RobotStudio Tutorial

Requires:

- RobotStudio version: 6.x or later.
- RobotWare option: Externally Guided Motion (EGM) [689-1].

Notes:

- EGM is only fully supported for 6-axis robots.
- EGM has a partial support for IRB14000 (aka YuMi) and that is EGM's joint mode.
    - **For a real robot controller:** Contact your local ABB Robotics sales organization for more information about getting an EGM license for IRB14000.
- This tutorial assumes that the accompanying RAPID modules are used. E.g.:
    - <your path>/rapid_modules/**TRobMain.sys**
    - <your path>/rapid_modules/**TRobEGM.sys**
    - These modules **only** handle EGM's joint and pose modes. Not the path correction mode.
- This tutorial is exemplified with a simulated IRB1600 robot in RobotStudio. It is **strongly recommended** to do initial tests with simulations.
- The process is similar when working with a real controller:
    - Exclude step 1 and replace it with:
        - Under the **Controller** tab → Add Controller → Add Controller… → Follow the instructions. Then continue with step 2.

Step 1 – Create a Robot System

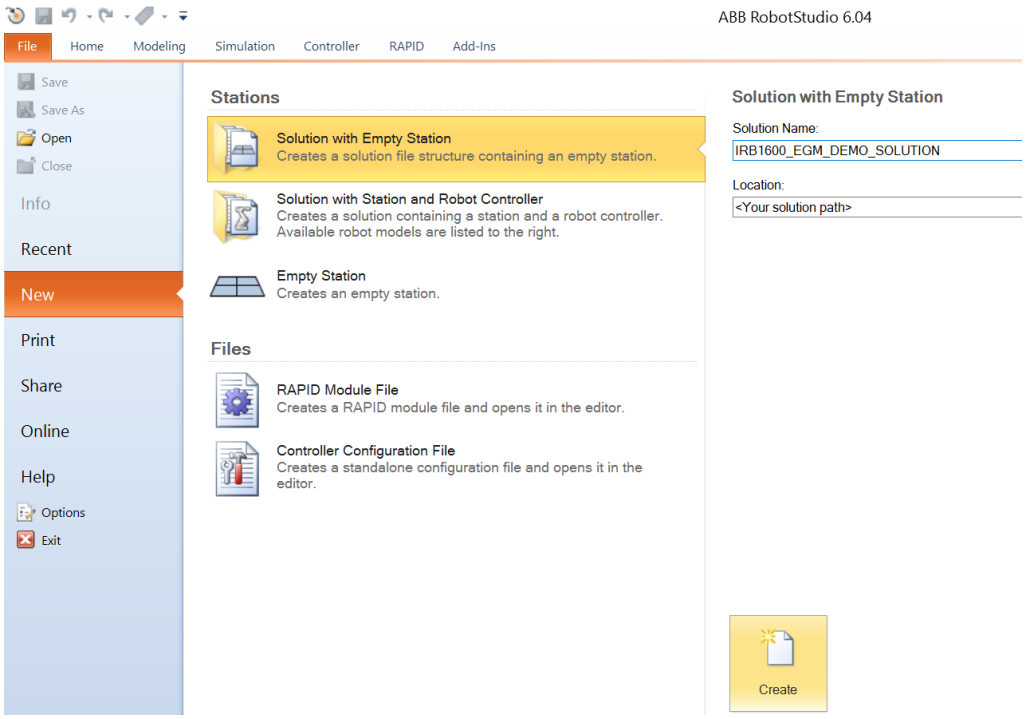

*Figure 1: Under the **File** tab → **New** → **Solution with Empty Station** → Choose a **Solution Name** and **Location** → Press **Create**.*

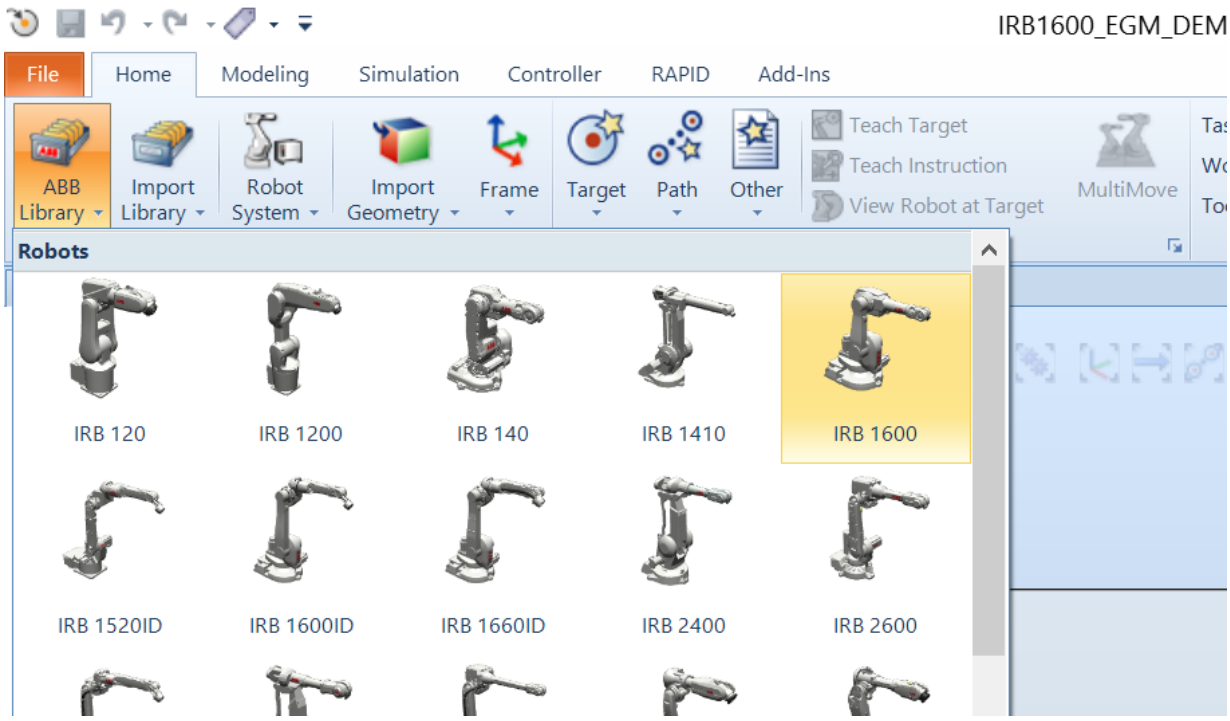

*Figure 2: Under the **Home** tab → Press **ABB Library** → Choose the **desired robot** (here IRB1600).*

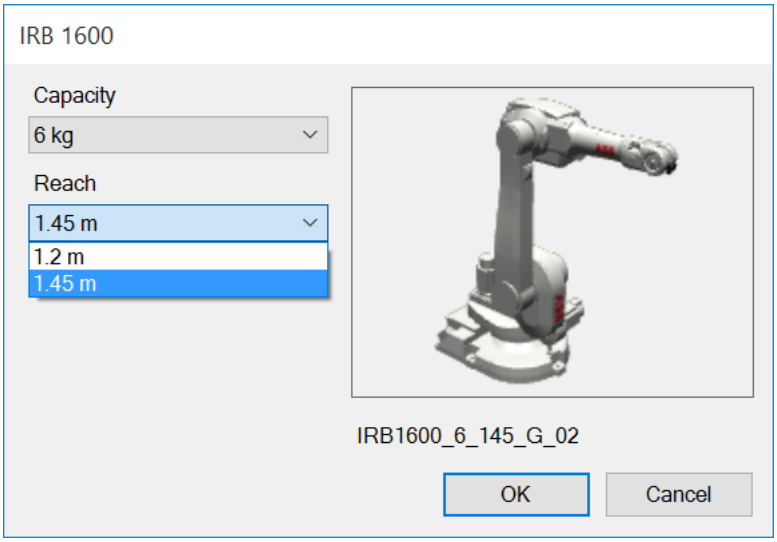

*Figure 3: Choose the **desired robot version** (here IRB1600 – 6 / 1.45) → Press **OK**.*

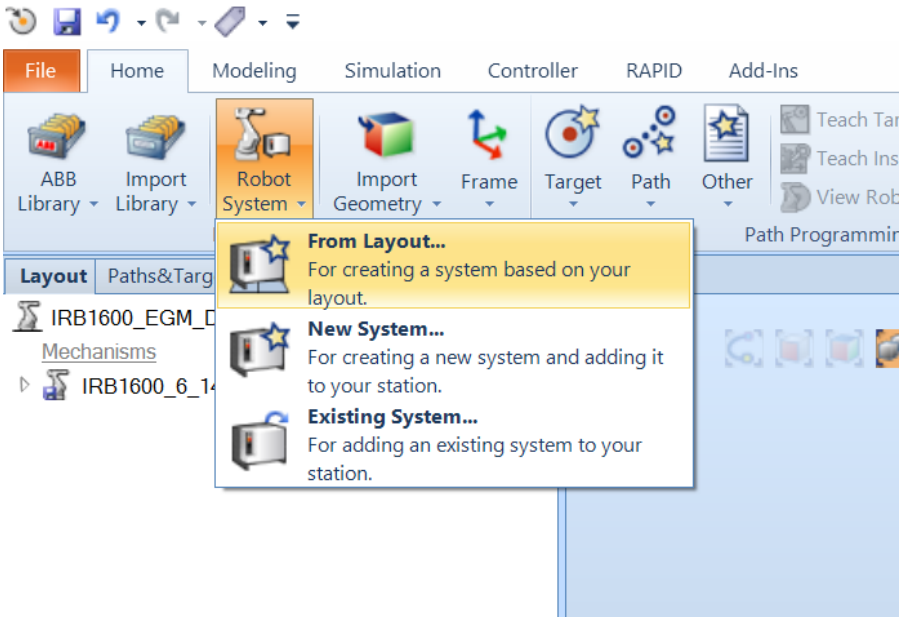

*Figure 4: Under the **Home** tab → Press **Robot System** → Choose **From Layout...***

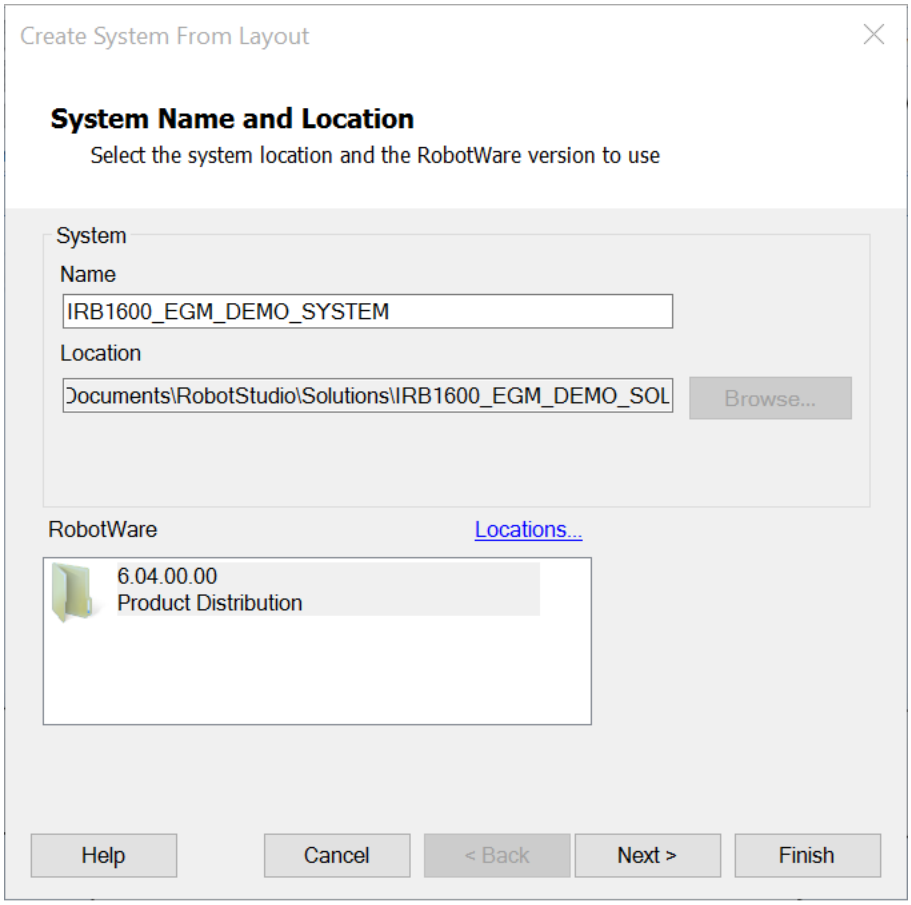

*Figure 5: Choose a **Name** and **RobotWare version** (here RobotWare 6.04) → Press **Next >**.*

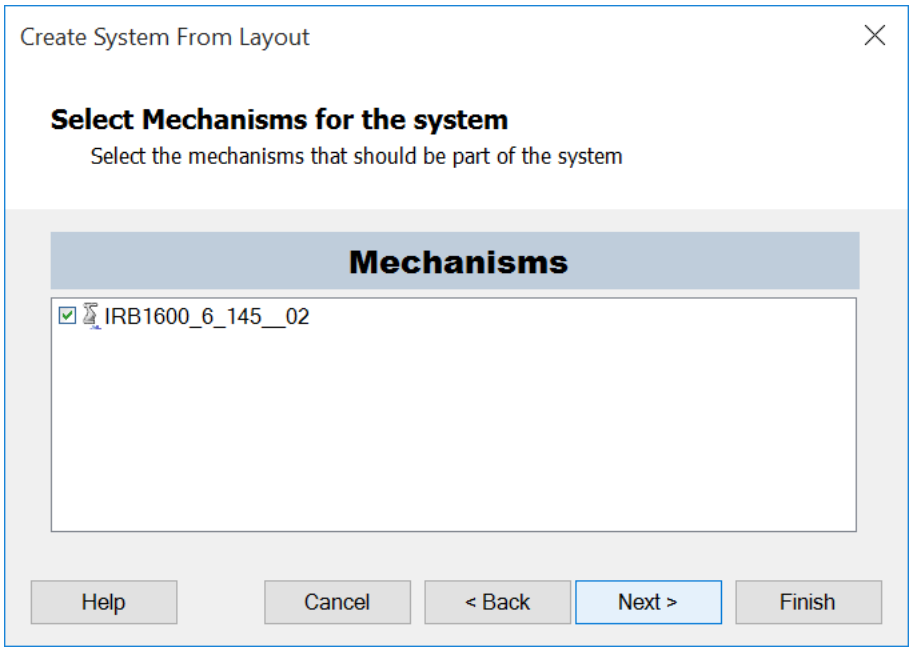

*Figure 6: Press **Next >**.*

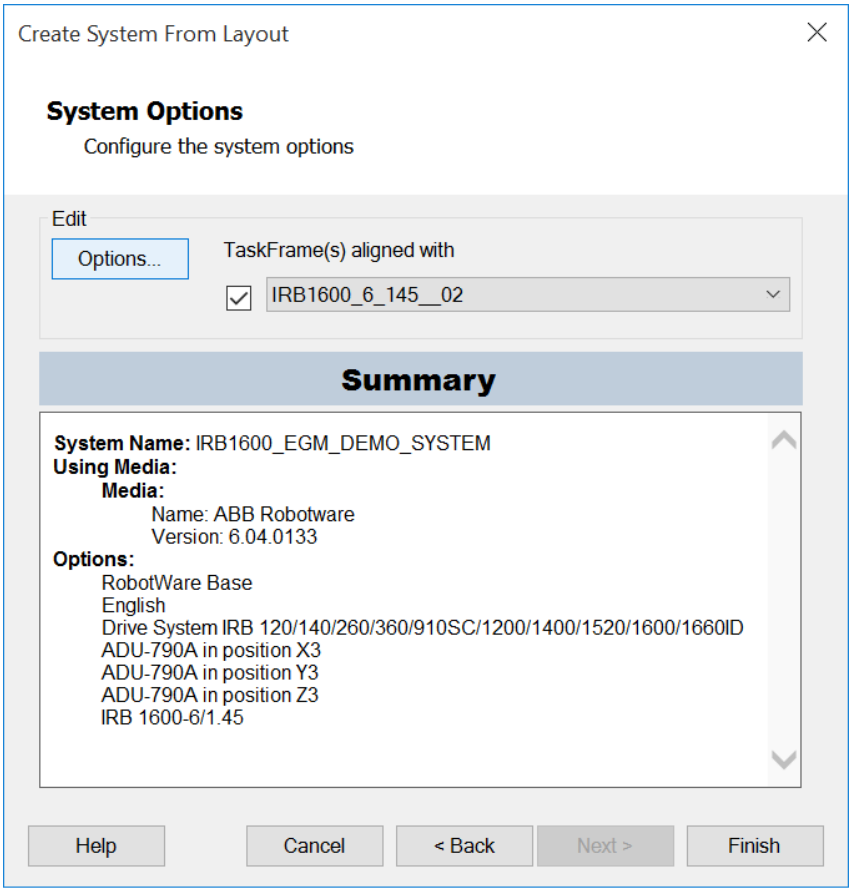

*Figure 7: Press **Options...***

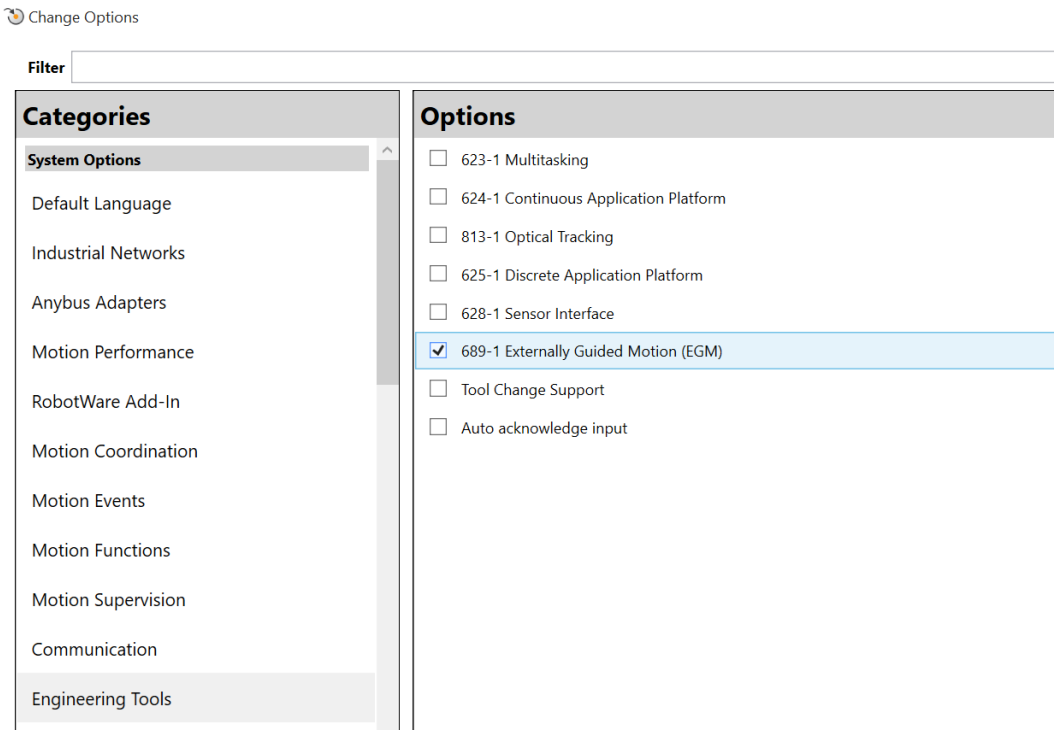

*Figure 8: Under **System Options** → **Engineering Tools** → Choose **689-1 Externally Guided Motion (EGM)** → Press **Ok**.*

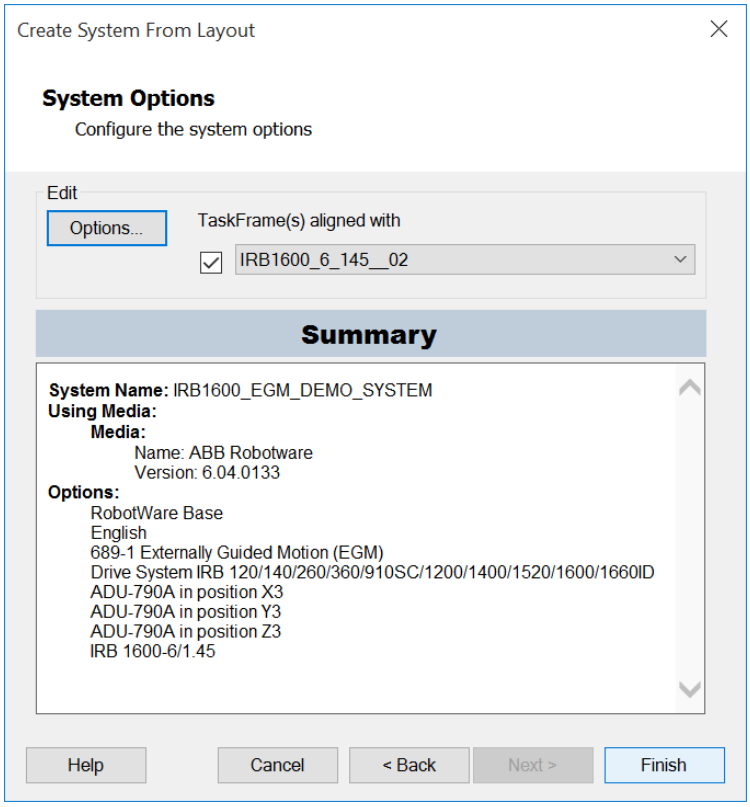

*Figure 9: Verify that the **desired Options** has been chosen → Press **Finish**.*

Step 2 – Configure the Robot Controller

Communication

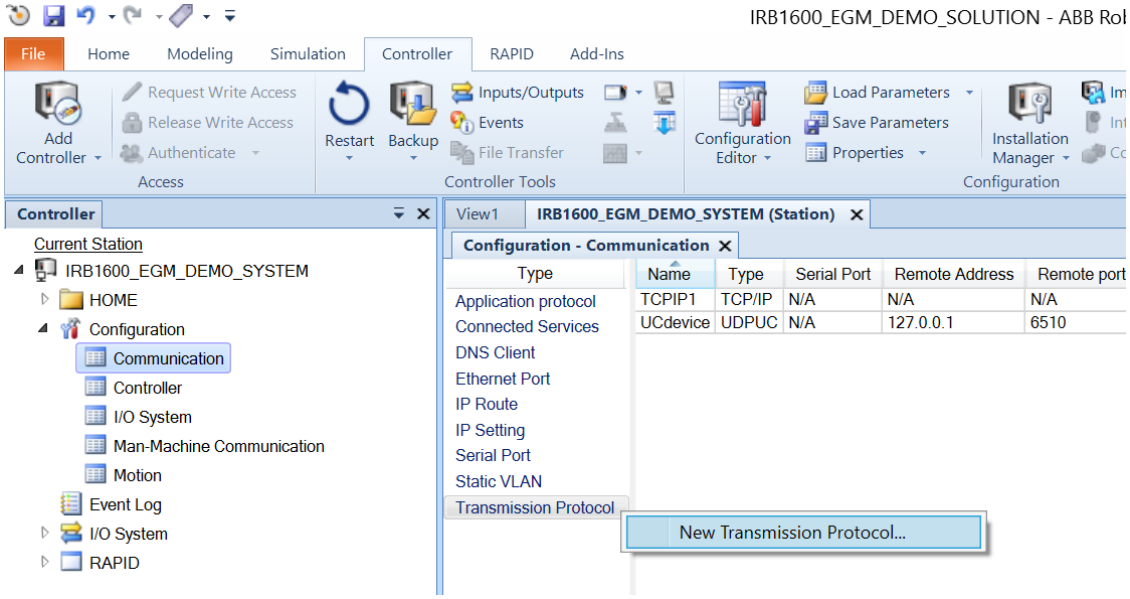

*Figure 10: Under the **Controller** tab → **Configuration** → **Communication** → Right-click **Transmission Protocol** → Choose **New Transmission Protocol…***

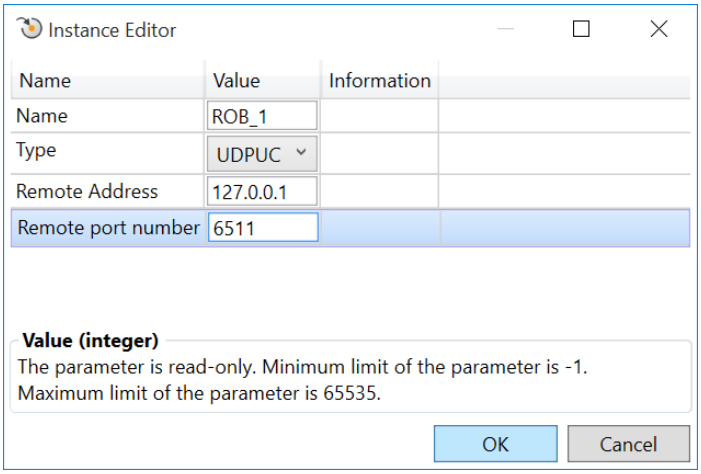

*Figure 11: Set the values (see below) and press **OK**. Also, don't restart the robot controller until later on.*

Note: Create a **Transmission Protocol** for each robot in your system:

- **Name:** This tutorial assumes that the name is **ROB_X**. Where X is the robot number or, in the case of IRB14000, L or R for left respective right arm.
- **Type:** Choose **UDPUC**
- **Remote Address:** Specify your remote address (**important to set**)
- **Remote port number:** This tutorial assumes that the port number is 6511 for ROB_1, 6512 for ROB_2, etc. For IRB14000 it should be 6511 for ROB_L and 6512 for ROB_R.

I/O System

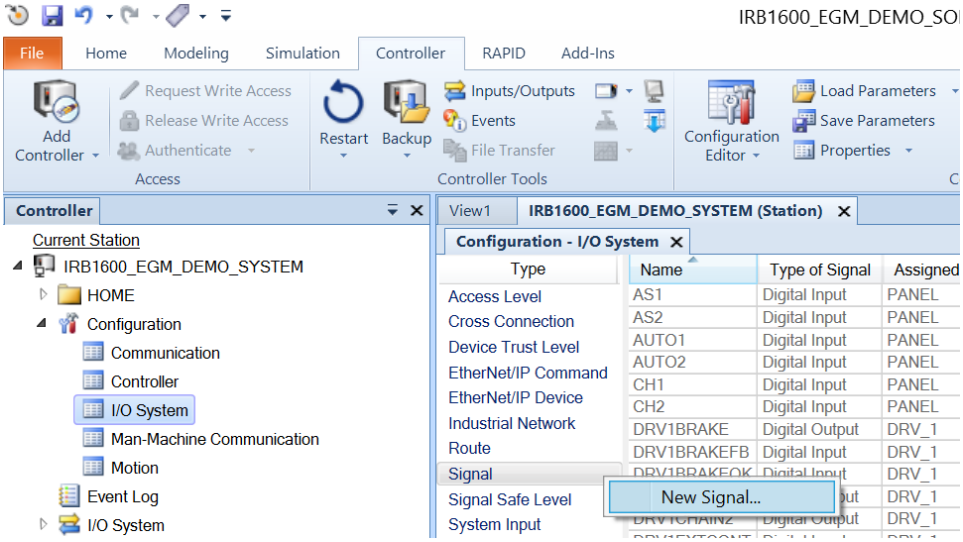

*Figure 12: Under the **Controller** tab → **Configuration** → **I/O System** → Right-click **Signal** → Choose **New Signal…***

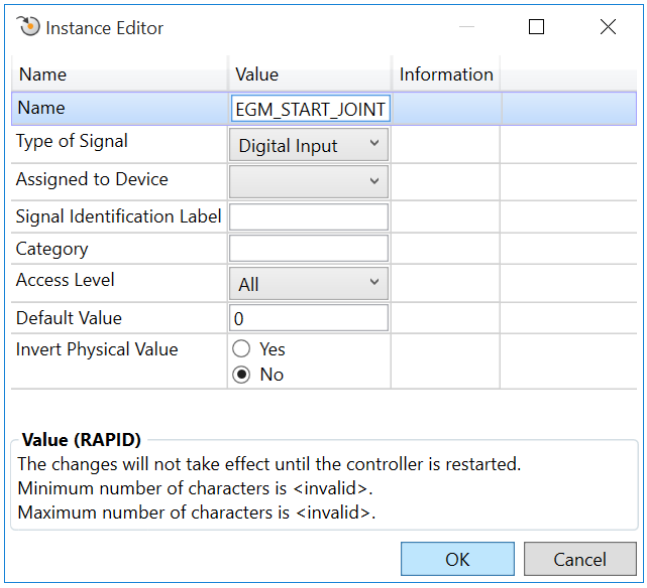

*Figure 13: Set the values (see below) and press **OK**. Also, don't restart the robot controller until later on.*

Note: Create a **Signal** for each name below:

- **Name:** This tutorial assumes that these signals are defined:
  - **EGM_START_JOINT**, **EGM_START_POSE**, **EGM_STOP** and **GO_TO_HOME_POSITION**.
  - Extra signals for IRB14000: **RUN_CAMERA_COMMAND** and **RUN_SG_COMMAND**.
    - SG = Smart Gripper
- **Type of Signal:** Choose **Digital Input**
- **Access Level:** Set to **All**
- These signals are used by a Robot Web Services (RWS) client.

Motion

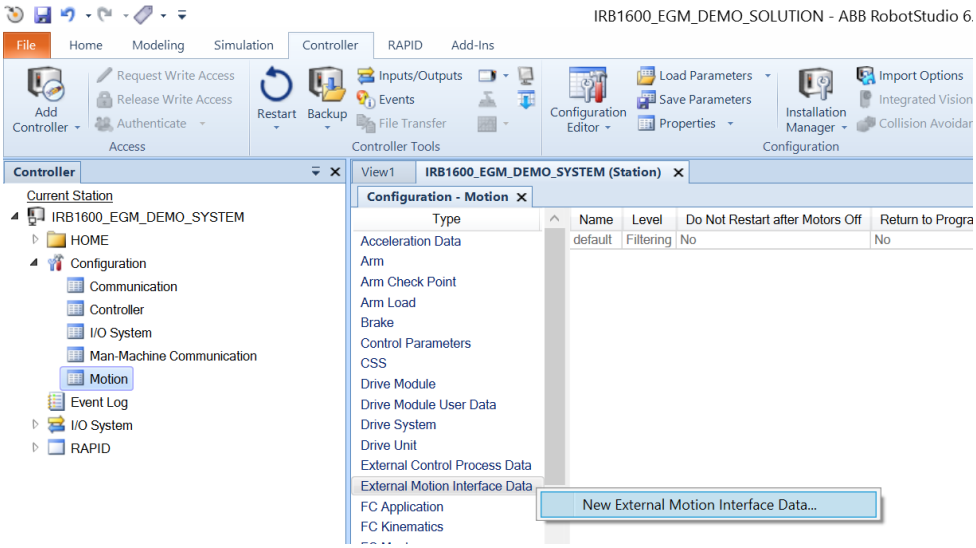

*Figure 14: Under the **Controller** tab → **Configuration** → **Motion** → Right-click **External Motion Interface Data** → Choose **New External Motion Interface Data…***

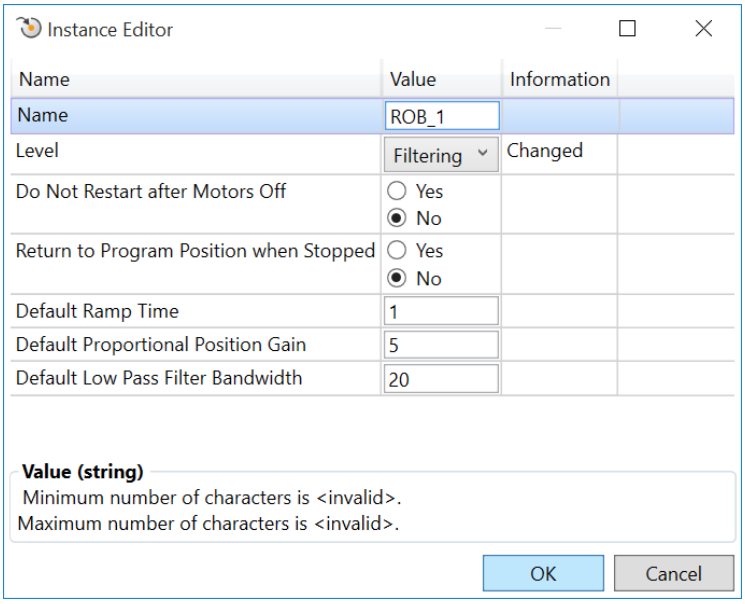

*Figure 15: Set the values (see below) and press **OK**. Also, don't restart the robot controller until later on.*

Note: Create an **External Motion Interface** for each robot in your system:

- **Name:** This tutorial assumes that the name is **ROB_X**. Where X is the robot number or, in the case of IRB14000, L or R for left respective right arm.
- **Level:** Choose **Filtering** or **Raw**. Path is not supported by this tutorial (see the notes on the first page.
- The remaining values are arbitrary.

Restart the Controller

Note: If using IRB14000, then an additional optional task can be created as well:

- Under the **Controller** tab → **Configuration** → **Controller** → Right-click **Task** → Choose **New Task…**
    - Name: **T_CAMERA**.
    - Task in Foreground: **T_ROB_L** or **T_ROB_R**.
    - Type: **Normal** for easy debugging, otherwise **Semistatic** or **Static**.
    - Use the default values for the remaining values.

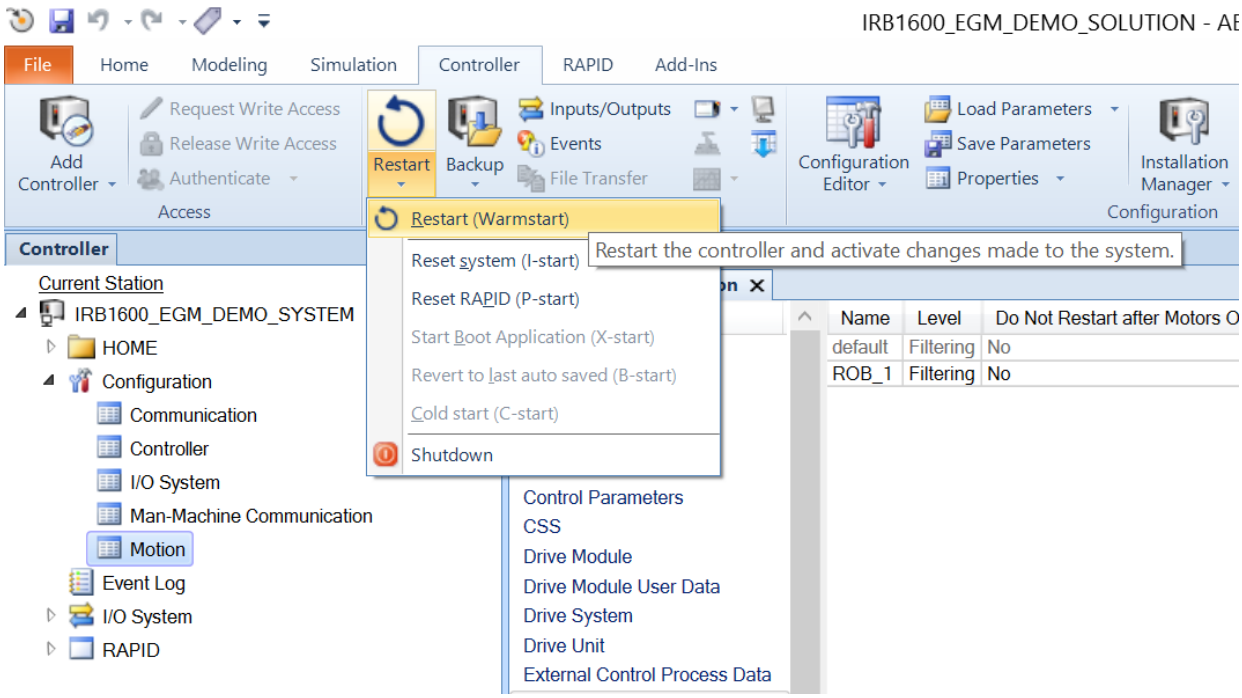

*Figure 16: Under the **Controller** tab → **Restart** → Choose **Restart (Warmstart)** to apply the modified configurations.*

Step 3 – Load RAPID Modules

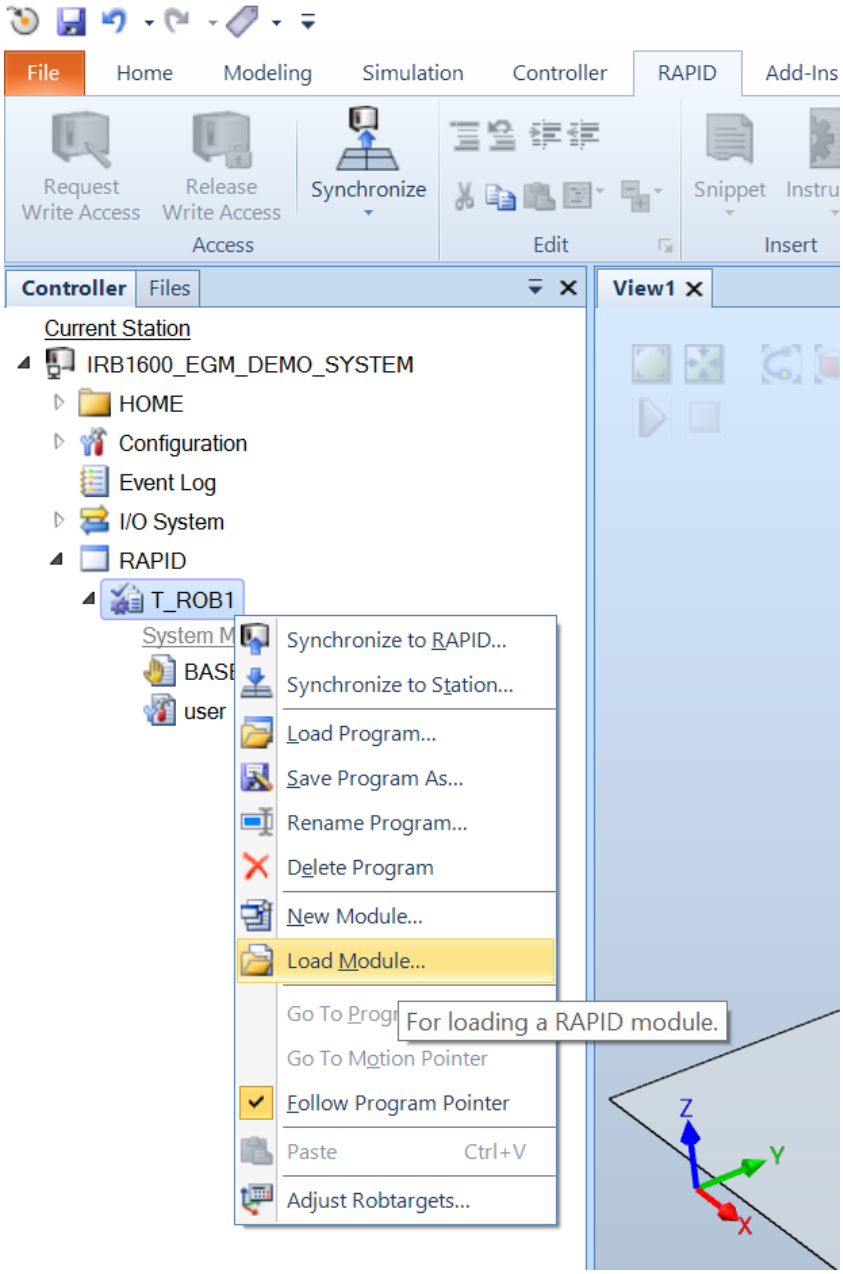

*Figure 17: Under the **RAPID** tab → **RAPID** → Choose task **T_ROBX** (where X is 1 – 4 or, in the case of IRB14000 L or R) → Choose **Load Module…***

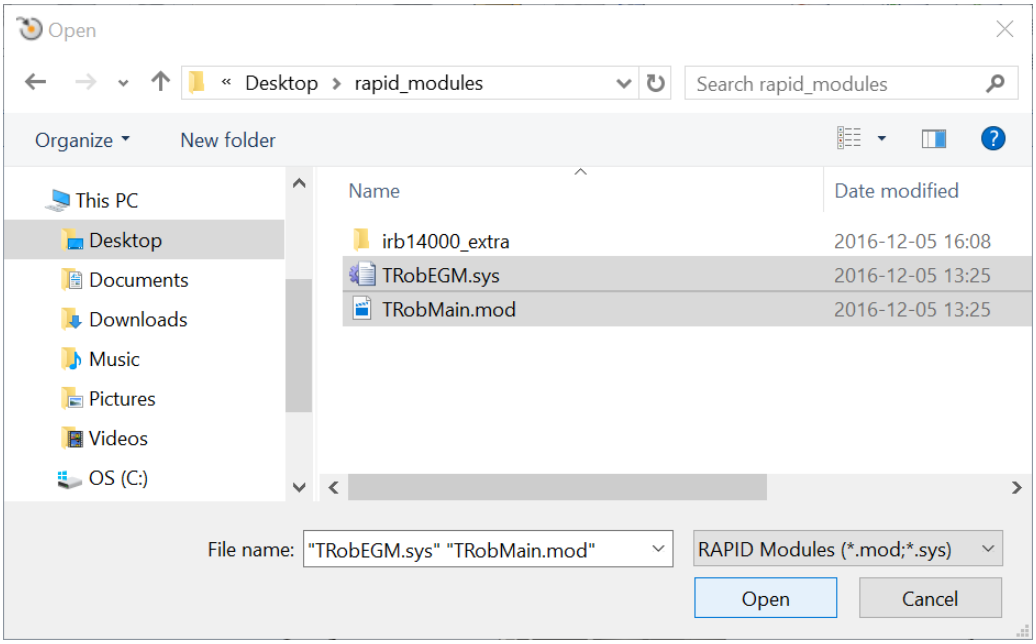

*Figure 18: Find the **RAPID modules** in the provided folder. Mark the required files (see below) and press **Open** (see next figure).*

Note: Load the same **RAPID modules** (.mod or .sys) into **every task** matching the file prefix. E.g. "**TRob" with "T_ROB"**.

- For a single robot it is only necessary to load **TRobEGM.sys** and **TRobMain.mod** into the **T_ROB1** task.
- If using multiple 6-axis robots, then it might be useful to also load:
  - <your path>/extra/**TRobSynchronization.sys**.
- If using IRB14000 then load:
  - For the tasks **T_ROB_L** and **T_ROB_R**:
    - <your path>/extra/**TRobSynchronization.sys**
    - <your path>/extra/irb14000/**TRobSG.sys** (optional, for using Smart Gripper(s))
  - For the optional task **T_CAMERA**:
    - <your path>/extra/irb14000/**TCameraMain.mod**

Important: It is recommended to at least skim through the RAPID modules to get a partial understanding of the implementation.

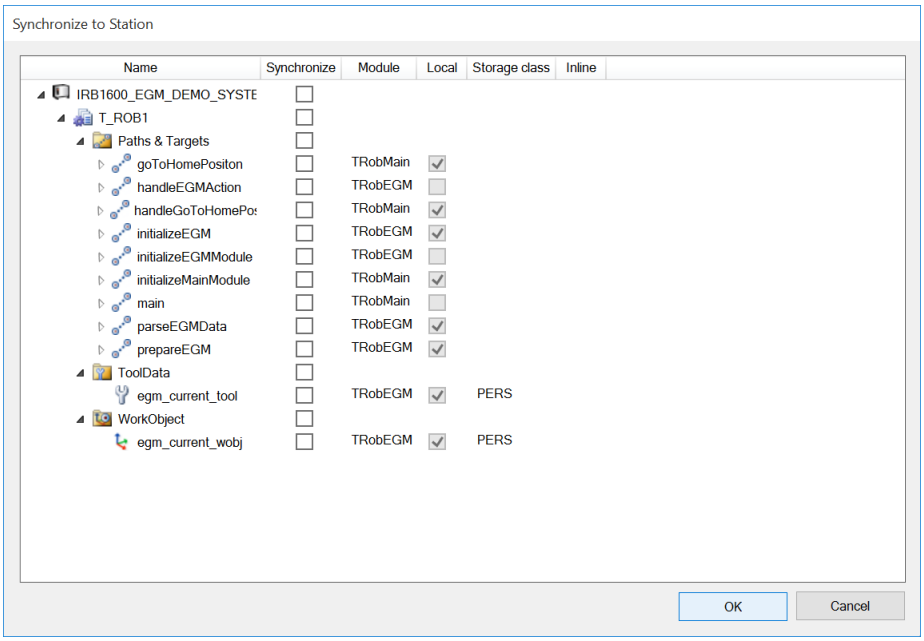

*Figure 19: It is optional to synchronize the robot controller data to the robot station (RobotStudio's representation of the robot system). Press **OK**.*

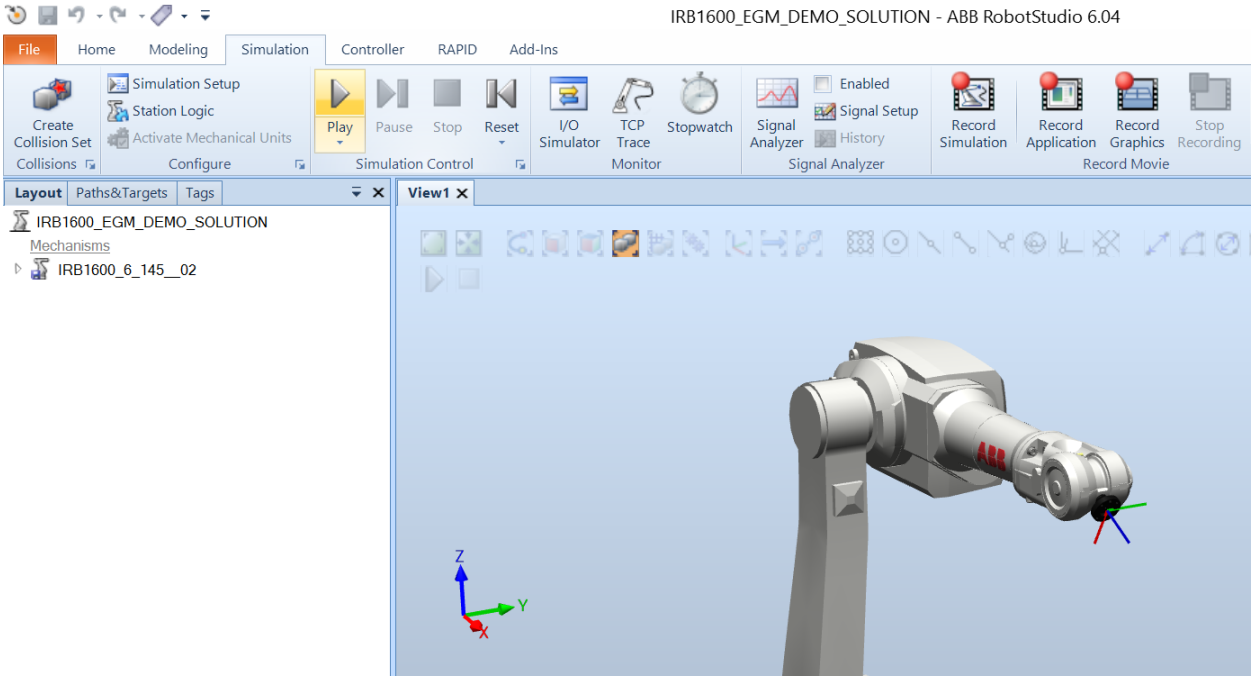

*Figure 20: Under the **Simulation** tab → Press **Play** to start a simulation. If everything is properly setup, then the robot controller is now waiting for **Robot Web Services (RWS)** messages to trigger **IO signals** for starting/stopping listening for **Externally Guided Motion (EGM)** references.*

Note: If the RWS client isn't on the same local machine as the RobotStudio simulation, then it might be required to set up a HTTP proxy server for transferring the RWS client's HTTP messages to the robot controller's RWS HTTP server. This can for example easily be implemented with C#.