

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

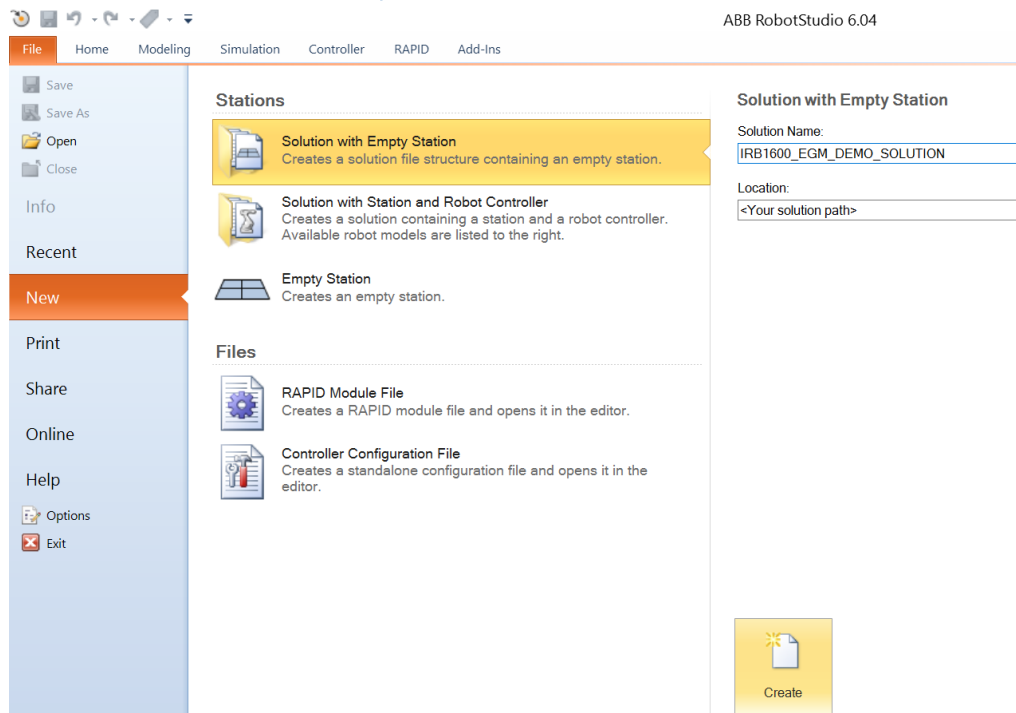


Figure 1: Under the **File** tab → **New** → **Solution with Empty Station** → Choose a **Solution Name** and **Location** → Press **Create**.

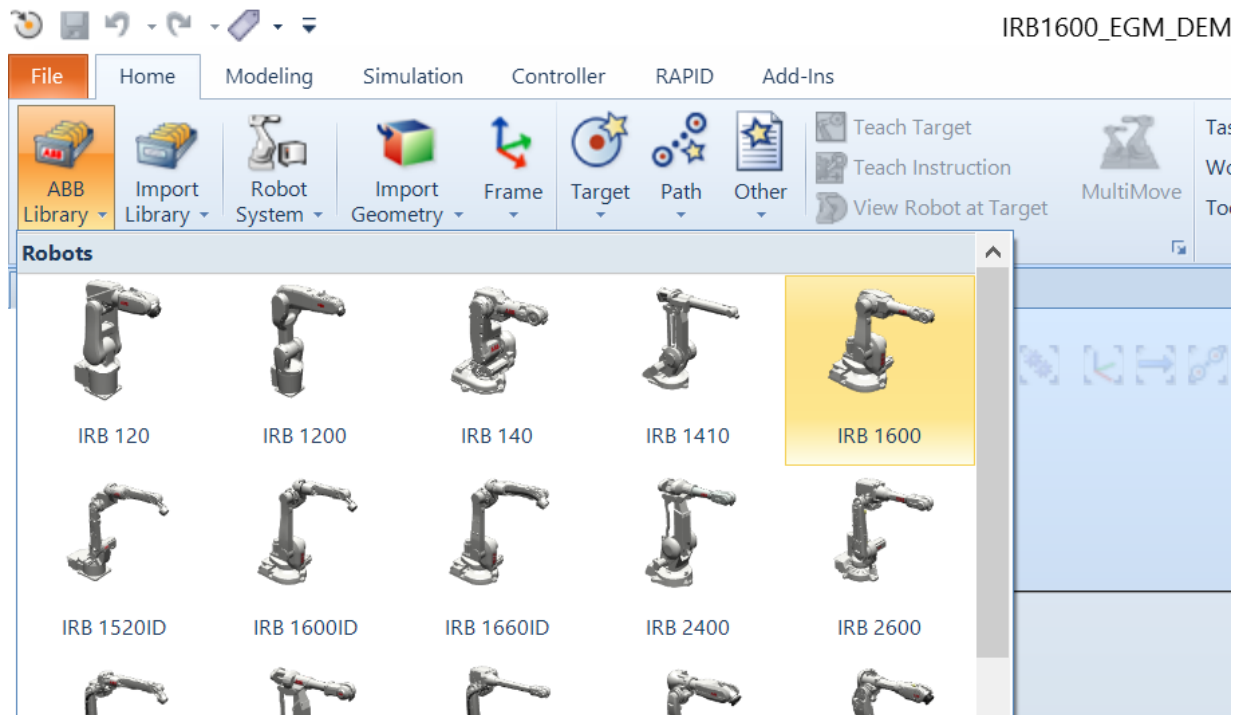


Figure 2: Under the **Home** tab → Press **ABB Library** → Choose the **desired robot** (here IRB1600).

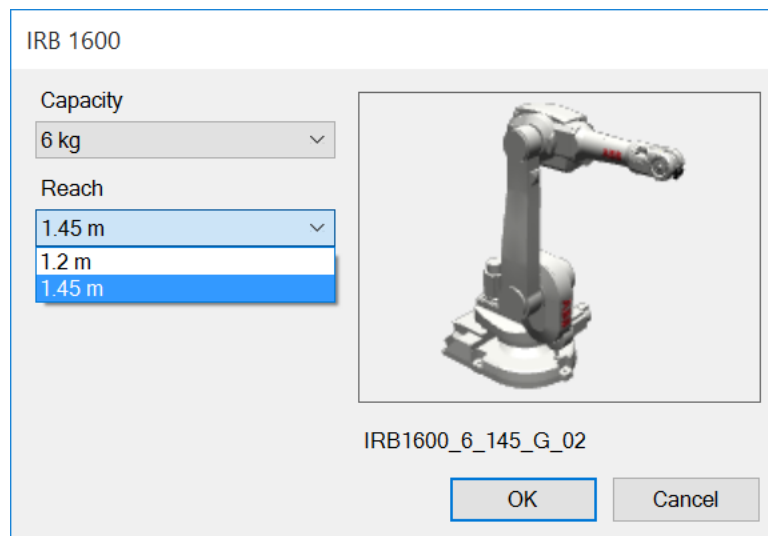


Figure 3: Choose the **desired robot version** (here IRB1600 – 6 / 1.45) → Press **OK**.

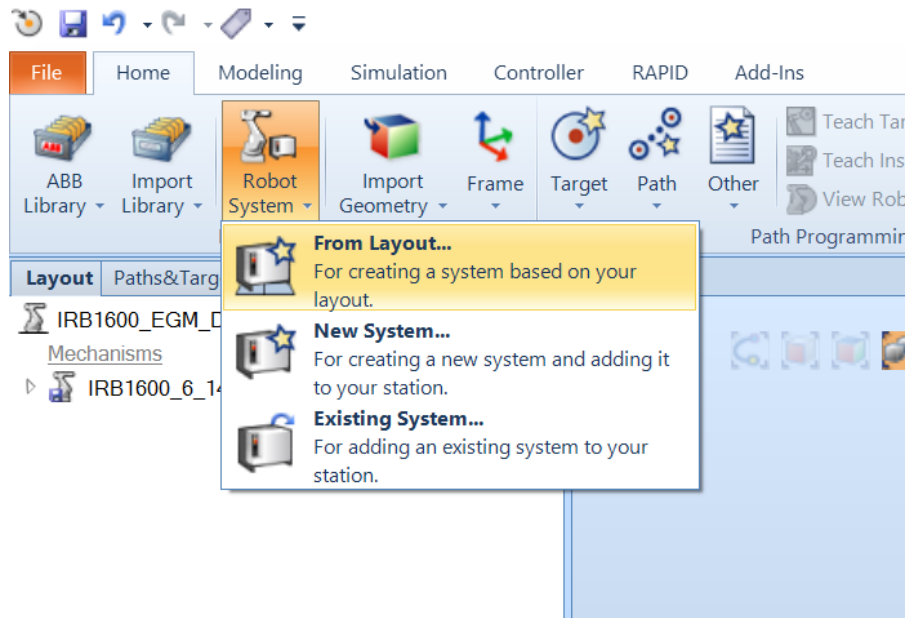


Figure 4: Under the **Home** tab → Press **Robot System** → Choose **From Layout...**

The screenshot shows the 'Create System From Layout' dialog box. The title bar reads 'Create System From Layout'. The main section is titled 'System Name and Location' with the instruction 'Select the system location and the RobotWare version to use'. There are two main input areas: 'System' and 'RobotWare'. The 'System' area has a 'Name' field containing 'IRB1600_EGM_DEMO_SYSTEM' and a 'Location' field containing 'Documents\RobotStudio\Solutions\IRB1600_EGM_DEMO_SOL', with a 'Browse...' button next to it. The 'RobotWare' area has a 'Locations...' link and a list box showing '6.04.00.00' and 'Product Distribution'. At the bottom, there are five buttons: 'Help', 'Cancel', '< Back', 'Next >', and 'Finish'.

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


Create System From Layout

×

Select Mechanisms for the system

Select the mechanisms that should be part of the system

Mechanisms

☒  IRB1600_6_145__02

Help

Cancel

< Back

Next >

Finish

Figure 6: Press **Next >**.

Create System From Layout

×

System Options

Configure the system options

Edit

Options...

TaskFrame(s) aligned with

☒ IRB1600_6_145__02

Summary

System Name: IRB1600_EGM_DEMO_SYSTEM

Using Media:

Media:

Name: ABB Robotware

Version: 6.04.0133

Options:

RobotWare Base

English

Drive System IRB 120/140/260/360/910SC/1200/1400/1520/1600/1660ID

ADU-790A in position X3

ADU-790A in position Y3

ADU-790A in position Z3

IRB 1600-6/1.45

Help

Cancel

< Back

Next >

Finish

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

Filter

Categories

- System Options**
- Default Language
- Industrial Networks
- Anybus Adapters
- Motion Performance
- RobotWare Add-In
- Motion Coordination
- Motion Events
- Motion Functions
- Motion Supervision
- Communication
- Engineering Tools

Options

- ☐ 623-1 Multitasking
- ☐ 624-1 Continuous Application Platform
- ☐ 813-1 Optical Tracking
- ☐ 625-1 Discrete Application Platform
- ☐ 628-1 Sensor Interface
- ☒ 689-1 Externally Guided Motion (EGM)
- ☐ Tool Change Support
- ☐ Auto acknowledge input

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

Create System From Layout
✕

System Options

Configure the system options

Edit
TaskFrame(s) aligned with

Options...

☒

IRB1600_6_145_02

▼

Summary

System Name: IRB1600_EGM_DEMO_SYSTEM

Using Media:

Media:

Name: ABB Robotware

Version: 6.04.0133

Options:

RobotWare Base

English

689-1 Externally Guided Motion (EGM)

Drive System IRB 120/140/260/360/910SC/1200/1400/1520/1600/1660ID

ADU-790A in position X3

ADU-790A in position Y3

ADU-790A in position Z3

IRB 1600-6/1.45

Help

Cancel

< Back

Next >

Finish

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

Step 2 – Configure the Robot Controller Communication

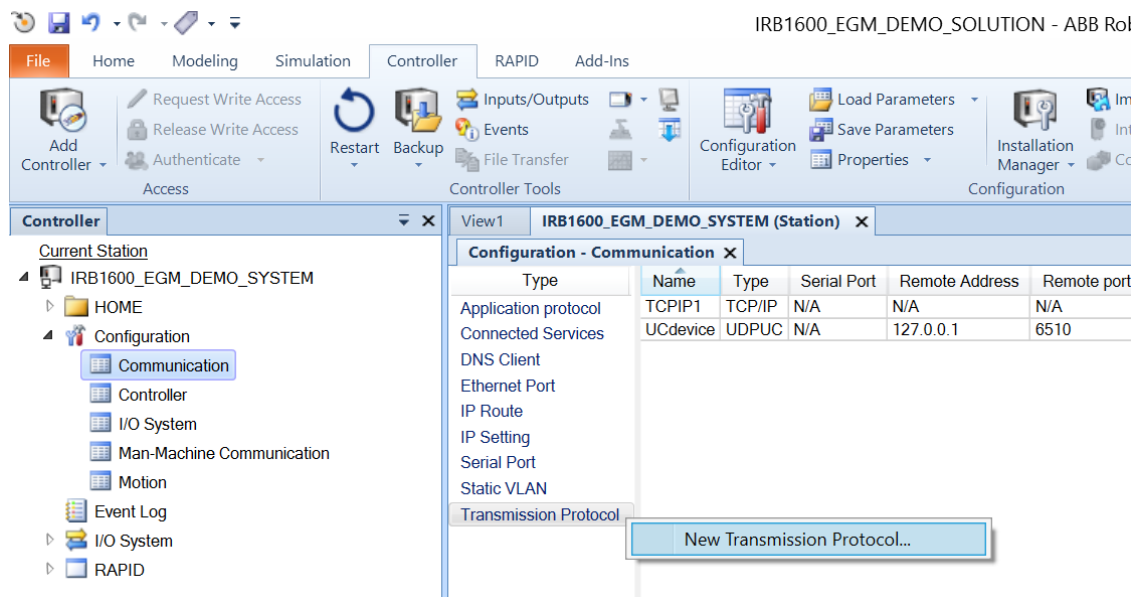


Figure 10: Under the **Controller** tab → **Configuration** → **Communication** → Right-click **Transmission Protocol** → Choose **New Transmission Protocol...**

The 'Instance Editor' dialog box is shown with the following fields and values:

Name	Value	Information
Name	ROB_1	
Type	UDPUC	
Remote Address	127.0.0.1	
Remote port number	6511	

Below the table, there is a section titled 'Value (integer)' with the text: 'The parameter is read-only. Minimum limit of the parameter is -1. Maximum limit of the parameter is 65535.' At the bottom right, there are 'OK' and 'Cancel' buttons.

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

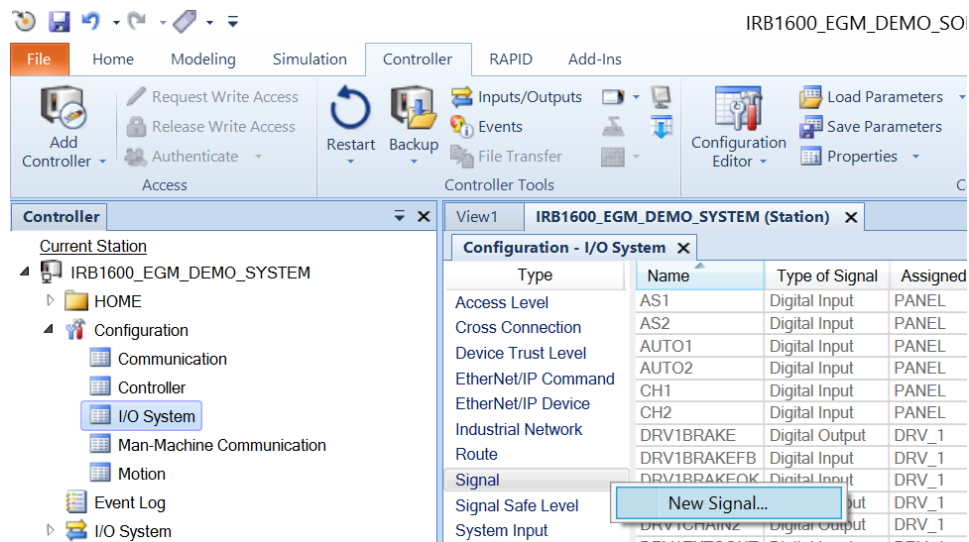


Figure 12: Under the **Controller** tab → **Configuration** → **I/O System** → Right-click **Signal** → Choose **New Signal...**

Name	Value	Information
Name	EGM_START_JOINT	
Type of Signal	Digital Input	
Assigned to Device		
Signal Identification Label		
Category		
Access Level	All	
Default Value	0	
Invert Physical Value	<input type="radio"/> Yes <input checked="" type="radio"/> No	

Value (RAPID)
 The changes will not take effect until the controller is restarted.
 Minimum number of characters is <invalid>.
 Maximum number of characters is <invalid>.

OK Cancel

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

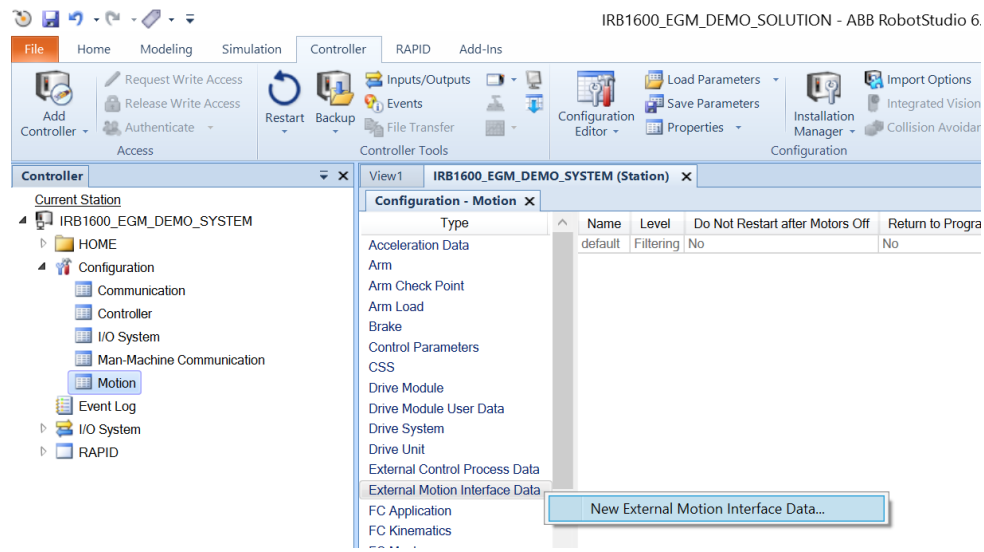


Figure 14: Under the **Controller** tab → **Configuration** → **Motion** → Right-click **External Motion Interface Data** → Choose **New External Motion Interface Data...**

The Instance Editor dialog box is shown. It contains the following fields and values:

Name	Value	Information
Name	ROB_1	
Level	Filtering	Changed
Do Not Restart after Motors Off	<input type="radio"/> Yes <input checked="" type="radio"/> No	
Return to Program Position when Stopped	<input type="radio"/> Yes <input checked="" type="radio"/> No	
Default Ramp Time	1	
Default Proportional Position Gain	5	
Default Low Pass Filter Bandwidth	20	
Value (string)	Minimum number of characters is <invalid>. Maximum number of characters is <invalid>.	

Buttons: OK, Cancel

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.

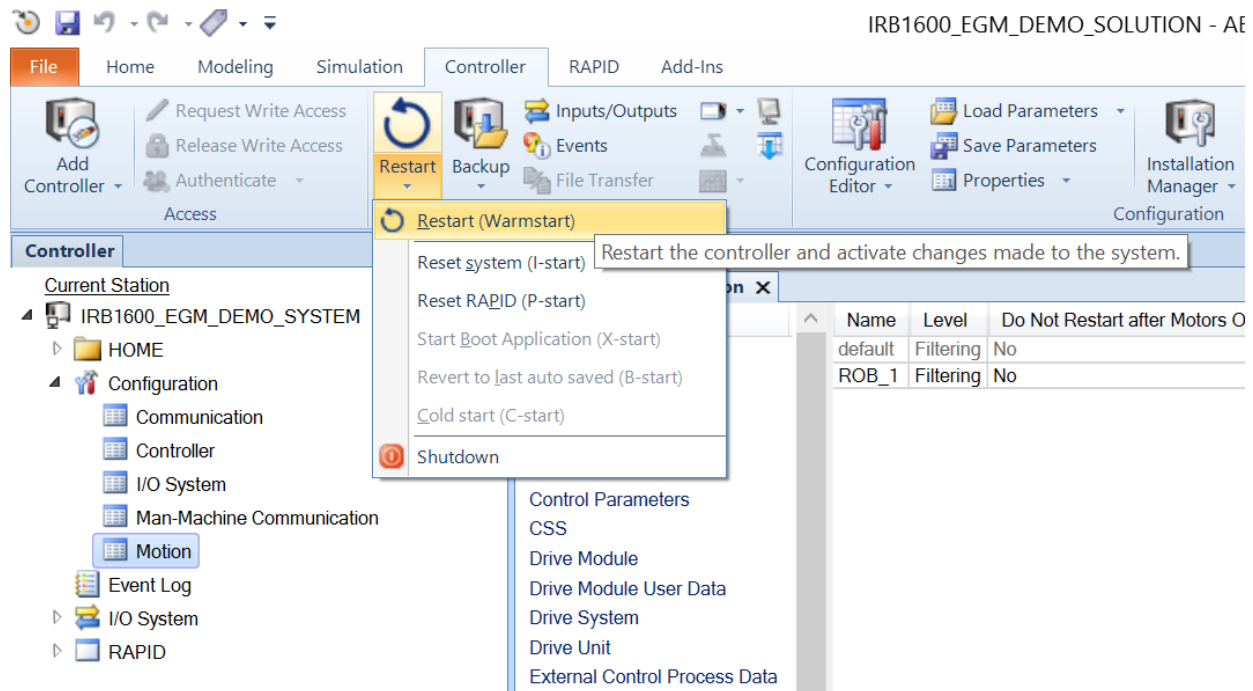


Figure 16: Under the **Controller** tab → **Restart** → Choose **Restart (Warmstart)** to apply the modified configurations.

Step 3 – Load RAPID Modules

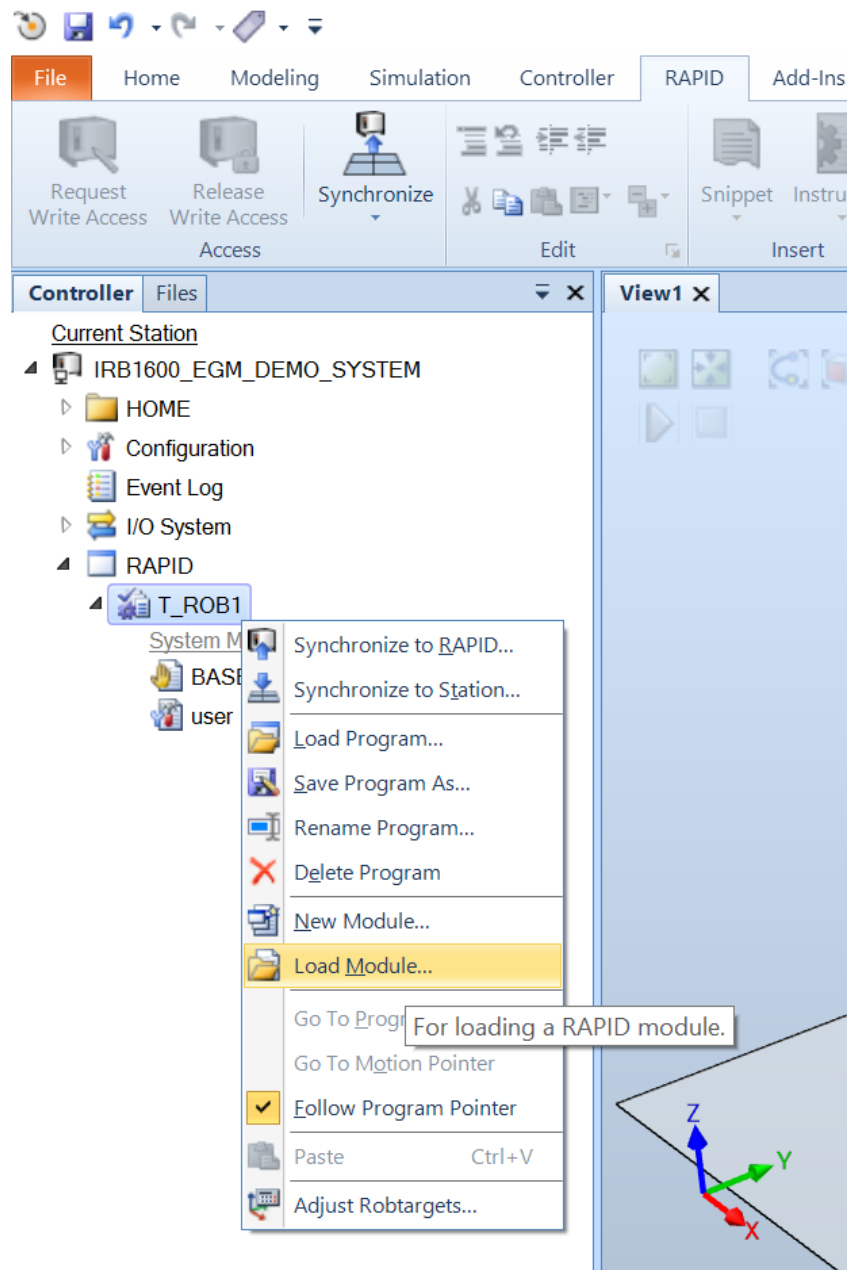


Figure 17: Under the **RAPID** tab → **RAPID** → Choose task **T_ROB_X** (where X is 1 – 4 or, in the case of IRB14000 L or R) → Choose **Load Module...**

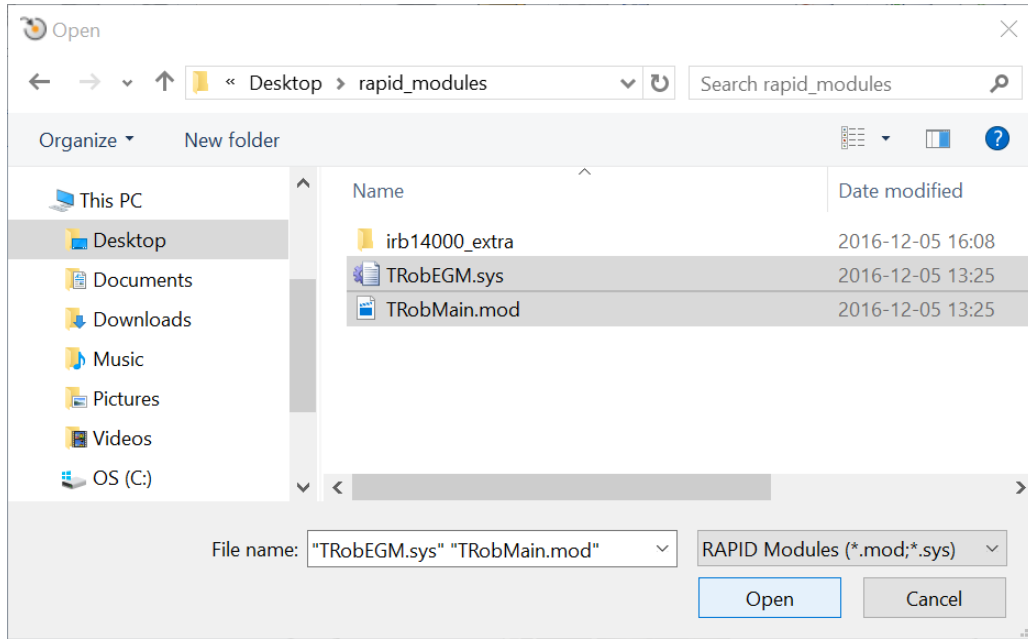


Figure 18: Find the **RAPID modules** in the provided folder. Mark the required files (see below) and press **Open** (see next figure).

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.

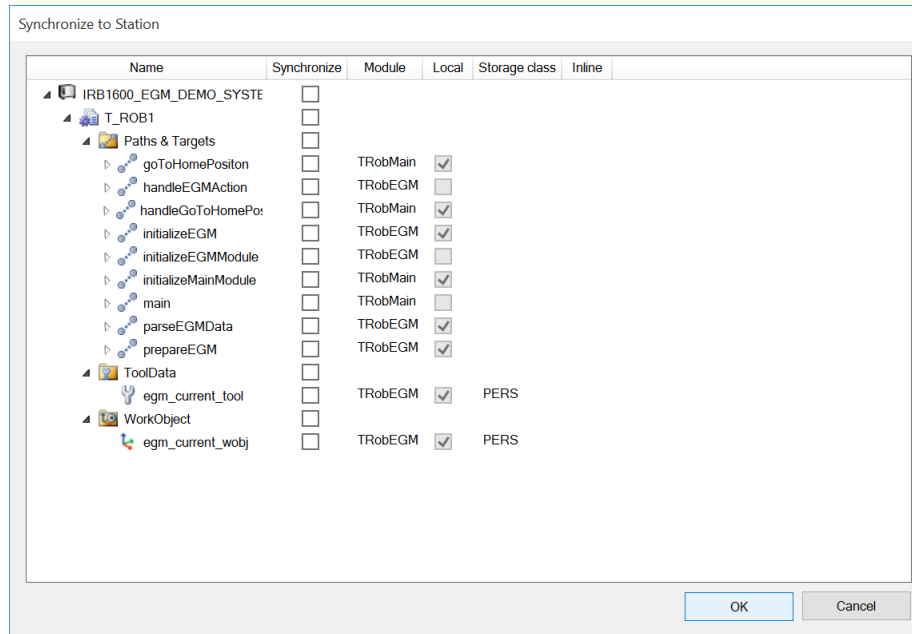


Figure 19: It is optional to synchronize the robot controller data to the robot station (RobotStudio's representation of the robot system). Press **OK**.

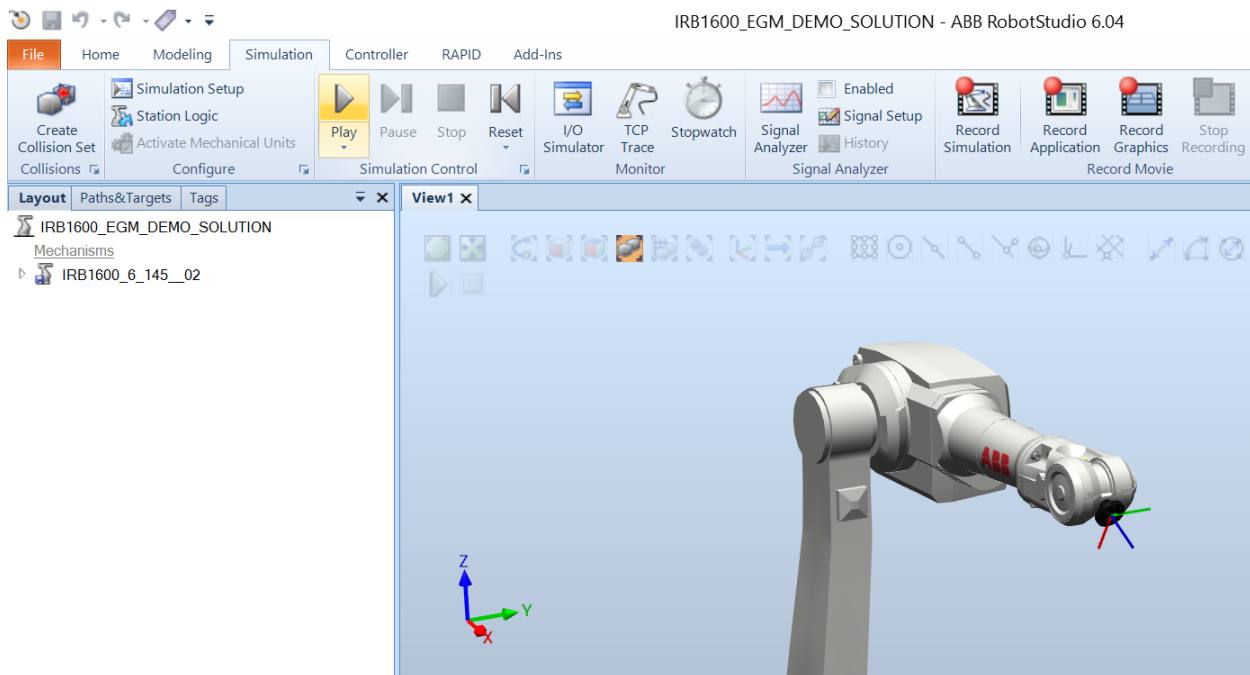


Figure 20: Under the **Simulation** tab → Press **Play** to start a simulation. If everything is properly setup, then the robot controller is now waiting for **Robot Web Services (RWS)** messages to trigger **IO signals** for starting/stopping listening for **Externally Guided Motion (EGM)** references.

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#.