controlled using the Keolabs software. To use it, open a command prompt in the directory "C:\Program Files (x86)\KEOLABS\RobX\Bin" and enter the command "Rob6xManager P S192.168.30.34 DENSO VS-AV6".

GUI user guide

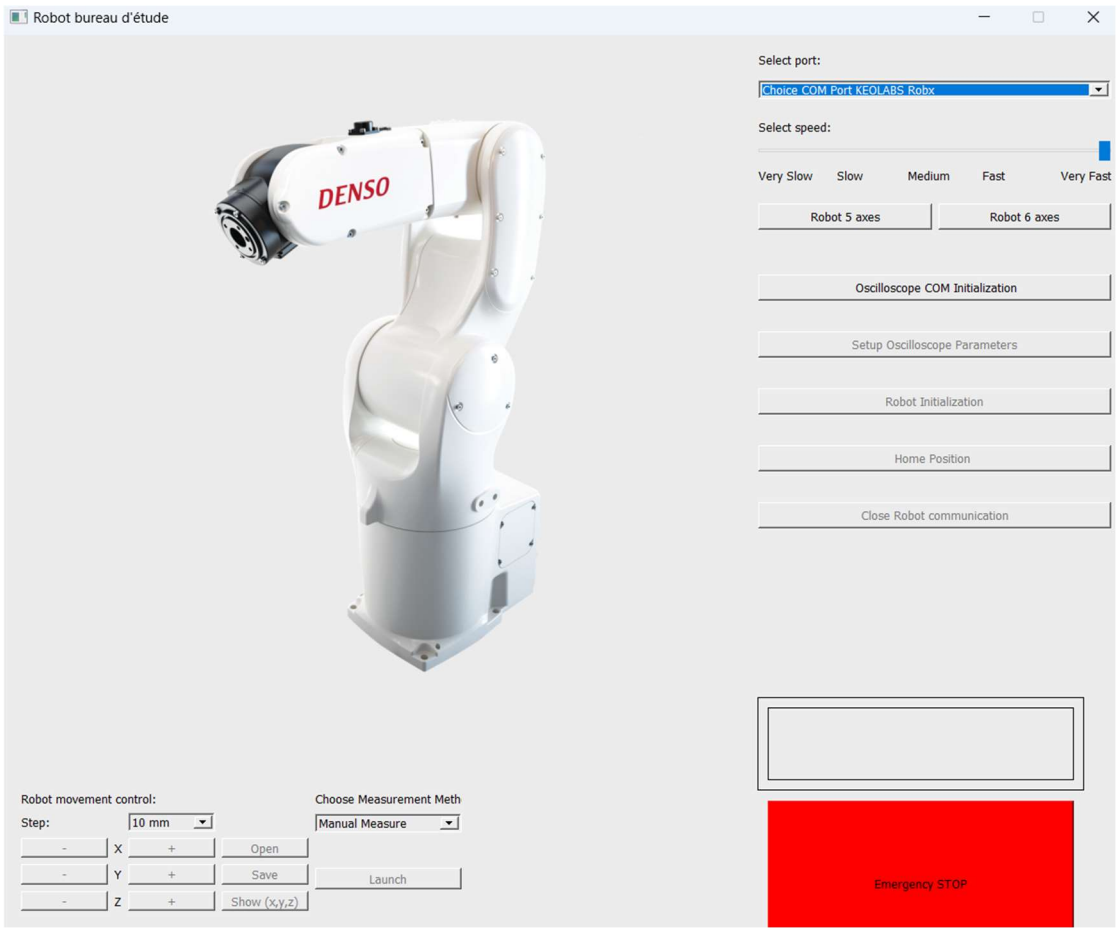
For the DENSO 6-axis robot specifically, please launch Wincaps III and log in as a developer beforehand to use the tool:

- Connect the powered-on robot and the oscilloscope to the computer
- Run the script MainWindow.py (navigate to the folder and execute: Python ./MainWindow.py) or double click ‘control_robot.bat’
- In the case of ‘5 axes’:
    - Open the dropdown menu and select the corresponding COM port (USB to Serial Bridge) for the robot

- Clic ‘5 axes’

- In the case of ‘6 axes’, click ‘6 axes’ directly (connected by TCP/IP) while the robot 6 axes is ready. (The flash green light is off on the manual controller)
- Initialize the oscilloscope using the "Oscilloscope COM Initialization"
- "Setup Oscilloscope Parameters" button is used to select and activate the parameters (such as **Pk-Pk, Amplitude, Frequency** etc.) that need to be measured in each channel (**Ch1, Ch2**, … etc.) on scope.

  (Note:
  a. Setup in scope the trigger to ‘**Normal**’ for TRAIN signal measurement, not ‘**Auto**’ nor ‘**Single**’.
  b. Setup the trigger to ‘**Normal**’ or ‘**Auto**’ (the same) for continuous signal measurement.)
- Initialize the robot with the bouton "Robot Initialization"



Once, Robot initialization is done, the user can move the Robot arm to its “Initial Position” - (0,0,0) point illustrated in the picture.

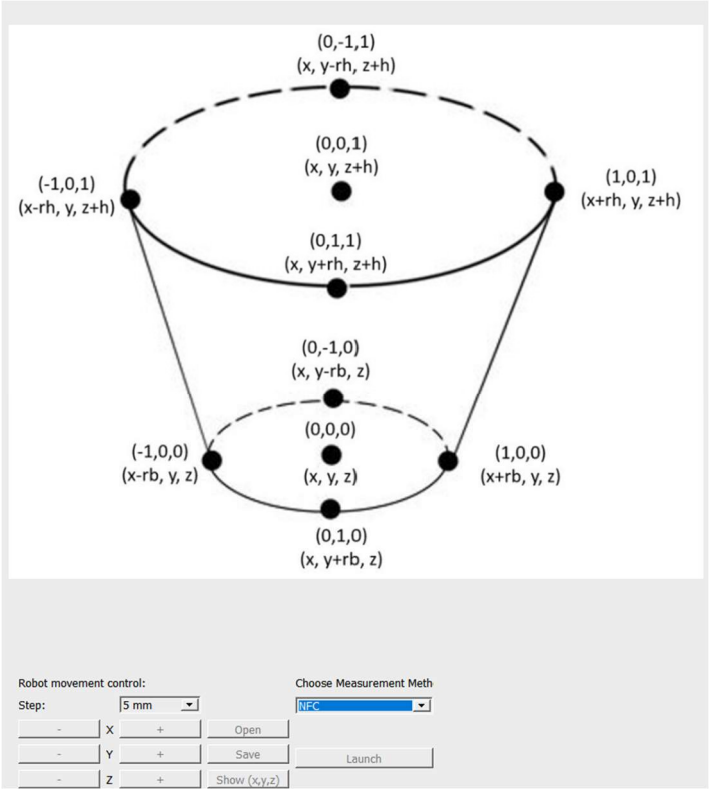
1. Use ‘select speed’ to change the speed of robot movement
2. Use ‘Robot movement control’ to move the robot
3. ‘step’ is the step of robot movement each time when user click the ‘-’ or ‘+’ button in x, y, z direction respectively
4. Once initial position of robot head is selected, user can use ‘save’ button to save the coordinator of the robot, and can use ‘show (x,y,z)’ to see the coordinates of the robot in the display part on the right side of the GUI. (Note, robot coordinates is defined by Robot itself. It is not the same as these coordinates defined in pictures)
5. User can reuse the initial position saved before by click ‘open’ button, the robot will move to its corresponding coordinates in the saved file.
6. Use ‘show (x,y,z)’ to see the coordinate in the display screen

Once, Robot initial position is done, the user can ‘choose the measurement method’ in the list. There are 5 types of measurements.

1. Manual measure

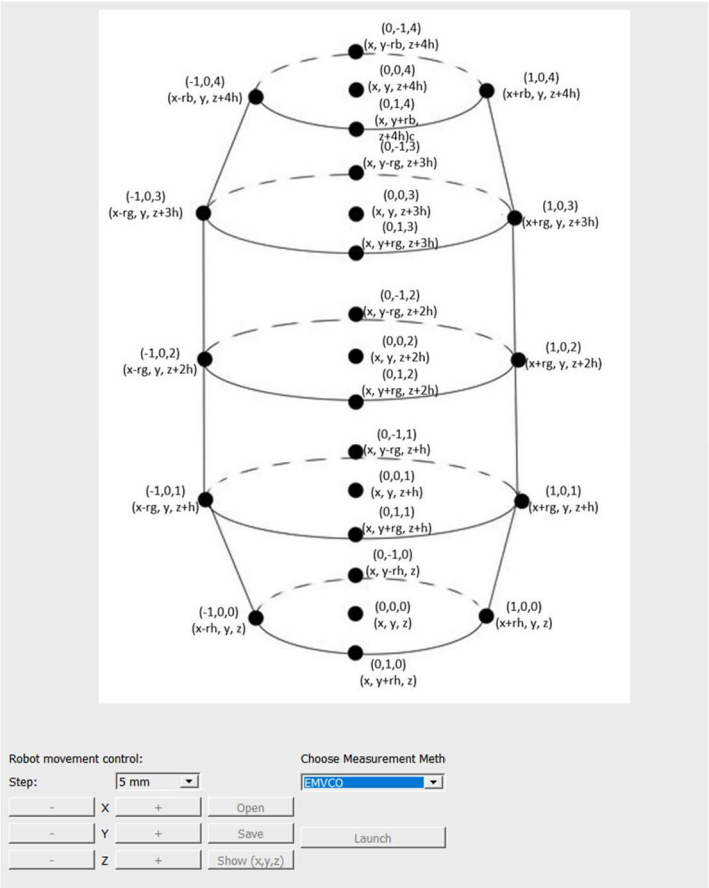
   This is for user to do a measurement at current position.
2. NFC

   The robot will do the measurement around its initial position as shown in picture NFC



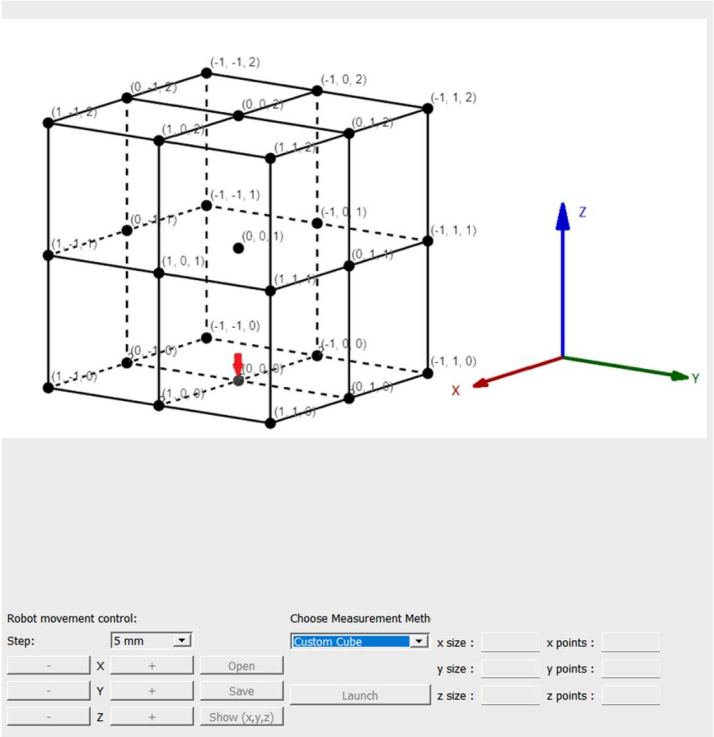
3. EMVOC

   The robot will do the measurement around its initial position as shown in picture EMVOC



4. Custom cube

   The robot will do the measurement around its initial position (0,0,0) in cube which is defined by user on the right side with ‘x, y, z size’ and ‘points’.

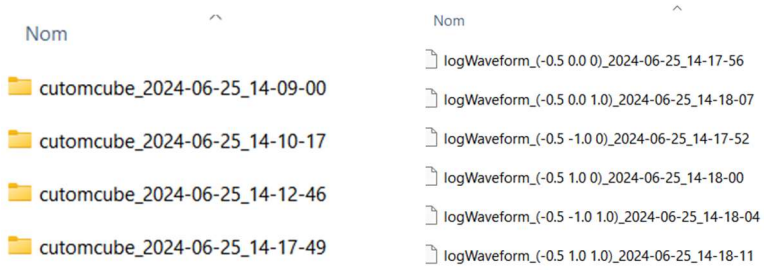


‘x, y, z size’ is the cube side length in x, y, z axes. ‘Points’ is the number of points to measure in each axe.

For example, x size = 10, x point = 3. This means that in x axe, 3 points will be measured.

1. There coordinates in x are (-5, *, *), (0, *, *) and (+5, *, *).
2. The unit of the size is always **millimeter**.
3. The ‘x size’ value can be both **integer** and **float**.
4. The smallest resolution of robot movement is **0.1 mm** that is defined by robot.
5. (0,0,0) is the initial position defined in previous step.
6. ‘y size’ and ‘z size’ are the same as ‘x size’.

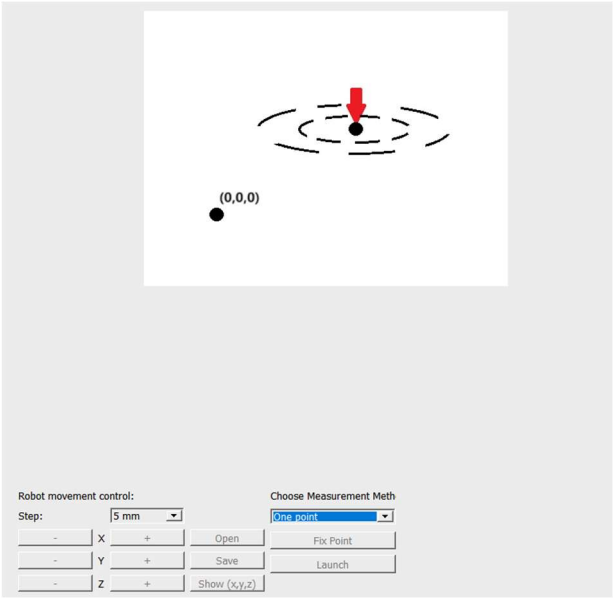
Once cube size is defined, click ‘launch’. The measurement is launched automatically. Each time when the robot arrives the measurement point, the motors are shut down, and the measurement is done automatically. Then the oscilloscope will capture the signals and save all the signals’ data and transfer them to computer in a user folder that is created automatically and named by its coordinates.



5. One point

   The robot can do the measurements at current point. User can move the robot by 'robot movement control' and launch the measurement.

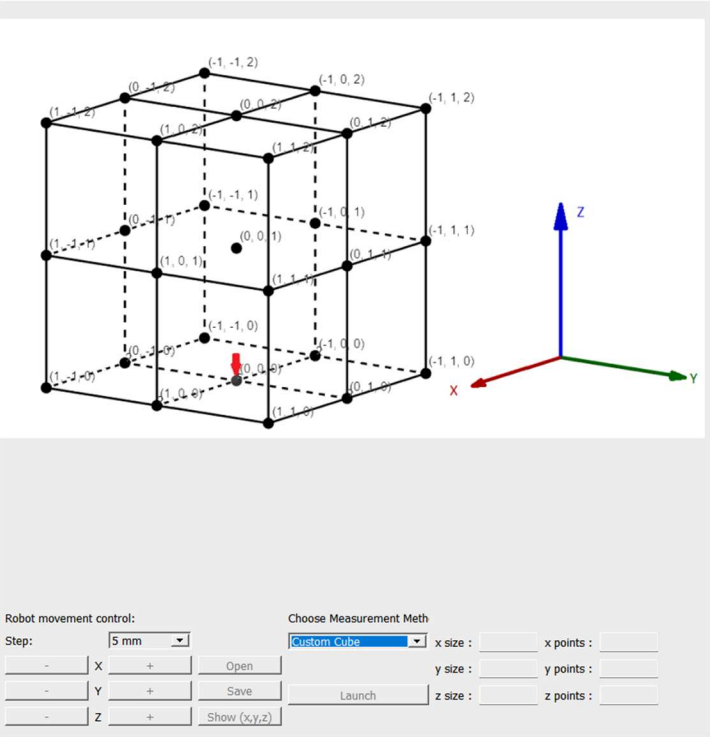
   'Fix point' is used to define the initial position for measurement.



   Once click 'Fix point', the initial position will be set to the current position. Then user can move the robot to other place, and click 'show (x,y,z)' to see the coordinates relative to its initial position as shown in the picture. After 'launch', measurement will be done at this point and signals will be saved automatically in computer named by its relative coordinates.

6. Cylinder

   The robot will do the measurement around its initial position (0,0,0) in cylinder which is defined by user on the right side with 'Radius', 'Height', 'Circle points' and 'Layers'.



'Radius' and 'Height' are the cylinder parameters. 'Circle points' is the number of points will be measured in one layer on the circle. 'Layers' is the number of layers to measure in Z direction. The center point of each circle will also be measured.

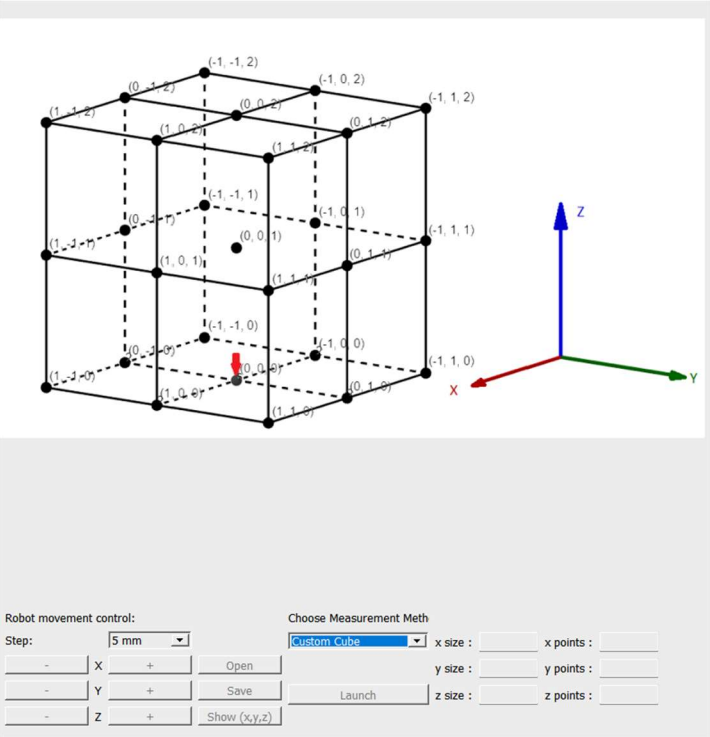
For example, 'Circle points' = 3, 'Layers' = 4. This means that in xy plane on each circle, 3 points will be measured. And there are 4 layers in Z direction.

a. The unit of the size is always **millimeter**.
b. The 'x size' value can be both **integer** and **float**.
c. The smallest resolution of robot movement is **0.1 mm** that is defined by robot.
d. (0,0,0) is the initial position defined in previous step.

Once Cylinder is defined, click 'launch'. The measurement is launched automatically. Each time when the robot arrives the measurement point, the motors are shut down, and the measurement is done automatically. Then the oscilloscope will capture the signals and save all the signals' data and transfer them to computer in a user folder that is created automatically and named by its coordinates.

7. Semi-sphere

   ‘Semi-sphere’ can measure these points on the surface of a semi sphere centered by the initial position (0,0,0) which is defined by user on the right side with ‘Radius’, ‘Circle points’ and ‘Layers’.



   ‘Radius’ is the Sphere parameter. ‘Circle points’ is the number of points will be measured in one layer on the sphere. ‘Layers’ is the number of layers to measure in Z direction.

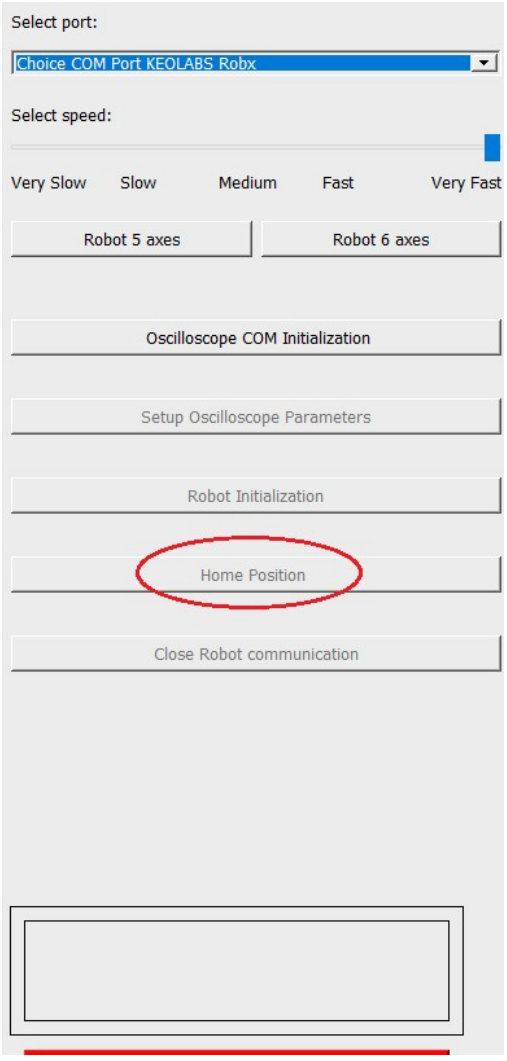
   For example, ‘Circle points’ = 3, ‘Layers’ = 4. This means that on each circle of measurement plane XY, 3 points will be measured. And there are 4 layers in Z direction. The center point of each circle will also be measured.

   a. The unit of the size is always **millimeter**.
   b. The ‘x size’ value can be both **integer** and **float**.
   c. The smallest resolution of robot movement is **0.1 mm** that is defined by robot.
   d. (0,0,0) is the initial position defined in previous step.

Once Sphere is defined, click ‘launch’. The measurement is launched automatically. Each time when the robot arrives the measurement point, the motors are shut down, and the measurement is done automatically. Then the oscilloscope will capture the signals and save all the signals’ data and transfer them to computer in a user folder that is created automatically and named by its coordinates.

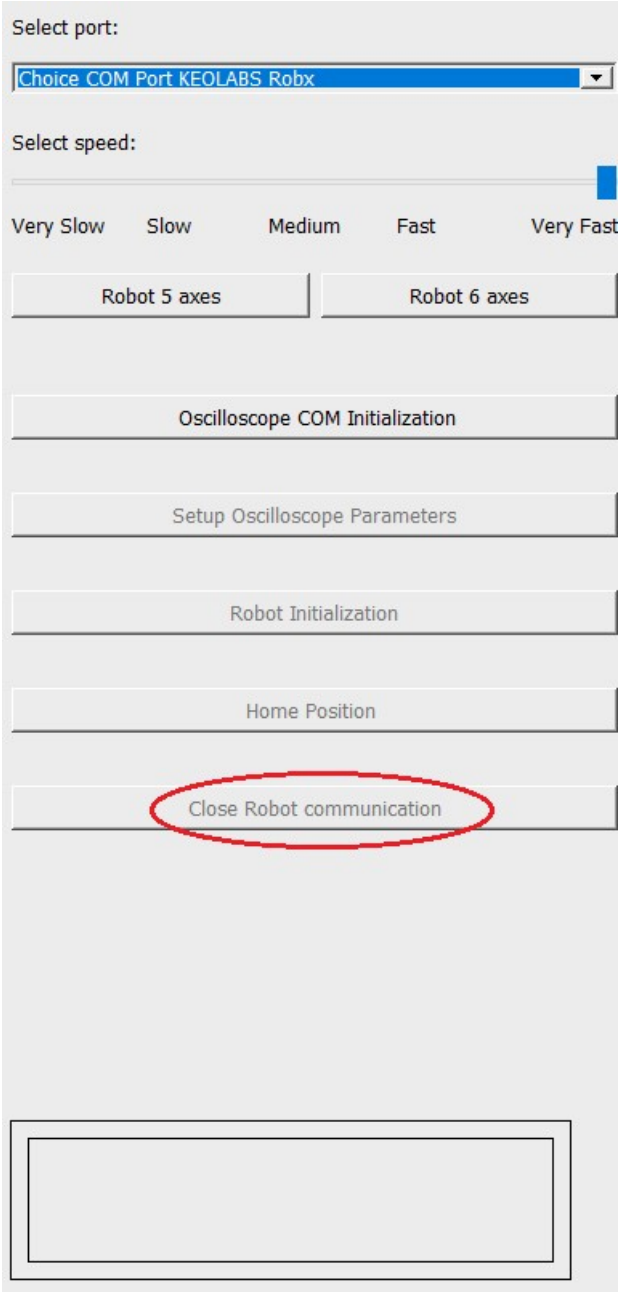
8. Home position

   ‘Home position’ is defined by robot, its coordinates are (400,0,480) for robot for 6 axes and (0, 269, 27) for 5 axes. User can click ‘Home position’ to move robot to this point anytime.



9. Close robot communication

   Once measurements are finished, user should click ‘Close robot communication’ to cut the communication between the robot and computer.



10. Once the robot is not correctly shut down or the GUI crashes, user should reconnect USB cable and TCP/IP port to the computer and restart the GUI software. It not, the robot cannot be restarted properly.

    The adaptor of TCP/IP to USB C can cause connection problems during measurement.