FactoryTalk Motion Analyzer
User Guide

Version 2.1

MOTION-UM004E-EN-P

Rockwell Automation

Important User Information

Read this document and the documents listed in the additional resources section about installation, configuration, and operation of this equipment before you install, configure, operate, or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards.

Activities including installation, adjustments, putting into service, use, assembly, disassembly, and maintenance are required to be carried out by suitably trained personnel in accordance with applicable code of practice.

If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

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Throughout this manual, when necessary, we use notes to make you aware of safety considerations.

WARNING: Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.

ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence.

IMPORTANT Identifies information that is critical for successful application and understanding of the product.

Labels may also be on or inside the equipment to provide specific precautions.

SHOCK HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.

BURN HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.

ARC FLASH HAZARD: Labels may be on or inside the equipment, for example, a motor control center, to alert people to potential Arc Flash. Arc Flash will cause severe injury or death. Wear proper Personal Protective Equipment (PPE). Follow ALL Regulatory requirements for safe work practices and for Personal Protective Equipment (PPE).

Rockwell Automation recognizes that some of the terms that are currently used in our industry and in this publication are not in alignment with the movement toward inclusive language in technology. We are proactively collaborating with industry peers to find alternatives to such terms and making changes to our products and content. Please excuse the use of such terms in our content while we implement these changes.

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Overview

FactoryTalk® Motion Analyzer™ is a comprehensive motion-application design tool used for the analysis, optimization, selection, and validation of your motion control system. This software simplifies the machine design process, letting you quickly design and validate new machine concepts without purchasing or installing physical equipment. You can select from a wide range of Kinetix motors and drives, PowerFlex drives, and motors and gearboxes from our Technology Partners. The tool recommends solutions based on your application requirements and generates a bill of materials that can be exported into ProposalWorks for procurement.

Additional Resources

These documents contain additional information concerning related Rockwell Automation products.

Resource	Description
FactoryTalk Motion Analyzer User guide	Provides complete instructions for using FactoryTalk Motion Analyzer.

View or download publications at http://www.rockwellautomation.com/literature. To order paper copies of technical documentation, contact the local Rockwell Automation distributor or sales representative.

Legal Notices

Copyright notice

End User License Agreement (EULA)

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Open Source Licenses

The software included in this product contains copyrighted software that is licensed under one or more open source licenses. Copies of those licenses are included with the software. Corresponding Source code for open source packages included in this product are located at their respective web site(s).

Alternately, obtain complete Corresponding Source code by contacting Rockwell Automation via the Contact form on the Rockwell Automation

website:
http://www.rockwellautomation.com/global/about-us/contact/contact.page
Please include "Open Source" as part of the request text.

A full list of all open source software used in this product and their corresponding licenses can be found in the OPENSOURCE folder. The default installed location of these licenses is `C:\Program Files (x86)\Common Files\Rockwell\Help\<Product Name>\Release Notes\OPENSOURCE\index.htm`.

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This document is current as of the time of release of the product; however, the accompanying software may have changed since the release. Rockwell Automation, Inc. reserves the right to change any information contained in this document or the software at any time without prior notice. It is your responsibility to obtain the most current information available from Rockwell when installing or using this product.

Contact Rockwell Automation

Customer Support Telephone — 1.888.382.1583

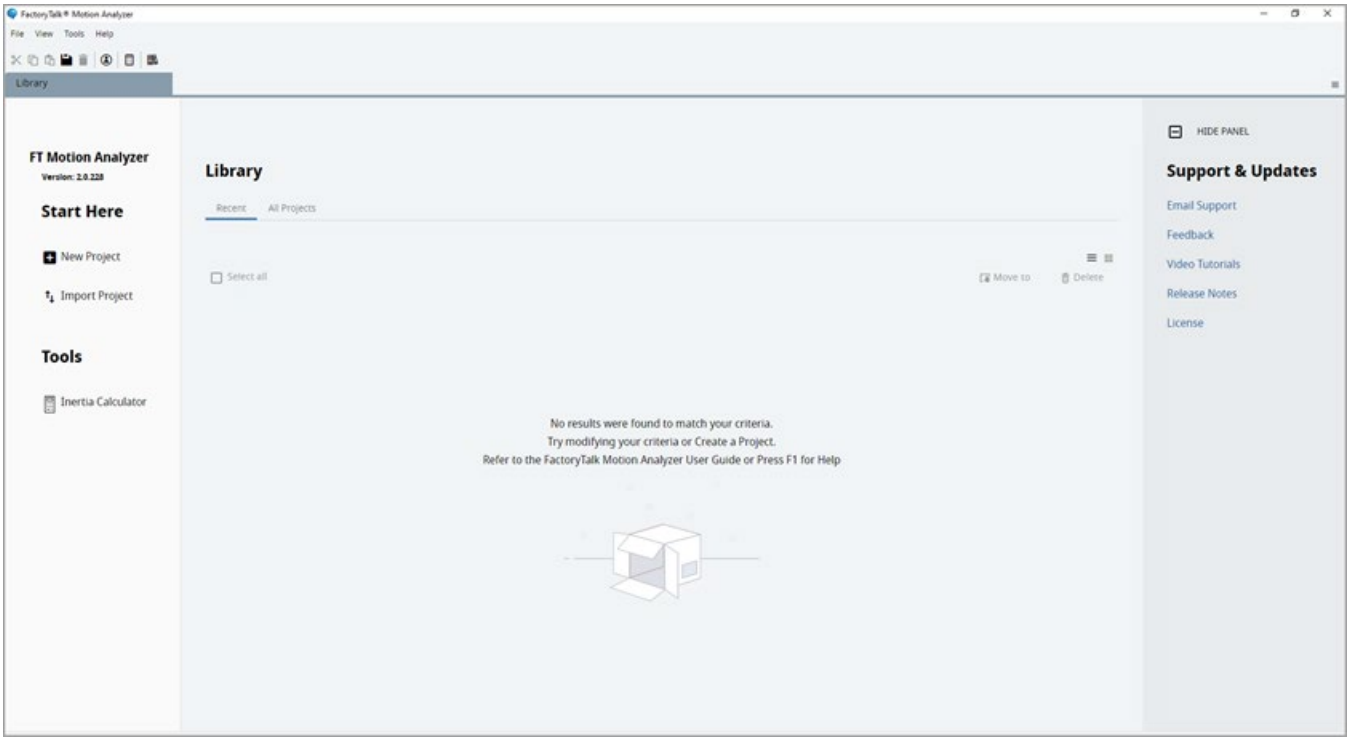
Online Support — http://www.rockwellautomation.com/support/

Welcome to FactoryTalk Motion Analyzer

Double-click the [ ] icon to launch the application. The application homepage displays.

NOTE: User can also launch the application from the Start menu. .

Figure: FactoryTalk Motion Analyzer Home Screen



Motion Analyzer is opened with following sections displayed on the Welcome Screen: Menu Bar, Quick access toolbar, Tab bar and Home tab.

Menu Bar

The Motion Analyzer menu bar is a graphical control element which contains drop-down menus. It provides four main options: File, View, Tools and Help which are accessible across the application.

Figure: Menu bar

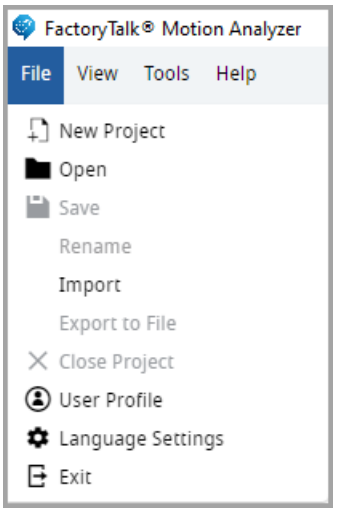


Table: Menu bar options description

Options	Description
File	Standard File menu options
View	Options related to application appearance
Tools	Additional tools
Help	Options related to support contact and documentation

File Menu

The File menu is similar to the file menu in many computer applications. These files are stored in the local database and do not behave like normal files.

Figure: File Menu

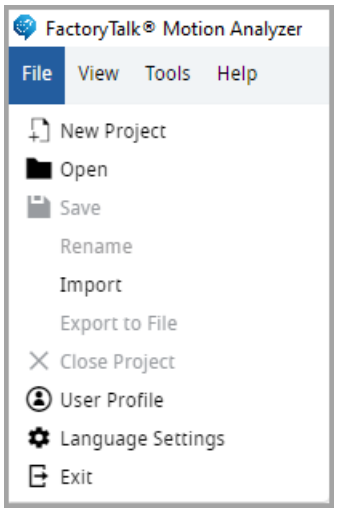


Table: File menu options description

Options	Description
New project	Create a new project
Open	Open Projects
Save	Save project
Rename	Rename the project name
Import	Import a project name
Export to File	Exports a project to an XML file
Close Project	Close the currently opened project

User Profile	View and edit the User Profile
Language Settings	Edit the Language Settings. By default, English is selected.
Exit	Exit the application.

View Menu

The View menu consists of options allowing to manipulate application appearance and layout.

Figure: View Menu

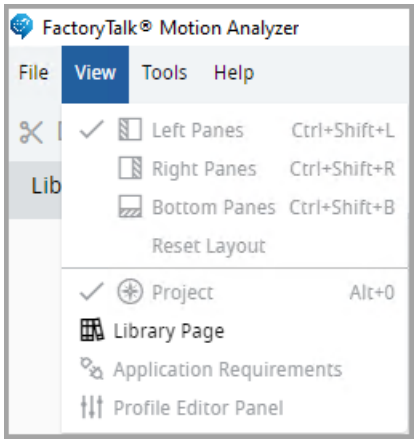


Table: View menu options description

Options	Description
Left Panes	Enable/disable left panes while a project is open
Right Panes	Enable/disable right panes while a project is open
Bottom Panes	Enable/disable bottom panes while a project is open
Reset Layout	Reset layout to default settings while a project is open
Project	Enable/disable the Project Tree panes while a project is open
Home Page	Open the Home Tab
Application Requirements	Enable/disable Application Requirements while project is open
Profile Editor Tool	Enable/disable the Profile Editor tool panel while project is open

Tools Menu

The Tools drop-down menu consists of options allowing to open additional Motion Analyzer tools.

Figure: Tools Menu

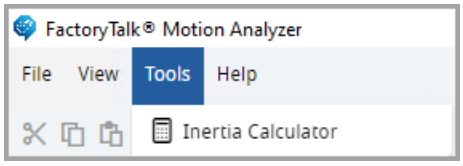


Table: Tools menu options description

Options	Description
Inertia Calculator	To open Inertia Calculator. Refer to Inertia Calculator on page 14.

Help Menu

The Help menu consists of options allowing to contact Motion Analyzer support, access release notes and licenses, provide feedback, and open application help document.

Figure: Help Menu

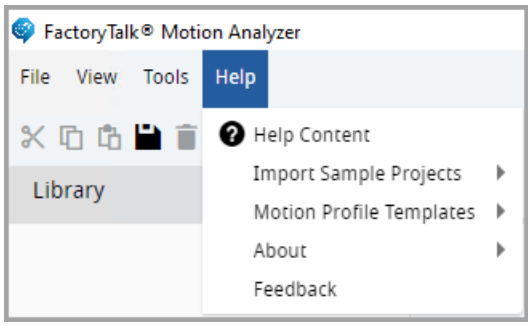


Table: Help menu options description

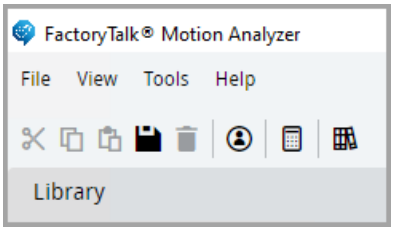
Options	Description
Help Content	Open application help document
Import Sample Projects	A list of sample projects displays. User can import these projects into the application.
Motion Profile Templates	To import Motion Profile Templates and sample templates
About	To get the current application details: License: Displays the document with licenses in a PDF. If Adobe reader is not installed, the PDF is opened in a browser. Version: Displays the application and database version being used at the bottom of the page.
Feedback	Open questionnaire regarding Motion Analyzer feedback

Quick Access Toolbar

The quick access toolbar contains:

1. **Actions Toolbar**: To cut, paste, copy, save, and delete the data.
2. **User Profile**: To set User profile.
3. **Inertia Calculator**: To calculate the inertia of objects with different shapes.
4. **Library Page:** To go to the Library page.

Figure: Quick Access Toolbar



User Profile

The user profile can be accessed by clicking user profile button on the quick access toolbar. After clicking the button, a model with user related settings will be displayed.

User profile consists of two sections:

- Personal Information
- Units Settings

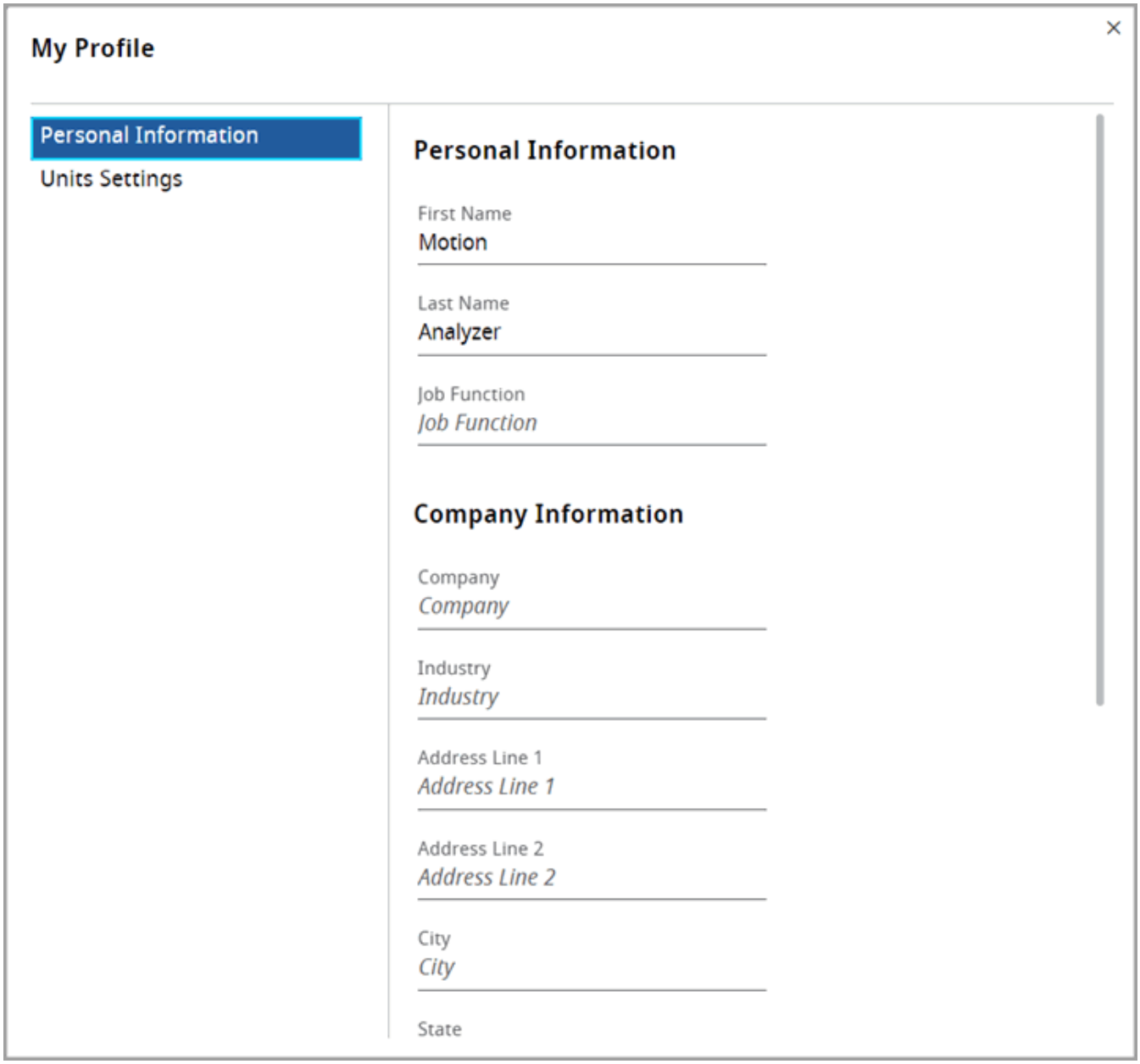
Personal Information

In the personal information tab, the following information can be provided:

- First Name
- Last Name
- Job Function

- Company information:
- Company
- Industry
- Address
- City
- State
- Postal code
- Country
- Phone
- Location

Figure: Personal Information Tab

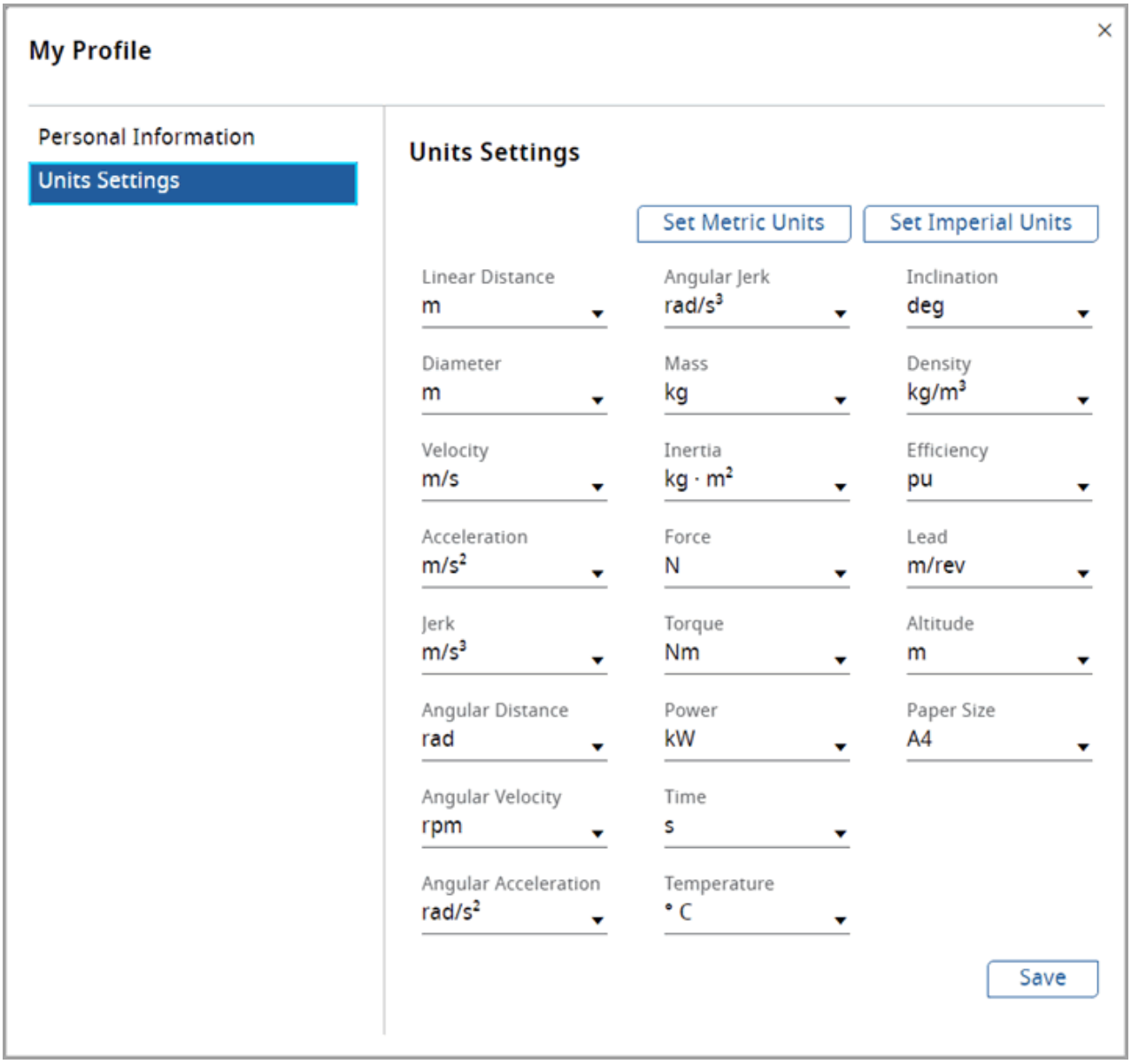


After providing the information data must be saved by clicking save button at the bottom of the section.

Units Settings

In the units settings tab, the global default units can be set. It is possible to set all units to one of two predefined sets: metric or imperial or modify specific units selected by the user.

Figure: Unit Settings Tab



After changing the default units, any changes must be saved by clicking save button at the bottom of the section.

Inertia Calculator

The Inertia Calculator has several options for input parameters to calculate the Inertia for an application. There are two modes of Inertia Calculators in Motion Analyzer application.

- **Standard Inertia Calculator**: It can be accessed from the Tools Menu and it can be used always in any place but does not save the calculation.
- **Contextual Inertia Calculator**: It can be used only in place where is defined (currently on Transmission's page). It saves the calculation as well as the project and it can be reopened.

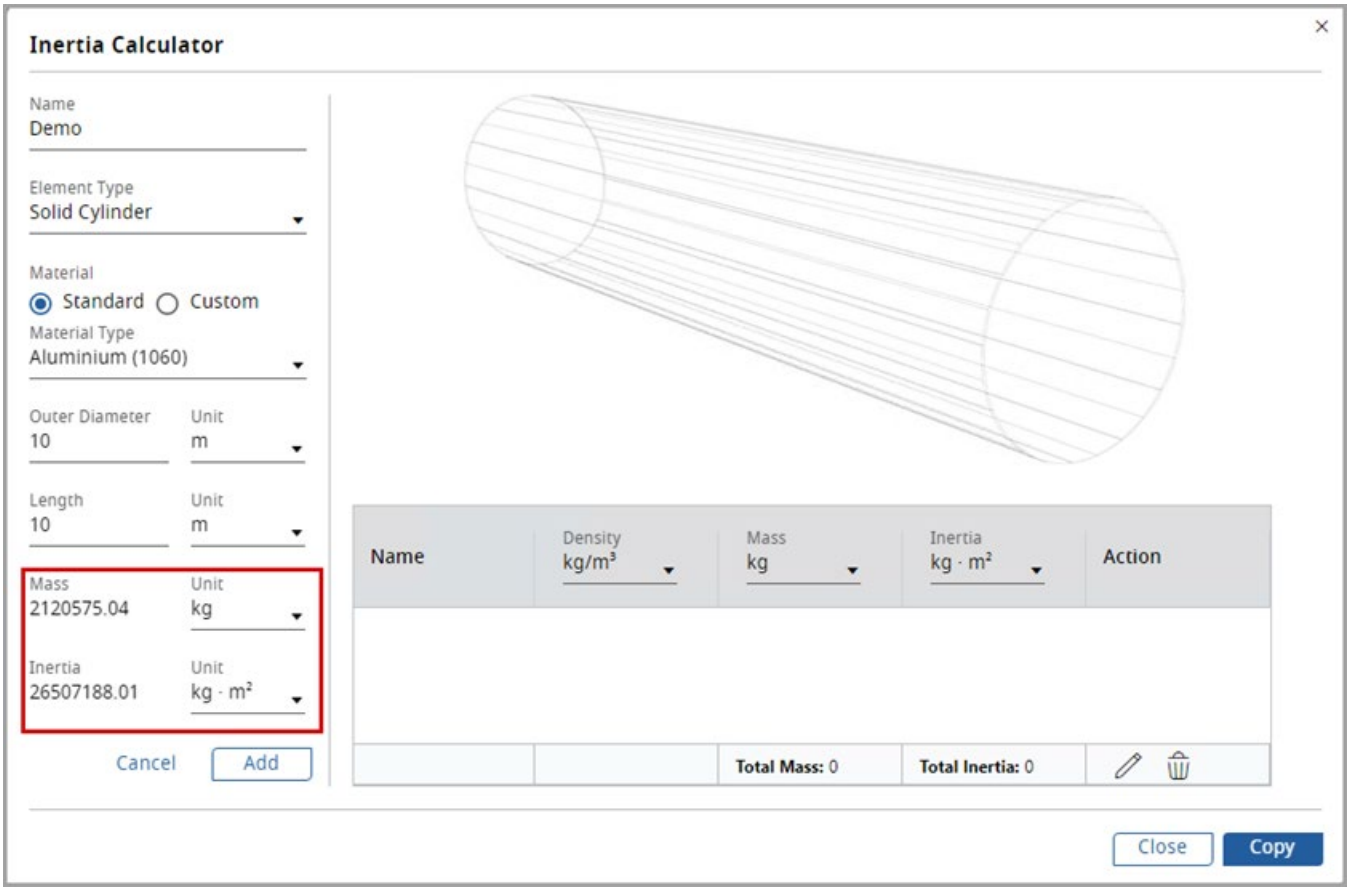
Perform the following steps to calculate the Inertia:

1. Click the [ ] icon or the Inertia Calculator from the Tools menu.
2. Provide the following details:

Table: Inertia Calculator

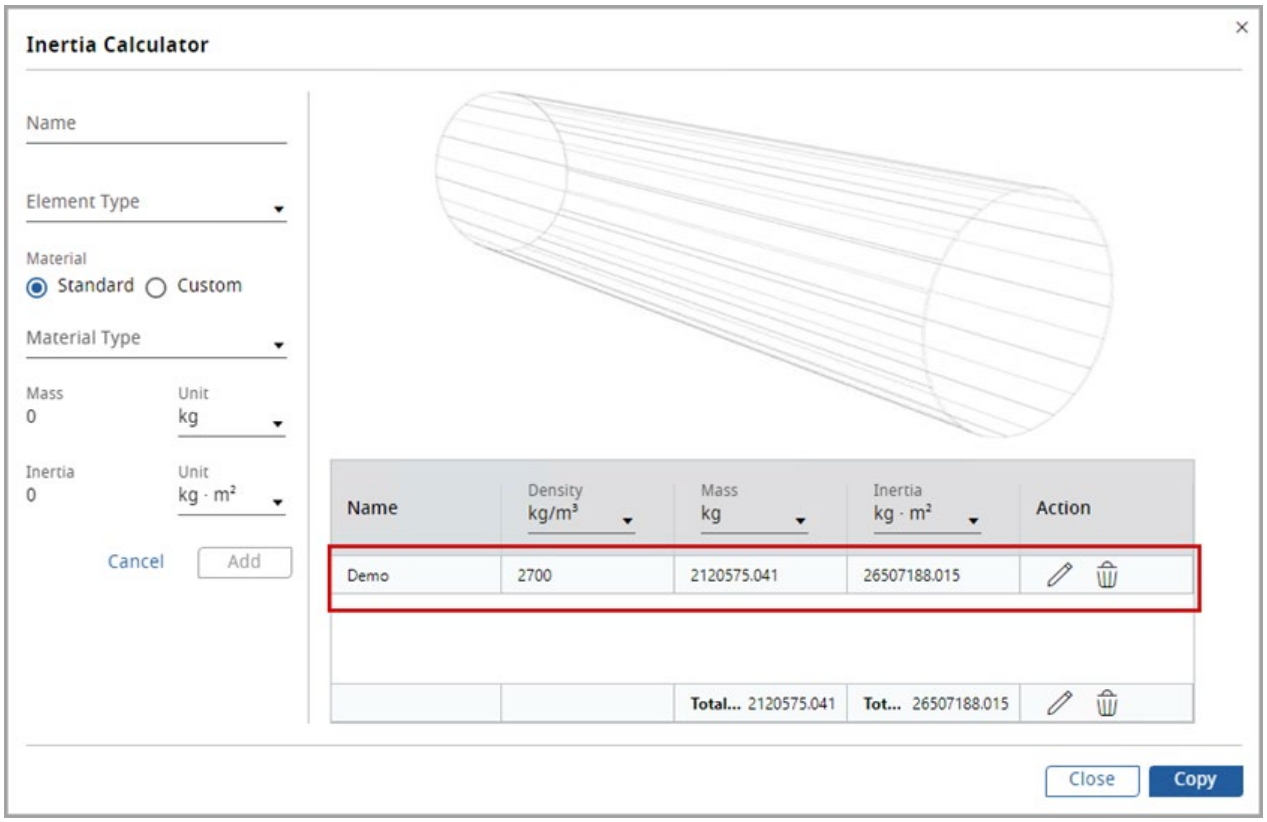
Field	Description
Name	Enter a name for the element.
Element Type	Select the type of the element (solid cylinder or hollow cylinder).
Material	Select the material of the cylinder: Standard or Custom. If the user selects Custom as the material, then the density value needs to be provided.
Material Type	Select the material type of the cylinder.
Density	Enter the density of the material.
Outer Diameter	Enter the outer diameter of the inertia element.
Inner Diameter	Enter the inner diameter of the inertia element if it is a hollow cylinder.
Length	Enter the length of the inertia element.
Mass	The mass of the cylinder is calculated based on the parameters.
Inertia	The Inertia of the cylinder is calculated based on the parameters.

Figure: Inertia Calculator



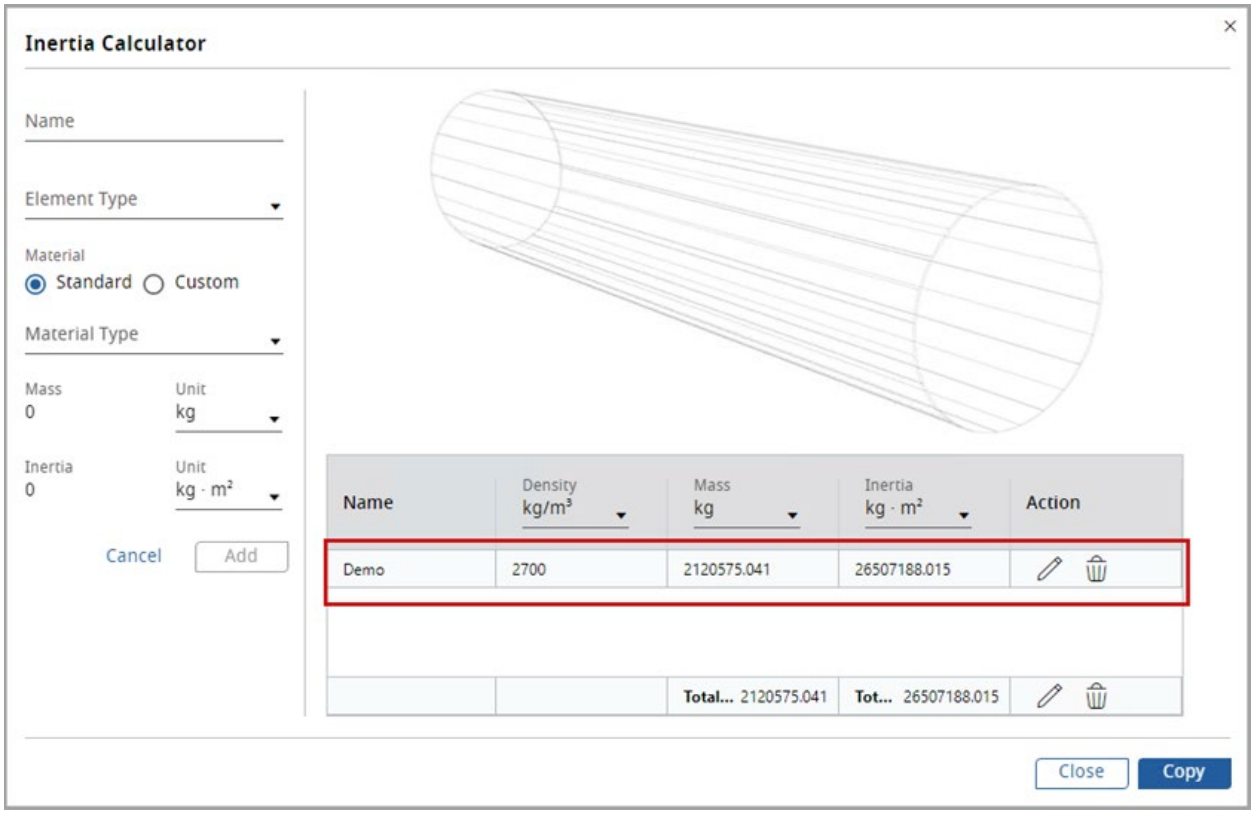
3. Click [Add]. The relevant values get saved to the project and reflected in the right panel as shown in the following image:

Figure: Right Panel



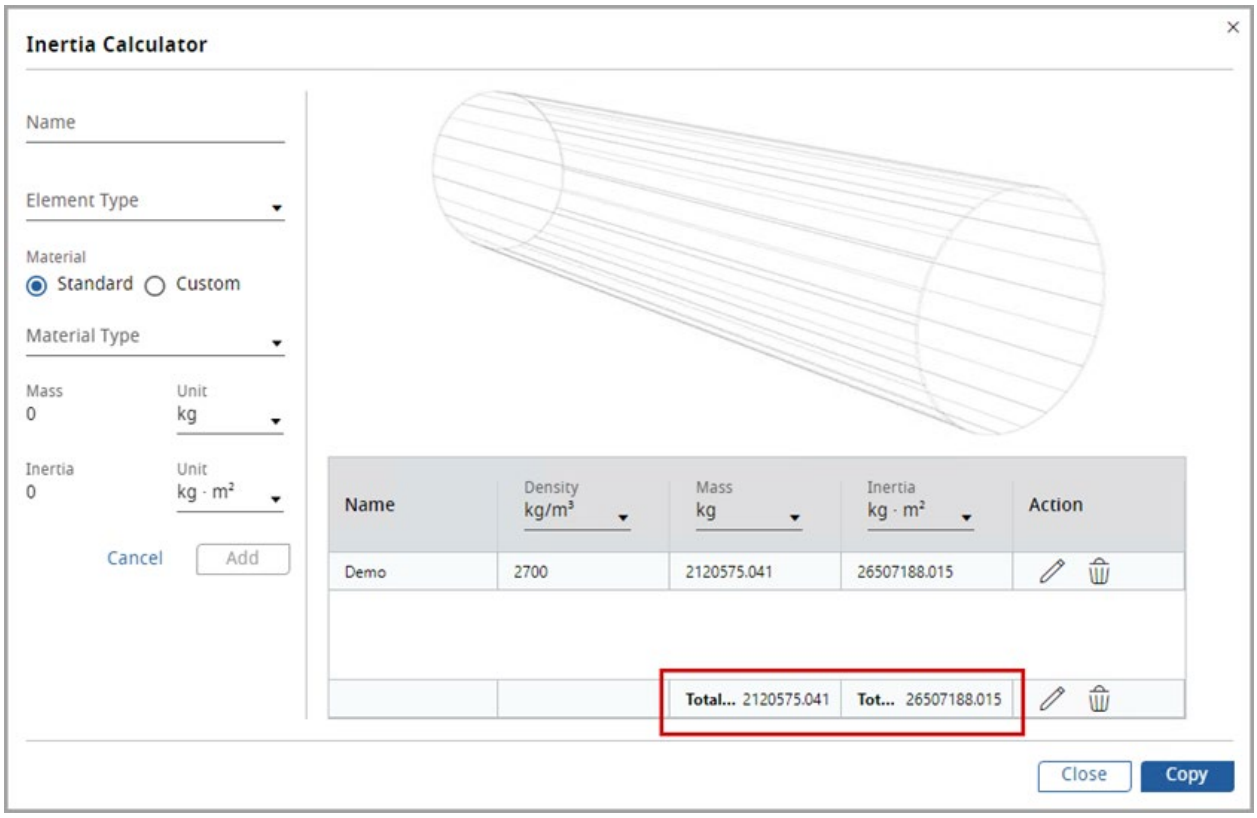
4. User can edit or delete the existing Inertia, or user can also add a new Inertia to the same element.

Figure: Edit or Delete



The Total Mass and the Total Inertia are displayed as shown in the following image:

Figure: Total Mass and Total Inertia

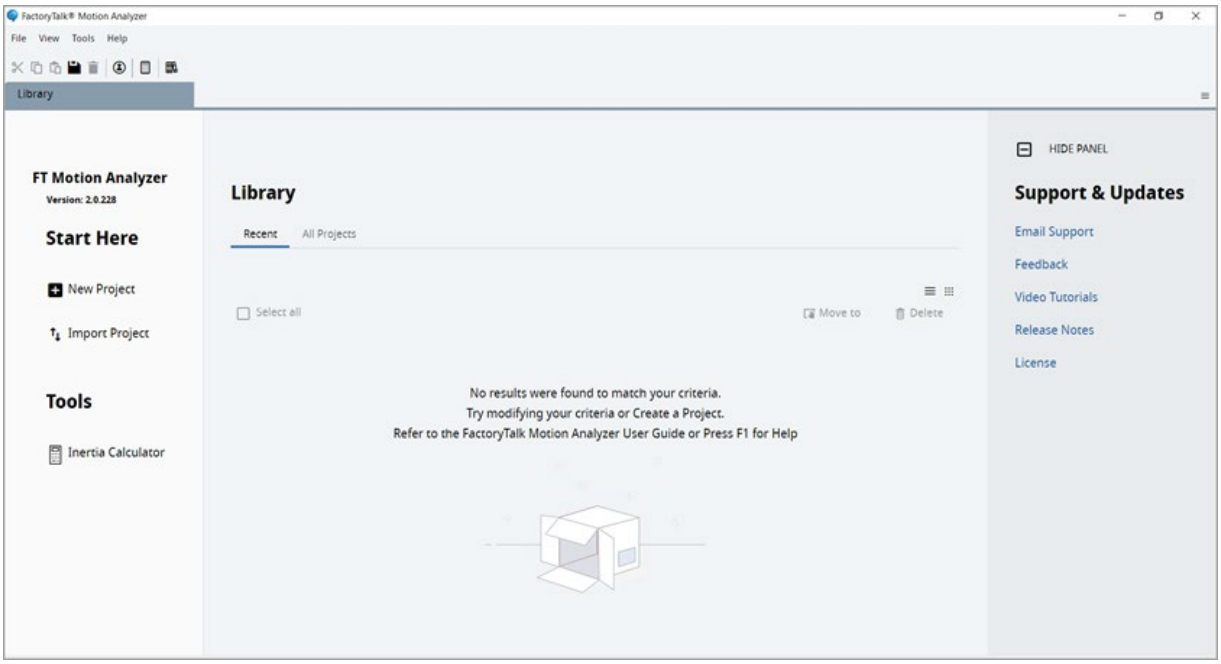


5. Click [Copy] to copy the Total Mass and the Total Inertia values to a clipboard.

Tab Bar

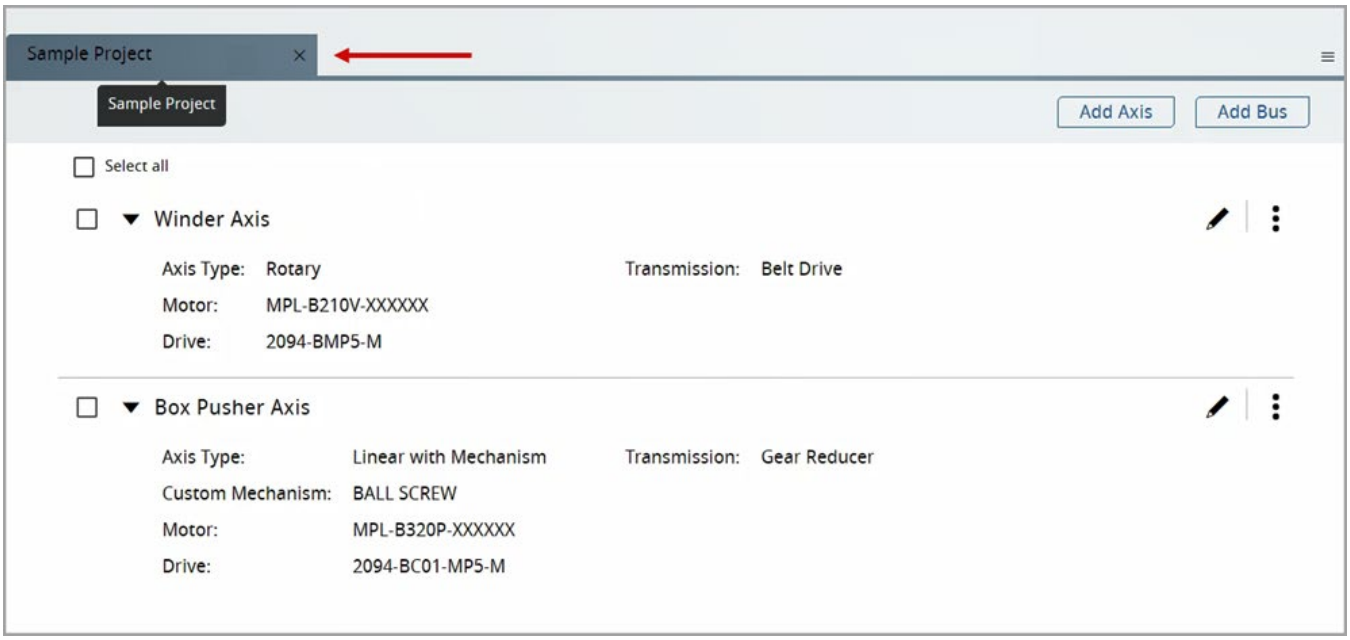
The tab bar is located under the Quick Action Toolbar and allows to switch between the opened tabs.

Figure: Tab Bar



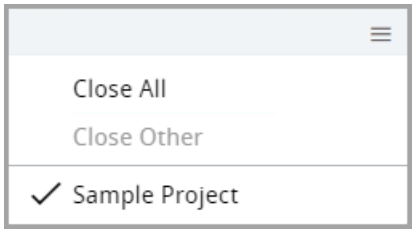
- To close the tab, hover the mouse on the tab and click the [X] icon.

Figure: Closing Tab



- List of currently opened tabs can be toggled by clicking the [ ] at the right side of the tab bar.
- Click the tick icon to display the current tab. Click a tab name in this list and the selected tab displays.

Figure: Opened Tabs List



- User can Drag and drop the tabs to move them across the tab bar.

Home Tab

The home tab is opened by default when the Motion Analyzer application is launched. It consists of a left-hand panel with start here, section, and tools, a middle area with library view, and a right-hand panel with release notes, feedback, support, and licenses links.

Library Page

The Library page is opened by default when the Motion Analyzer application is launched. It consists of a left-hand panel with Start Here section to start creating projects or to import projects, and Inertia Calculator tool, a middle area with Library view, and a right-hand panel with Email Support, Feedback, and Licenses links.

Left Panel

The left panel allows user to create new empty project, import project XML and open Motion Analyzer additional tools.

Figure: Left Panel

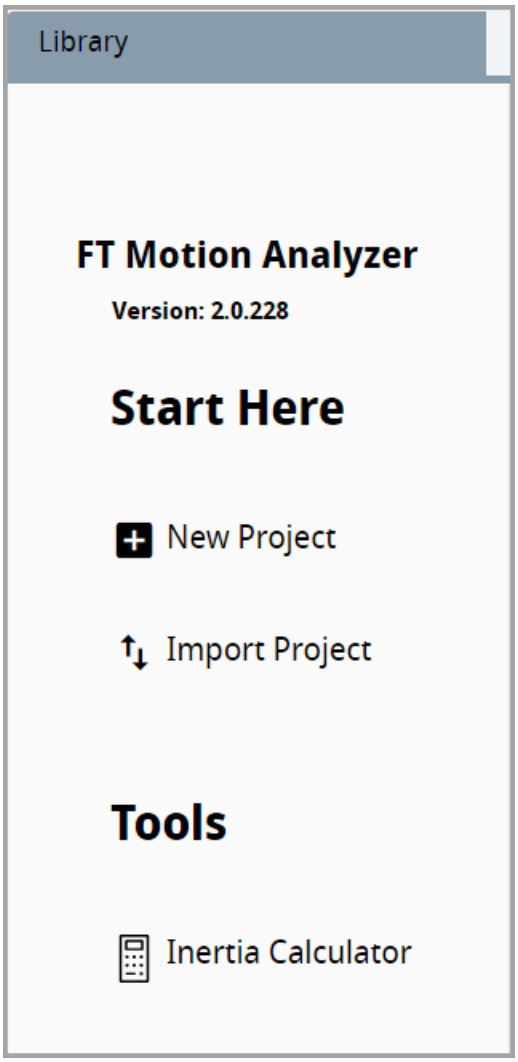


Table: Left panel options description

Options	Description
New Project	Create new empty project
Import project	Import project from XML
Inertia Calculator	Open Inertia Calculator

Library

The library section consists of three tabs: recent, all projects, components. On the recent tab the list of 10 recently modified projects is displayed. On the All-Projects tab, a list of all projects is available along with search input and pagination. On the components tab, a list of all standalone components which can be imported to the project is available along with search input and pagination.

Figure: Recent Tab

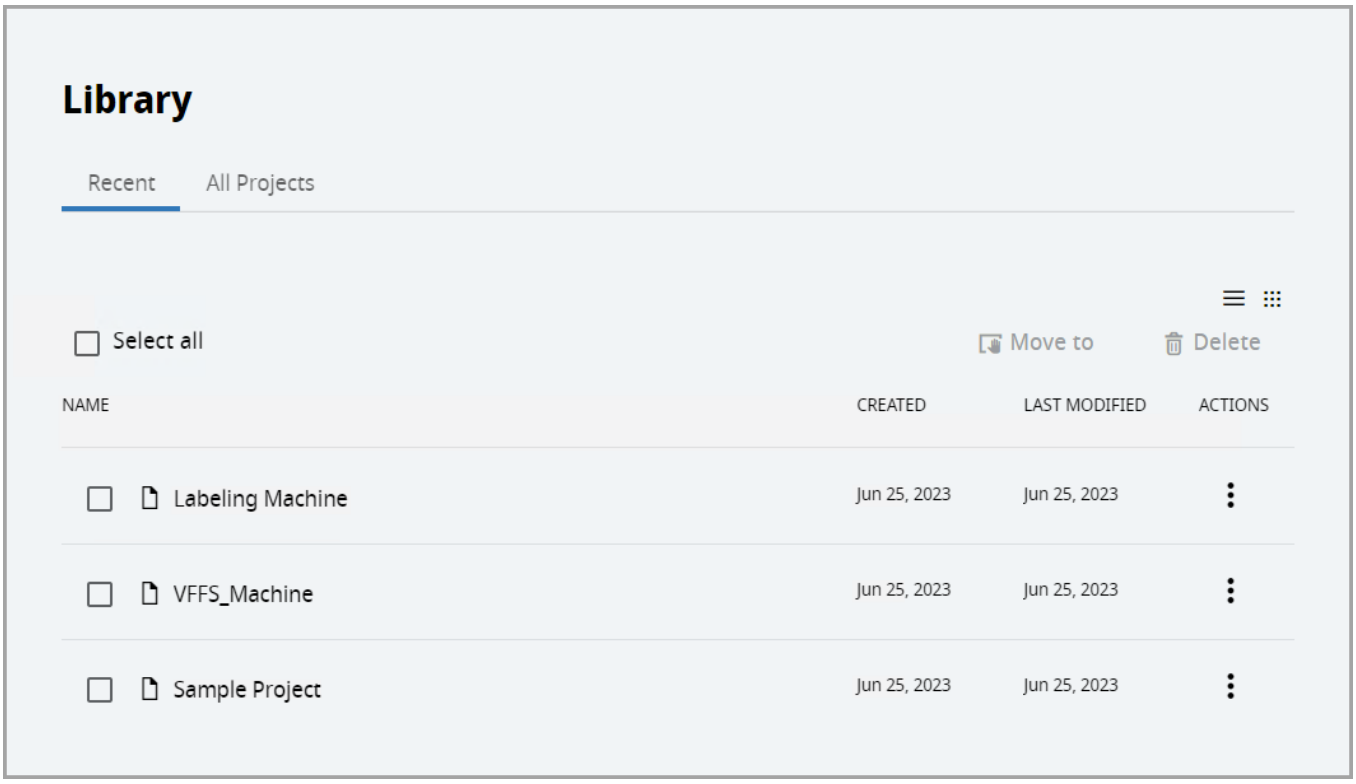
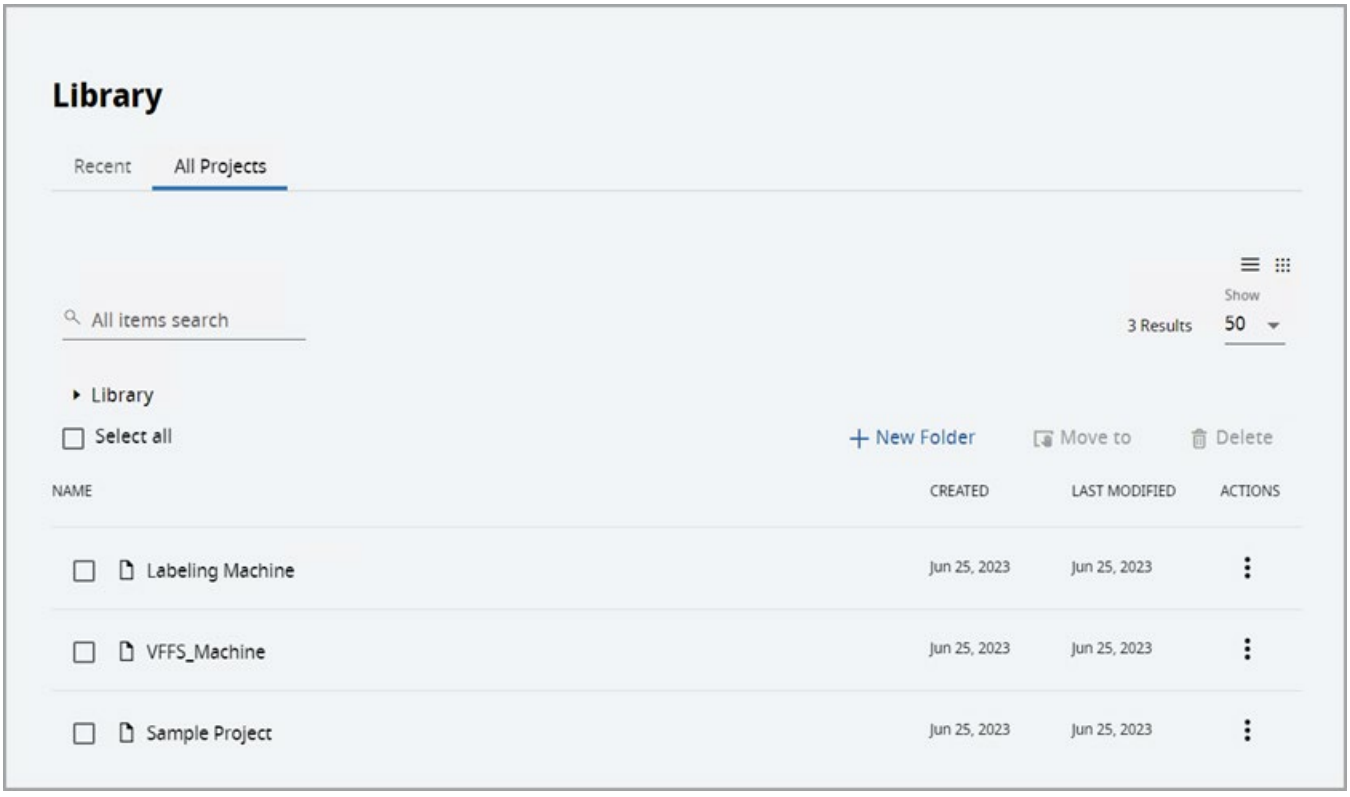


Figure: All Projects Tab



Projects and components are listed on library tabs in the grid with name, created, last modified, creator, shared and actions column headers. Each row contains the values for each of those columns and represents single

project or component. Clicking actions button on specific row will pop up context menu with delete and shared options.

Figure: Project/Component Actions Context Menu

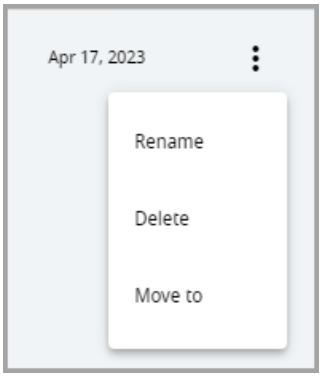
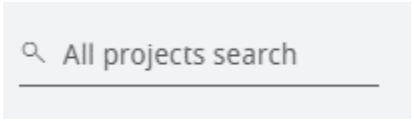


Table: Left panel options description

Options	Description
Delete	Delete project/component from library
Rename	To rename the project/component
Move to	To move the project/component.

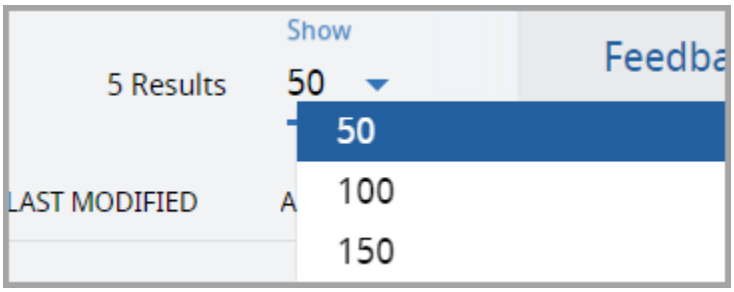
Search input is available on all projects tab and components tab and allows to find project with the specific name.

Figure: Search Input



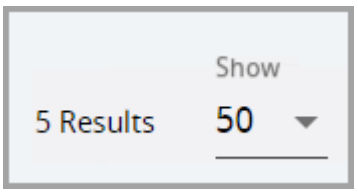
Pagination component displayed on those tabs changes dynamically depending on number of results. Number of displayed results per page can be changed by selecting value in the show select input.

Figure: Pagination Show Select Input



If there is less or equal results to the value selected in show select input the pagination will be displayed in simplified form with the results number and show select input displayed.

Figure: Pagination Simplified Form



When there are more results than selected in show input the pages numbers, pagination arrows and jump to input will be displayed. Entering page number to jump to input and confirming it by pressing enter will change current page. If there is more than 6 pages on the pagination "…" button will appear allowing to jump to the first page not visible on the pagination.

Figure: Pagination Extended Form

Right Panel

The right panel consists of options allowing to check view application's version release notes, send email to Motion Analyzer support, and provide feedback regarding the application and to view Motion Analyzer licenses. Panel by default is expanded for resolution width higher than 1440px and can be collapsed by clicking Hide Panel button. For the width lower than 1440px panel by default is collapsed and can be opened by clicking Show Panel button. For the width less than 1440px panel is displayed on top of the middle section and does not distort the appearance of the application.

Figure: Right Panel

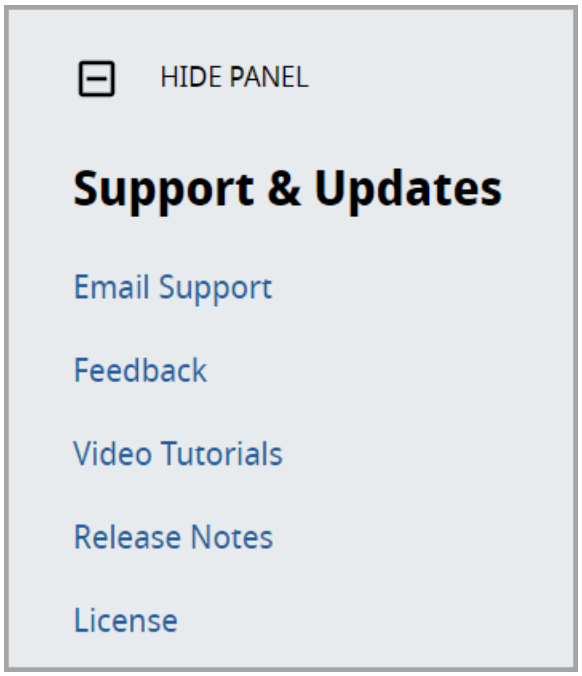


Table: Right panel options description

Options	Description
Show/Hide Panel	Open/collapse right panel
What's new	Open document with release notes
Support	Create new e-mail to Motion Analyzer support
Feedback	Opens a link to provide feedback to the Motion Analyzer Team
License	Open document with licenses

Figure: Collapsed Right Panel

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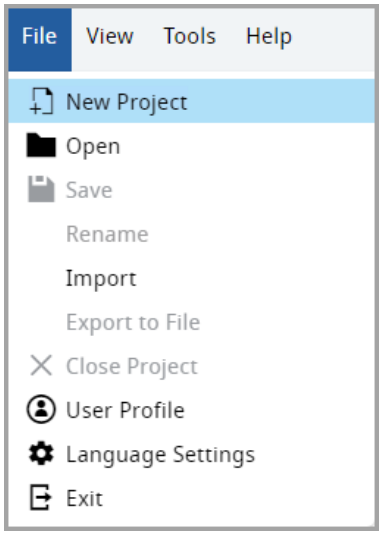
Project

The Project Pane provides a Windows Explorer-style graphical user interface for navigating through the Motion Analyzer project.

Create Project

1. Open the File menu, and click [+ New Project].

Figure: Create New Project



A new Project homepage displays with a sample project name.

Figure: New Project

2. On the Quick access toll bar, click the [ ] icon.
3. The Save Project dialog displays. Provide the Project name and Click [Save].

Figure: Save Project

The project pane tree displays the following features:

Table: Project Pane Main Nodes Description

Node	Description
Preferences	Open the project preference.
Architecture Overview	Open the architecture overview
Power Analysis	To calculate the Power Analysis of a power supply for the selected power bus.
Bill of Materials	Open the bill of materials
Project Report	Open the project report

Manage Projects

Motion Analyzer allows users to manage the Projects by creating folders and store them inside in groups. User can move and delete the Projects or the Folders.

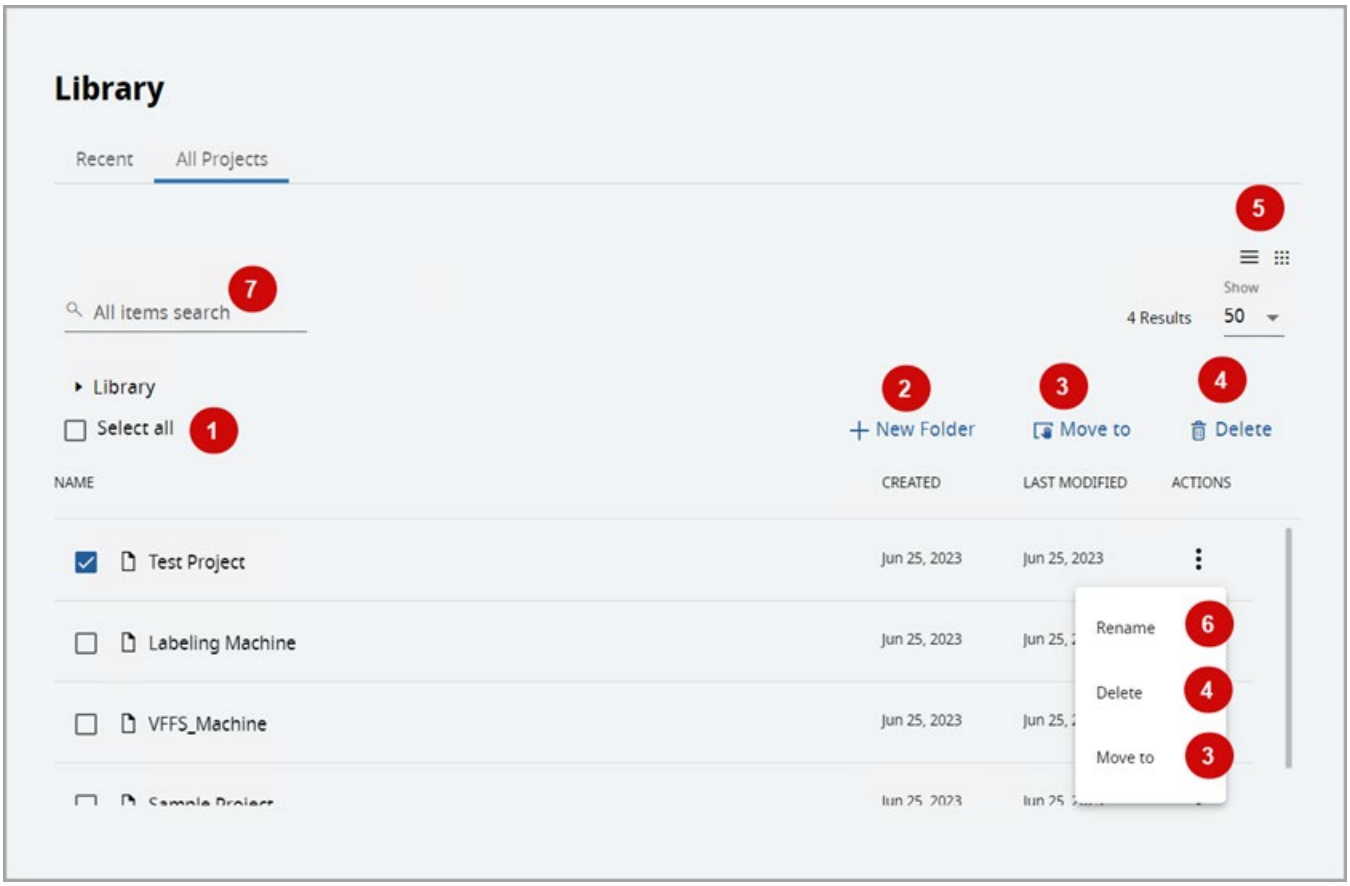
On the Library page, the following tab displays:

- Recent: Displays the recent projects.
- All Projects: Displays the list of all available Projects and Folders.

Motion Analyzer provides the following functionalities to manage Projects:

1. Select All: To select or deselect all the Project(s) or Folder(s).
2. New Folder: To create new folders to store the Projects/sub Folders. This feature is only enabled in the “All Projects” tab view.
3. Move to: To move the selected Projects/Folders to respective folders.
4. Delete: To delete the selected Project or Folder.
5. View: List View or Tile View
6. Rename: To rename the Project or the Folder.
7. Search: To search for a Folder or Project.

Figure: Library



Create New Folder

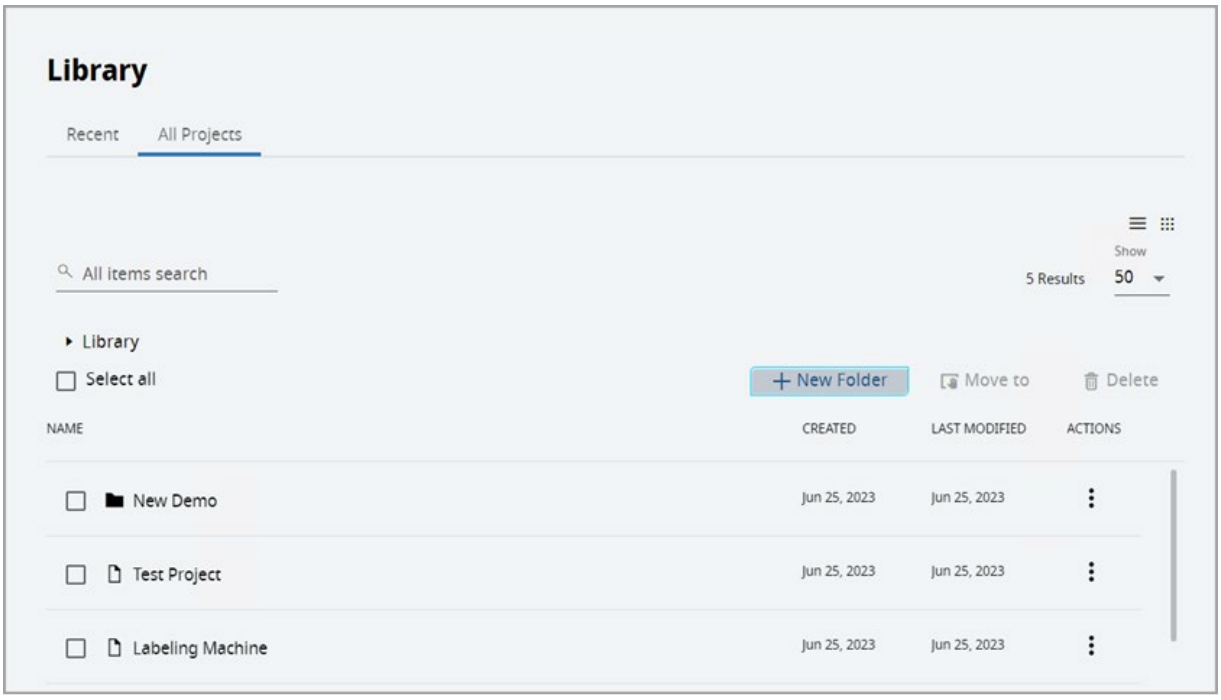
Perform the following steps to create a Folder:

1. Click [+New Folder].
2. The New Folder dialog displays. Provide a folder name and click [Create].

Figure: New Folder

The new folder will be created on the Library page as shown in the following image:

Figure: New Folder



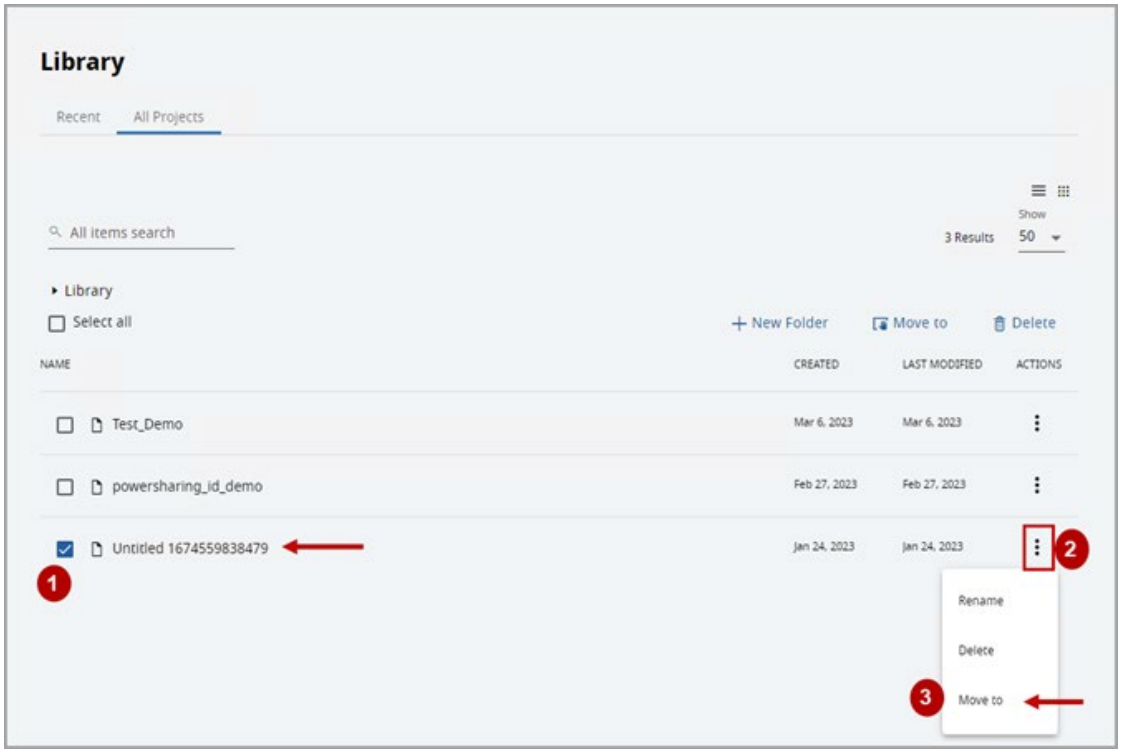
User can create multiple folders and sub folder based on the requirement.

Move Project-Folder

Perform the following steps to move the Project or Folder:

1. Select the Project or Folder from the list.
2. Click the [⋮] icon.
3. Click [Move to].

Figure: Move

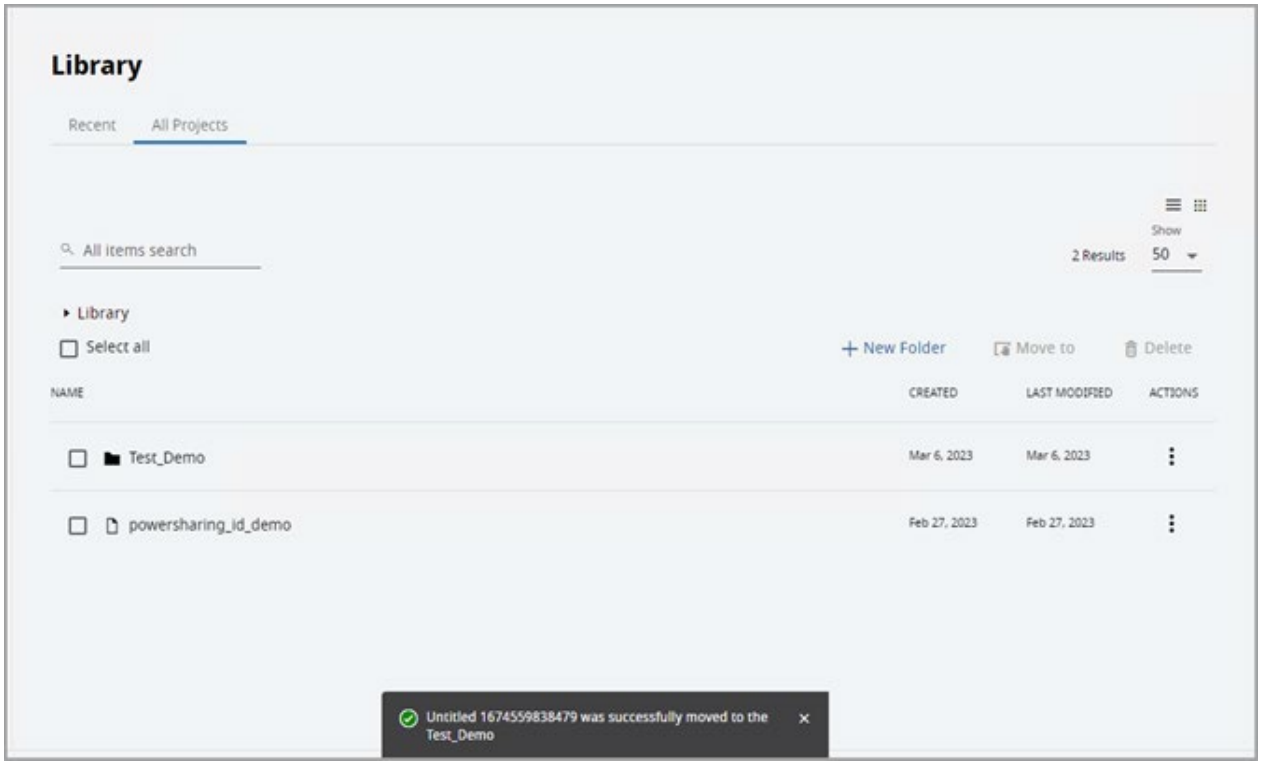


4. The ‘Move to’ dialog displays. Select the destination folder from the list and click [Move].

Figure: Move To

The “Project was successfully moved to the library” message displays. If multiple projects are selected and moved then "Selected items were successfully moved to the Library" message displays.

Figure: Moved Successfully

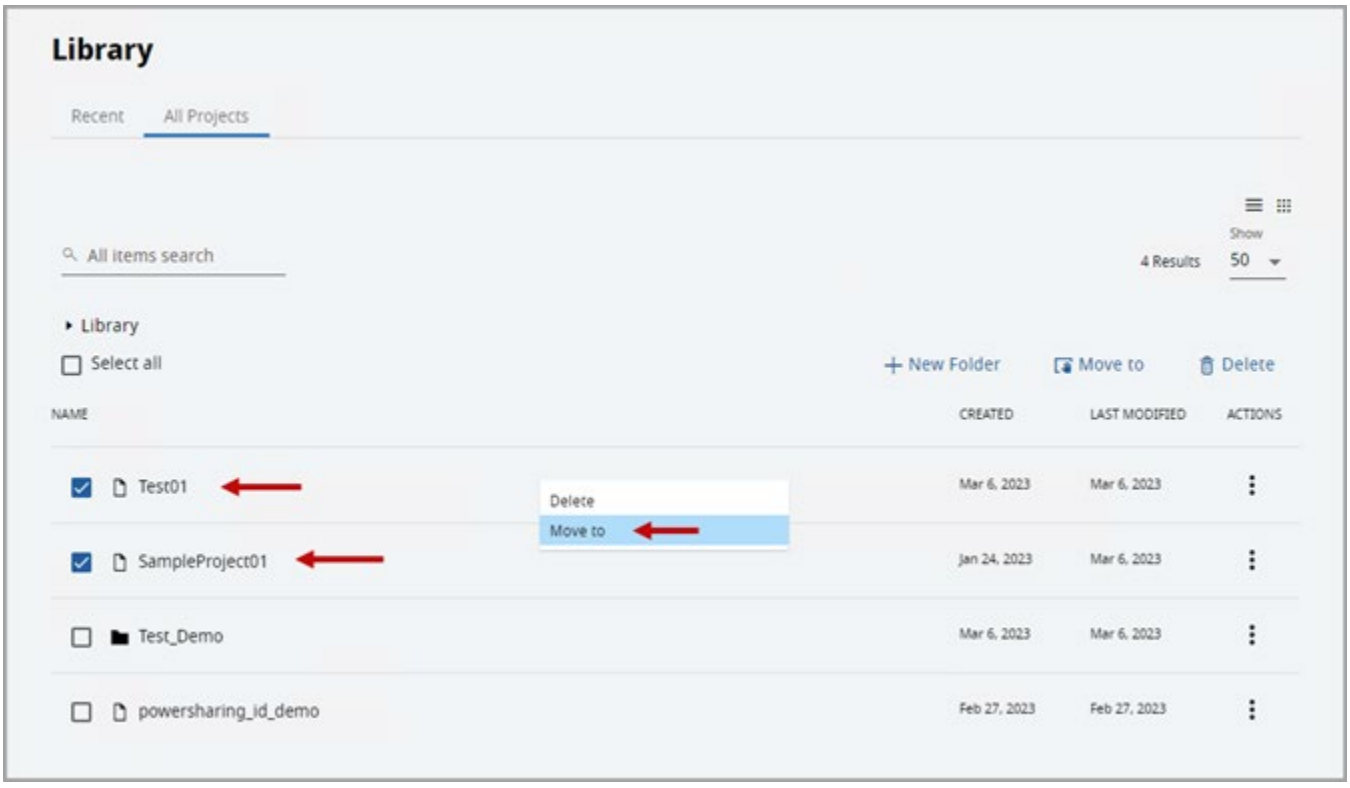


The Project will be relocated to the destination folder.

Figure: Destination Folder

Note: User can select the multiple folders and Projects at the same time and move them to a dedicated location. User can also right-click on one of the folder/project and move them.

Figure: Select Multi-items and Move



Both the Folder and the Project can be moved to the destination Folder.

Note: While importing the Projects, user can select the destination location to save the Project.

Figure: Save

While browsing through the Folders, the Navigation panel displays the Folder structure.

Figure: Folder

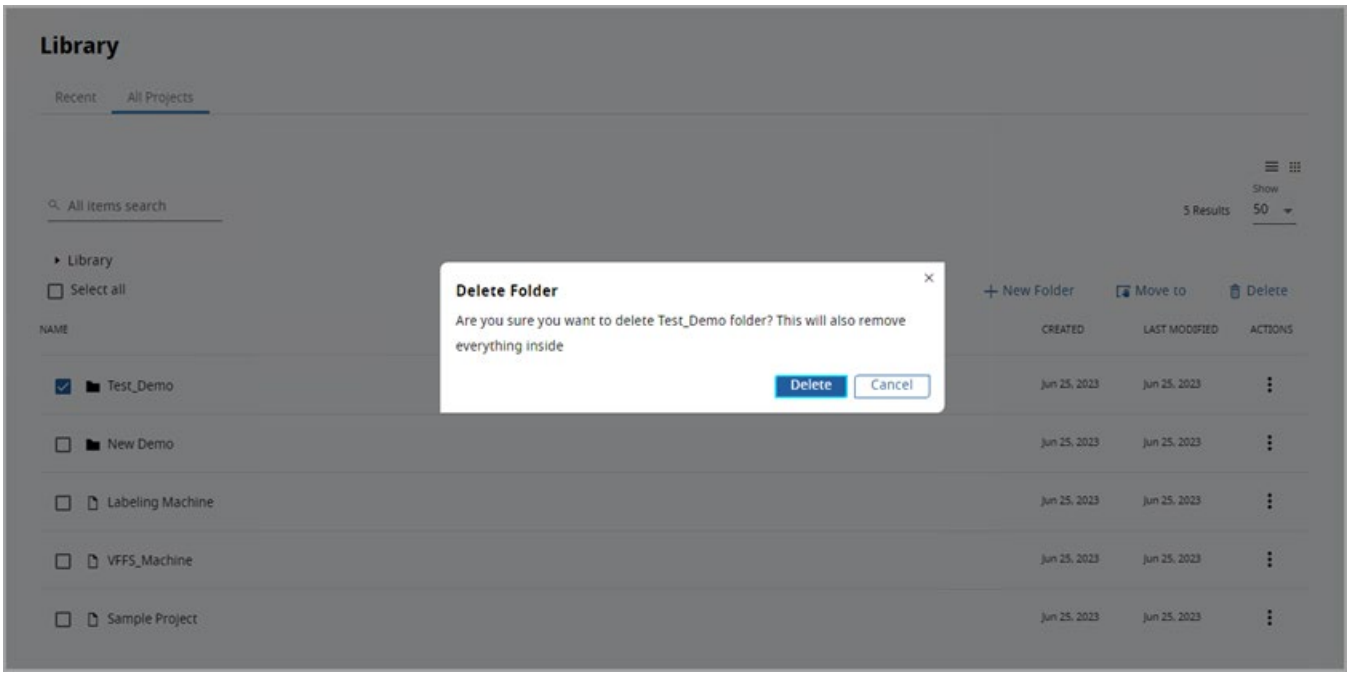
Delete Project-Folder

Perform the following steps to delete the selected Project or Folder:

1. Select the Project/Folder from the list.
2. Click [Delete] or click the [⋮] icon under Actions.
3. The ‘Delete Project’ or ‘Delete Folder’ dialog displays. Click [Delete].

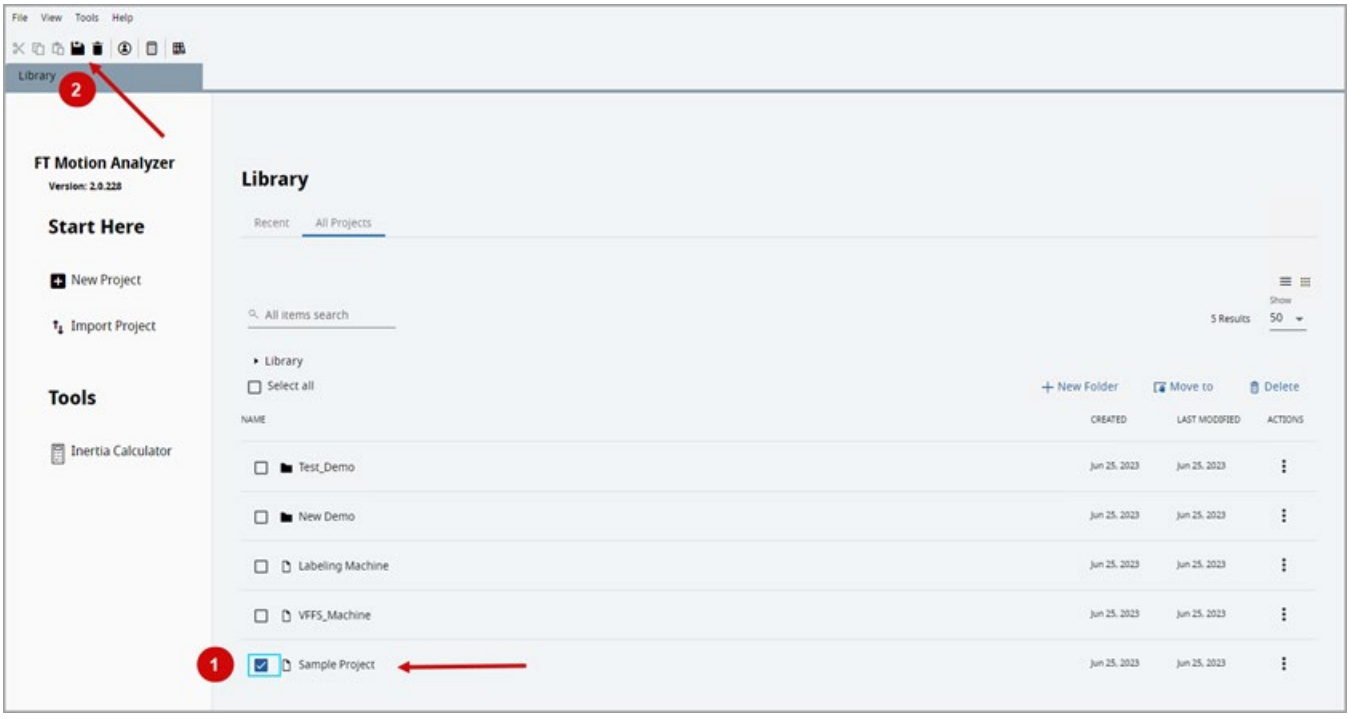
IMPORTANT: Be careful while deleting the Folders. This action will delete the entire content under the Folder and there is no backup option to retrieve the data.

Figure: Delete Project



NOTE: User can select the Folders and Projects at the same time and delete them.
User can also delete the selected Folder/Project from the main tool bar.

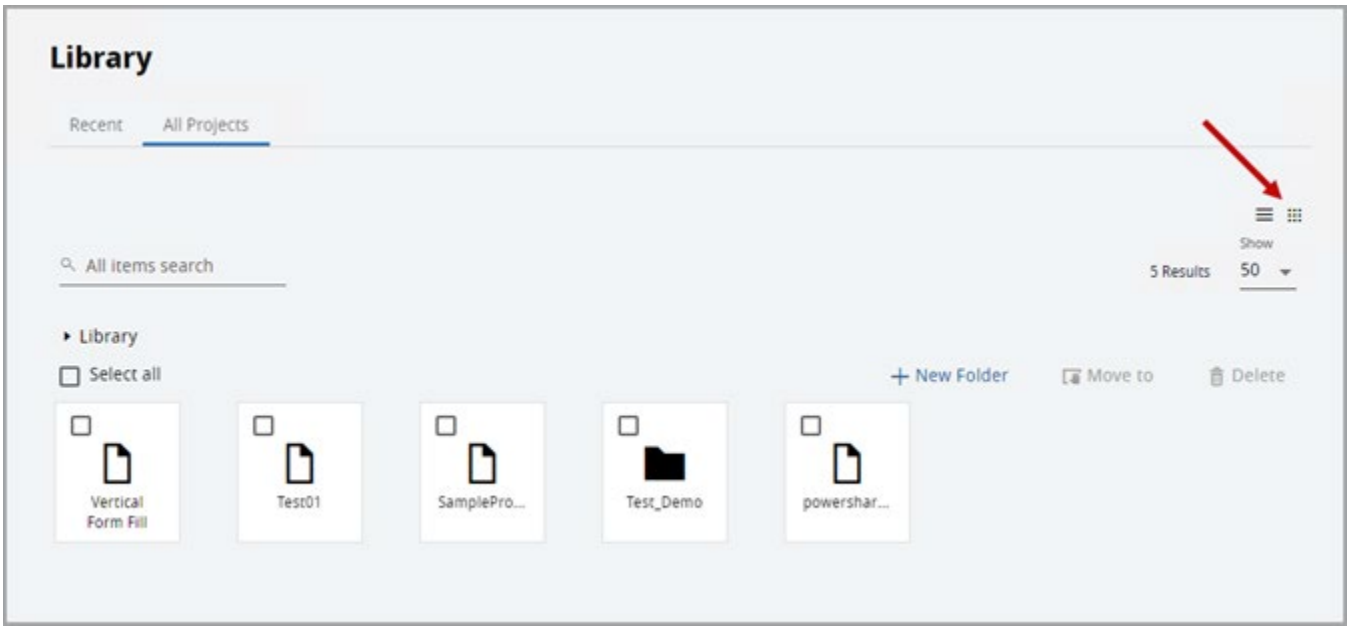
Figure: Delete Icon



Project-Folder View

User can switch between the List View and Tile View.

Figure: Library View



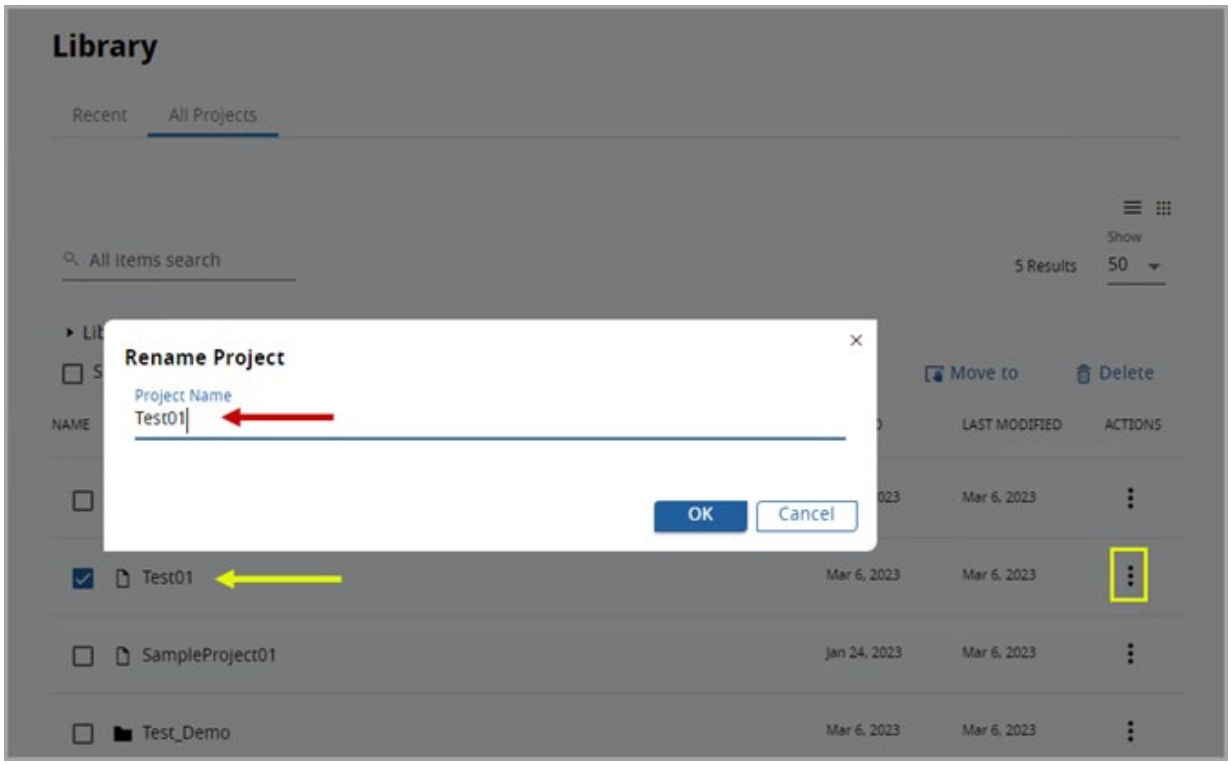
NOTE: In the Tile view, user need to right-click on the tile to view the actions.

Rename Project-Folder

Perform the following steps to rename the Project/Folder:

1. Select the Project/Folder and click the [⋮] icon under Actions.
2. Click [Rename].
3. The Rename dialog displays. Rename the Project/Folder and click [OK].

Figure: Rename Project



Search

User can preform search operation to find a Project or Folder by name. This search operation is carried in the entire repository from the Homepage library and display the results.

Figure: Search

Project Preferences

The Project Preferences menu allows the user to store the Customer Information.

1. On the left panel, double-click the [Preferences] menu and the Project Preferences screen is displayed.
2. Provide the following information:

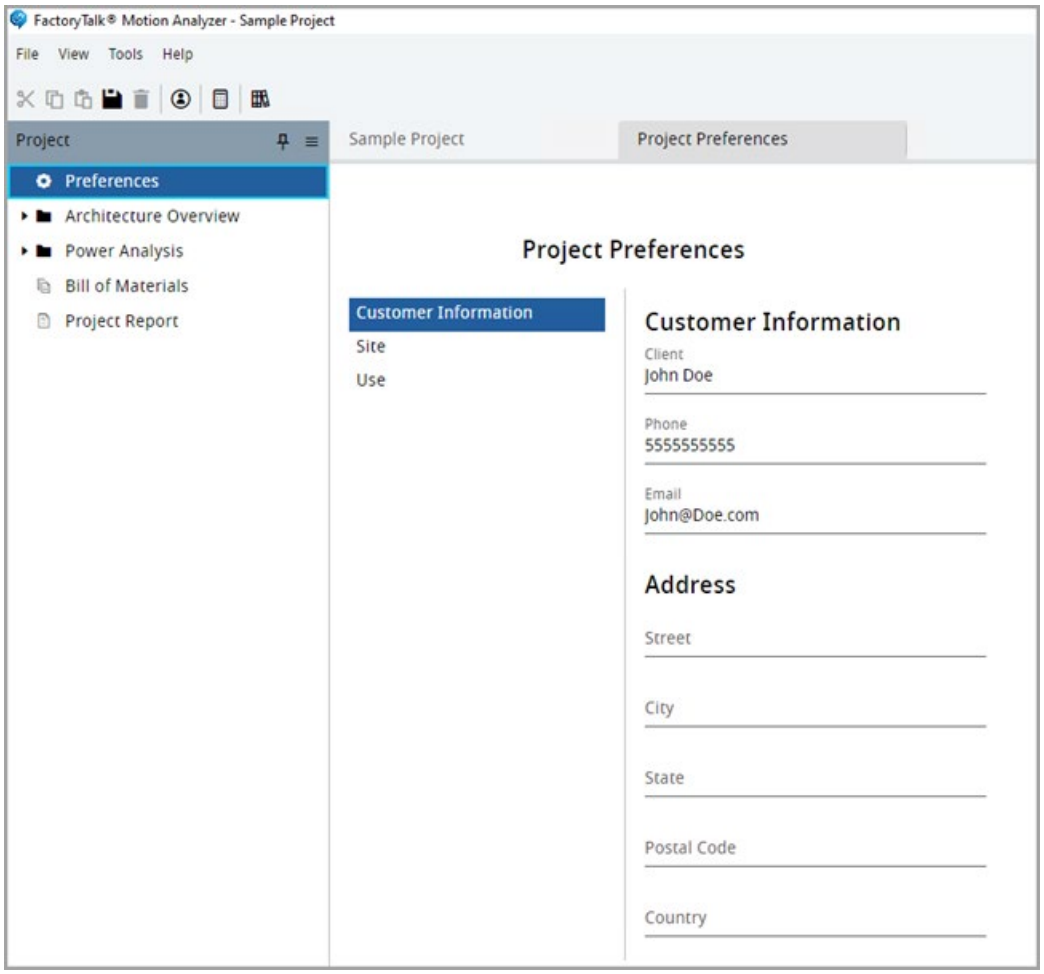
Table: Project Preferences

Field	Description
Customer Information	
Client	Name of the client.
Phone	The phone number of the customer.
Email	The Email ID of the customer.
Address	The address with street, city, state, postal code, and country.
Site	
Altitude	The altitude of the client's location.
Temperature	The temperature of the client's location.
Use	
Industry	Provide the type of Industry where the project is used. Click [Add] to add the new records.
Application	Provide the application name, the project is used for. Click [Add] to add the new records.

Tip: In the Customer Information section, all the fields are limited to 50 characters.

3. Click the [] icon on the Quick access tool bar on the top left corner to save the changes.

Figure: Save Project Preferences



Architecture Overview

Architecture Overview provides a user interface to access, add, remove, or modify the components like axes, buses, dual axes, and clusters in the Motion Analyzer project. Each component is presented in a hierarchical manner.

Figure: Sample Project Tree

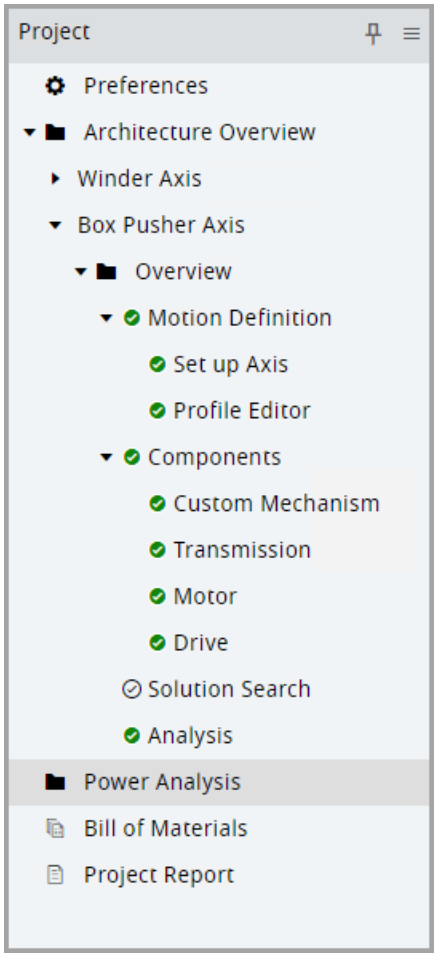


Table: Project Pane Description

Feature	Description
Overview	Open the axis overview
Motion Definition	Open motion definition Set up Axis: open Set up axis Profile Editor: Open Profile Editor
Components	Open the following components: Custom Mechanism: Provides the list of available Mechanisms to configure. Transmission: Provides the list of available transmissions to configure. Motor: Provides the list of available motors to configure. Drive: Provides the list of available Drive to configure.
Solution Search	Open solution search

Analysis	Open axis analysis

Right-click on the components to view their context menus available. From the Architecture Overview tab, user can access the Library allowing to import axes created within the scope of the current project or save axes from current project to the Library allowing to reuse them in the other projects. Click the [Select all] checkbox or the individual component's checkbox to select the components in the project.

Figure: Architecture Overview

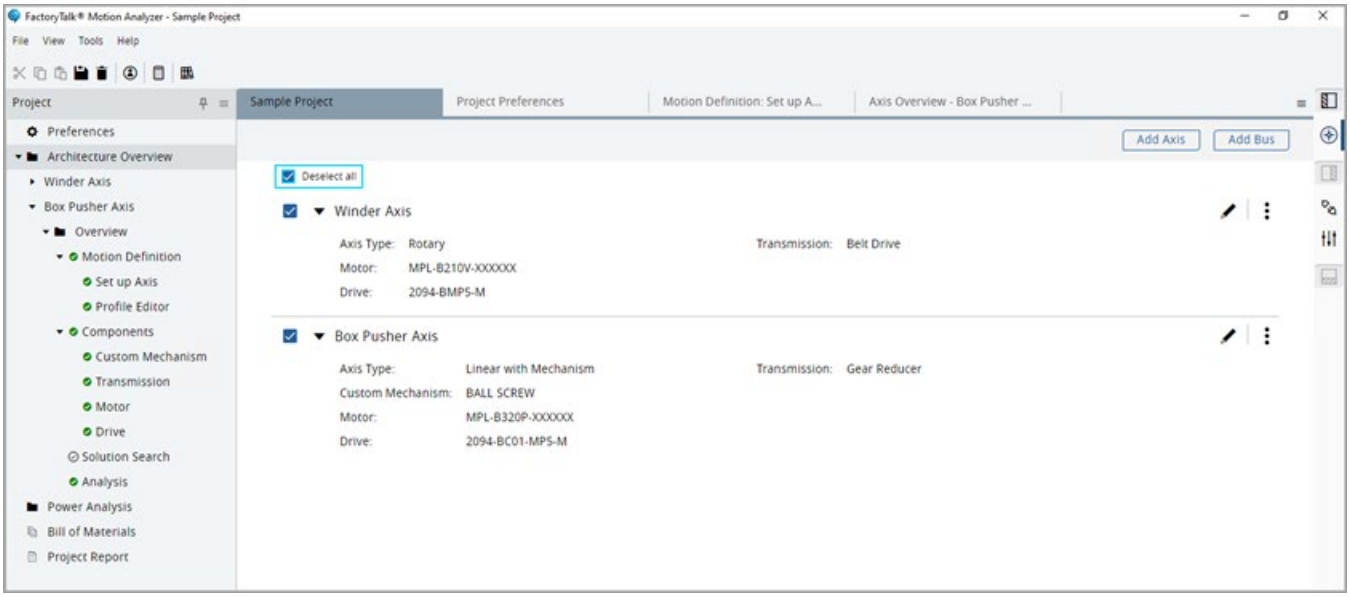


Table: Architecture Overview

Options	Description
Add axis	Add a new axis
Add bus	Add a new bus
Library	Open the library
Select all	Select all components

Axis

Axis is the base element in Motion Analyzer and can be added to the project, click [add axis] or import it from the user's library. Axis can be a standalone component, can be added to bus (more in Bus), cluster (more in Cluster), or be merged with another axis into dual axis (more in Dual Axis). Axes can only be merged into dual axis containers if the drive family has dual axis drives. Double click on the axis name or select the rename option from the axis context menu to rename the Axis. Click [Edit] from the axis context menu to edit the axis.

Figure: Standalone Axis

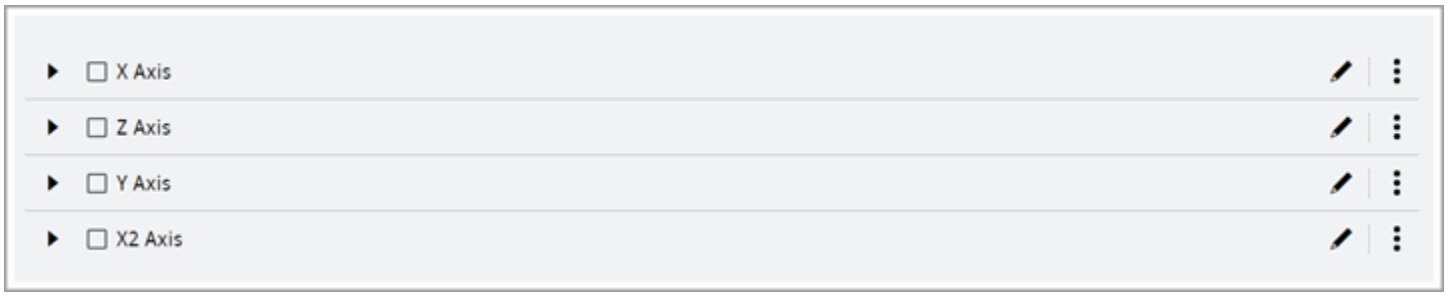
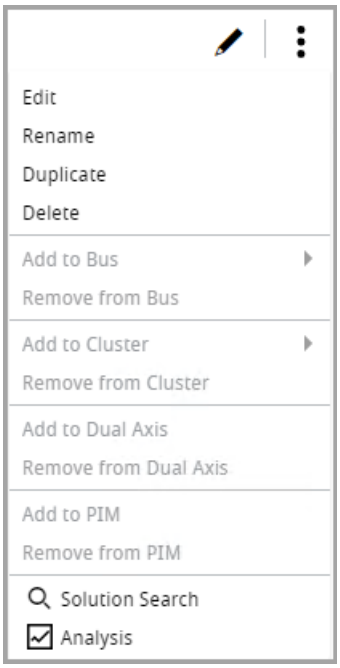


Table: Axis options description

Options	Description
Chevron	Show/collapse axis details
Axis name	Double-click to rename the axis
Share	Share the axis with another user
Comments	Add comments to the axis
Add to library	Add axis to the library
More actions	Show the axis context menu

Click [More Actions] or right-click on the axis to open the Axis context menu.

Figure: Axis Context Menu



On the axis, click [Chevron] to toggle the Axis details. They consist of selected axis types and components e.g., for rotary axis: transmission, motor, and drive. For the new axis by default, the rotary motion type is selected. On the axis, click [Edit] to change the rotary motion type in the set-up axis section.

Figure: Rotary Axis Details

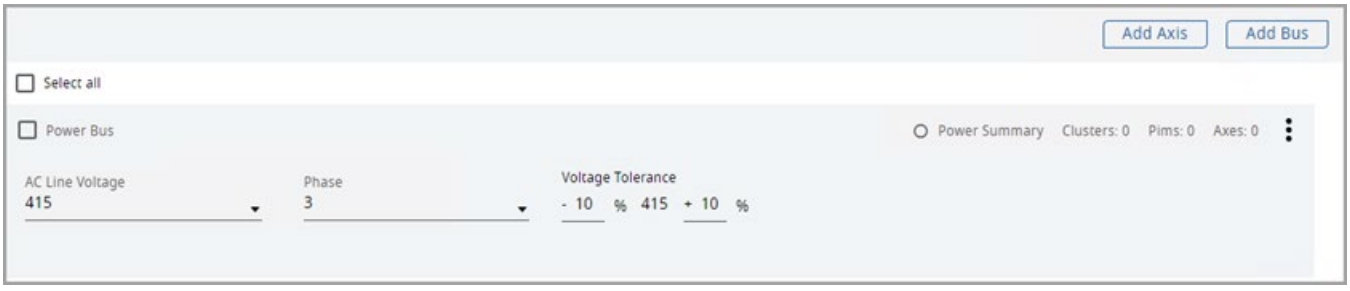
Table: Axis Context Menu

Options	Description
Edit	Click to edit the axis
Rename	Click to rename the axis
Duplicate	Click to duplicate the axis
Delete	Click to delete the axis
Save to library	Click to save axis to the library
Share	Click to share axis with another user
Add to bus	Click to display a list of buses to which the axis can be moved (disabled if none of the buses meet the requirements or there is no bus added)
Remove from bus	Click to remove the axis from the bus (disabled if selected axis is not in the bus)
Add to cluster	Click to display a list of clusters to which the axis can be moved or add the axis to a new cluster (disabled if axis does not meet the requirements)
Remove from cluster	Click to remove the axis from the cluster (disabled if selected axis is not in the cluster)
Solution search	Click to open to solution search tab
Analysis	Click to open the axis analysis tab
Additional components	Click to open additional components tab

Bus

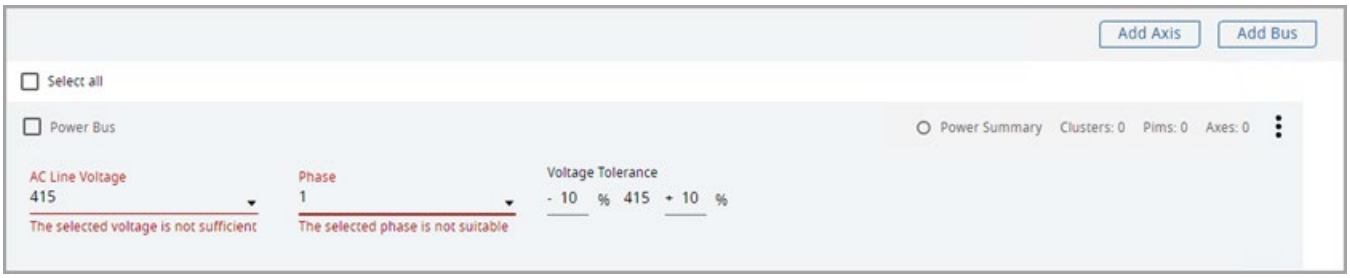
Click [Add bus] to added Bus to the project. Double click the new Bus to rename or select the rename option from the bus context menu. In the bus section, the user can select AC line voltage, phase, and voltage tolerance. The Motion Analyzer validates the power requirements based on the selected voltage against the phase and vice versa. The bus section also displays the information about power summary status and the number of clusters and axes inside the bus.

Figure: New Bus



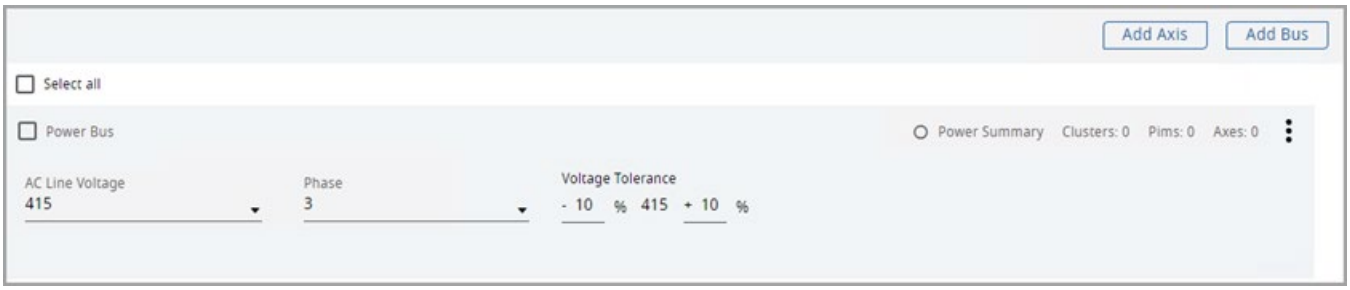
Ensure to provide valid voltage and phase, else an error message displays as shown in the following image:

Figure: Power Requirements



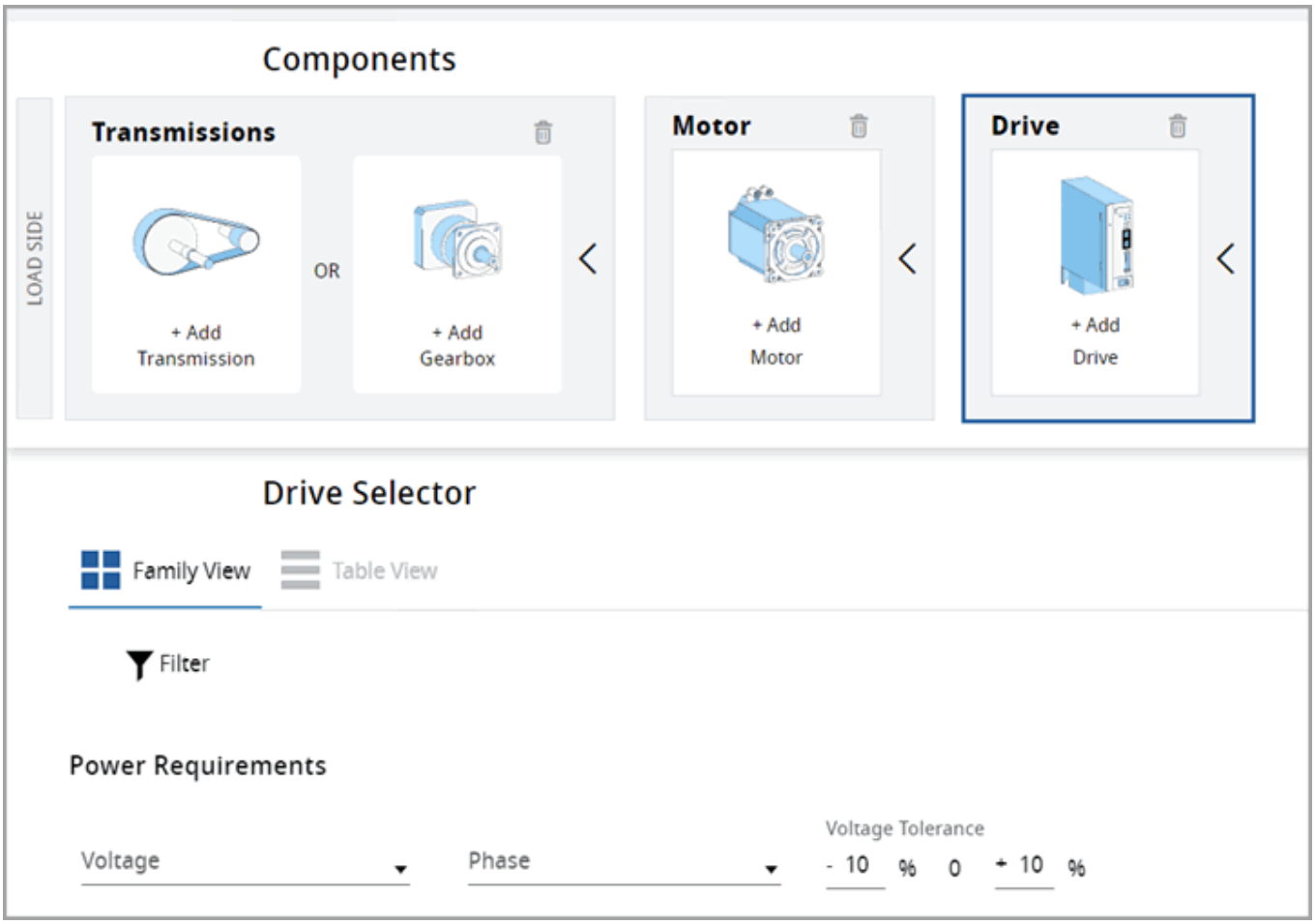
After the user selects the phase, the AC line voltages are filtered. If the AC line voltage is selected and the user selection does not match the phase, the AC line voltage value gets reset. After adding a new empty axis to the bus its drive power requirements are inherited from bus values if selected and the edition of them in the axis is disabled. If the axis with filled drive power requirements is moved to a new bus without AC line voltage and phase selected the values are copied from axis drive power requirements and the edition of them in axis is disabled. If the axis and bus have different voltages and phases selected then the axis cannot be moved to the bus.

Figure: Axis in the bus with selected Voltage and Phase



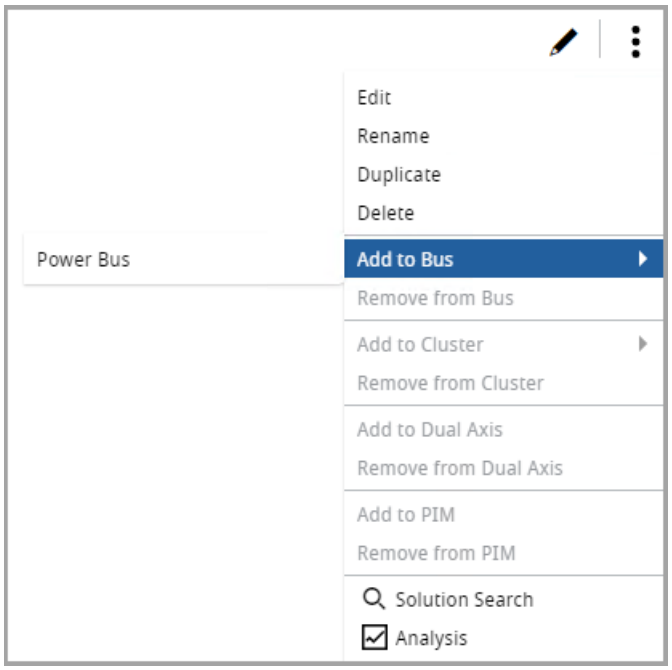
NOTE: The power requirement validation of Voltage and Phase also depends upon the validation of axes power requirements that are children of the selected bus. These power requirements are also validated even though no axes are added to the bus.

Figure: Locked drive power requirements for axis in bus



1. On the axis context menu, click [Add to bus] and select the matching bus to meets the requirements mentioned above for the Moving axis.
2. On the axis context menu, click [Remove from bus] to the Axis.

Figure: Add to bus



3. Right-click on the bus to open the Bus context menu.

Figure: Bus Context Menu

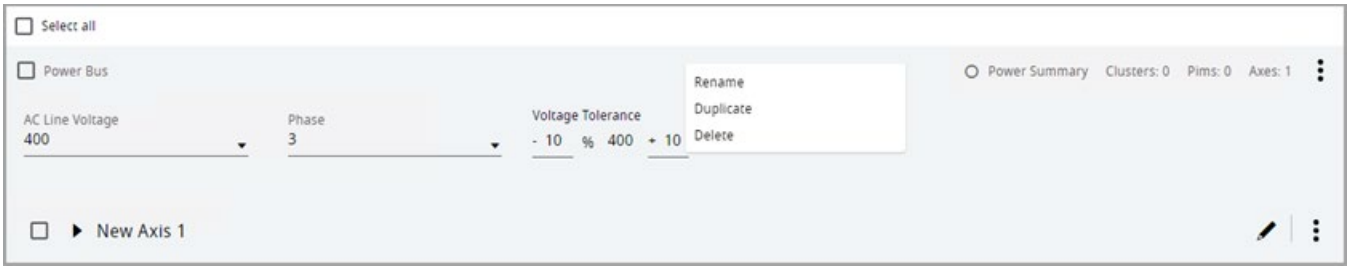


Table: Bus Context Menu

Options	Description
Rename	Rename the bus
Duplicate	Duplicate the bus
Delete	Delete the bus

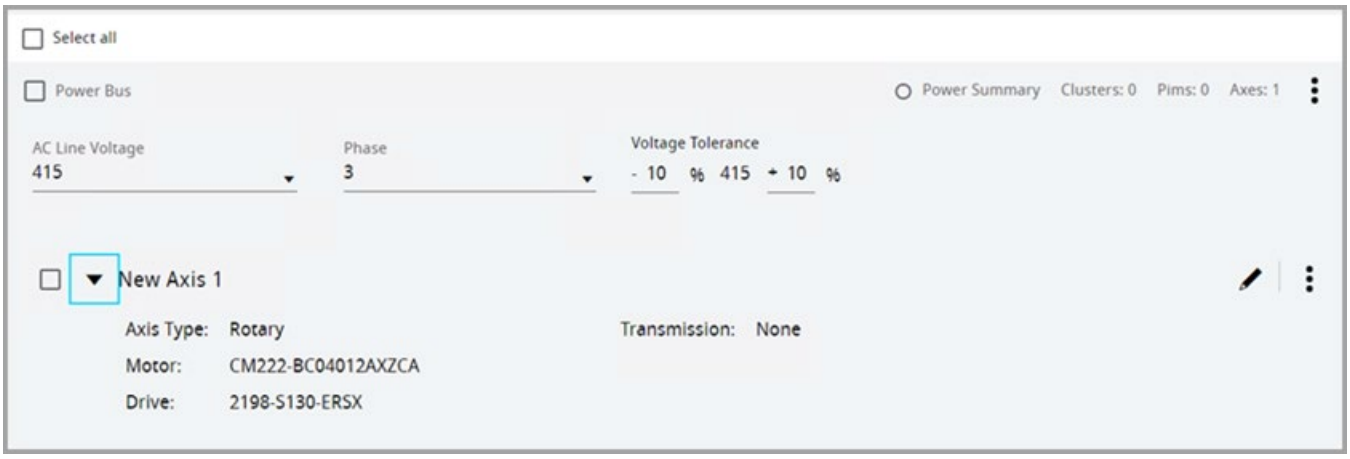
Power Inheritance: If the power requirements are not defined in the axis and the axis is added to the bus, the axis inherits the power requirements from the bus. Also, if the axis with defined power requirements is added to a bus with no power requirements, then the bus inherits the power requirements from axis.

Cluster

To create a new cluster the bus, and the axis with K5700 drive must be created first and the axis must be moved to the bus. When those requirements are met add to cluster option in the axis context menu is enabled.

1. Double click on the name or select the rename option from the cluster context menu to rename the Axis.

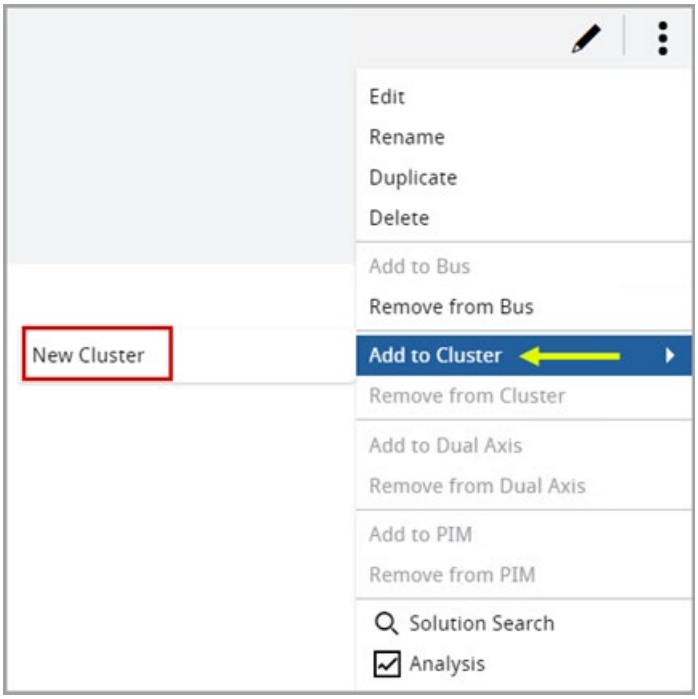
Figure: Cluster



2. On the axis context menu, click [Add to cluster]. This displays a new cluster option or an existing matching cluster.
3. Click [New cluster] to move the axis to the new cluster and click the existing cluster name to move the selected axis to that cluster.
4. On the axis context menu, click [Remove] to remove the Axis from the cluster.
5. In the cluster context menu, under add to bus option, click the bus name to move the Cluster to another bus with the same power.
6. On the cluster or in the cluster's context menu, click [Split] to split the Cluster.

   The splitting cluster will remove it and move all its children to the parent node what in this case always will be a bus in which cluster was.

Figure: Add to Cluster



7. Right-click on the cluster title bar to open the Cluster context menu.

Figure: Cluster Context Menu

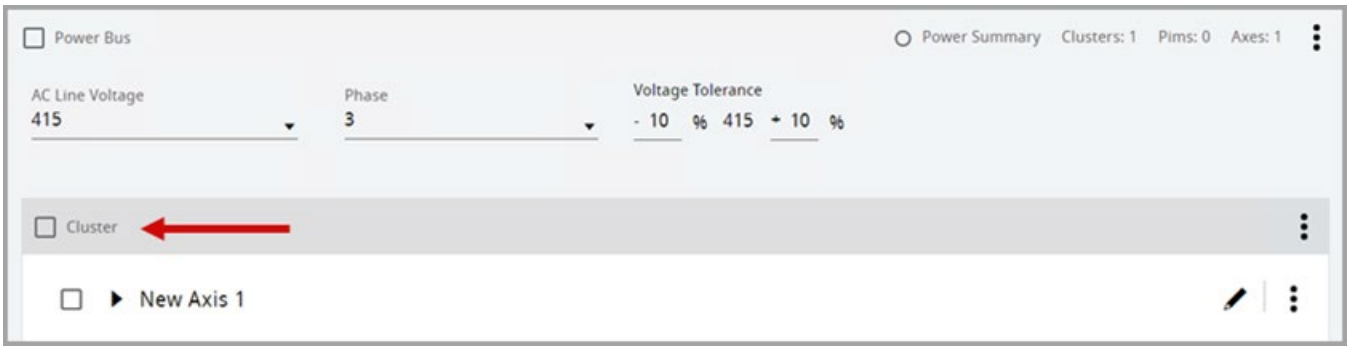


Table: Cluster Context Menu

Options	Description
Rename	Rename the Cluster
Duplicate	Duplicate the Cluster
Delete	Delete the Cluster with all its children
Split	Delete the cluster and move the children to the bus
Add to bus	Display a list of buses to which the cluster can be moved (disabled if none of the buses meet the requirements or there is no other bus added)

Power Interface Module - PIM

Power Interface Module - PIM

ArmorKinetix® Power Interface Modules (PIM) provide the interconnectivity between the Kinetix® 5700 common DC bus architecture (in-cabinet) and the On Machine™ decentralized units (DSM, DSD). The PIM mounting is similar to other Kinetix® 5700 modules (e.g. DAI) and connects to a common DC bus. It provides the interconnect for both power and communications to the first DSM or DSD unit as part of a daisy chain arrangement. Multiple PIMs can be used within a common DC bus arrangement with each servicing up to 24 DSD/DSM units mounted On Machine.

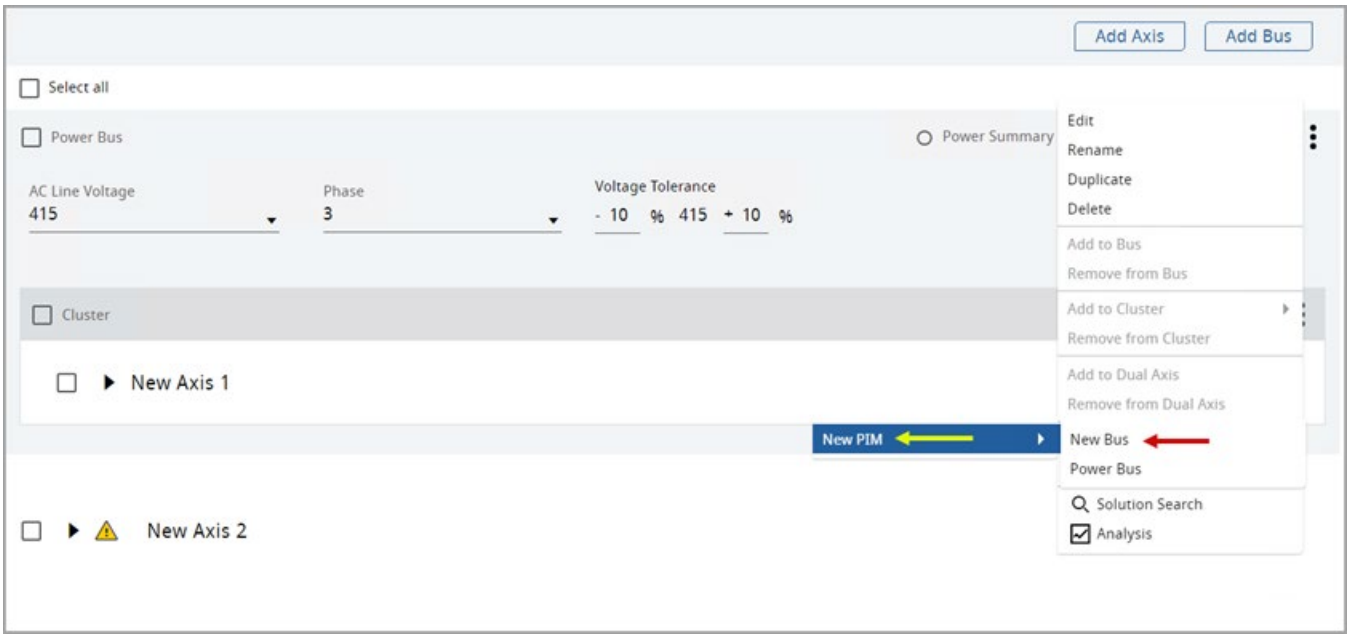
As the DSM motor contains a drive inside and cannot be powered directly, we need to connect the DSM Motor to a power supply through a PIM module.

Perform the following steps to add the DSM-configured axes to the PIM module:

NOTE: Ensure that the axis contains DSM components. For an axis without a DSM component, the PIM feature is disabled.

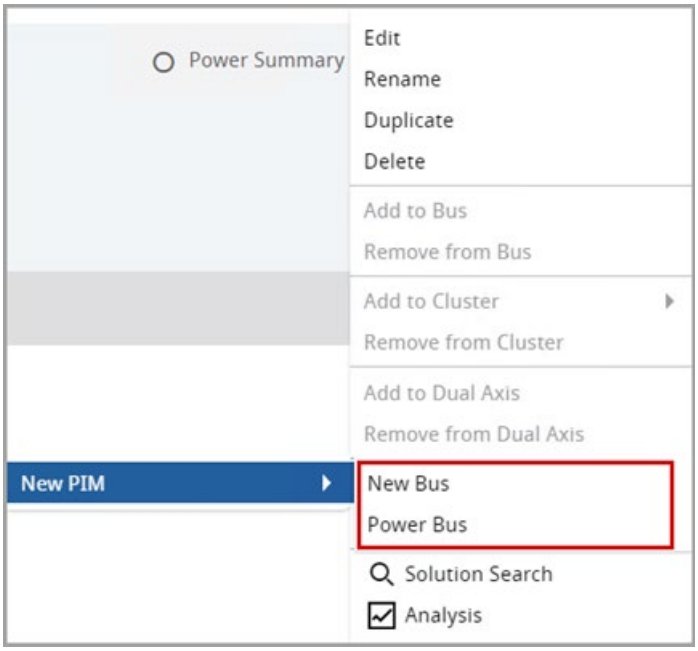
1. On the architectural overview page, click the ellipsis icon [ ]of the axis containing any DSM components.
2. Click [Add to PIM] and then click [New PIM].

Figure: Add to PIM



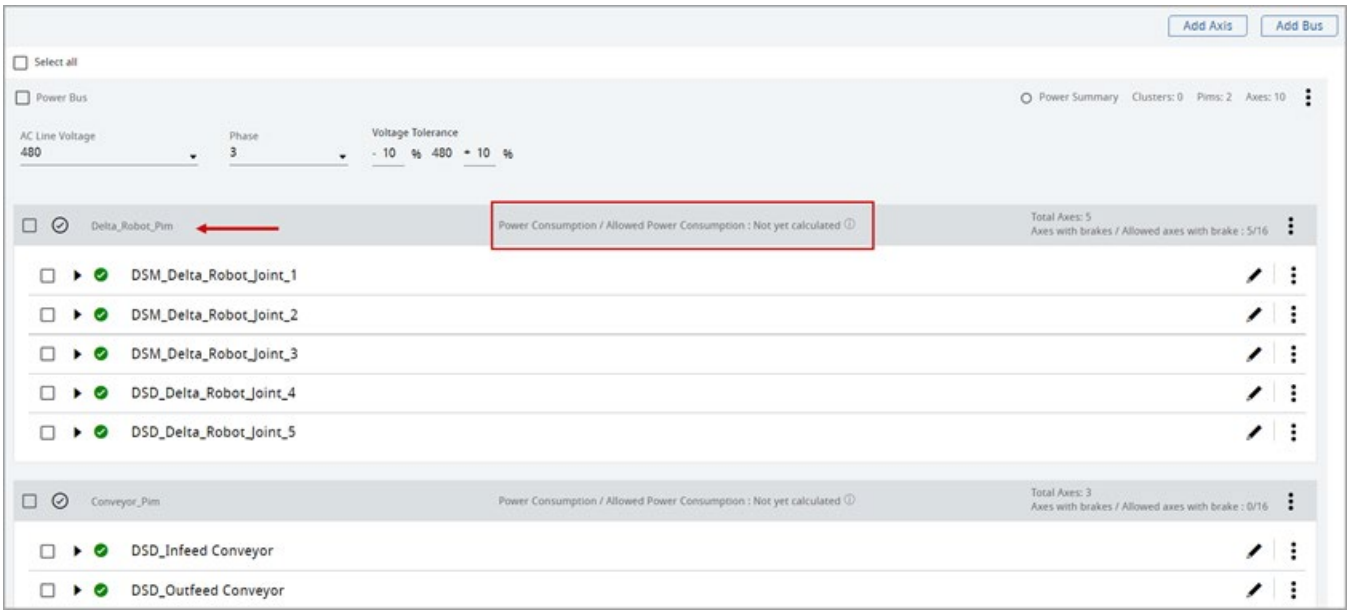
3. Select the list of the available buses.

Figure: New PIM



4. The respective axis is added to the selected PIM module. The PIM name along with the Power Consumption displays.

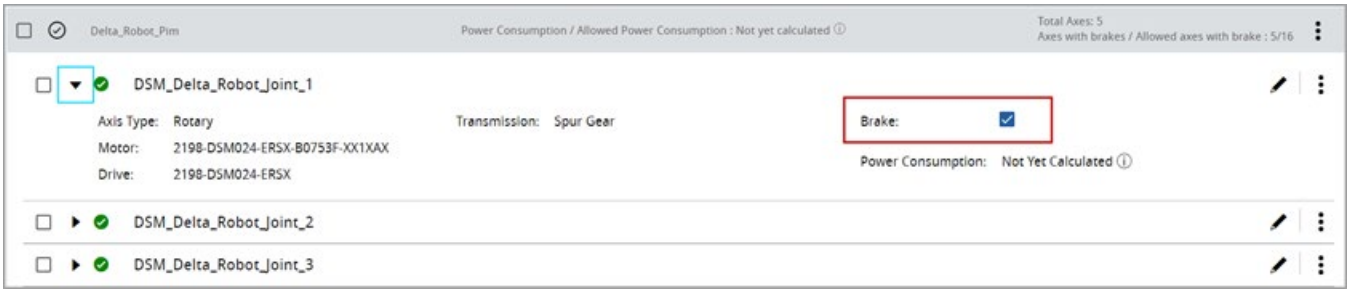
Figure: Axis added to PIM



NOTE: If a bus is present inside the PIM, the user can add the PIM and Power Bus at the same time.

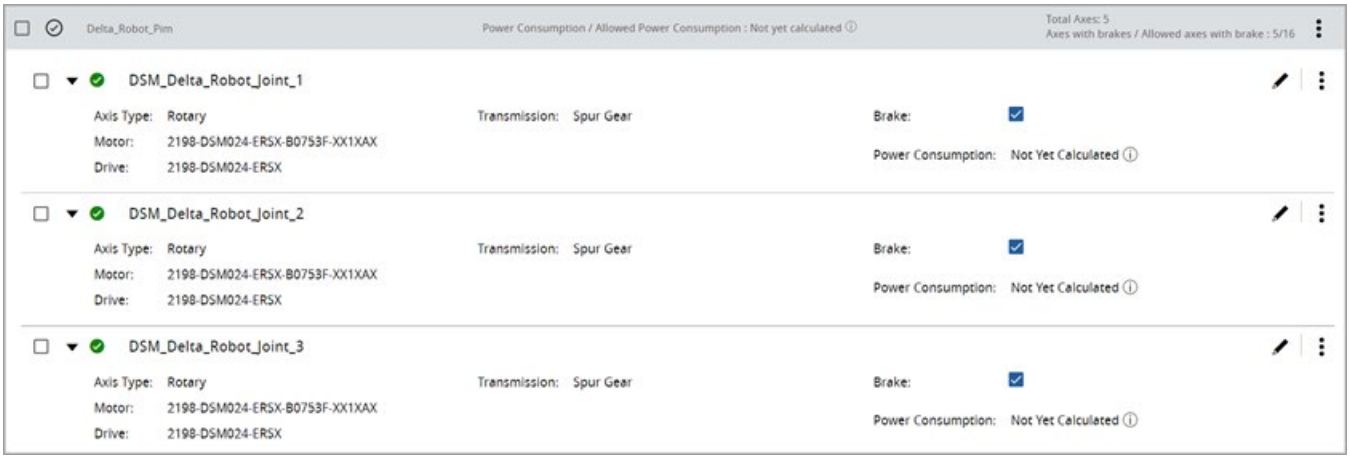
5. When the axis is added to the PIM, the [Brake] checkbox is enabled and user can brake, if required.

Figure: Brake



6. User can add multiple axes to a PIM.

Figure: Multiple Axes

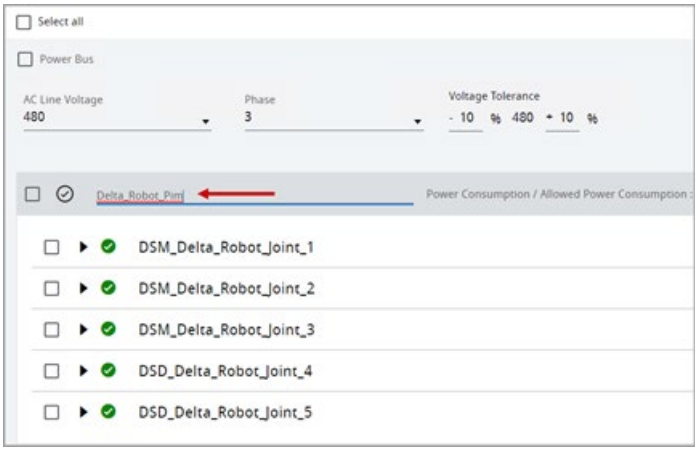


NOTE: User can internally move the axis from one PIM to another PIM.

7. Other Features:

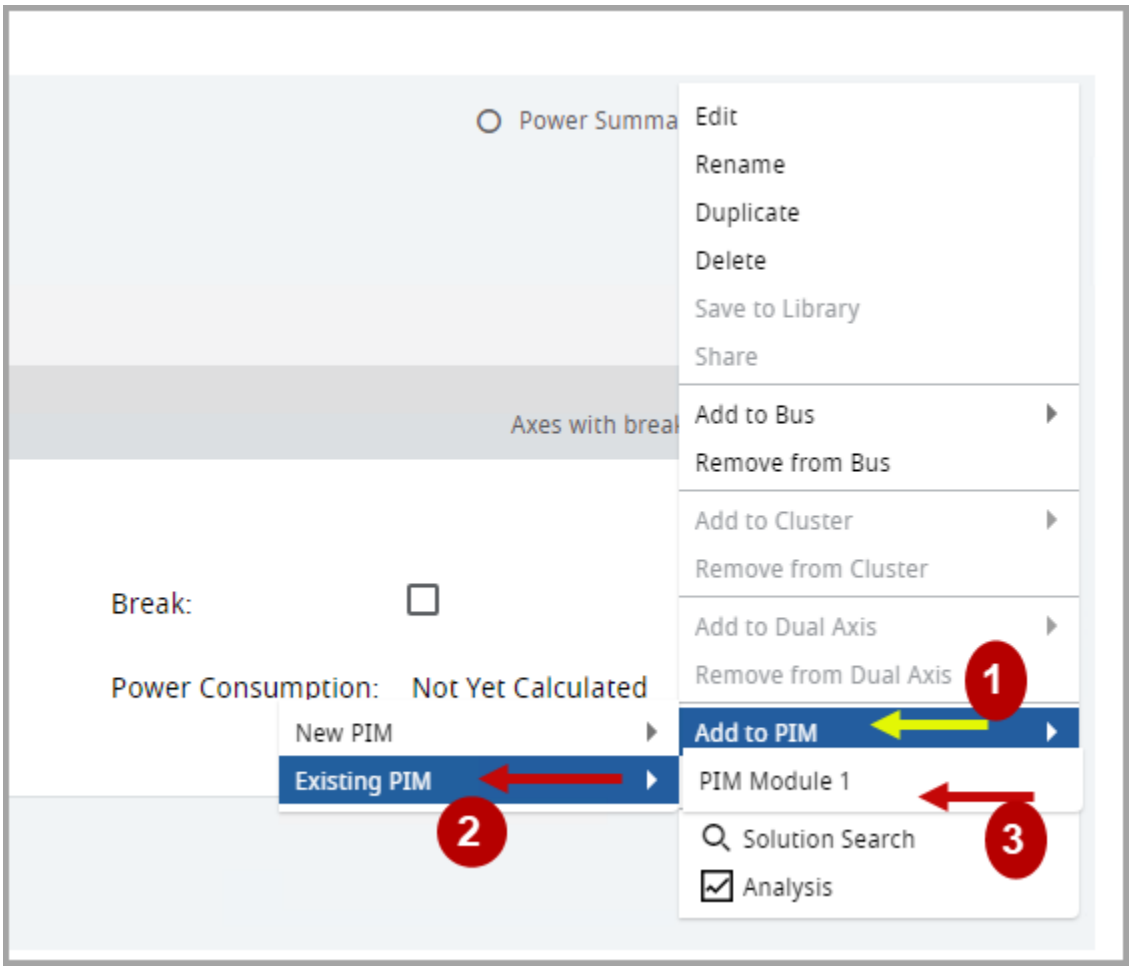
   a. Rename: To rename the PIM, double-click on the PIM name and rename it.

   Figure: Rename PIM



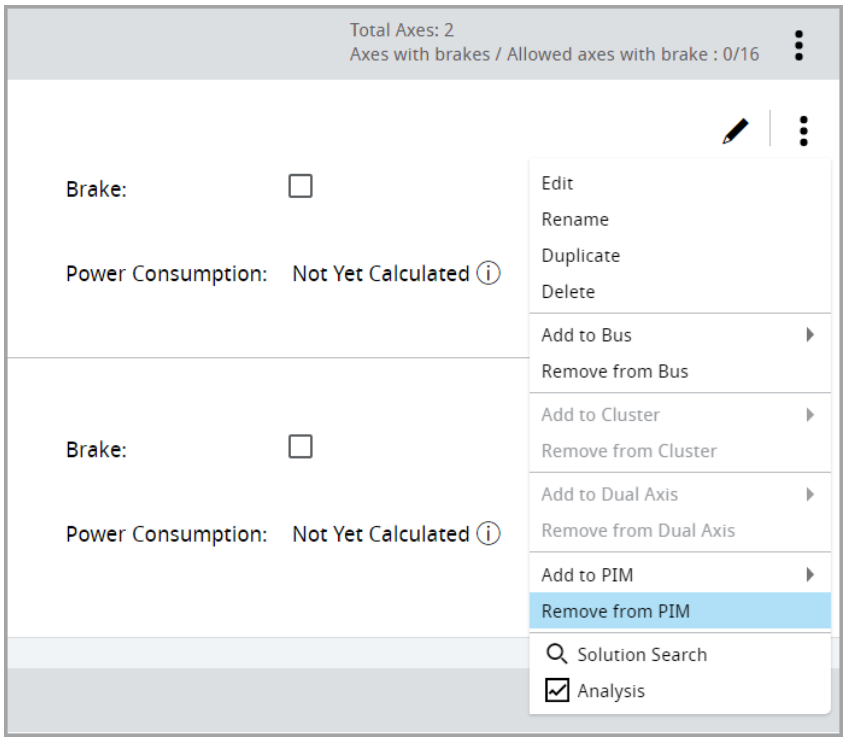
   b. Existing PIM: Once a PIM module is created, user can assign axis to the existing PIM modules.

   Figure: Existing PIM



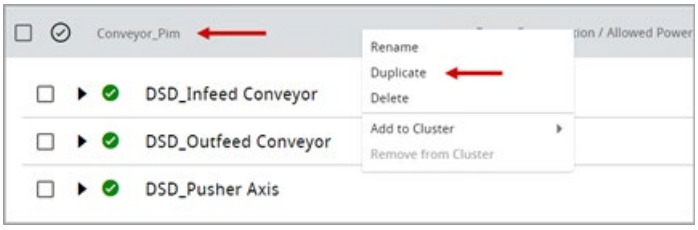
   c. Remove from PIM: To remove the axis from the PIM module.

Figure: Remove from PIM



d. Duplicate PIM: User can duplicate the PIM module. Right-click on the PIM section and click [Duplicate].

Figure: Duplicate PIM



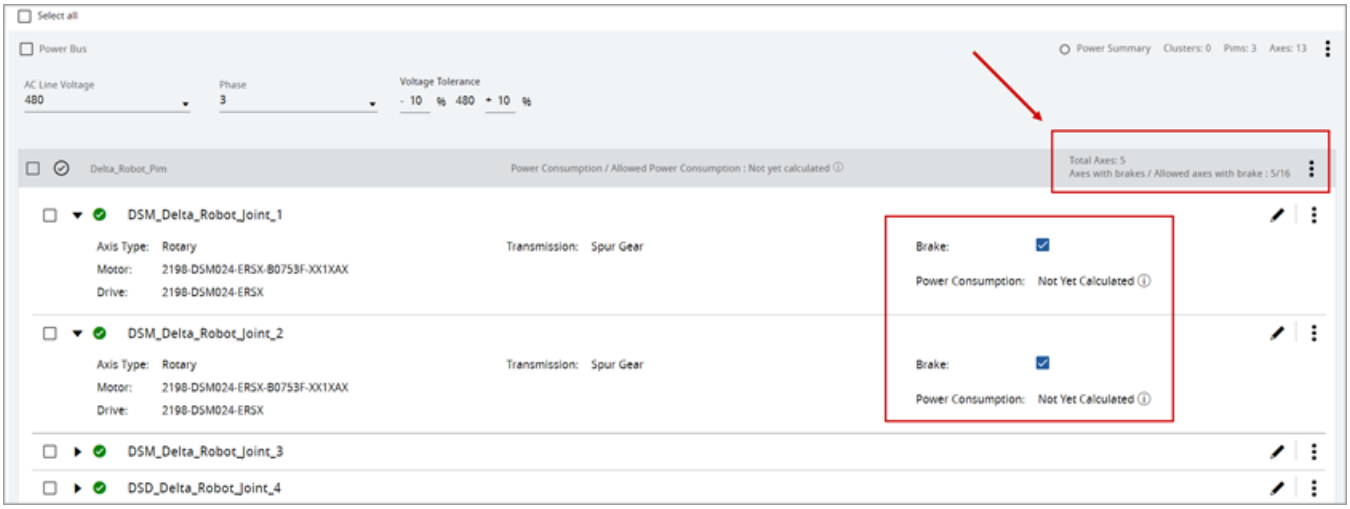
The duplicated PIM module displays on the Architecture Overview page as a copy.

Figure: Architecture Overview

User can double-click on the PIM name and rename it.

e. Brake: To provide brakes for a given number of axes into groups in a PIM considering power consumption.

Figure: Brake



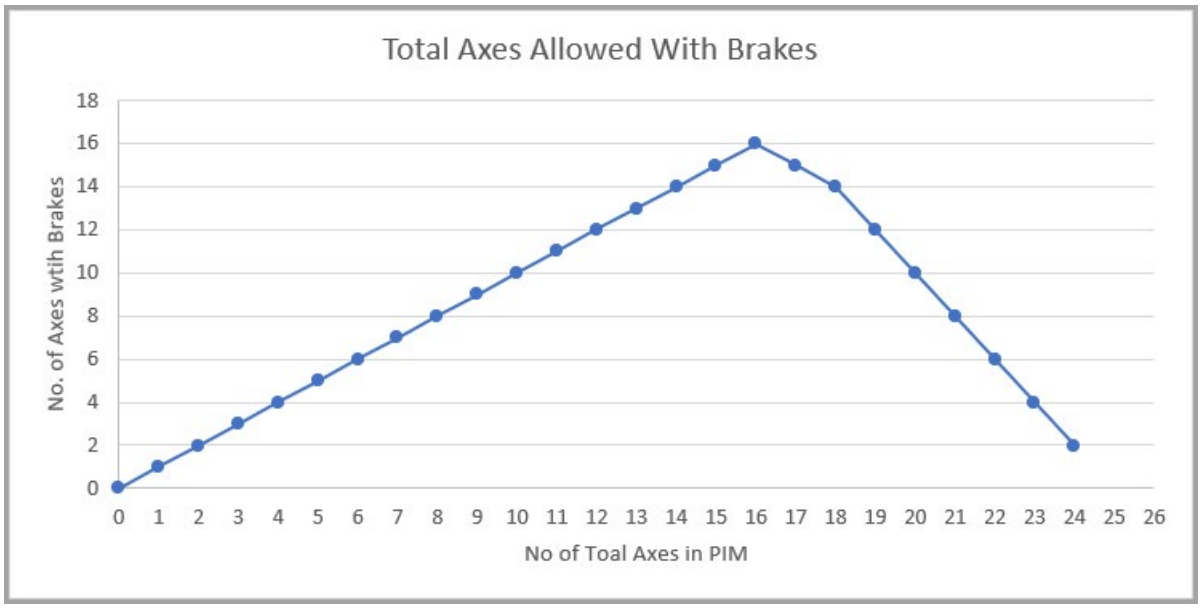
8. The maximum number of axes allowed in a PIM module is 16.
9. In a PIM module, 16 axes can contain maximum of 16 brakes, and brake validation is not required.
10. The following table describes the number of brakes allowed in a PIM module along with the brake validation:

Figure: Brake Validation

No of Axes in PIM	Total Axes Allowed With Brakes	Brake Validation
0	0	Not required
1	1	Not required
2	2	Not required
3	3	Not required
4	4	Not required
5	5	Not required
6	6	Not required
7	7	Not required
8	8	Not required
9	9	Not required
10	10	Not required
11	11	Not required
12	12	Not required
13	13	Not required
14	14	Not required
15	15	Not required
16	16	Not required
17	15	Required
18	14	Required
19	12	Required
20	10	Required
21	8	Required
22	6	Required
23	4	Required
24	2	Required

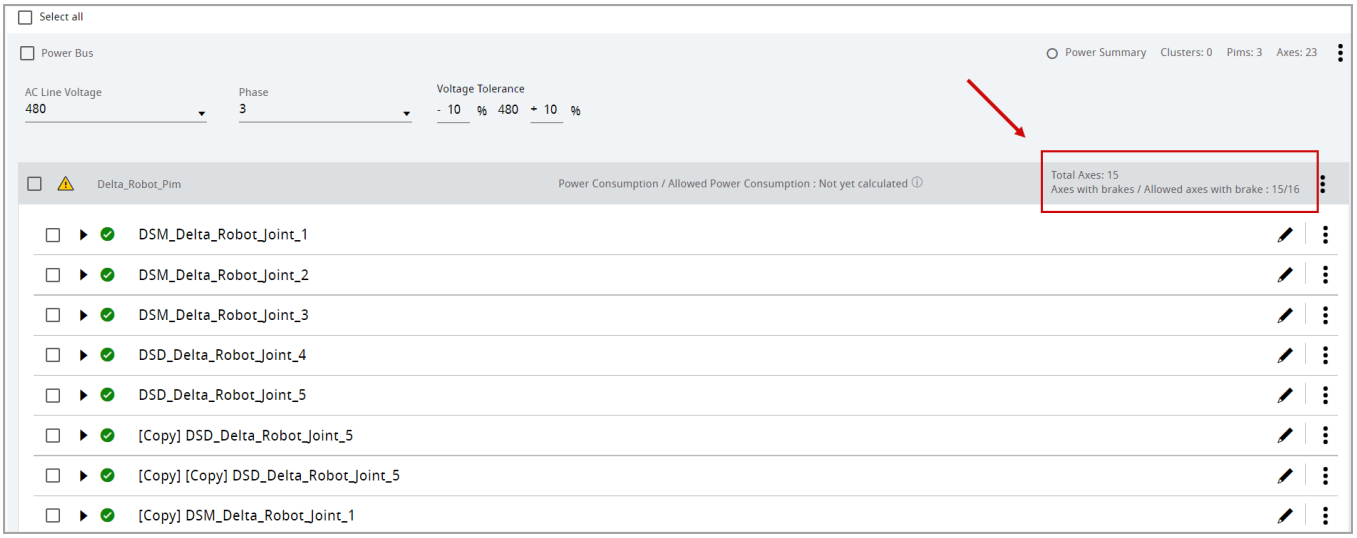
Here is the chart describing the number of brakes allowed in a PIM module.

Figure: Graph



11. The allowed brake values automatically change based on the number of axes in a PIM module.

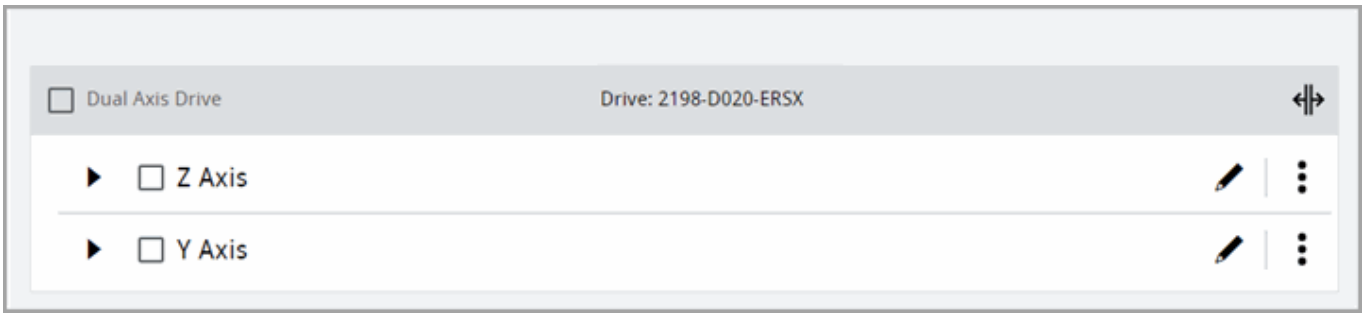
Figure: Brake



Dual Axis

To create dual axis two axes with the same, the K5700 drive model must be created first. When those requirements are met add to dual axis option in the axis context menu is enabled. Dual-axis can be standalone, placed in the bus by clicking add to bus option and selecting compatible bus or in the cluster by add to cluster option and selecting compatible cluster or creating a new one. In the dual axis title bar, there is information about the selected drive for both motors.

Figure: Dual-Axis



1. Click [Split] or the split option from the dual-axis context menu to split the Dual-axis into two separate axes.
2. Right-click on the dual axis title bar to open the Dual-axis context menu.

Figure: Dual-Axis Context Menu

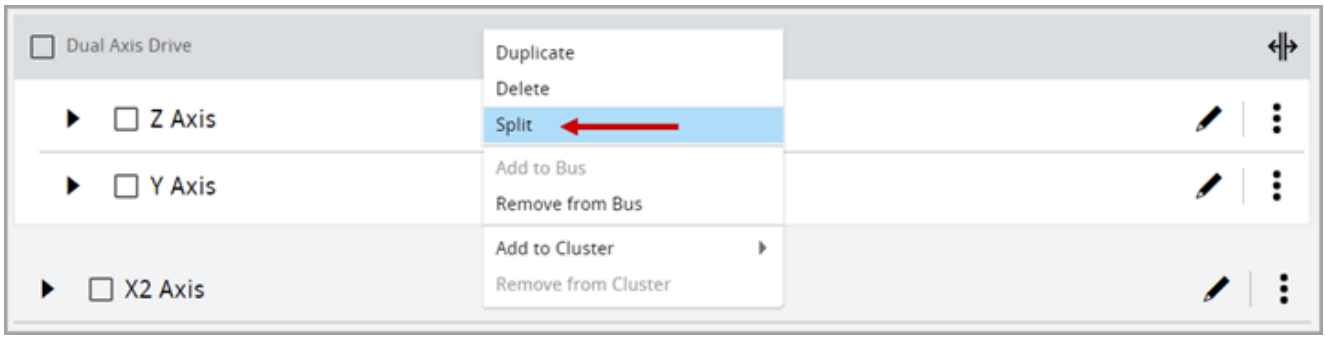


Table: Dual-Axis Context Menu

Options	Description
Duplicate	Duplicate the dual axis
Delete	Delete the dual axis with all its children
Split	Split the dual axis into two separate axes
Add to bus	Display a list of buses to which the dual axis can be moved (disabled if none of the buses meet the requirements or there is no bus added)
Remove from bus	Remove the dual axis from the bus (disabled if selected dual axis is not in the bus)
Add to cluster	Display a list of clusters to which the dual axis can be moved or add dual axis to a new cluster (disabled if dual axis does not meet the requirements)
Remove from cluster	Remove the dual axis from the cluster (disabled if selected dual axis is not in the cluster)

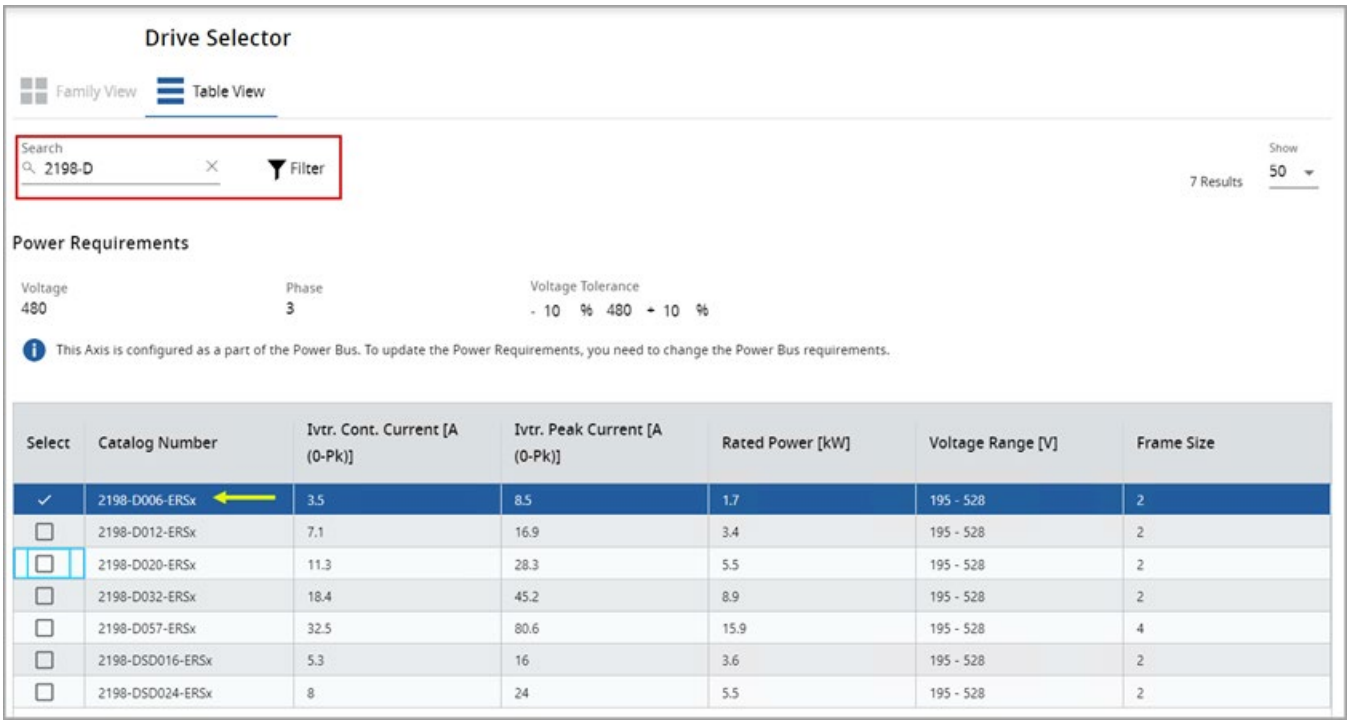
Merge Dual-Axis

User should have a drive that supports dual axis. User should have two axes of same type of drive and power requirements, then user can merge them to one dual axis drive group. This means one drive manages two axes.

Perform the following steps to create a dual-axis:

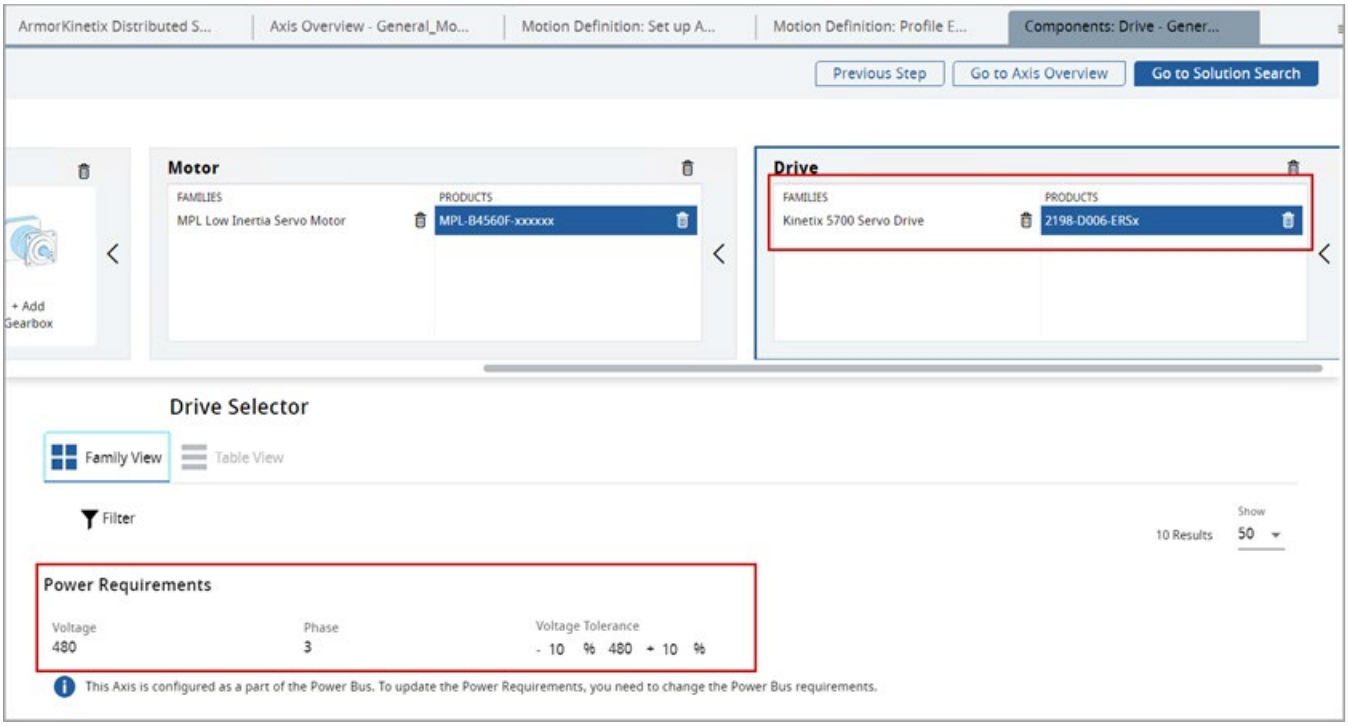
1. Create two axes with different motors and same drive from the K5700 model family.
   Alphabet "D" in the Drive Product catalog number indicates the Dual-Axis drive.

Figure: Drive Selector



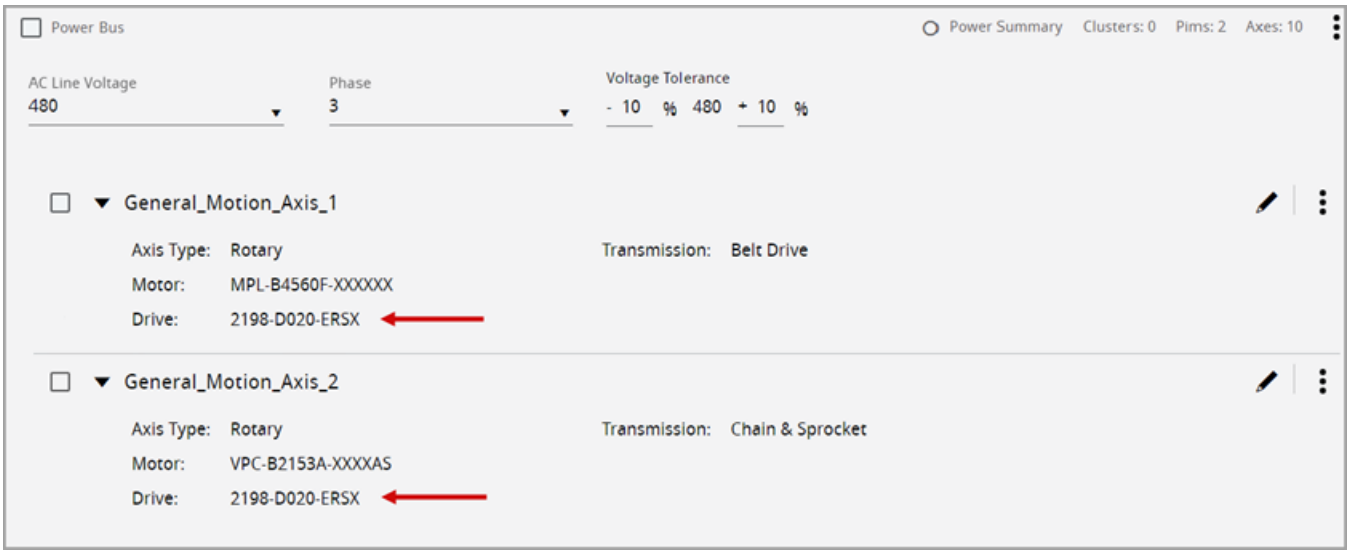
2. Ensure that the Power Requirements are same for both the axes.

Figure: Power Requirements



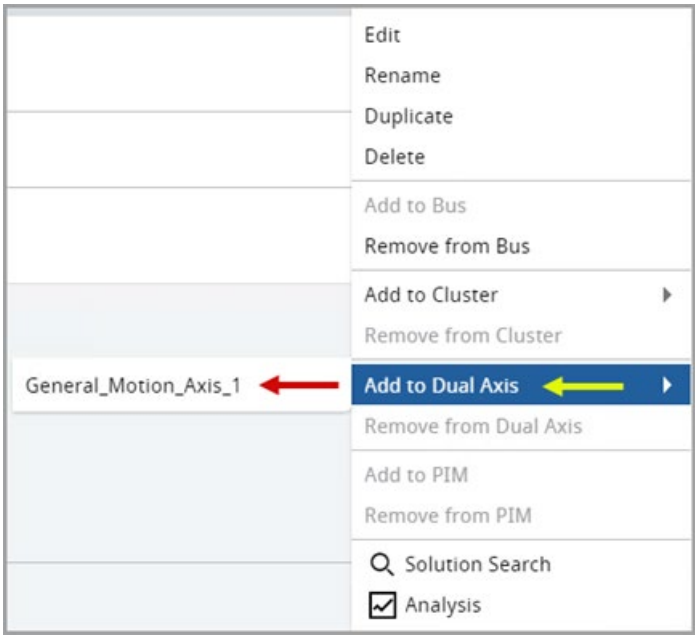
The two axes displayed in the Project summary page.

Figure: Project Summary Page



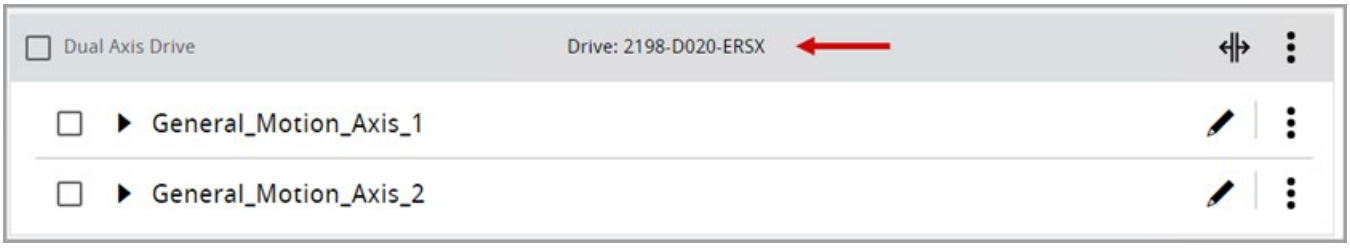
3. Click the ellipsis icon of one axis, the available options display.
4. Click [Add to dual axis] and select the required axis to merge.

Figure: Add Dual-Axis



5. The two axes are merged and displayed under the same drive as shown in the following image:

Figure: Same Drive



6. This drive manages both axes.

Split Dual-Axis

The Dual-Axis will have one drive to manage, but when the user splits the Dual-Axis, it divides into two separate axes with a drive for each having the same configurations.

The Dual-Axis can be split in the following ways:

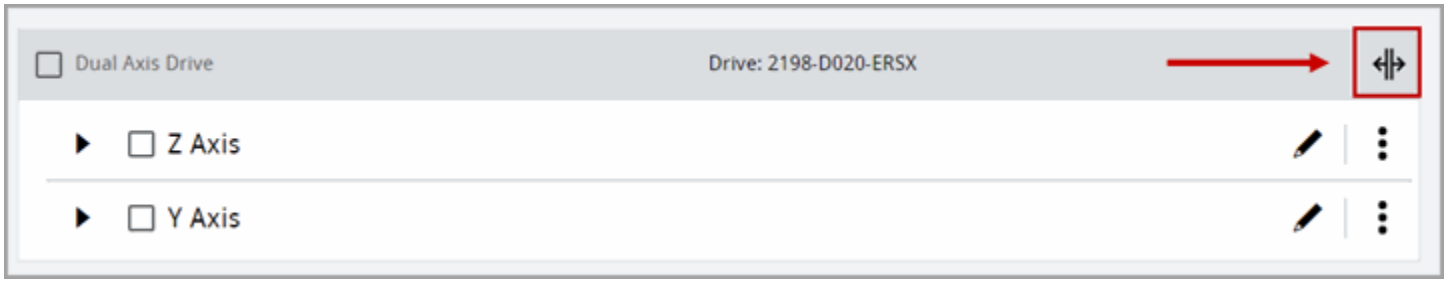
- Split one of the axis on Architecture Overview Page
- Add new drive to one of the axis that Dual-Axis consists
- Delete a drive from one of axes which Dual-Axis component
- Delete one of the axes which made up the Dual-Axis

Split Option on Architecture Overview Page

Perform the following steps to split a Dual-Axis using Split option:

Click the Split icon on a Merged Dual-Axis.

Figure: Merge Dual-Axis



1. The axes are separated as shown in the following image:

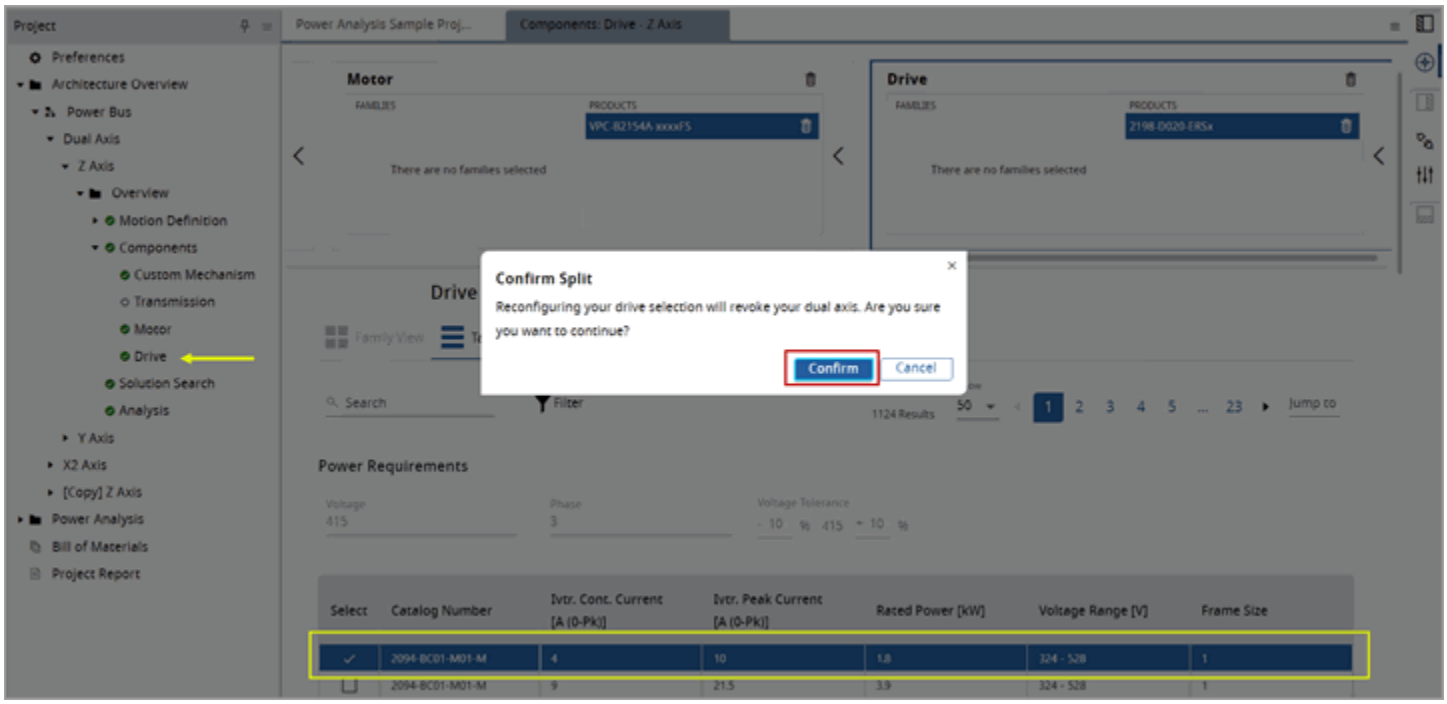
Figure: Axes Separated

Add New Drive

Perform the following steps to split the Dual-Axis by adding a new drive for one of the axes which Dual-Axis consists of:

1. On the Project with Dual-Axis, open the Drive Component page.
2. Add a new drive as shown in the following image:

Figure: Confirm Split



The Confirm Split warning dialog will be displayed. This action will split the Dual-Axis.

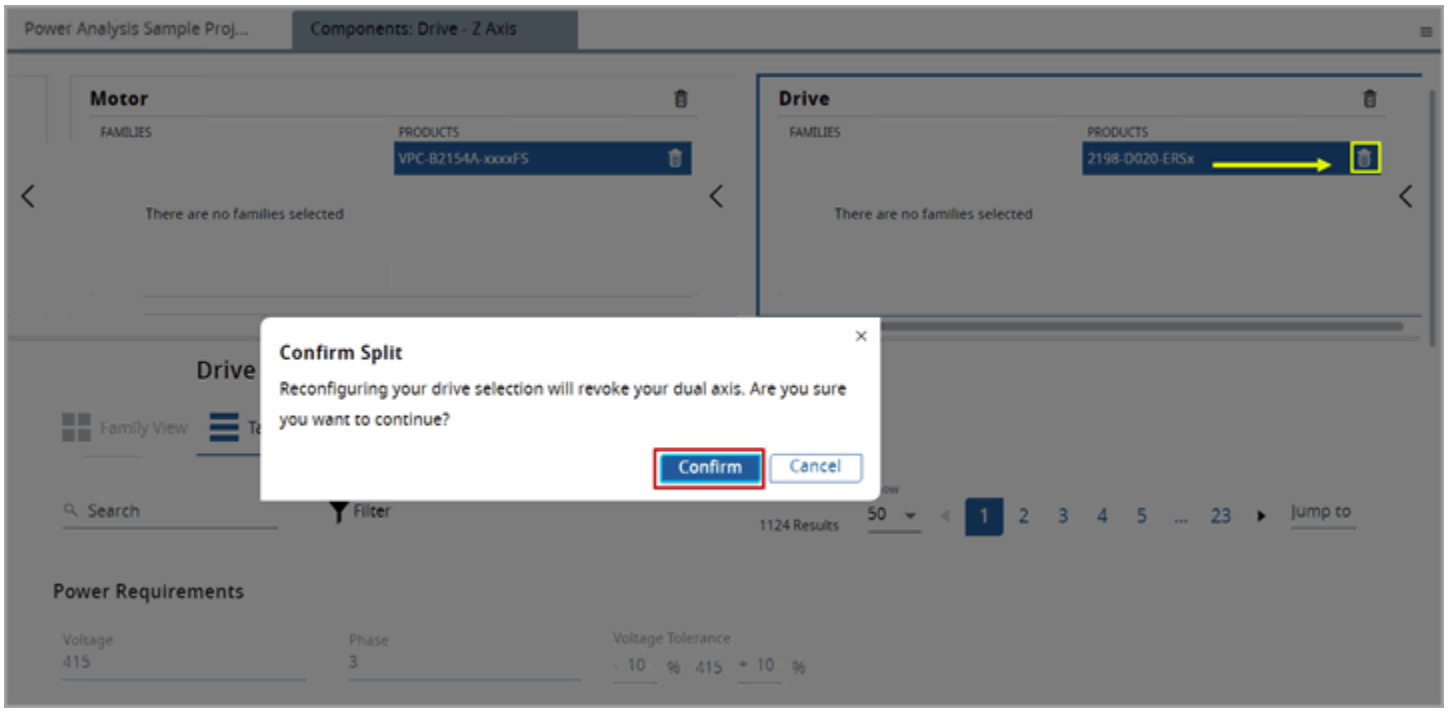
3. Click [Confirm] and the Dual-Axis that are components of Dual-Axis will be separated.

Delete Drive

Perform the following steps to split a Dual-Axis by deleting a drive from one of the axes which is component of Dual-Axis:

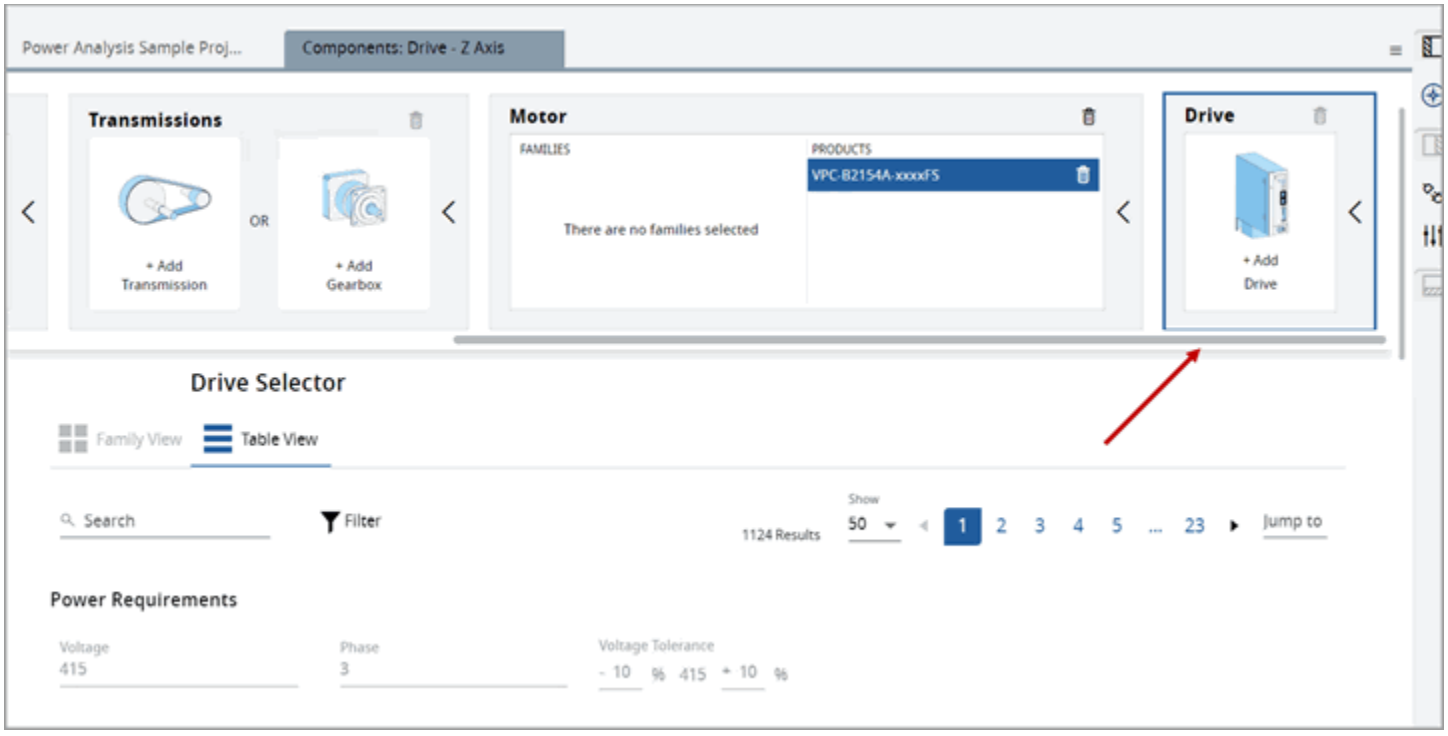
1. On the Drive component page, if the user deletes a drive, the confirm split warning dialog will be displayed.

Figure: Confirm Split



2. Click [Confirm] and the driver will be removed.

Figure: Driver Deleted



3. The axes which are components of Dual-Axis will be separated.

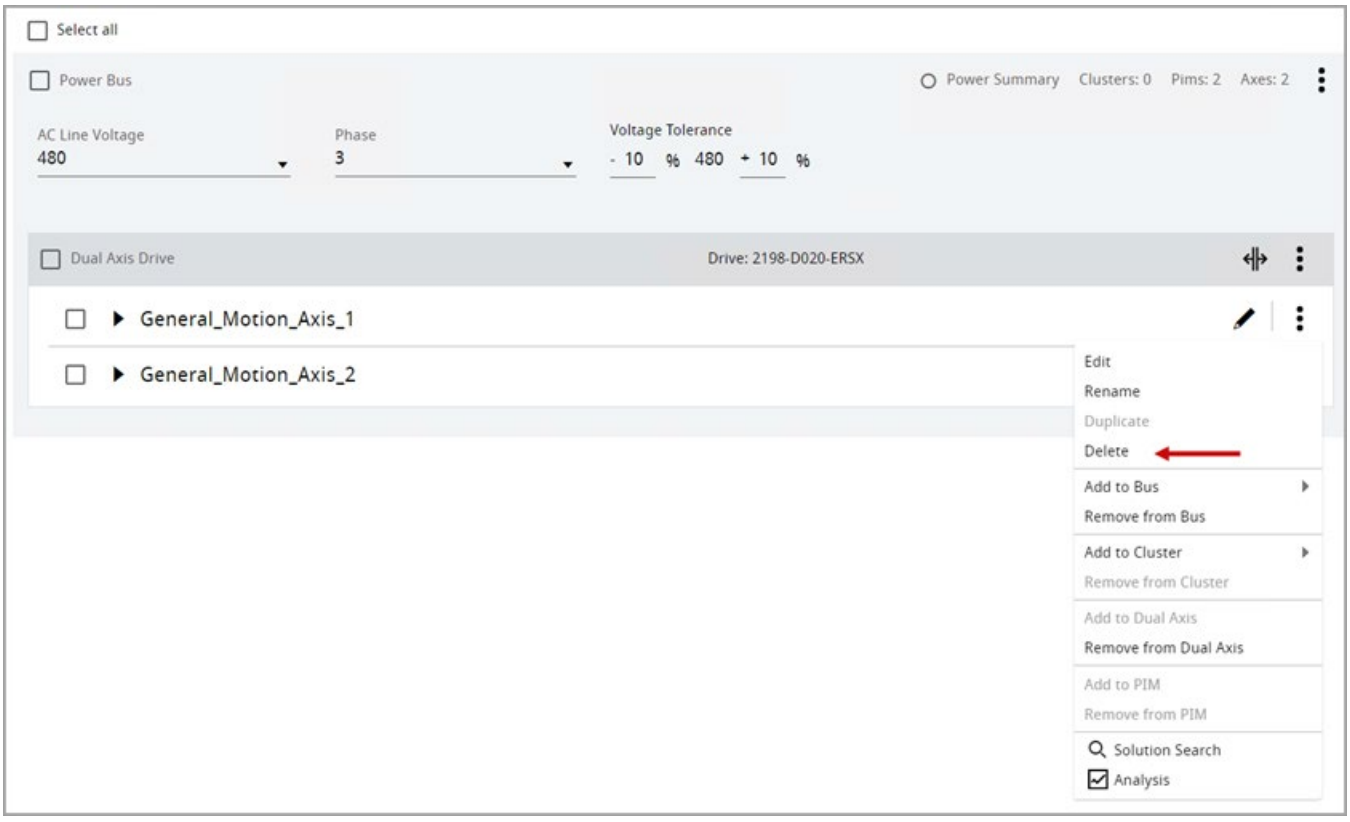
Figure: Axes Separated

Delete Axis

Perform the following steps to split a Dual-Axis by deleting either axis of Dual-Axis:

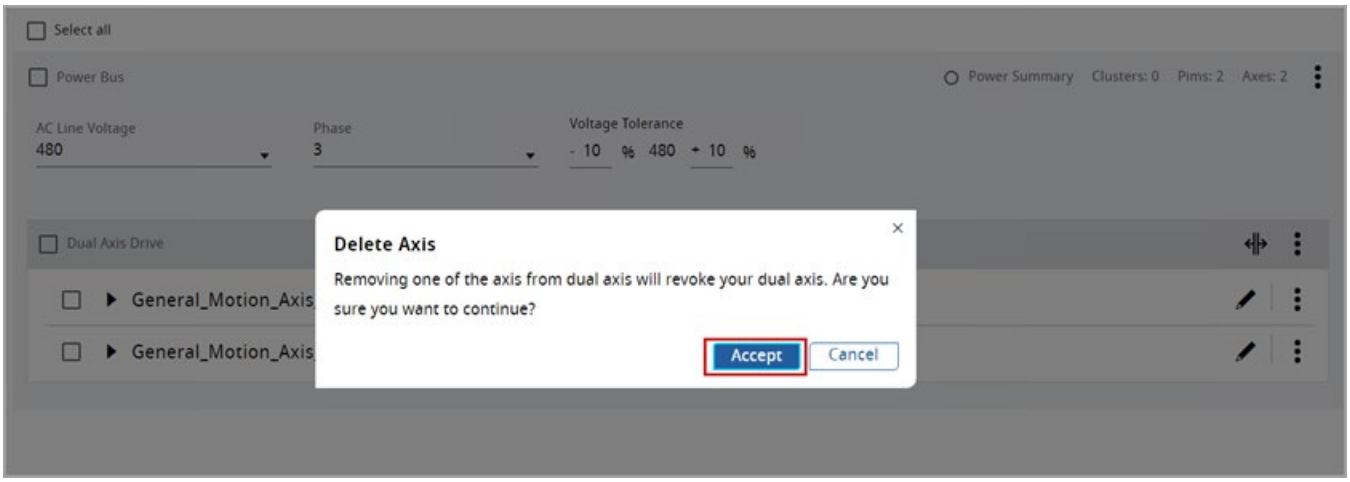
1. Click the ellipsis icon of one of the axes which is component the Dual-Axis and click [Delete].

Figure: Delete Axis



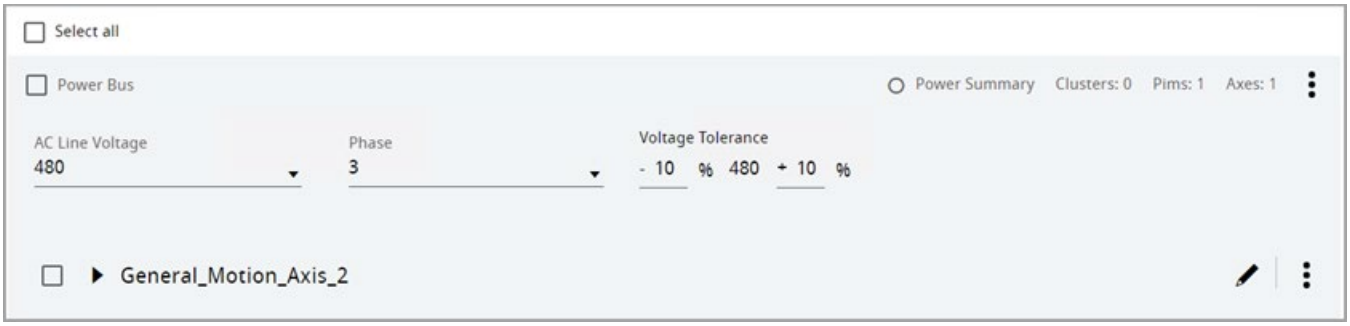
2. The Delete axis warning dialog will be displayed. Click [Accept].

Figure: Delete Axis



The axis will be deleted and the Dual-Axis will be split.

Figure: Axis Deleted



Duplicate Architecture Overview Items

Motion Analyzer allows user to duplicate the following Architectural Overview elements:

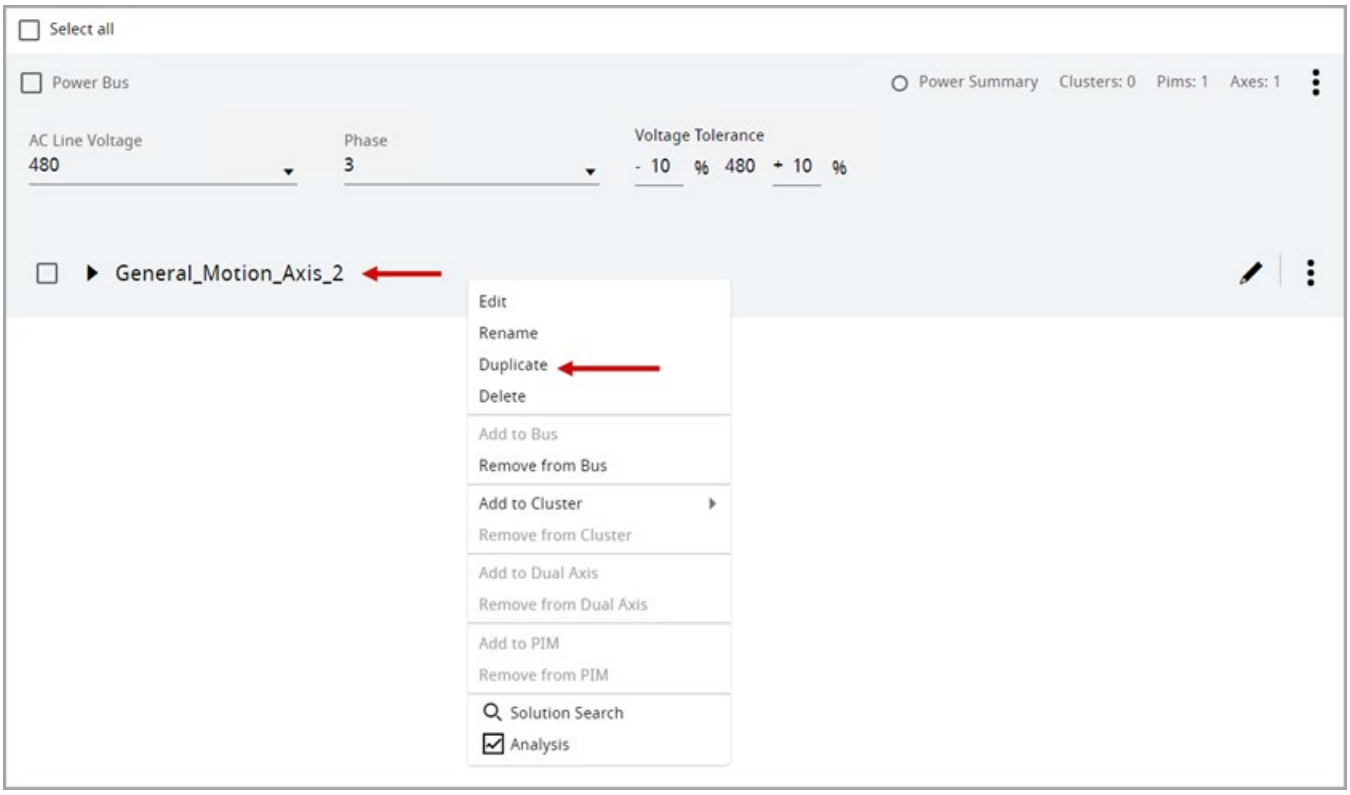
- Standalone Axis
- Dual-Axis
- Cluster
- Power Bus

Standalone Axis

Perform the following steps to duplicate a standalone Axis:

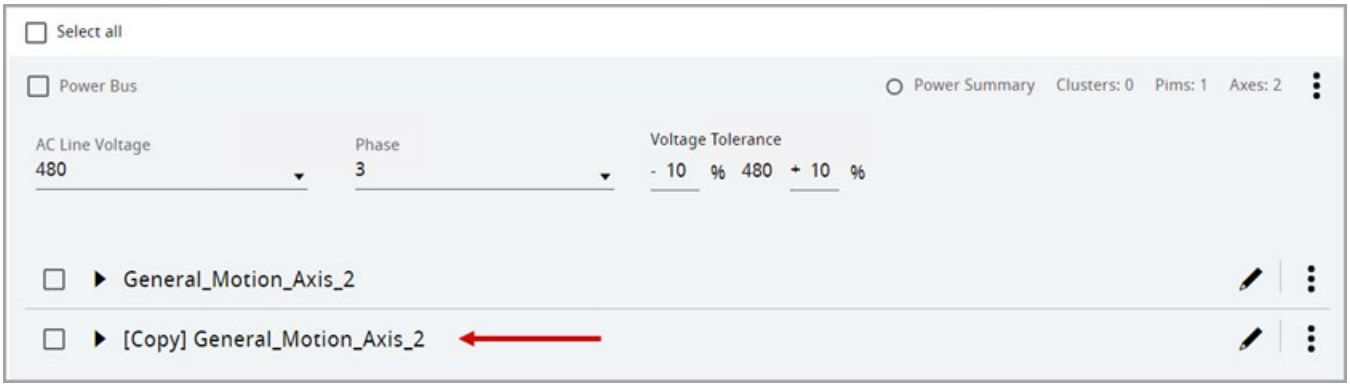
1. Right-click on a selected axis and click [Duplicate].
   (Or)
   Click the ellipsis icon of an axis that needs to be duplicated and click [Duplicate].

Figure: Duplicate Standalone Axis



This creates a copy of the selected axis with same data such as Axis type, Motor family, and Driver details.

Figure: Duplicated



- User can also create a copy of axis by duplicating a cluster. This creates a copy of all the Axes or Power Bus available in within a Cluster.
- User can also duplicate an element outside the cluster in the same way.

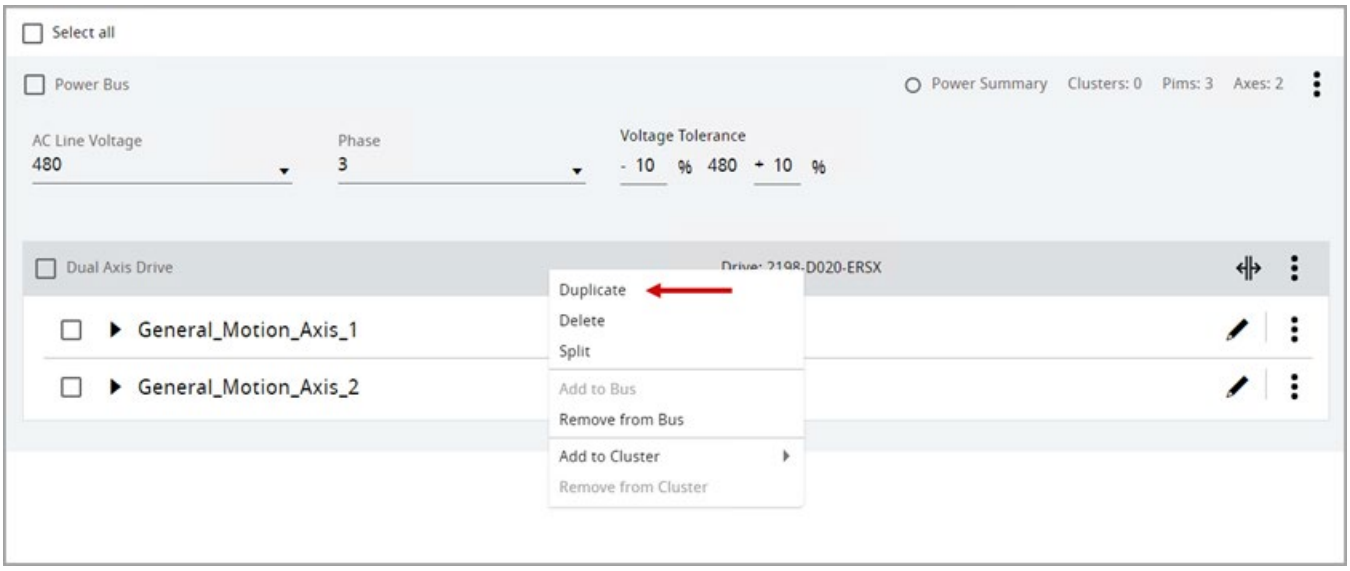
NOTE: It is recommended to rename the copied element.

Dual-Axis

Perform the following steps to duplicate a Dual-Axis:

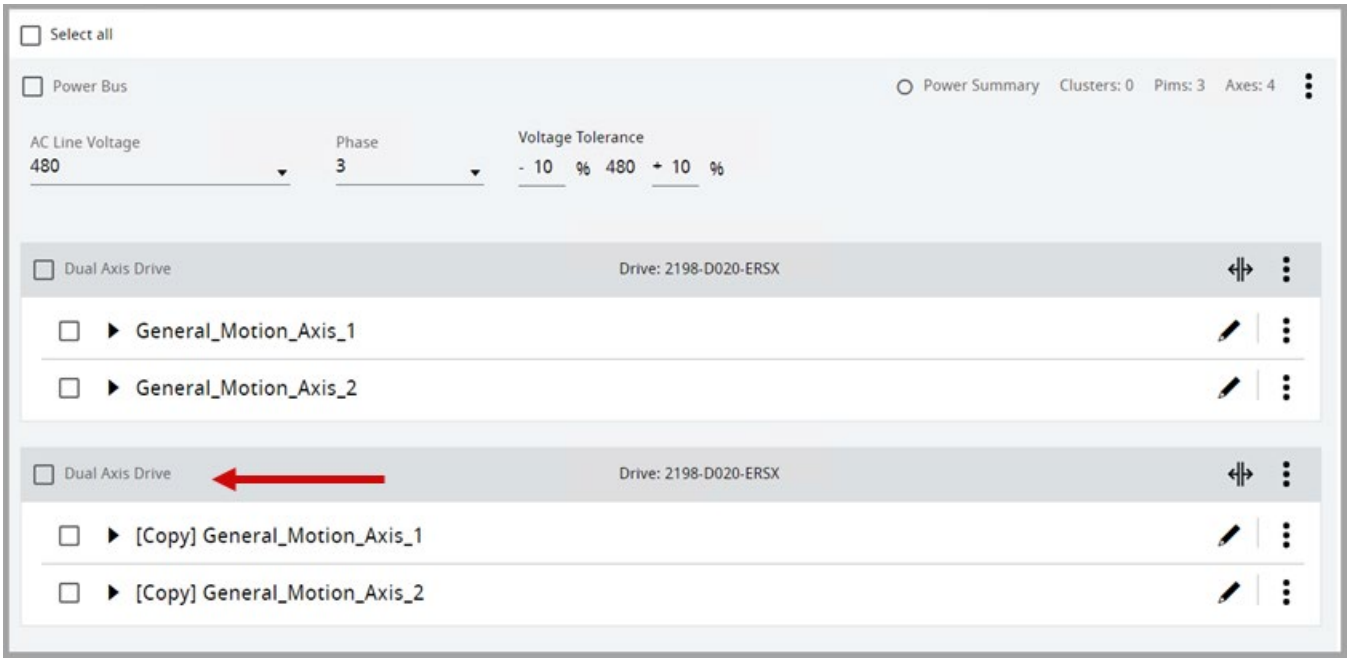
1. Right-click on a selected Dual-Axis header and click [Duplicate].

Figure: Duplicate Dual-Axis



A copy of the selected Dual-Axis is generated with same data.

Figure: Duplicated



2. User can also duplicate a Dual-Axis drive within a Cluster.

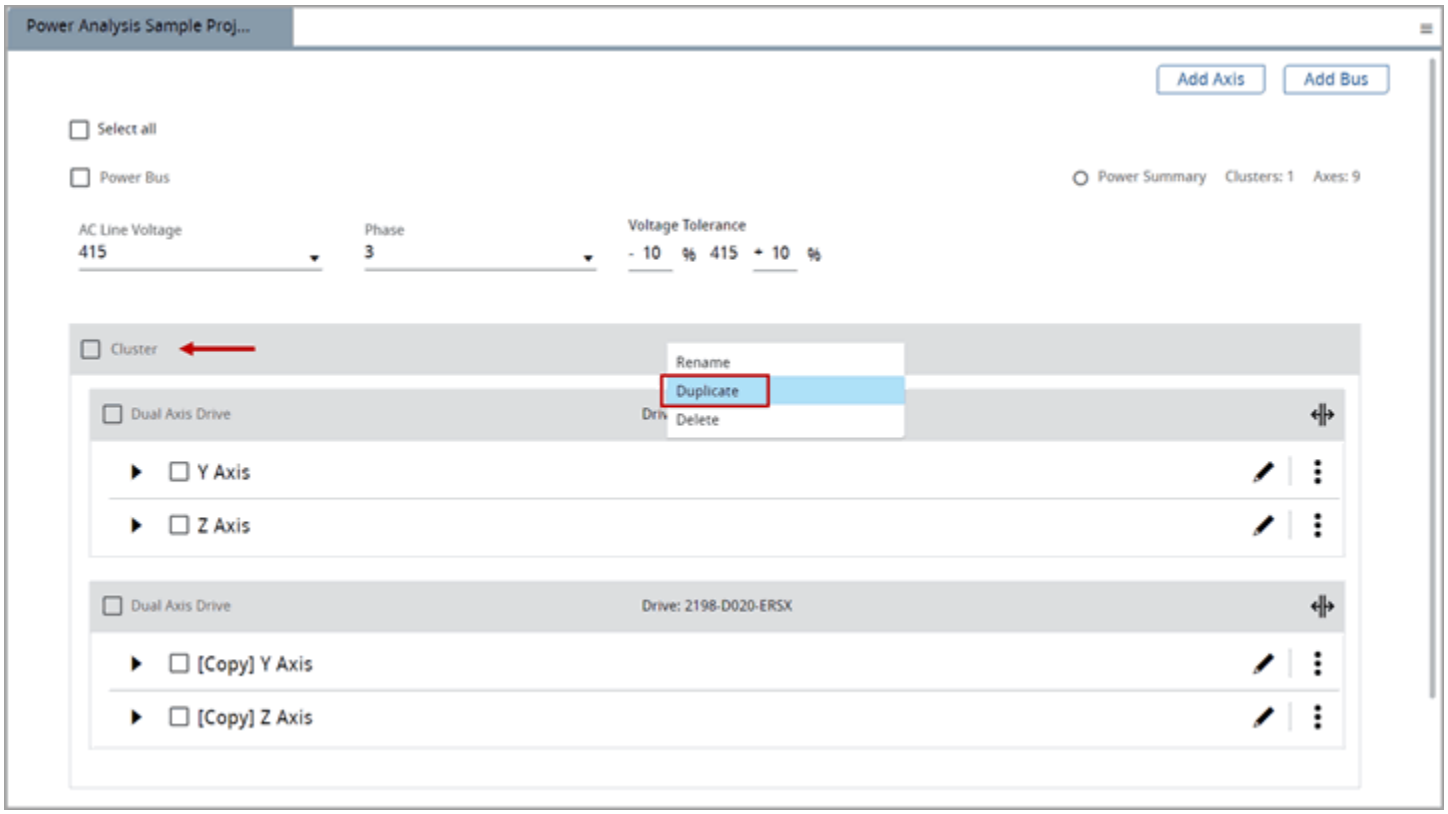
   NOTE: It is recommended to rename the copied element.

Cluster

Perform the following steps to duplicate a Cluster:

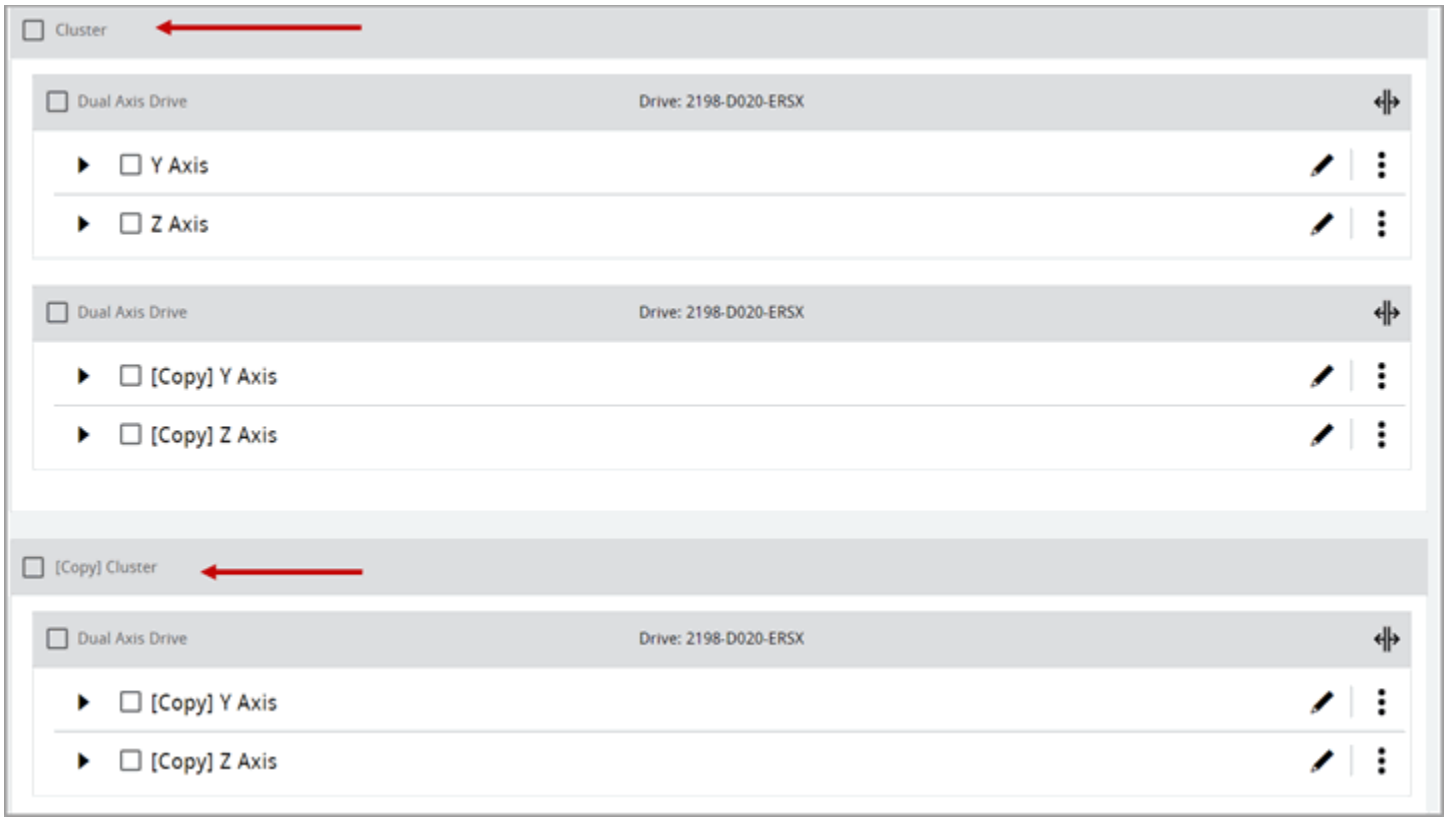
1. Right-click on a cluster header and click [Duplicate].

Figure: Duplicate Cluster



A copy of the selected cluster is generated with same data.

Figure: Duplicated Cluster



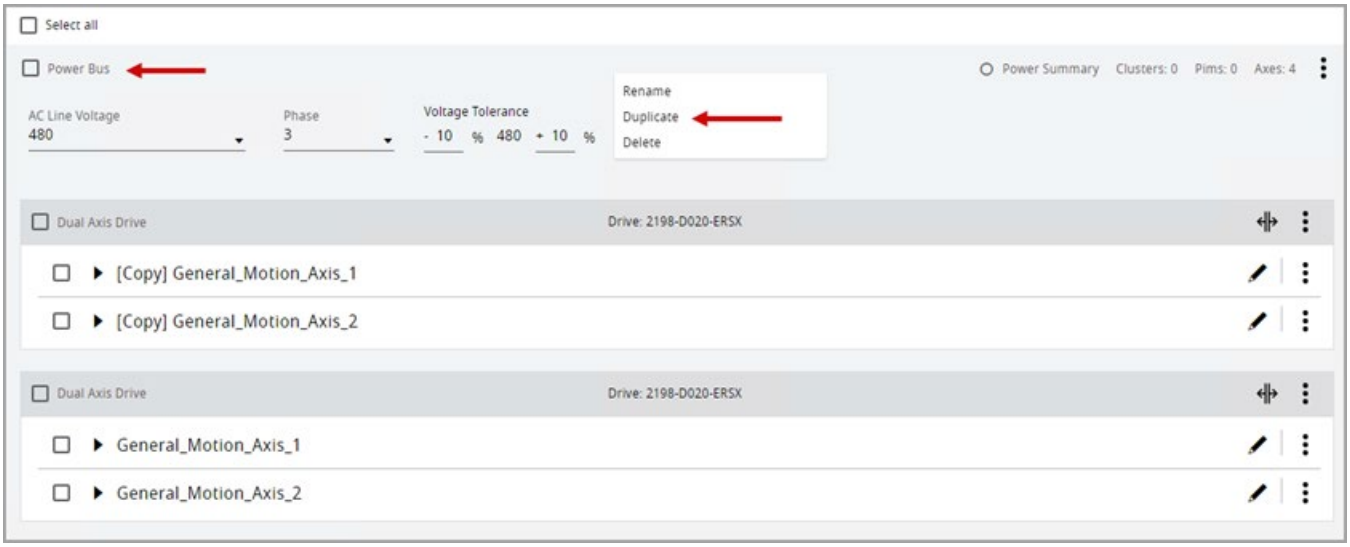
NOTE: It is recommended to rename the copied element.

Power Bus

Perform the following steps to duplicate a Power Bus:

1. Right-click on a Power Bus header and click [Duplicate].

Figure: Duplicate Power Bus



A copy of the selected Power Bus is generated with same data.

Figure: Duplicated Power Bus

NOTE: It is recommended to rename the copied element.

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Define your profile

Profile Editor allows user to create a variety of industry-standard motion profiles to define motion and the load based on the type of axis (linear/rotary) in a project. Motion profile consists of various types of motion segments with some additional loads and units based on the axis type. These profile editor values are persisted even after the tab is closed and can also be displayed on Overview page.

Figure: Profile Editor

Table: Profile Editor Features

Feature	Description
Profile Toolbar	To add, move, and remove profile segments or an entire motion profile
Segment Load Window	Each profile segment type has an associated Segment Parameters window. Highlight a particular profile segment in the motion profile, that segment's parameter window becomes available for entering data. The default profile segment type is an Index profile segment.
Segment Plot Window	Displays a plot for a single profile segment in the motion profile. The x-axis is time, and the y-axis can be adjusted to display various motion curves (for example, Distance, Velocity, or Acceleration.
Profile Plot	Displays the entire motion Profile Plot that consists of a series of profile segments. The plot can be adjusted and analyzed with the two sub-windows that accompany the plot.

Set up Axis

The application templates allow users to provide pre-configured complex mechanism application data. These templates convert the complex

mechanisms into Motion Analyzer mechanism data and Motion profiles with additional inertia and loads.

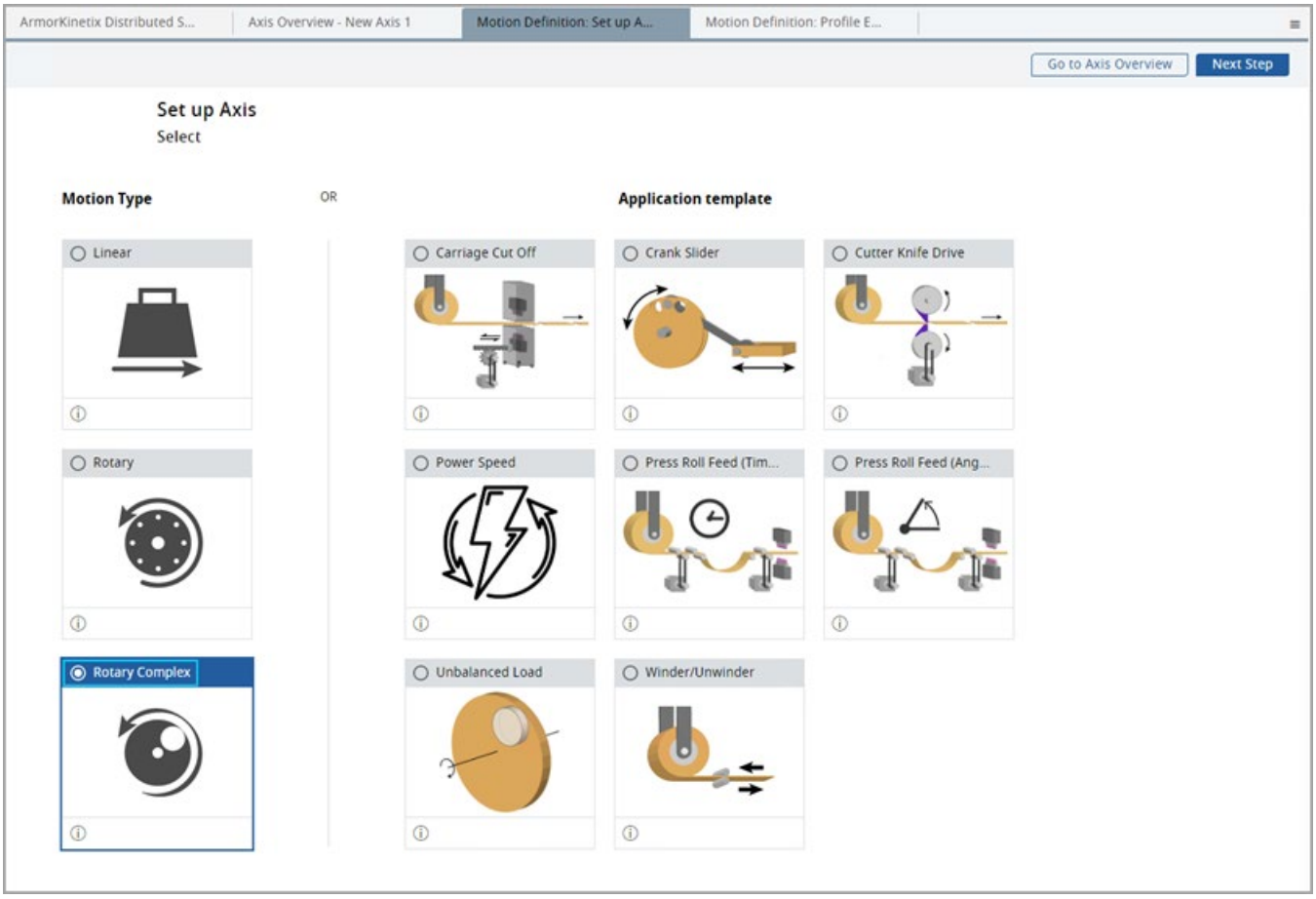
Rotary Complex Template

The Rotary Complex template is used to calculate Complex Load Data for Unbalanced Load and Crank application types.

Perform the following steps to add the Rotary Complex template to the Motion Profile:

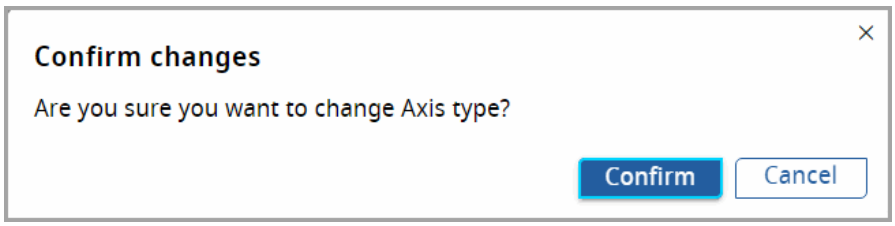
1. Under the Motion Definition menu, click [Set up Axis].
2. Under the Motion Type, select the Rotary Complex template and click [Next Step].

Figure: Rotary Complex Template



3. The ‘Confirm changes’ dialog displays. Click [Confirm].

Figure: Confirm Changes



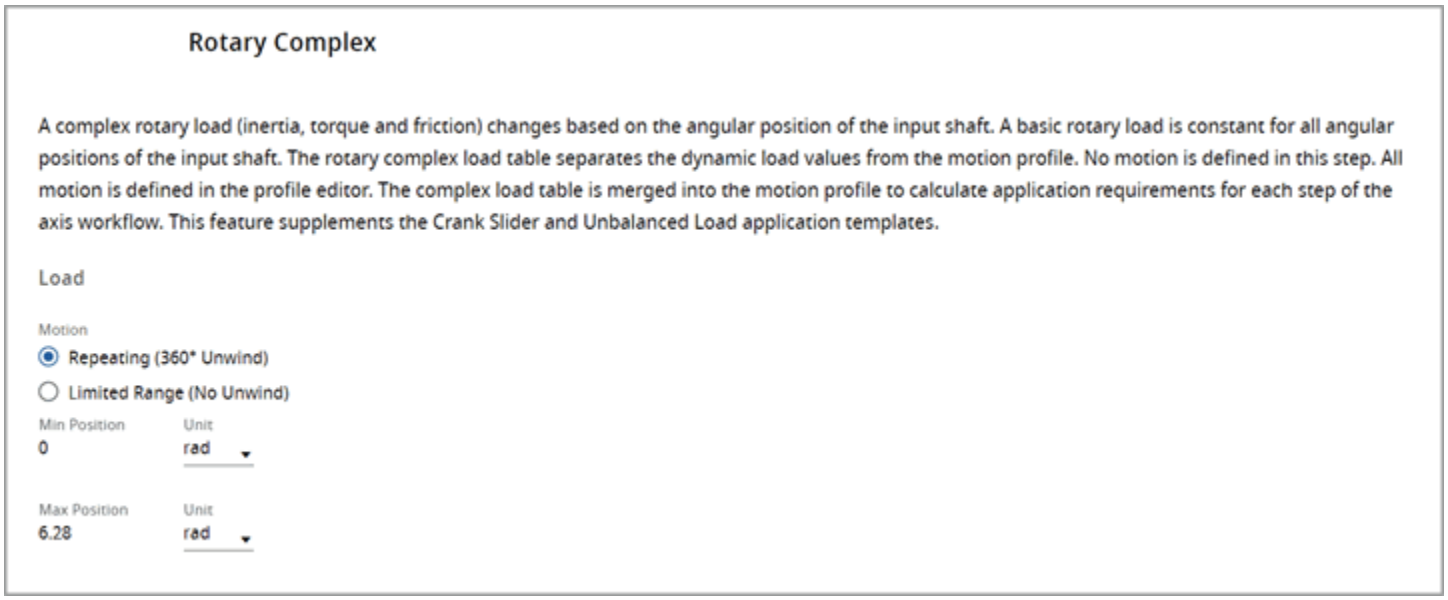
4. The Rotary Complex template page displays along with the template description.

5. Provide the load data details:

Table: Rotary Complex Template

Field	Description
Motion Type	Select the Motion type
Repeating (360 ° unwind)	Here the first and last points should be identical so that the motion profile can be repeated (for example, zero and 360 °). Motion Analyzer software assumes that rotation may continue indefinitely in either direction.
Limited range (no Unwind)	The first and last points indicate the maximum and minimum positions permitted.

Figure: Rotary Complex



6. The Inertia table displays.

Table: Inertia Table

Field	Description
Position	Driving shaft angle with reference to the starting angle.
Inertia	Load inertia for the given shaft angle.
External Torque	Torque applied at the given position.
Friction Torque	Torque loss due to friction.
	To add a row above the selected row. The new row is generated with the average value from the top and bottom rows.
	To add a row below the selected row. The new row is generated with the average value from the top and bottom rows.
	To delete the selected row.
Import	To import load data from an external file (.csv) into the Complex Load Data table.
Export	To export load data as an external file in .csv format from the Complex Load Data table.
Clear	To delete all the rows.
Repopulate Sample date	To repopulate the sample load data.

- **Inertia Table Actions:**
  - User can edit the labels in the Inertia Table and the relevant changes will be affected in the limited range motion type.
  - If user changes the units in the Position column, the same units are reflected in the limited range motion type.
  - Every column in the Inertia table has its own unit's selector and the value may change based on the units selected.

- User can also edit the load data by exporting the load data, editing the fields in a spreadsheet, and re-uploading the Load data by Import option.

1. Click [Next Step] on the top right corner. Based on the provided parameters, the Motion Profile is defined on the Profile Editor page.
2. Refer to “Define your profile” section to proceed further.

Carriage Cut Off Template

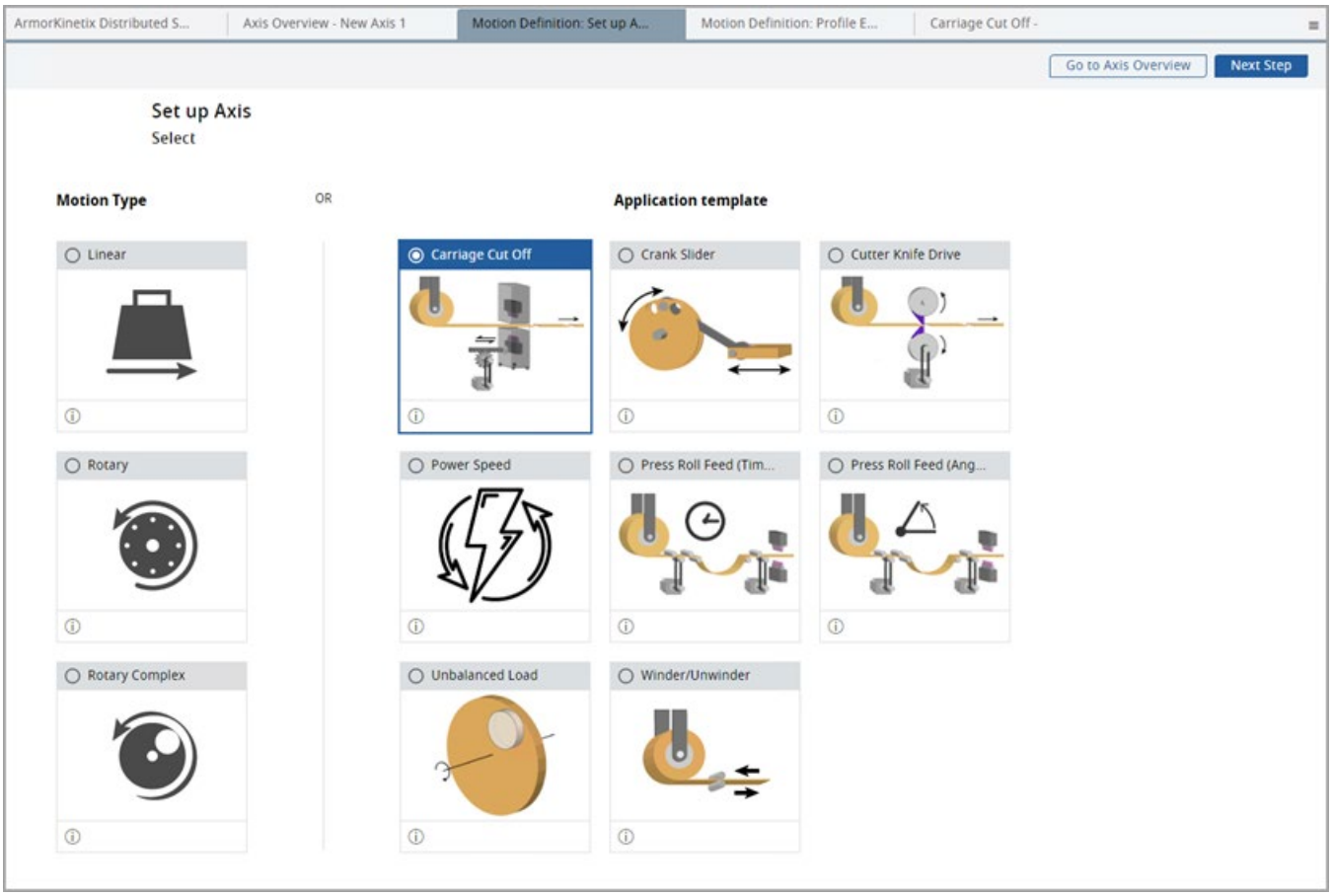
This application is typically cutting strip material into pre-set lengths with a ‘Flying Shear’ (heavy-duty knife on a moving carriage). The shear must be stationary relative to the material (for example, moving at line speed) when the cut is made, and the cut takes a fixed time.

Strip material is unwound from a reel at constant surface speed and fed via separately driven leveler rolls. After the cut is complete, the shear is stopped then moved back to its start position. It must accelerate to match the line speed at the correct position to cut the required length of material.

Perform the following steps to add the Carriage Cut Off template to the Motion Profile:

1. Under the Motion Definition menu, click [Set up Axis].
2. Under the Application Template, select the Carriage Cut Off Template and click [Next Step].

Figure: Application Template

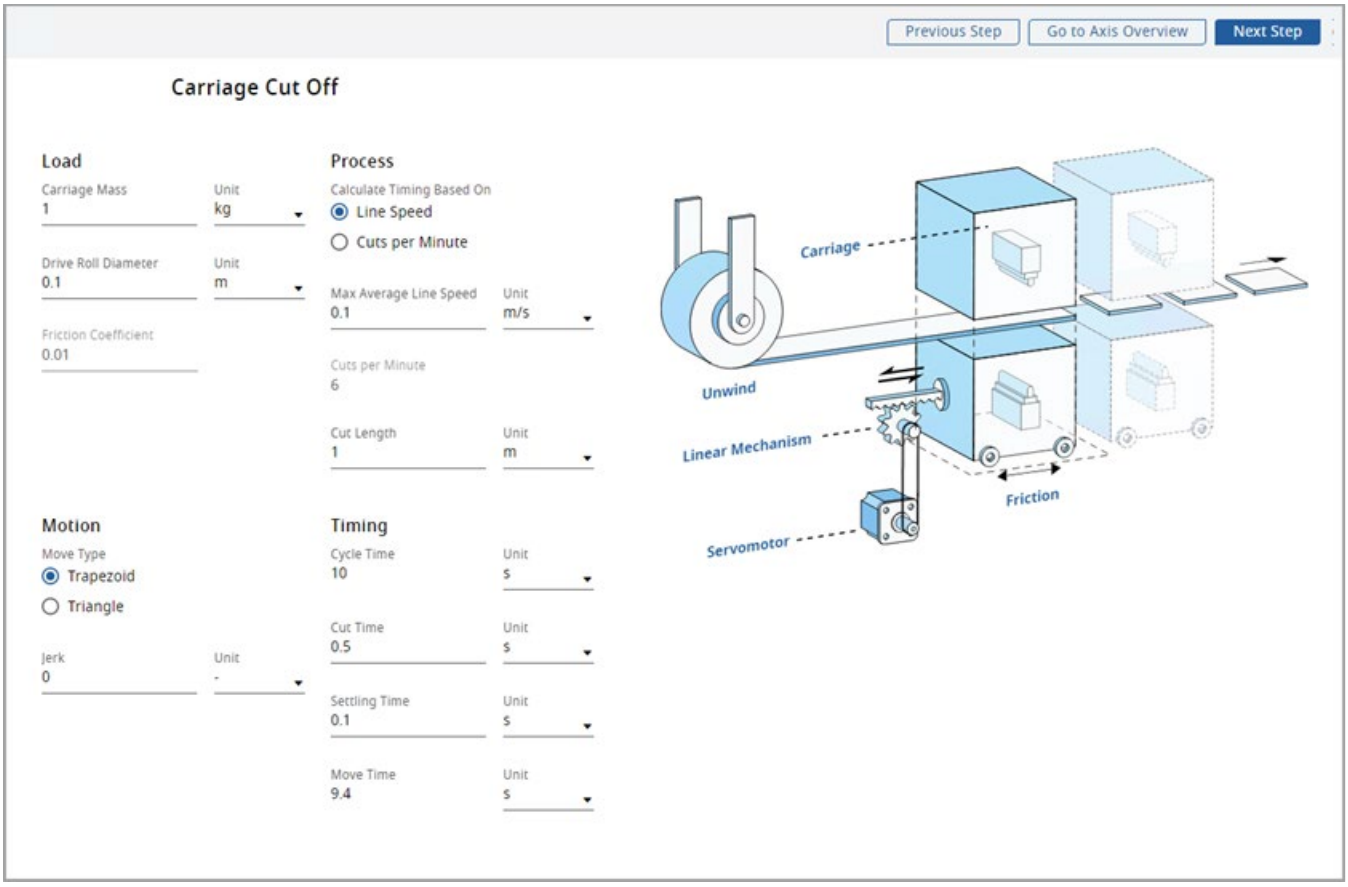


3. The ‘Confirm changes’ dialog displays. Click [Confirm].

Figure: Confirm Changes

The Carriage Cut Off template page displays.

Figure: Carriage Cut Off



4. Provide the load data details:

Table: Load Data

Type	Field	Description
Load	Carriage Mass	Total mass of the linear moving parts.
	Drive Roll Diameter	Diameter of the roll, driven from the motor.
	Friction Coefficient	Coefficient of friction of the sliding bearing.
Process	Calculate Timing Based On	Choose the option on which the timing should be calculated: • Line Speed: The speed of the line. • Cuts per Minute: Number of cuts made per minute.
	Max Average Line Speed	Provide the value when the maximum design speed of the constant-speed sections of the line is known. This speed does not refer to the peak velocity of the feeder section, which is determined by application.
	Cuts per Minute	Provide the value when the number of cuts made by the system per minute is known.

	Cut Length	The length of the cut. To cut longer lengths than this critical length, the line speed must be reduced.
Motion	Move Type	Select the Motion type: • Trapezoid: Select this option when the application needs to accelerate to a maximum velocity and then travel at that velocity for a specified time or distance. A trapezoidal move of the virtual axis produces a trapezoidal load profile. • Triangle: Select this option for a Triangular load profile.
	Jerk	This value sets the amount of S-curve of the Load Profile. For Trapezoid, the default Jerk value is 0%.
Timing	Cycle Time	Calculated cycle time for the specified load profile.
	Cut Time	Time required for the carriage to synchronize accurately with the material.
	Settling Time	This is the time required for the system to achieve the required position accuracy before the cut commences. The finer the required accuracy, the longer the settling time value.
	Move Time	Time through which the load profile takes place.

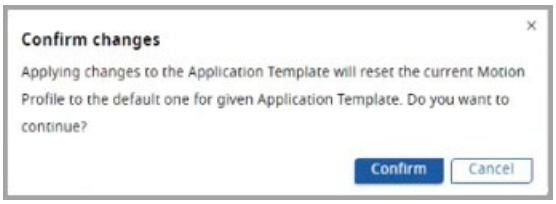
NOTE: Ensure to provide valid parameters to calculate.

5. Click [Next Step]. The Confirm changes dialog displays.

   NOTE: This dialog displays even if the user clicks [Previous Step] on top right corner or the user wanted to leave the application template page.

6. Click [Cofirm].

Figure: Confirm Changes



7. Based on the given parameters, the Motion Profile is defined on the Profile Editor page.
8. Refer to “Define your profile” section to proceed further.

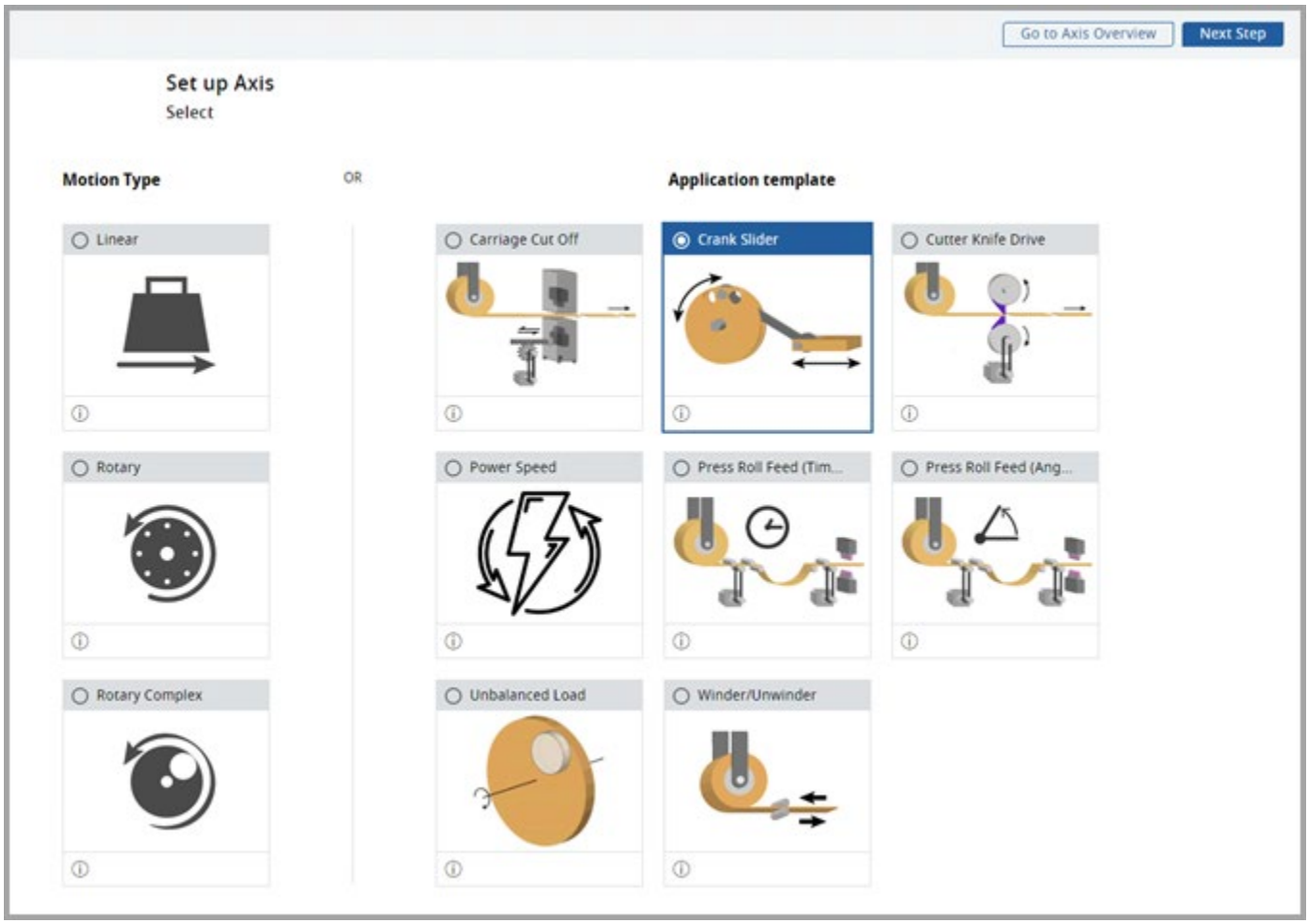
Crank Slider Template

The Crank Mechanism is an arm attached at a right angle to a rotating shaft by which reciprocating motion is imparted to or received from the shaft. The Crank Slider template is used to calculate the load profile for a given application.

Perform the following steps to add the Crank Slider template to the Motion Profile:

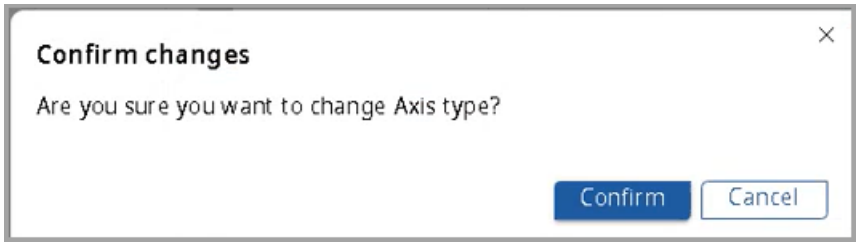
1. Under the Motion Definition menu, click [Set up Axis].
2. Under the Application template, select the Crank Slider template and click [Next Step].

Figure: Application Template



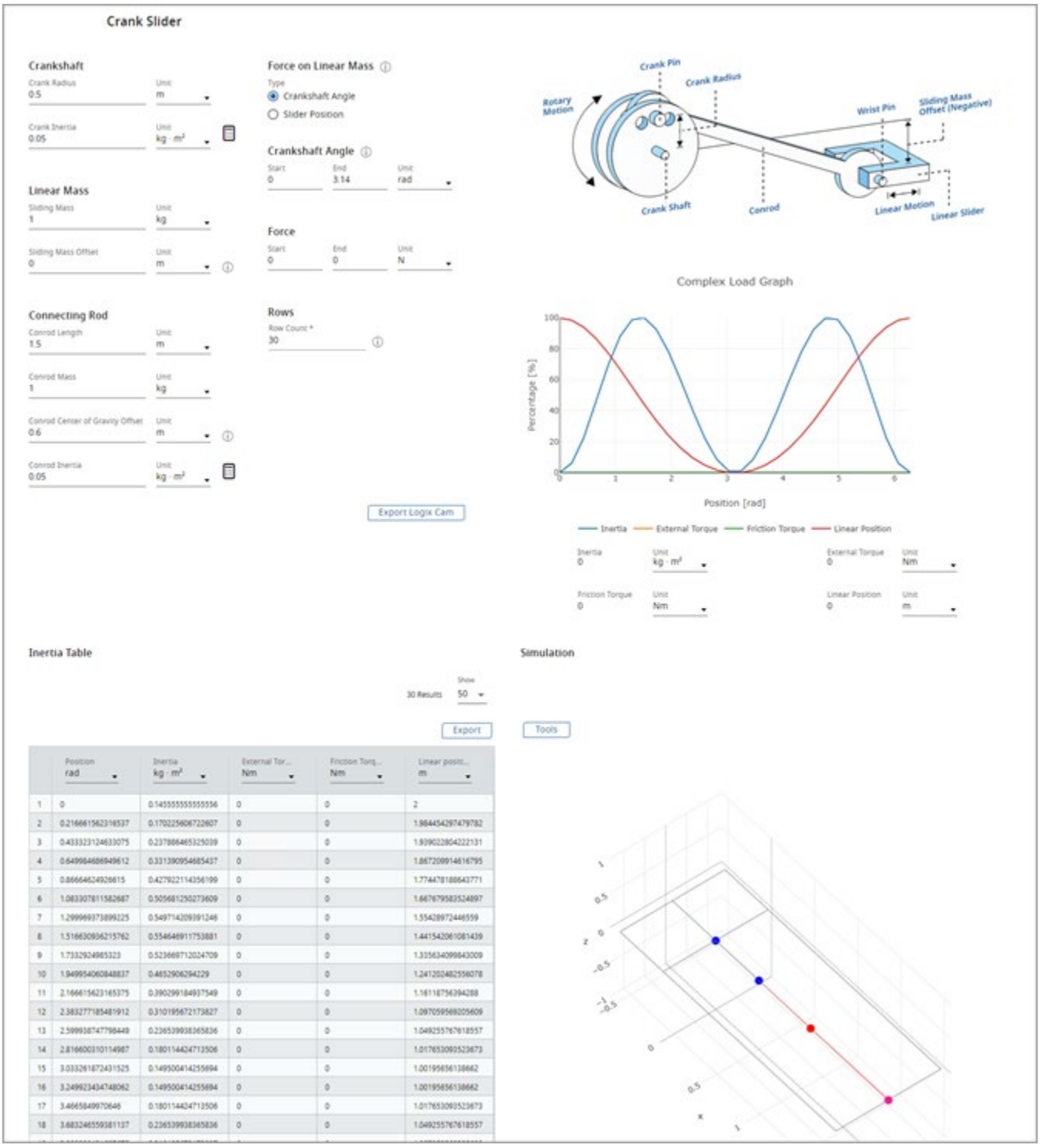
3. The ‘Confirm changes’ dialog displays. Click [Confirm].

Figure: Confirm Changes



The Crank Slider template page displays.

Figure: Crank Slider Template



4. Provide the load data details:

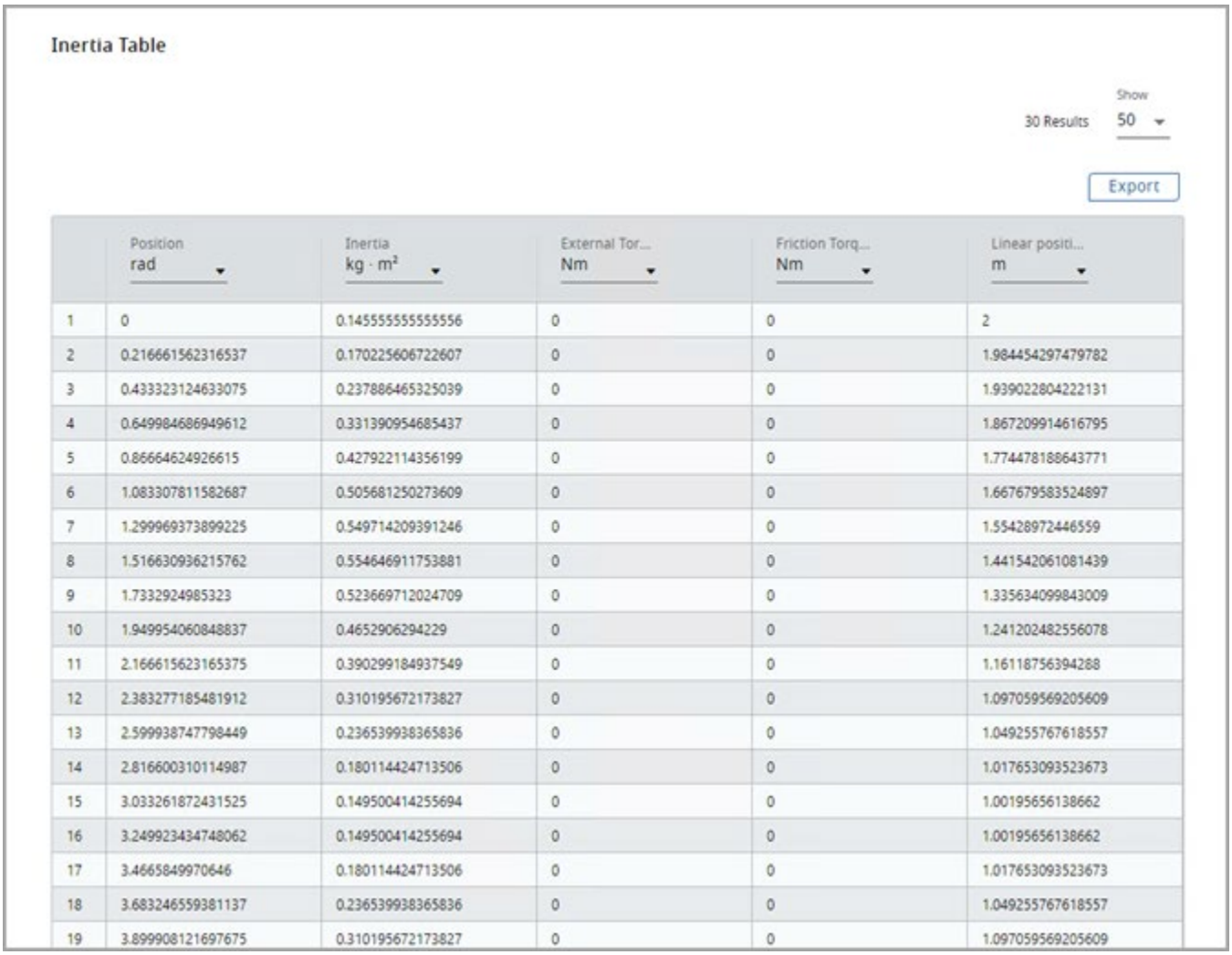
Table: Load Data

Type	Field	Description
Crankshaft	Crank Radius	The distance between crankshaft and crank pin.
	Crank Inertia	The inertia of the crank alone when the connecting rod is disconnected. Or the user can calculate the inertia using the [ ] icon. Refer to Inertia Calculator section.
Linear Mass	Sliding Mass	The mass of the load attached to the connecting rod at the gudgeon pin.

	Sliding Mass Offset	The minimum distance between the crankshaft and the path of motion of the slider.
Connecting Rod	Connecting Rod Length	The distance from the crank pin center to the gudgeon (wrist) pin center.
	Connecting Rod Mass	The total mass of the connecting rod.
	Conrod Centre of Gravity Offset	The location of the center of gravity of the connecting rod along its length starting from the point where it meets the crank arm
	Conrod Inertia	The inertia of the connecting rod about its own center of gravity. Or the user can calculate the inertia using the [] icon. Refer to Inertia Calculator section.
Force on Linear Mass	Determines whether the end force is applied to the sliding mass based on the angular position of the crank shaft or the linear position of the sliding mass.	
	Crankshaft Angle	The angular rotation of the crankshaft at which the force is applied to the sliding mass. Start force must be within one positive or negative revolution and less than the end force angular position. • Start: The starting angle for the Crank load profile. 90° indicates vertical and gravity has no effect. • End: The ending angle for the Crank load profile.
	Slider Position	The linear position at which the over is applied to the sliding mass. The position is measured relative to the crank shaft. The crank shaft is considered 0 position. Start force must be less than the End force position. • Start: The distance between gudgeon (wrist) pin and crank shaft center when force is applied. • End: The distance between the gudgeon (wrist) pin and crank shaft center when force stops.
Force	Start	The magnitude of the force at the start point.
	End	The magnitude of the force at the end point.
Rows	Define the number of rows in the Rotary Complex output.	
Export to Logic Cam	To transfer the geometrical data to the clipboard for pasting into the Logix Cam. The master axis is a virtual axis, and the slave axis is the crank axis. A trapezoidal move of the virtual axis produces a trapezoidal load profile at the gudgeon pin. The master data must increase positively so only that part of the cam that satisfies this requirement is exported.	

Based on the provided parameters, Motion Analyzer calculates the inertia table, complex graph, and simulation automatically
NOTE: Ensure to provide valid parameters to calculate and animate the simulation. A toast message displays if invalid parameters are provided.
The Inertia table displays.

Figure: Inertia Table



	Position rad	Inertia kg · m²	External Tor... Nm	Friction Torq... Nm	Linear positi... m
1	0	0.145555555555556	0	0	2
2	0.216661562316537	0.170225606722607	0	0	1.984454297479782
3	0.433323124633075	0.237886465325039	0	0	1.939022804222131
4	0.649984686949612	0.331390954685437	0	0	1.867209914616795
5	0.86664624926615	0.427922114356199	0	0	1.774478188643771
6	1.083307811582687	0.505681250273609	0	0	1.667679583524897
7	1.299969373899225	0.549714209391246	0	0	1.55428972446559
8	1.516630936215762	0.554646911753881	0	0	1.441542061081439
9	1.7332924985323	0.523669712024709	0	0	1.335634099843009
10	1.949954060848837	0.4652906294229	0	0	1.241202482556078
11	2.166615623165375	0.390299184937549	0	0	1.16118756394288
12	2.383277185481912	0.310195672173827	0	0	1.097059569205609
13	2.599938747798449	0.236539938365836	0	0	1.049255767618557
14	2.816600310114987	0.180114424713506	0	0	1.017653093523673
15	3.033261872431525	0.149500414255694	0	0	1.00195656138662
16	3.249923434748062	0.149500414255694	0	0	1.00195656138662
17	3.4665849970646	0.180114424713506	0	0	1.017653093523673
18	3.683246559381137	0.236539938365836	0	0	1.049255767618557
19	3.899908121697675	0.310195672173827	0	0	1.097059569205609

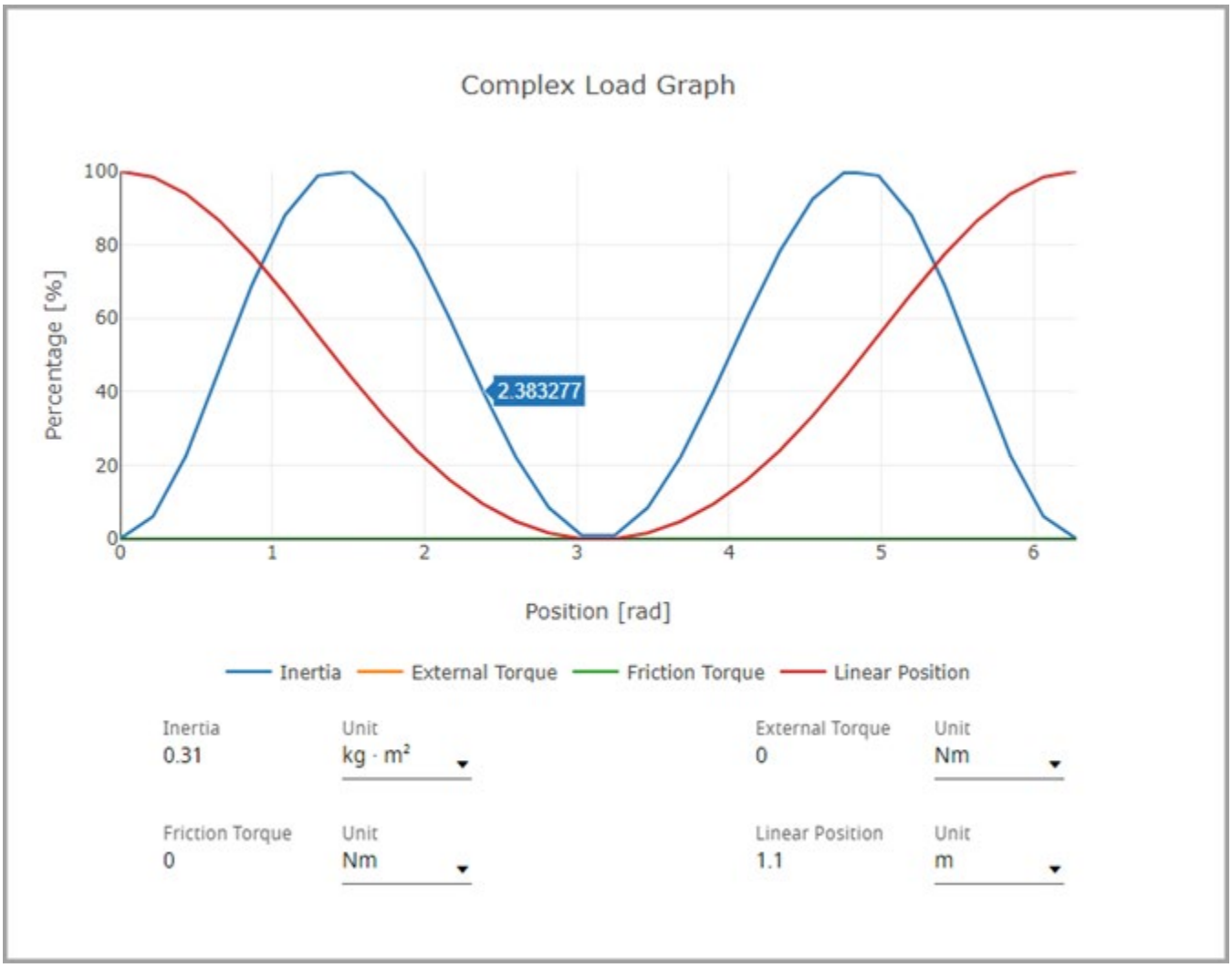
Table: Inertia Table

Field	Description
Position	Driving shaft angle with reference to the starting angle.
Inertia	Load inertia for the given shaft angle.
External Torque	Torque applied at the given position.
Friction Torque	Torque loss due to friction.
Linear Position	The motion of a point along a straight line.
Export	To export load data as an external file in .csv format from the Complex Load Data table.

NOTE: User cannot edit the labels and rows in the Inertia Table.

5. The Complex Load Graph displays the data on the graph. Hover the mouse pointer on the graph line to view the values.

Figure: Complex Load Graph



6. The simulator displays the animated view of crank slider.
7. Click [Tools] to change the view the slider action .

Figure: Tools

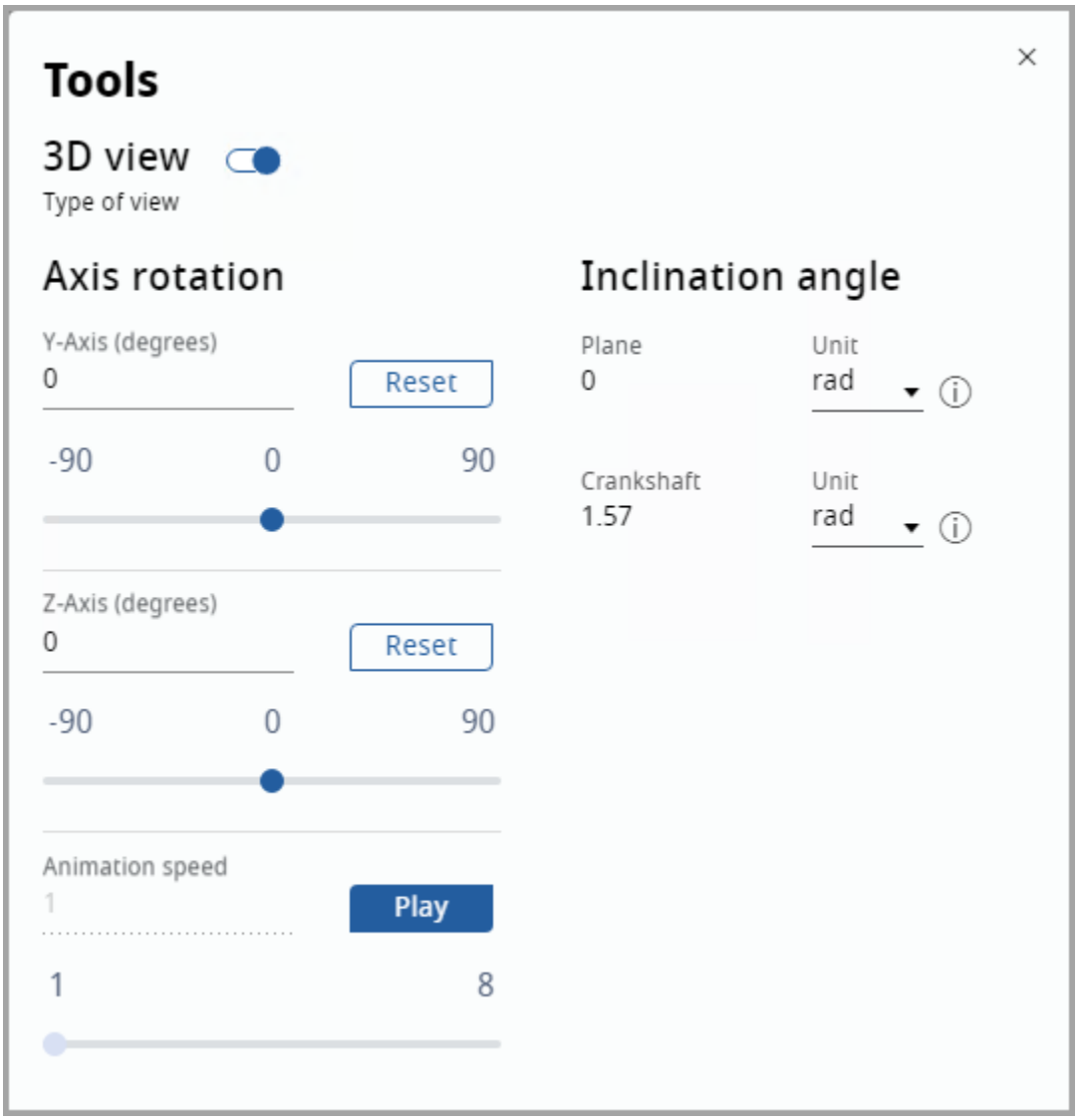
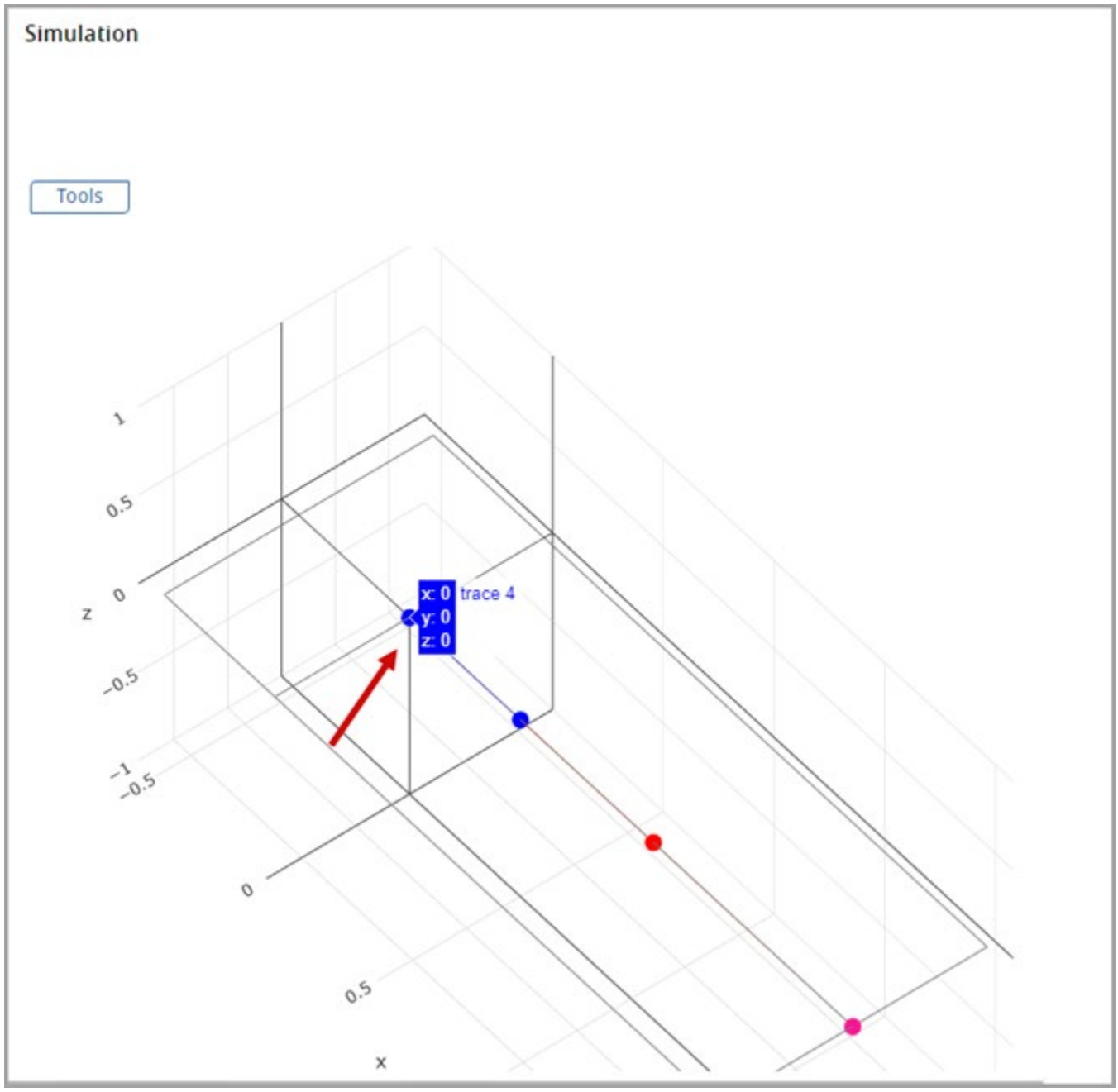


Table: Tools

Field	Description
3D view	3D view
Axis rotation	
Y-Axis (degree)	Angle of axis rotation on Y-axis. Use [Reset] to reset the Y-axis view to Zero.
Z-Axis (degree)	Angle of axis rotation on Z-axis. Use [Reset] to reset the Z-axis view to Zero.
Animation speed	The speed of the axis. Range: 1-8.
Play/Stop	To run the simulated crank image through the specified motion profile
Inclination angle	To change the Plane units and Crankshaft units. This action will change the inertia table view.

8. On the animation, point the cursor on any entry field, and the Parameter entry details display.

Figure: Animation

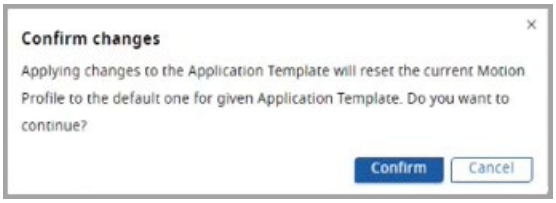


9. Click [Next Step]. The Confirm changes dialog displays.

   NOTE: This dialog displays even if the user clicks [Previous Step] on top right corner or the user wanted to leave the application template page.

10. Click [Confirm].

Figure: Confirm Changes



11. Based on the given parameters, the Motion Profile is defined on the Profile Editor page.

    Refer to "Define your profile" section to proceed further.

Cutter Knife Drive Template

This application is typically cutting strip material such as steel into pre-set lengths by means of a rotary knife (heavy-duty knife blades mounted on a pair of rotating drums). The blades must be stationary relative to the material (for example, moving at line speed) when the cut is made and the cut takes place over a fixed drum angle.

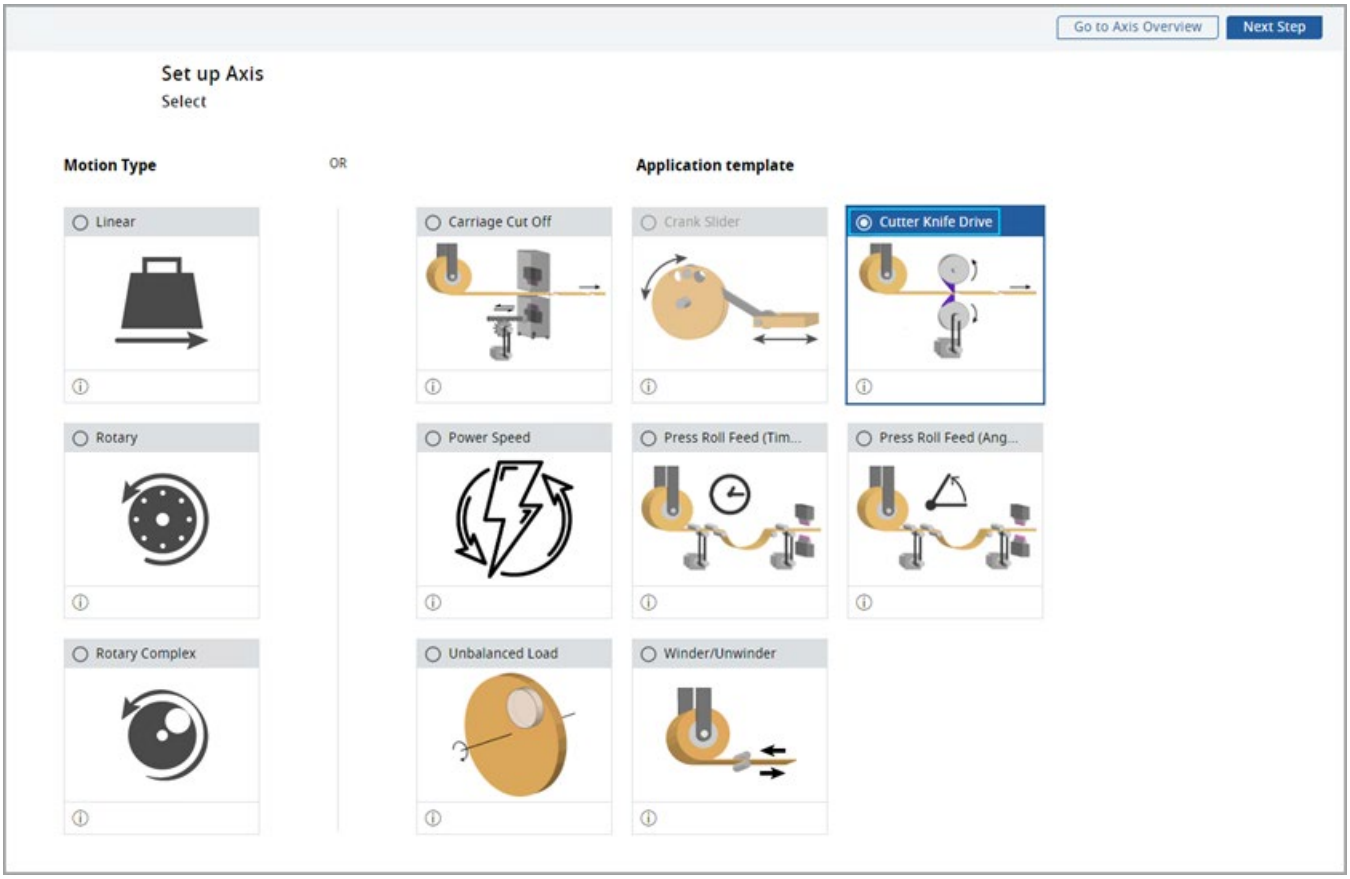
Strip material is unwound from a reel at constant surface speed and fed via separately driven leveler rolls. After the cut is complete, the drum is adjusted forward or backward relative to the material in order to cut the required length. It must return to line speed at the position required to cut the required length of material.

When the cut-length is equal to the circumference of the locus of the knife blade tip, it is said to be the synchronous cut length. In this special case, the knife drums rotate at a steady speed.

Perform the following steps to add the Cutter Knife Drive template to the Motion Profile:

1. Under the Motion Definition menu, click [Set up Axis].
2. Under the Application Template, select the Cutter Knife Drive Template and click [Next Step].

Figure: Application Template

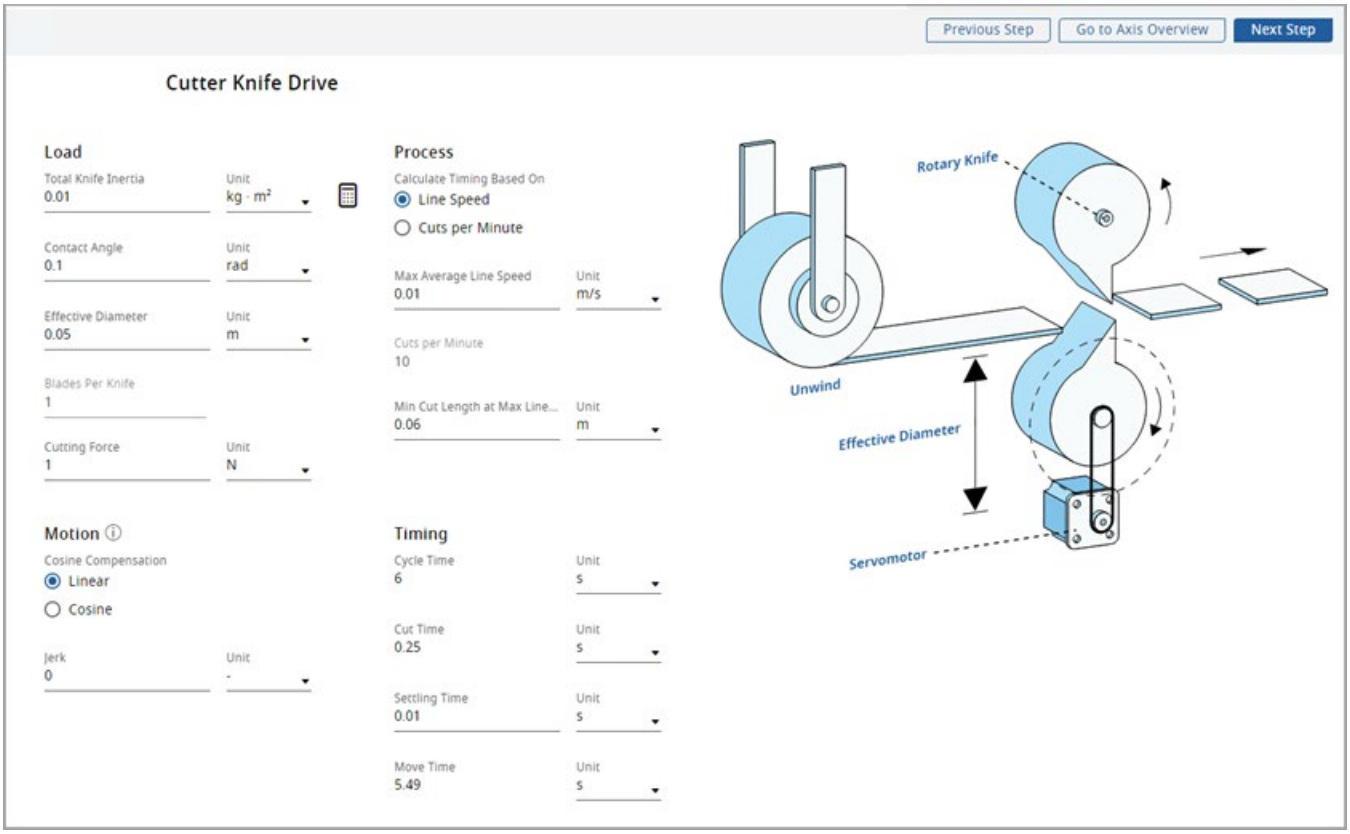


3. The ‘Confirm changes’ dialog displays. Click [Confirm].

Figure: Confirm Changes

The Cutter Knife Drive template page displays.

Figure: Cutter Knife Drive Template



4. Provide the load data details:

Table: Load Data

Type	Field	Description
Load	Total Knife Inertia	Inertia of the knife assembly at the drive shaft. Or the user can calculate the inertia using the [ ] icon. Refer to Inertia Calculator section.
	Contact Angle	Time the material must be stationary in an accurate position.
	Effective Diameter	As illustrated in the Cutter Knife Drive (Rotary Knife) diagram, this is the diameter of the circle passing through the cutting edge.
	Blades Per Knife	Number of blades around the circumference of the knife.
	Cutting Force	Maximum force required to cut through the material. Cutting force is essentially constant while maximum torque occurs at the first point of knife contact.
Process	Calculate Timing Based On	Choose the option on which the timing should be calculated: • Line Speed: The speed of the line. • Cuts per Minute: Number of cuts made per minute.

	Max Average Line Speed	Provide the value when the maximum design speed of the constant-speed sections of the line is known. This speed does not refer to the peak velocity of the feeder section, which is determined by application.
	Cuts per Minute	Provide the value entry when the number of cuts made by the system per minute is known.
	Min Cut Length at Max line speed	This data is required when you select the option to enter data based on Max Average Line Speed. This is the critical condition on which the sizing process is performed. To cut shorter lengths than this critical length, the line speed must be reduced.
Motion	Cosine Compensation	The Cosine Compensation is used to make sure that while the press cutter knife is in contact with the material being cut, the horizontal component of the knife's velocity matches the material speed.
	Jerk	This value sets the amount of S-curve of the Load Profile. For Trapezoid, the default Jerk value is 0%.
Timing	Cycle Time	Calculated cycle time for the specified load profile.
	Cut Time	Time required for the carriage to synchronize accurately with the material.
	Settling Time	This is the time required for the system to achieve the required position accuracy before the cut commences. The finer the required accuracy, the longer the settling time value.
	Move Time	Time through which the load profile takes place.

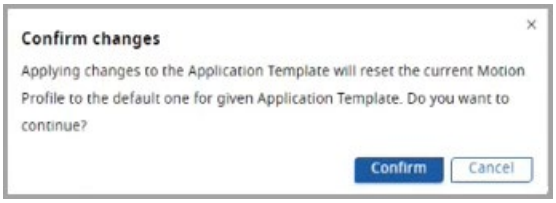
NOTE: Ensure to provide valid parameters to calculate.

5. Click [Next Step]. The Confirm changes dialog displays.

   NOTE: This dialog displays even if the user clicks [Previous Step] on top right corner or the user wanted to leave the application template page.

6. Click [Confirm].

   Figure: Confirm Changes



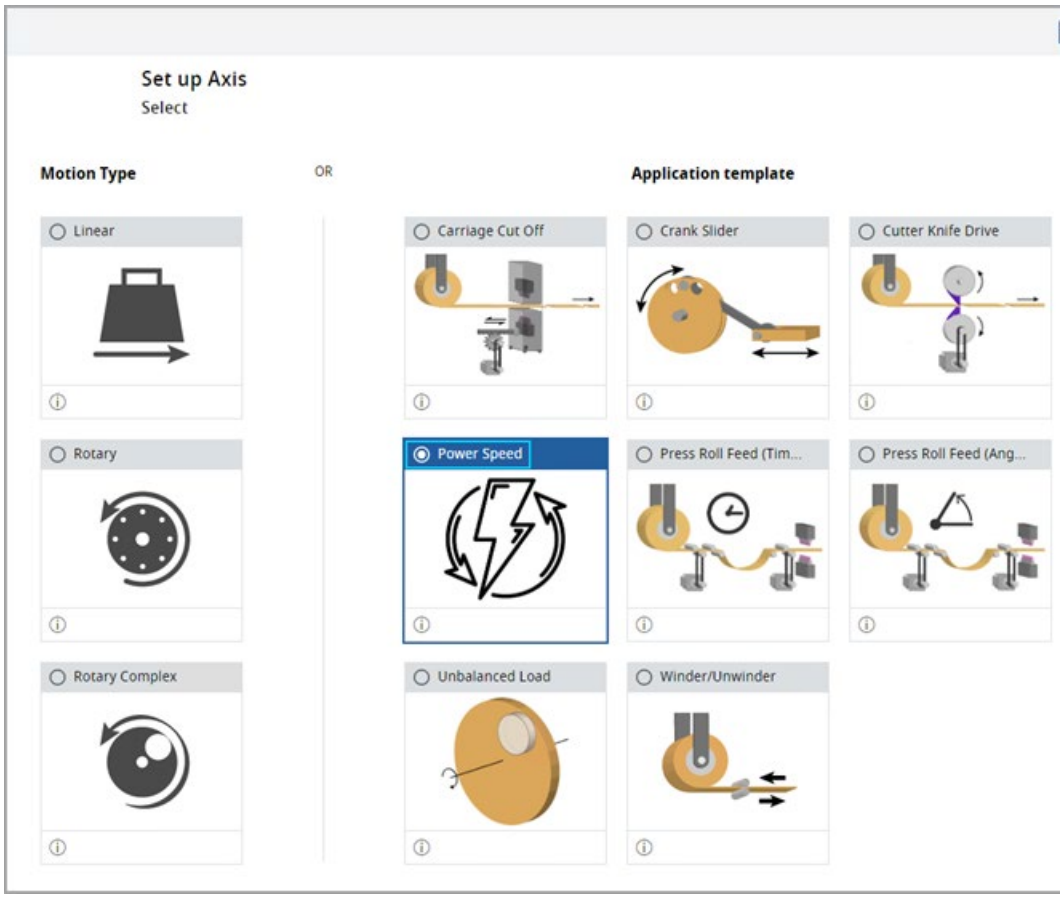
7. Based on the given parameters, the Motion Profile is defined on the Profile Editor page.

   Refer to "Define your profile" section to proceed further.

Power Speed Template

The Power Speed template is used to enter torque and speed values that are used to calculate the power requirements for the application.

Perform the following steps to add the Power Speed template to the Motion Profile:

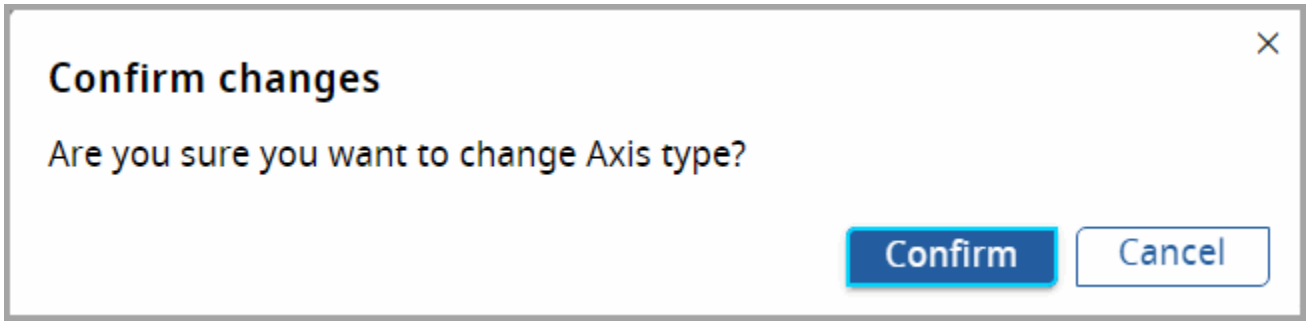


1. Under the Motion Definition menu, click [Set up Axis].
2. Under the Application template section, select the Power Speed template and click [Next Step].

Figure: Power Speed Template

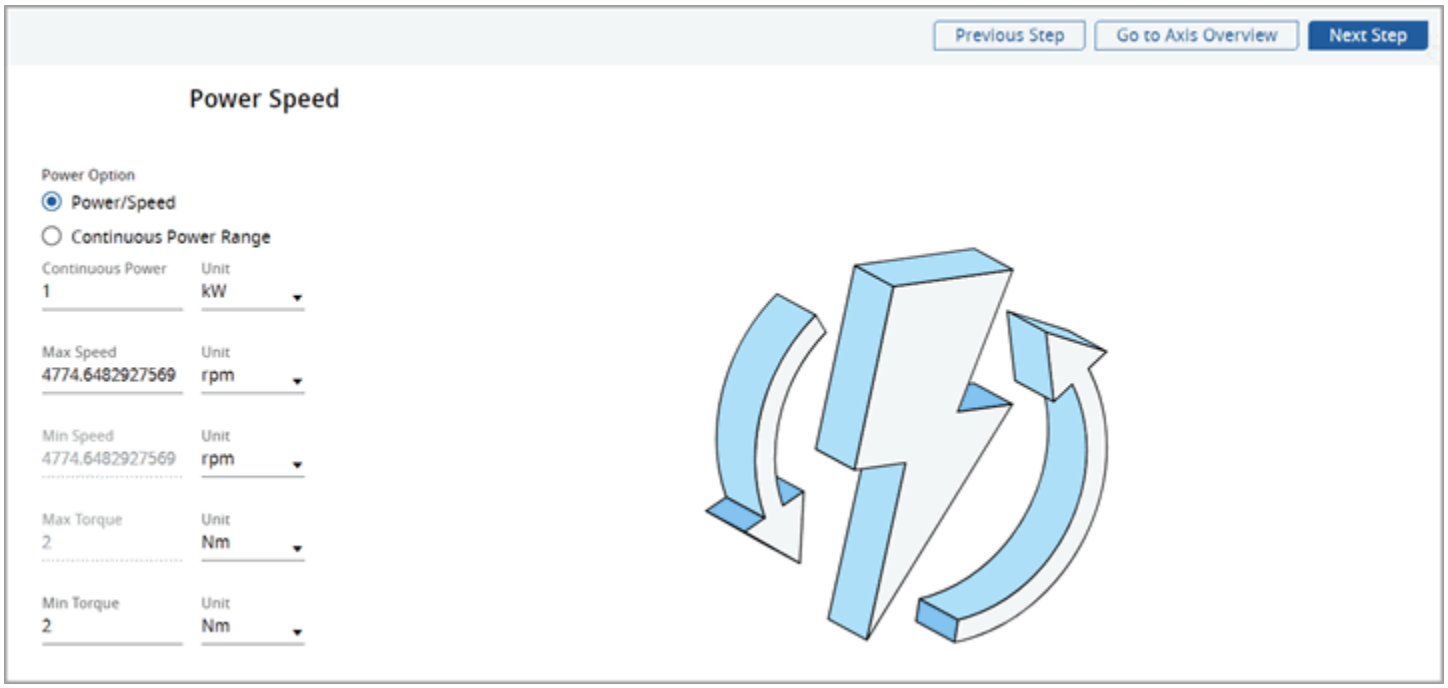
3. The 'Confirm changes dialog displays. Click [Confirm].

Figure: Confirm Changes



4. The Power Speed template page displays.

Figure: Power Speed Template



5. Provide the Power and speed values:

Table: Power Speed Template

Field	Description
Power Option	Select the power option: • **Power/Speed**: Use this template when the torque and speed values are known at the load for the application. • **Continuous Power Range**: Use this template when three of the following values are known: maximum torque, minimum torque, maximum speed, or minimum speed.
Continues Power	Provide the Continues Power value along with their units.
Max Speed	Maximum speed for the application.
Min Speed	Minimum speed for the application. Ensure that this value doesnot exceed the Max speed. This field is disabled if the Power option is Power/Speed.
Max Torque	Maximum torque value for the application. This field is disabled if the Power option is Power/Speed.
Min Torque	Minimum torque value for the application.

6. Click [Next Step] on the top right corner. Based on the provided parameters, the Motion Profile is defined on the Profile Editor page.
7. Refer to “Define your profile” section to proceed further.

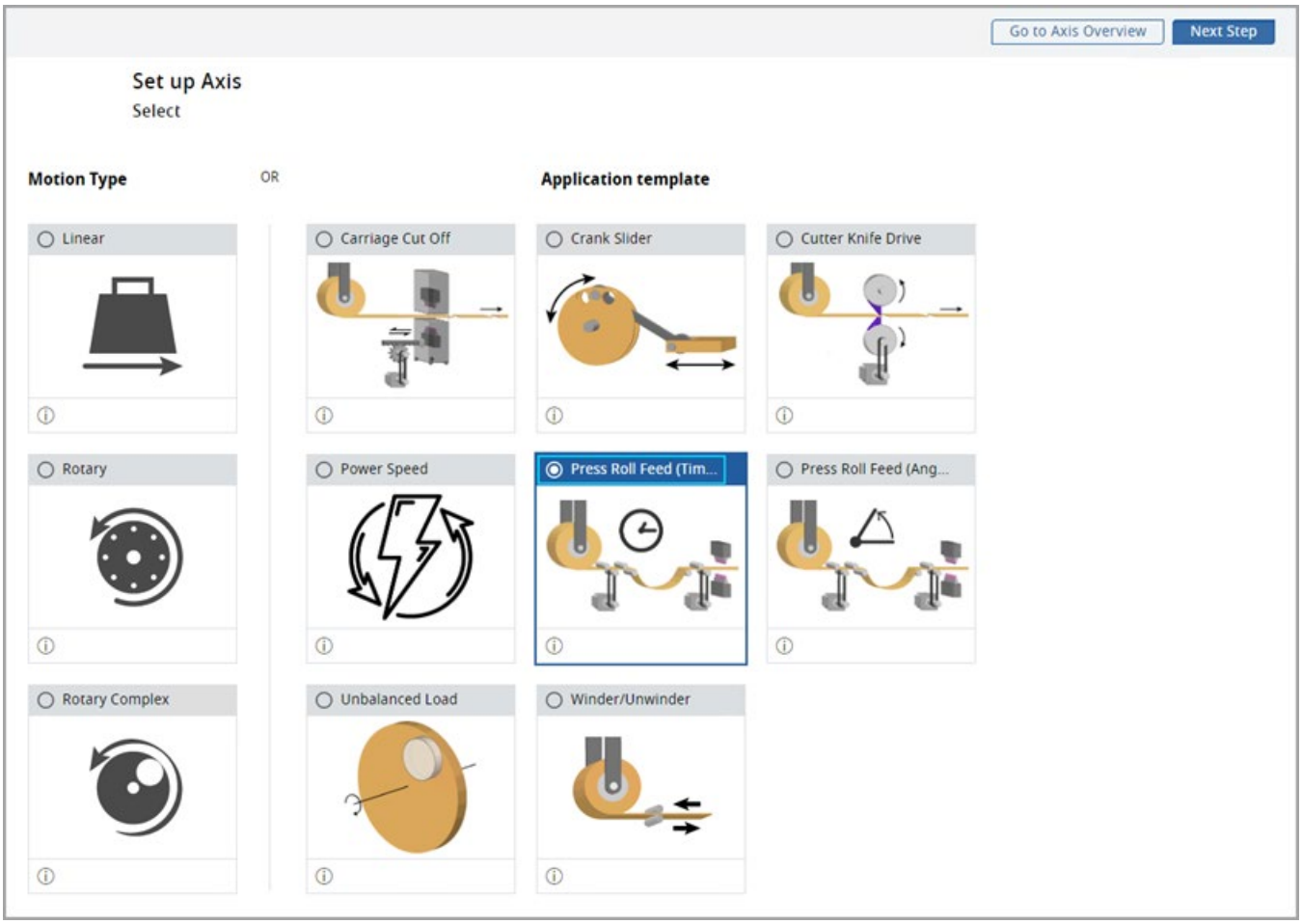
Press Roll Feed (Time) Template

This application is typically cutting strip material such as steel into pre-set lengths by means of a press shear (heavy-duty knife). The material must be stationary when the cut is made, and the cut takes place over a fixed amount of time of the driving crank whose speed is varied to match the cut rate. Strip material is unwound from a reel at constant surface speed and fed via separately driven leveler rolls into one end of a looping pit (a free-hanging loop of material providing storage). On the other side of the loop, a pair of feeder rolls grips the material and moves it forward the required cut length and then stops. After the cut is complete, the material is moved again. The average velocity of the nip/feeder rolls must be equal to the constant velocity of the unwinder and leveler rolls.

Perform the following steps to add the Press Roll Feed (Time) template to the Motion Profile:

1. Under the Motion Definition menu, click [Set up Axis].
2. Under the Application Template, select the Press Roll Feed (Time) Template and click [Next Step].

Figure: Application Template

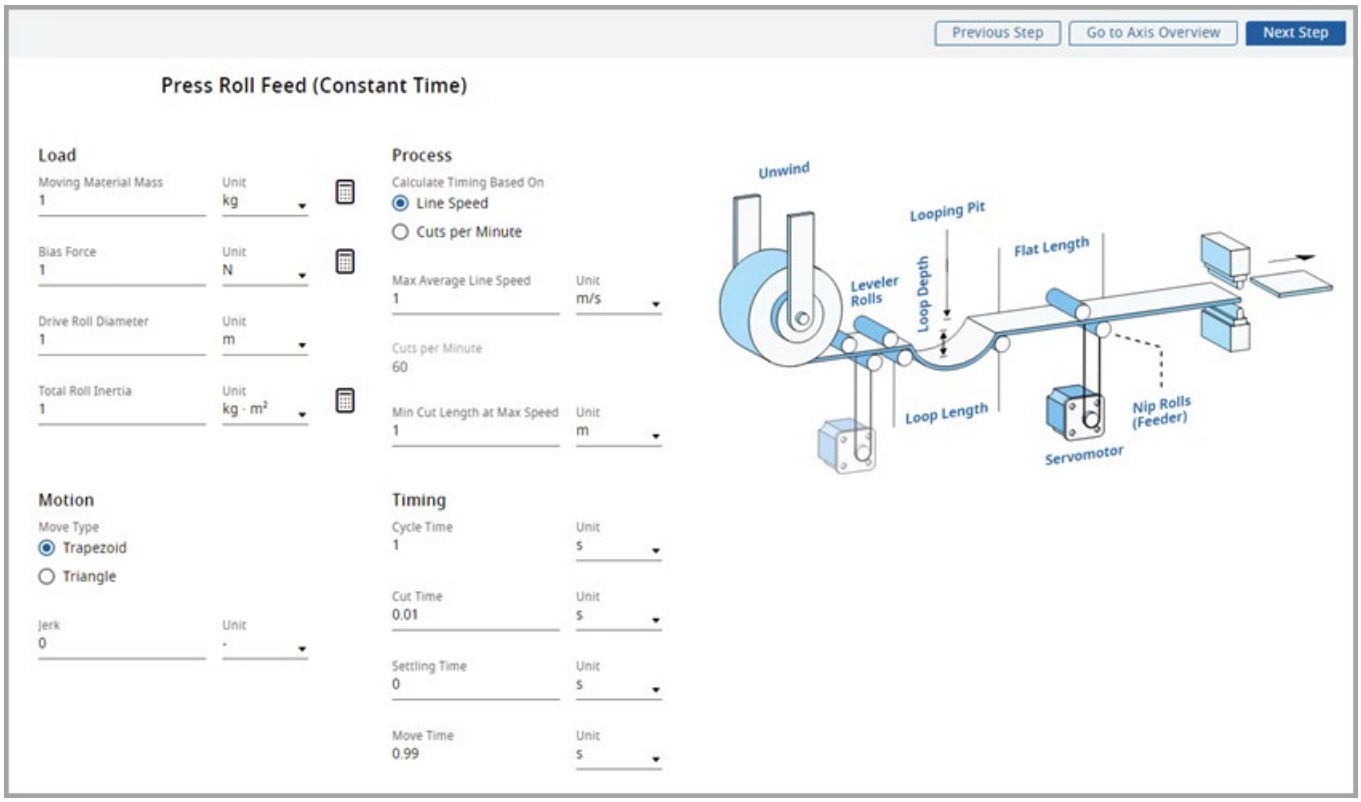


3. The 'Confirm changes' dialog displays. Click [Confirm].

Figure: Confirm Changes

The Press Roll Feed (Constant Time) template page displays.

Figure: Press Roll Feed (Constant Time) Template



4. Provide the load data details:

Table: Load Data

Type	Field	Description
Load	Moving Material Mass	The mass of the material in the loop and on the flat before the Nip/Feed rolls.
	Bias Force	The force required to overcome the force of gravity on the loop.
	Drive Roll Diameter	The diameter of the roll in direct contact with the strip, driven from the motor.
	Total Roll Inertia	The total inertia of the strip material at the drive shaft. Or the user can calculate the inertia using the [ ] icon. Refer to Inertia Calculator section.
Process	Calculate Timing Based On	Choose the option on which the timing should be calculated: • Line Speed: The speed of the line. • Cuts per Minute: Number of cuts made per minute.
	Max Average Line Speed	Select this option for data entry when the maximum design speed of the constant-speed sections of the line is known. This speed does not refer to the peak velocity of the feeder section, which is determined by Motion Analyzer software.
	Cuts per Minute	Provide this value when the number of cuts made by the system per minute is known.
	Max. Cut Length at Max Speed	This data is required when you select the option to enter data based on Max Average Line Speed. This is the critical condition on which the sizing process is performed. To cut shorter lengths than this critical length, the line speed must be reduced.

Motion	Move Type	Select the Motion type: • Trapezoid: Select this option when the application needs to accelerate to a maximum velocity and then travel at that velocity for a specified time or distance. A trapezoidal move of the virtual axis produces a trapezoidal load profile • Triangle: Select this option for a Triangular load profile.
	Jerk	This value sets the amount of S-curve of the Load Profile. The default Jerk value is 0%.
Timing	Cycle Time	Calculated cycle time for the specified load profile.
	Cut Time	Time required for the carriage to synchronize accurately with the material.
	Settling Time	This is the time required for the system to achieve the required position accuracy before the cut commences. The finer the required accuracy, the longer the settling time value.
	Move Time	Time through which the load profile takes place.

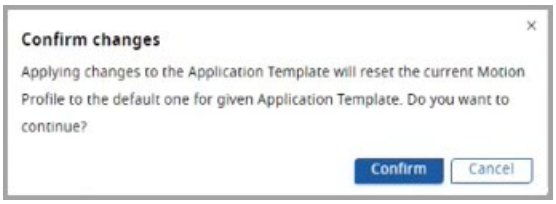
NOTE: Ensure to provide valid parameters to calculate.

5. Click [Next Step]. The Confirm changes dialog displays.

   NOTE: This dialog displays even if the user clicks [Previous Step] on top right corner or the user wanted to leave the application template page.

6. Click [Confirm].

Figure: Confirm Changes



7. Based on the given parameters, the Motion Profile is defined on the Profile Editor page.
8. Refer to “Define your profile” section to proceed further.

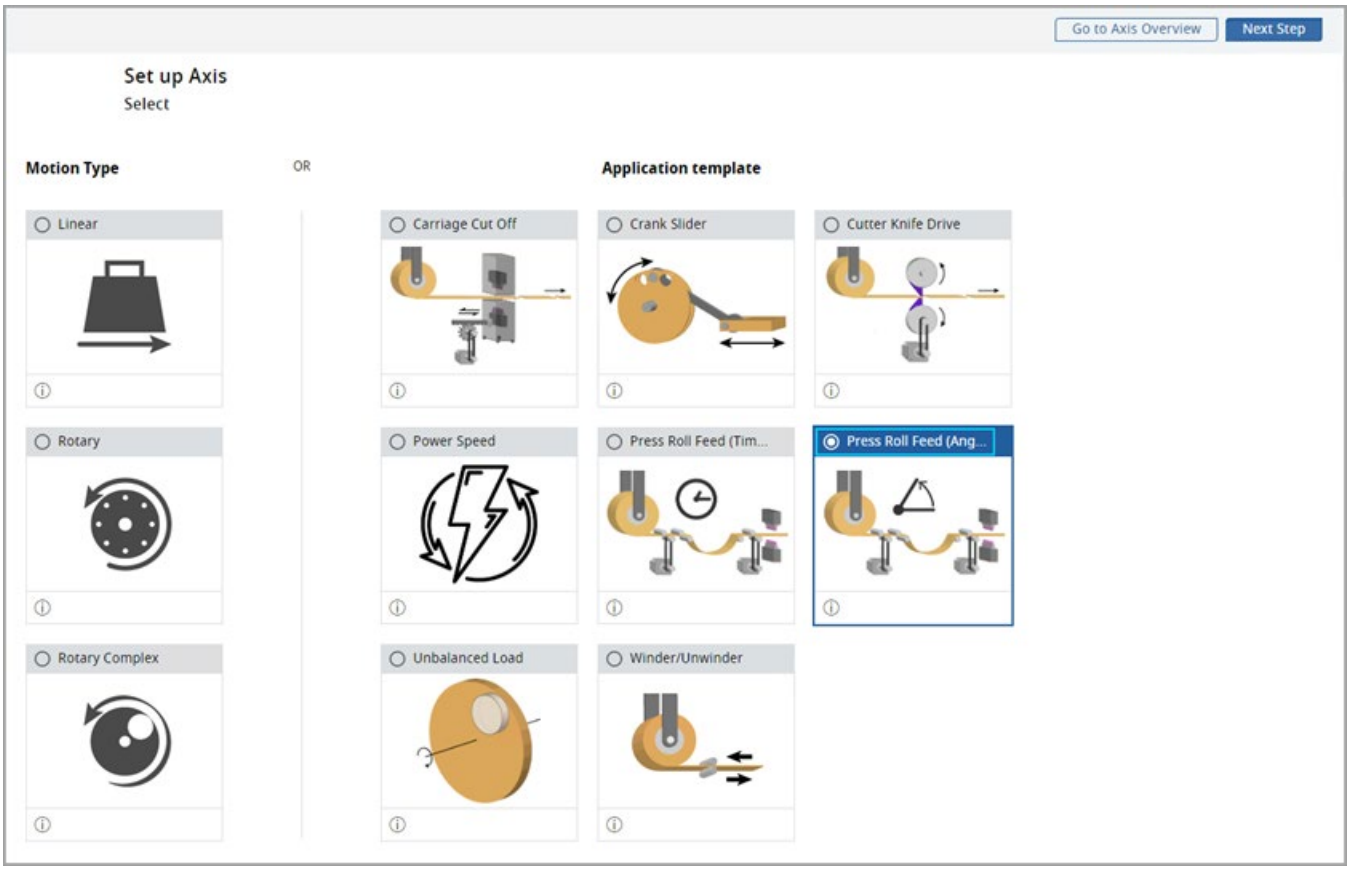
Press Roll Feed (Angle) Template

This application is typically cutting strip material such as steel into pre-set lengths by means of a press shear (heavy-duty knife). The material must be stationary when the cut is made and the cut takes place over a fixed angle of the driving crank whose speed is varied to match the cut rate. Strip material is unwound from a reel at constant surface speed and fed via separately driven leveler rolls into one end of a looping pit (a free-hanging loop of material providing storage). On the other side of the loop, a pair of feeder rolls grips the material and moves it forward the required cut length and then stops. After the cut is complete, the material is moved again. The average velocity of the nip/feeder rolls must be equal to the constant velocity of the unwinder and leveler rolls.

Perform the following steps to add the Press Roll Feed (Angle) template to the Motion Profile:

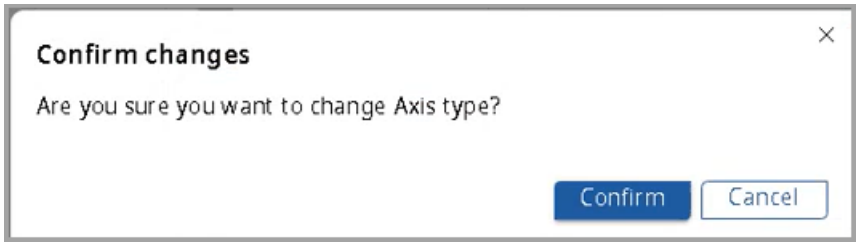
1. Under the Motion Definition menu, click [Set up Axis].
2. Under the Application Template, select the Press Roll Feed (Angle) Template and click [Next Step].

Figure: Press Roll Feed (Angle) Template



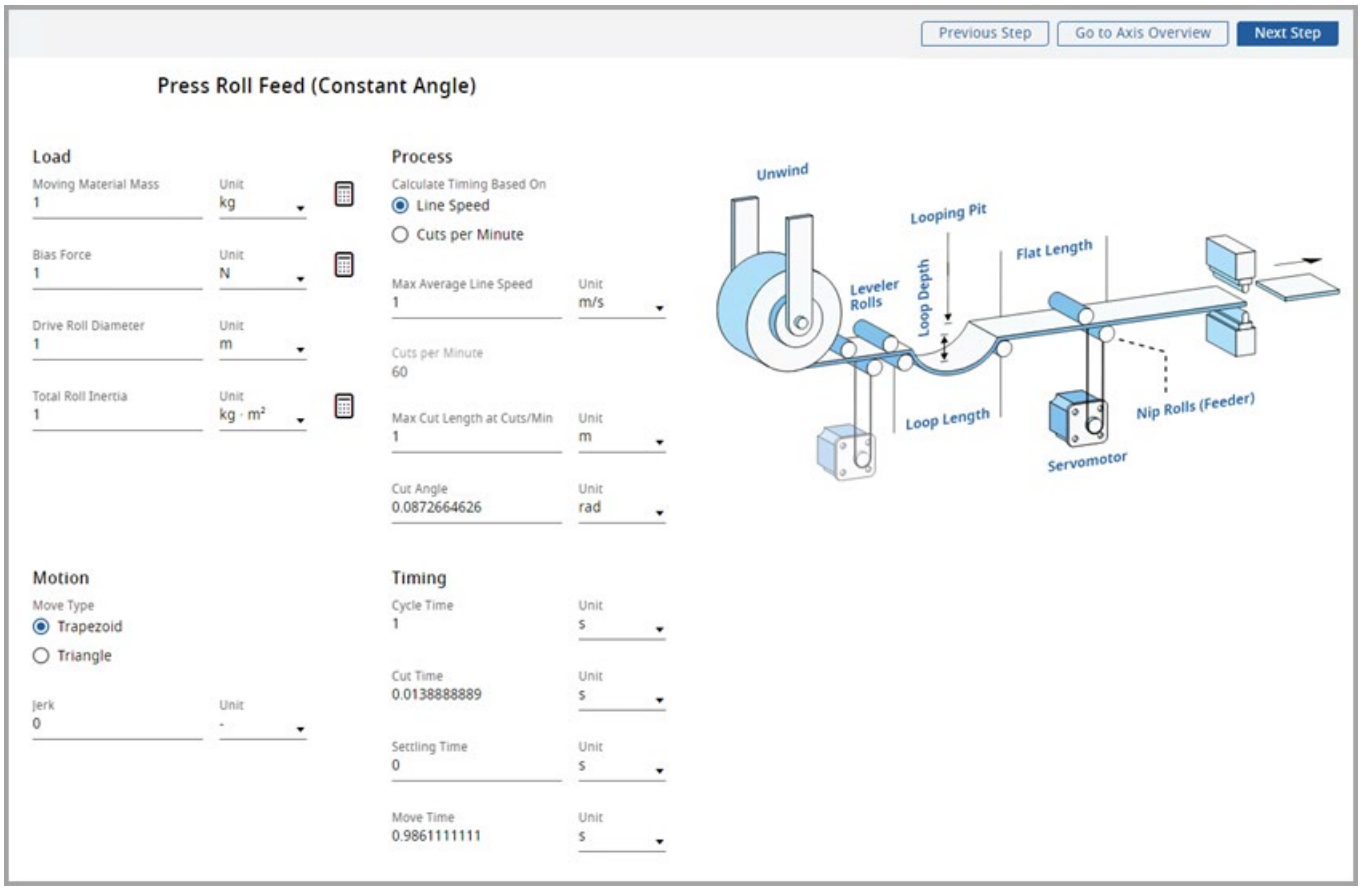
3. The ‘Confirm changes’ dialog displays. Click [Confirm].

Figure: Confirm Changes



The Press Roll Feed (Constant Angle) template page displays.

Figure: Press Roll Feed (Constant Angle)



4. Provide the load data details:

Table: Load Data

Type	Field	Description
Load	Moving Material Mass	The mass of the material in the loop and on the flat before the Nip/Feed rolls.
	Bias Force	The force required to overcome the force of gravity on the loop.
	Drive Roll Diameter	The diameter of the roll in direct contact with the strip, driven from the motor.
	Total Roll Inertia	The total inertia of the strip material at the drive shaft. Or the user can calculate the inertia using the [ ] icon. Refer to Inertia Calculator section.
Process	Calculate Timing Based On	Choose the option on which the timing should be calculated: • Line Speed: The speed of the line. • Cuts per Minute: Number of cuts made per minute.
	Max Average Line Speed	Select this option for data entry when the maximum design speed of the constant-speed sections of the line is known. This speed does not refer to the peak velocity of the feeder section, which is determined by Motion Analyzer software.
	Cuts per Minute	Provide this value when the number of cuts made by the system per minute is known.
	Max. Cut Length at Cuts/Min	This data is required when you select the option to enter data based on Cuts/min. This is the critical condition on which the sizing process is performed. To cut longer lengths than this critical length, the line speed must be reduced.
	Cut Angel	The crank angle during which the material must be stationary in an accurate position. This value is only required for Press Roll Feed - Constant Angle applications.

Motion	Move Type	Select the Motion type: • Trapezoid: Select this option when the application needs to accelerate to a maximum velocity and then travel at that velocity for a specified time or distance. A trapezoidal move of the virtual axis produces a trapezoidal load profile • Triangle: Select this option for a Triangular load profile.
	Jerk	This value sets the amount of S-curve of the Load Profile. The default Jerk value is 0%.
Timing	Cycle Time	Calculated cycle time for the specified load profile.
	Cut Time	Time required for the carriage to synchronize accurately with the material.
	Settling Time	This is the time required for the system to achieve the required position accuracy before the cut commences. The finer the required accuracy, the longer the settling time value.
	Move Time	Time through which the load profile takes place.

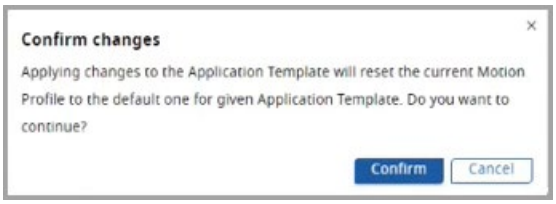
NOTE: Ensure to provide valid parameters to calculate.

5. Click [Next Step]. The Confirm changes dialog displays.

   NOTE: This dialog displays even if the user clicks [Previous Step] on top right corner or the user wanted to leave the application template page.

6. Click [Confirm].

   Figure: Confirm Changes



   Based on the given parameters, the Motion Profile is defined on the Profile Editor page.

7. Refer to “Define your profile” section to proceed further.

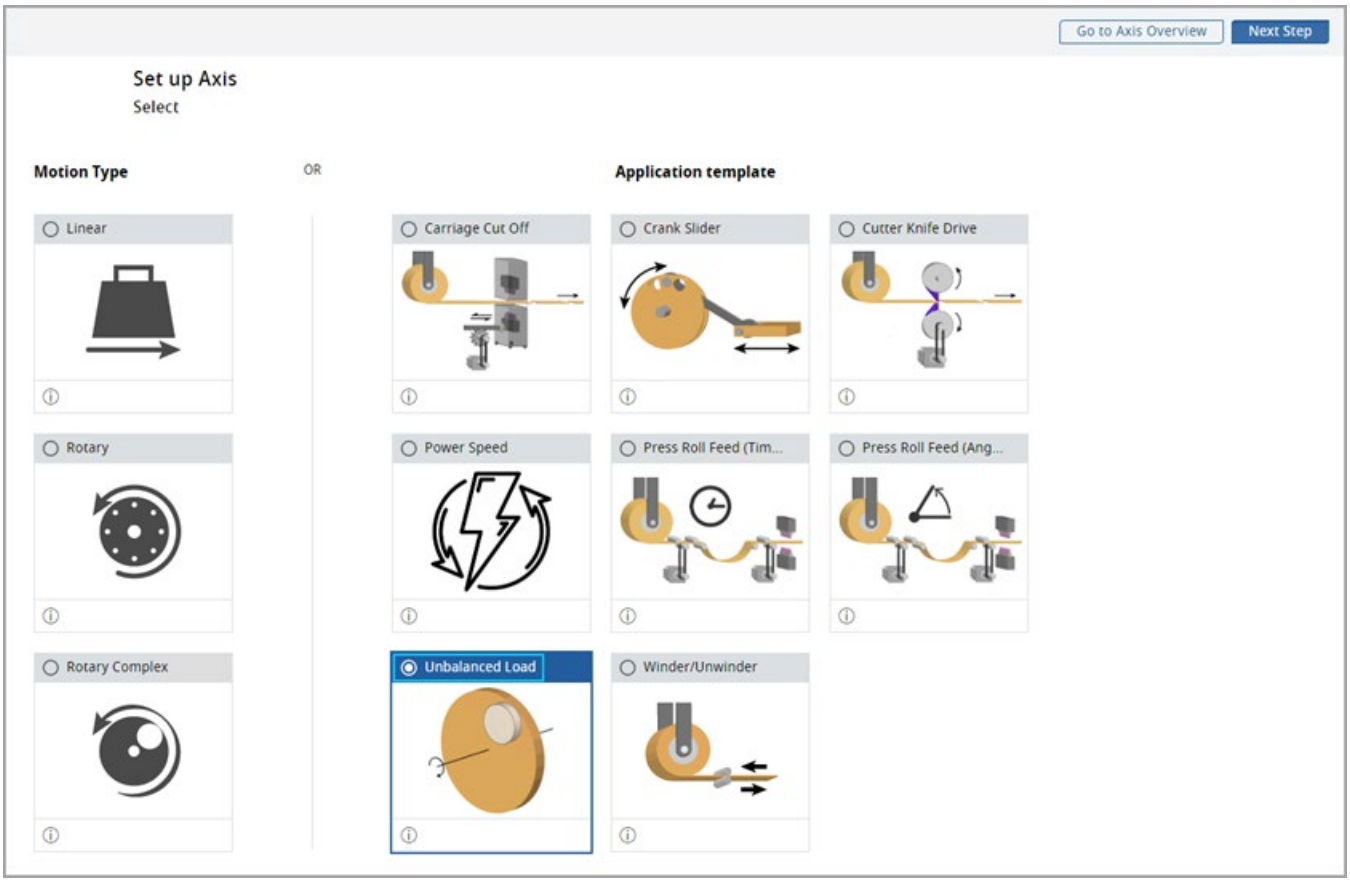
Unbalanced Load Template

The Unbalanced Load template allows user to enter parameters for an unbalanced load application. Motion Analyzer assumes that the axis of rotation is parallel to the ground if no axis angle is entered and that unbalanced masses create a gravity-related torque. Secondary Inertia, Secondary Mass and Axis Separation parameters are required to consider gravity-induced torque values.

Perform the following steps to add the Unbalanced Load template to the Motion Profile:

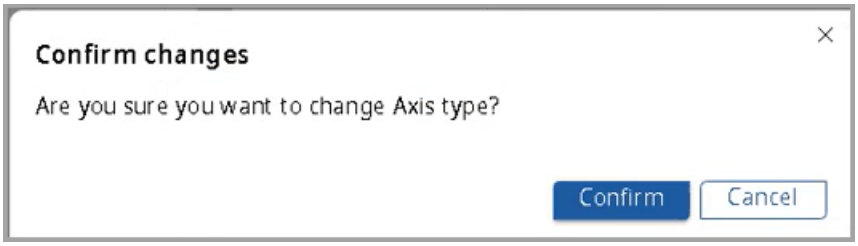
1. Under the Motion Definition menu, click [Set up Axis].
2. Under the Application Template, select the Unbalanced Load Template and click [Next Step].

Figure: Application Template



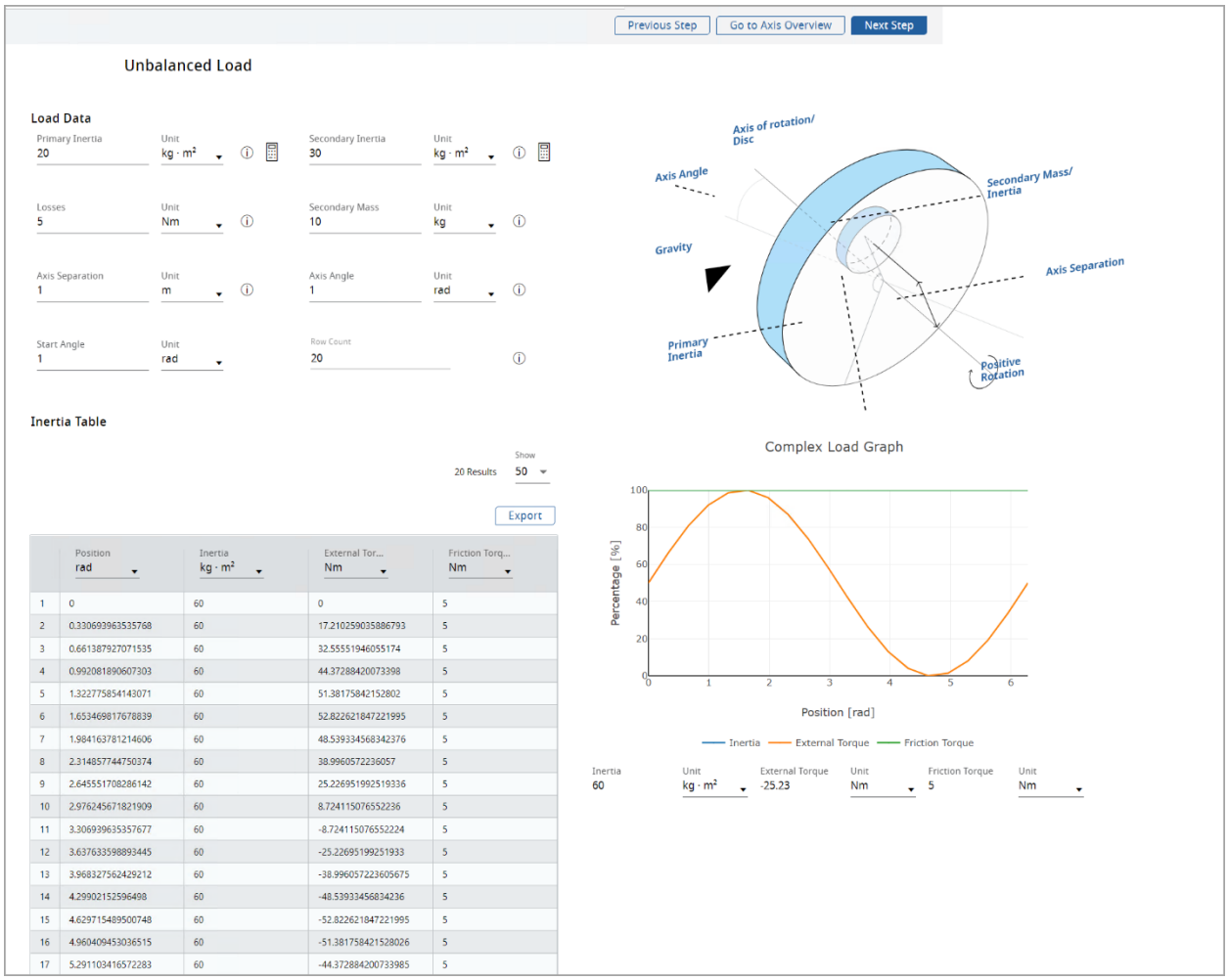
3. The ‘Confirm changes’ dialog displays. Click [Confirm].

Figure: Confirm Changes



The Unbalanced Load template page displays.

Figure: Unbalanced Load Template



	Position rad	Inertia kg · m²	External Tor... Nm	Friction Torq... Nm
1	0	60	0	5
2	0.330693963535768	60	17.210259035886793	5
3	0.661387927071535	60	32.55551946055174	5
4	0.992081890607303	60	44.37288420073398	5
5	1.322775854143071	60	51.38175842152802	5
6	1.653469817678839	60	52.822621847221995	5
7	1.984163781214606	60	48.539334568342376	5
8	2.314857744750374	60	38.9960572236057	5
9	2.645551708286142	60	25.226951992519336	5
10	2.976245671821909	60	8.724115076552236	5
11	3.306939635357677	60	-8.724115076552224	5
12	3.637633598893445	60	-25.22695199251933	5
13	3.968327562429212	60	-38.996057223605675	5
14	4.29902152596498	60	-48.53933456834236	5
15	4.629715489500748	60	-52.822621847221995	5
16	4.960409453036515	60	-51.381758421528026	5
17	5.291103416572283	60	-44.372884200733985	5

4. Provide the load data details:

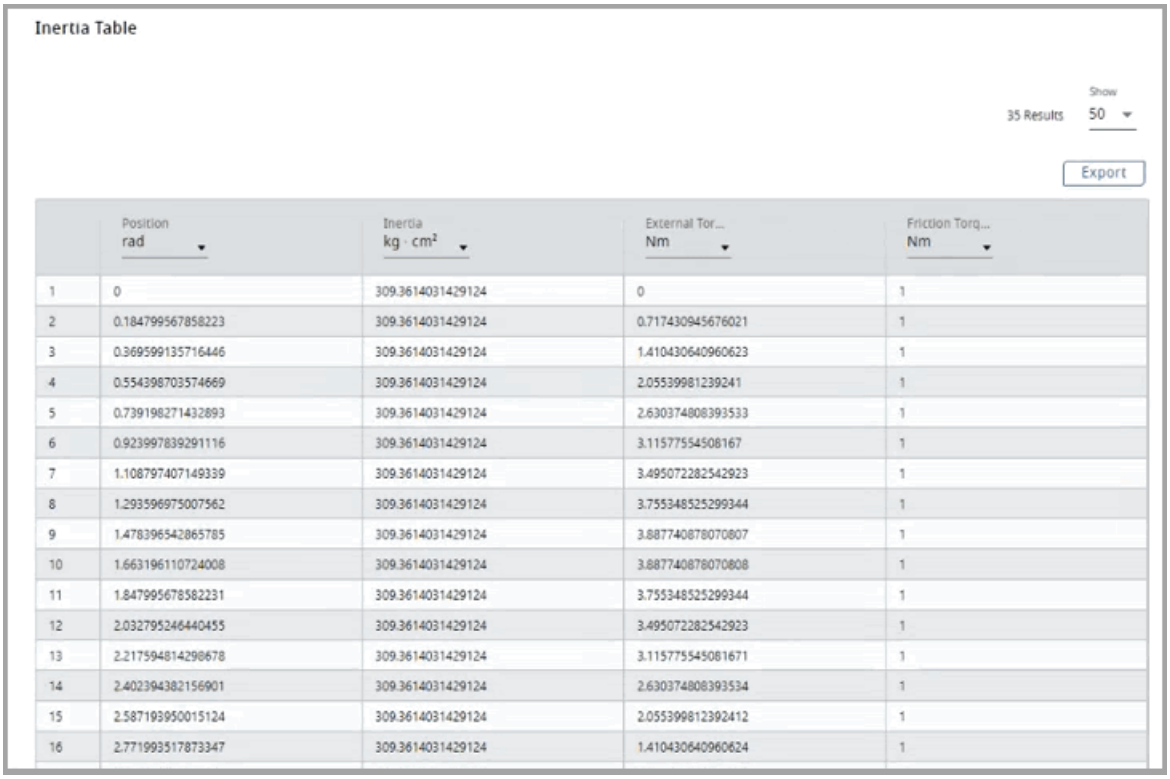
Table: Load Data

Field	Description
Primary Inertia	The inertia of any balanced load about its own axis of rotation. For example, if the main mass is a circular table which is driven about its own axis of symmetry, then Primary Inertia is equal to the table inertia. Or If the user has the measurements and other details of the balanced load, click the [ ] icon to calculate the inertia of the balanced load. Refer to Inertia Calculator section.
Losses	The losses consist of the torque lost in the system due to friction.
Axis Separation	The distance between the secondary mass' center of gravity and the axis of rotation.
Start Angle	The starting angle for the Unbalanced Load profile.
Secondary Inertia	The moment of inertia of the unbalanced mass about its own center of gravity. Or If the user has the measurements and other details of the unbalanced load, click the [ ] icon to calculate the inertia of the unbalanced load. Refer to Inertia Calculator section.
Secondary Mass	The unbalanced mass.

Axis Angle	The starting angle of rotation. Zero indicates that at the start of the motion profile, the center of gravity lies vertically below the center of rotation. This is the position of the load if it is allowed to swing freely. Positive rotation is clockwise. NOTE: Based on the angle selected, the unbalanced diagram changes its axis.
Row Count	Number of rows

Based on the provided parameters, Motion Analyzer calculates the inertia table and complex load graph automatically.
NOTE: Ensure to provide valid parameters to calculate.
The Inertia table displays.

Figure: Inertia Table



	Position rad	Inertia kg · cm²	External Tor... Nm	Friction Torq... Nm
1	0	309.3614031429124	0	1
2	0.184799567858223	309.3614031429124	0.717430945676021	1
3	0.369599135716446	309.3614031429124	1.410430640960623	1
4	0.554398703574669	309.3614031429124	2.05539981239241	1
5	0.739198271432893	309.3614031429124	2.630374808393533	1
6	0.923997839291116	309.3614031429124	3.11577554508167	1
7	1.108797407149339	309.3614031429124	3.495072282542923	1
8	1.293596975007562	309.3614031429124	3.755348525299344	1
9	1.478396542865785	309.3614031429124	3.887740878070807	1
10	1.663196110724008	309.3614031429124	3.887740878070808	1
11	1.847995678582231	309.3614031429124	3.755348525299344	1
12	2.032795246440455	309.3614031429124	3.495072282542923	1
13	2.217594814298678	309.3614031429124	3.115775545081671	1
14	2.402394382156901	309.3614031429124	2.630374808393534	1
15	2.587193950015124	309.3614031429124	2.055399812392412	1
16	2.771993517873347	309.3614031429124	1.410430640960624	1

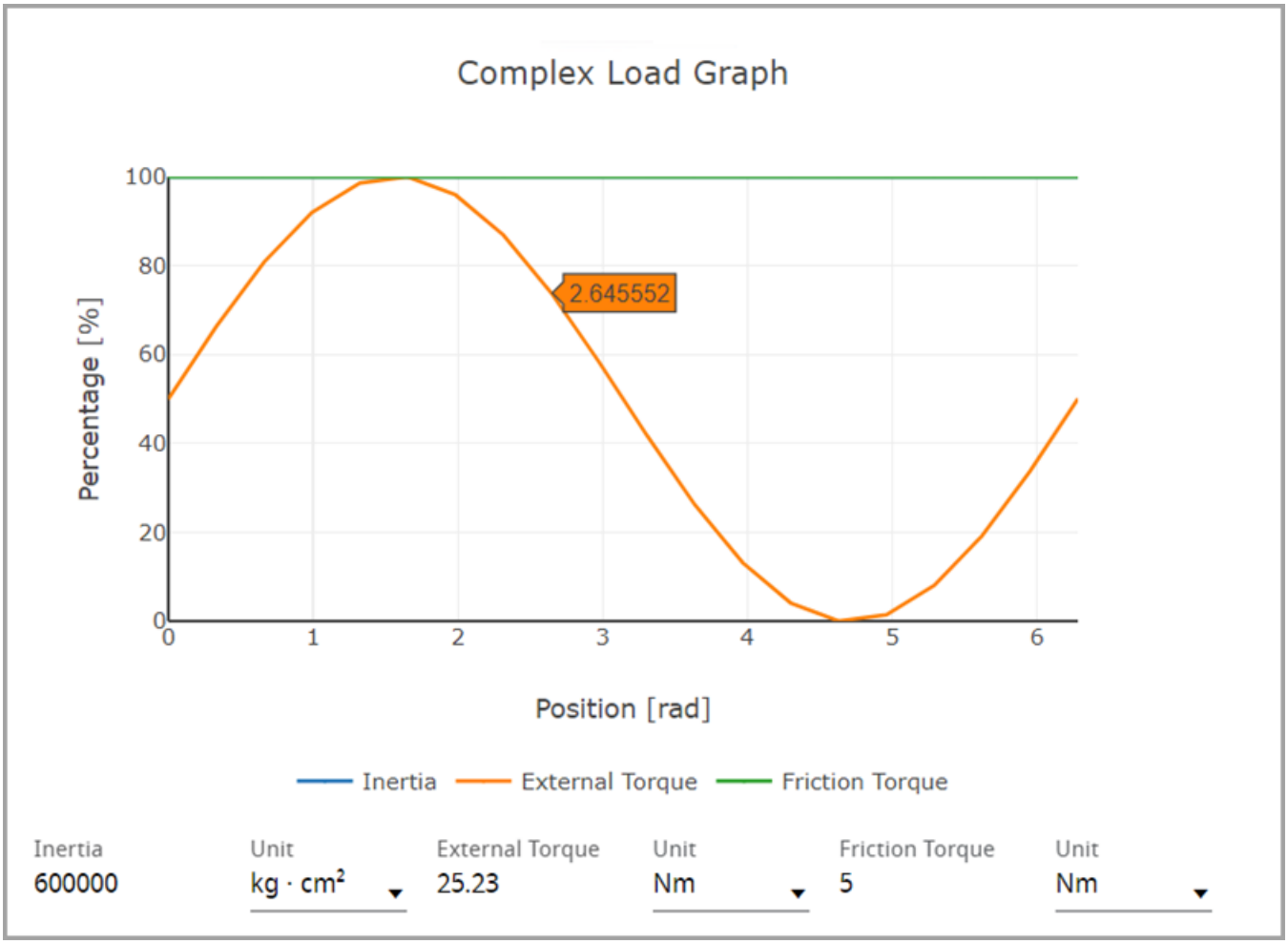
Table: Inertia Table

Field	Description
Position	Driving shaft angle with reference to the starting angle.
Inertia	Load inertia for the given shaft angle.
External Torque	Torque applied at the given position.
Friction Torque	Torque loss due to friction.
Export	To export load data as an external file in .csv format from the Complex Load Data table.

NOTE: User cannot edit the labels and rows in the Inertia Table.

5. The Complex Load Graph displays the data on the graph. Hover the mouse pointer on the graph line to view the values.

Figure: Complex Load Graph

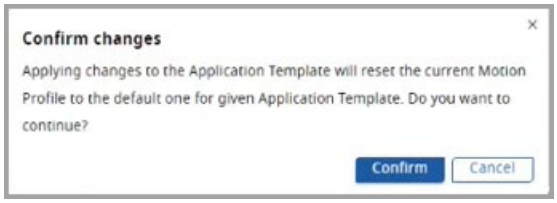


6. Click [Next Step]. The Confirm Changes dialog displays.

   NOTE: This dialog displays even if the user clicks [Previous Step] on top right corner or wanted to leave the application template page.

7. Click [Confirm].

   Figure: Confirm Changes



8. Based on the given parameters, the Motion Profile is defined on the Profile Editor page.
9. Refer to “Define your profile” section to proceed further.

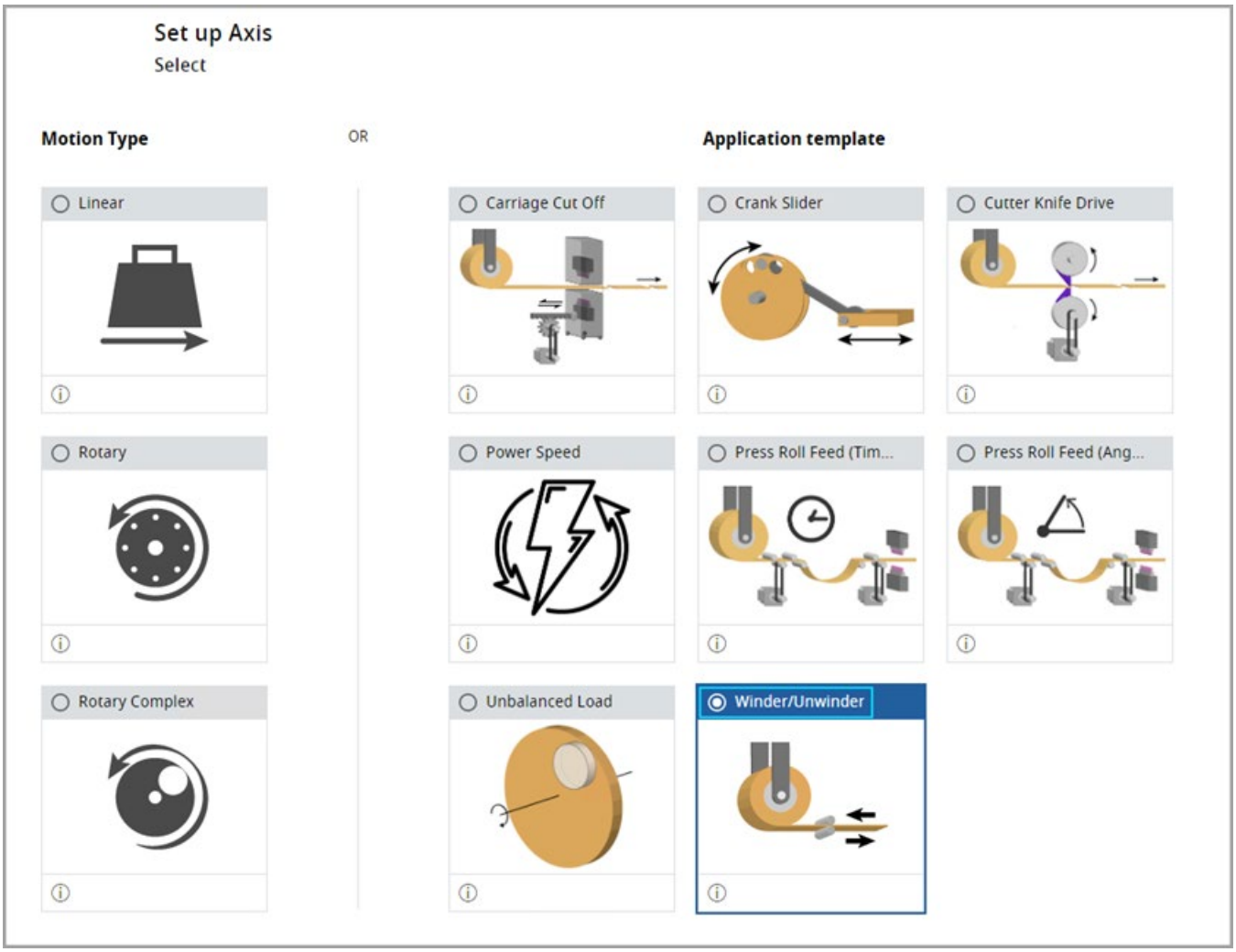
Winder/Unwinder

The Winder/Unwinder template provides the required inputs to calculate the Motion Profile for Winder or Unwinder applications.

Perform the following steps to add Winder/Unwinder template to the Motion Profile:

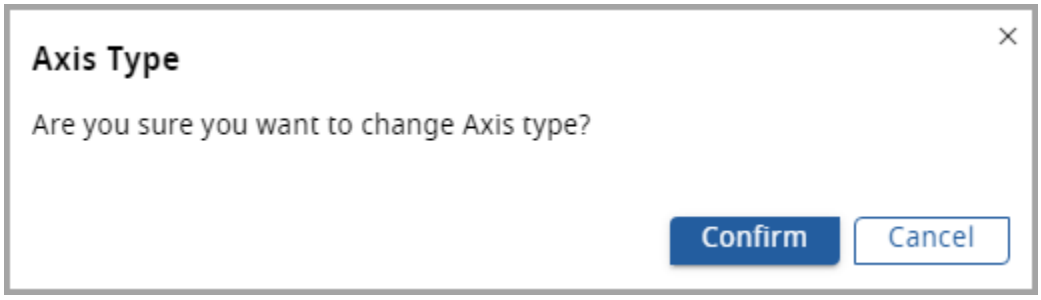
1. Under the Motion Definition menu, click [Set up Axis].

Figure: Set up Axis



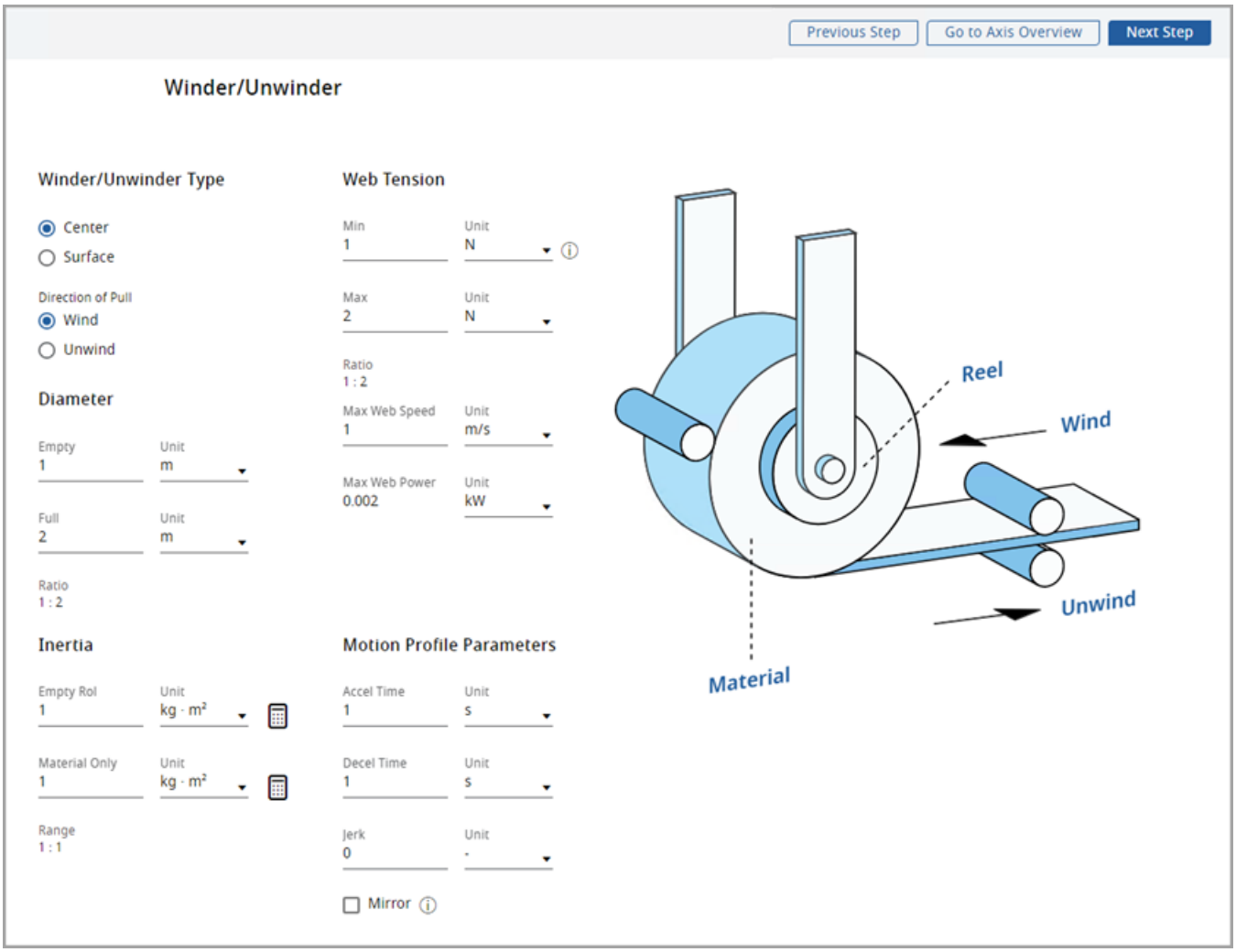
2. Under the Application Template, select the Winder/Unwinder template and click [Next Step].
3. The 'Axis Type' dialog displays. Click [Confirm].

Figure: Confirmation



4. The Winder/Unwinder template displays.

Figure: Winder/Unwinder Template



5. Provide the following details:

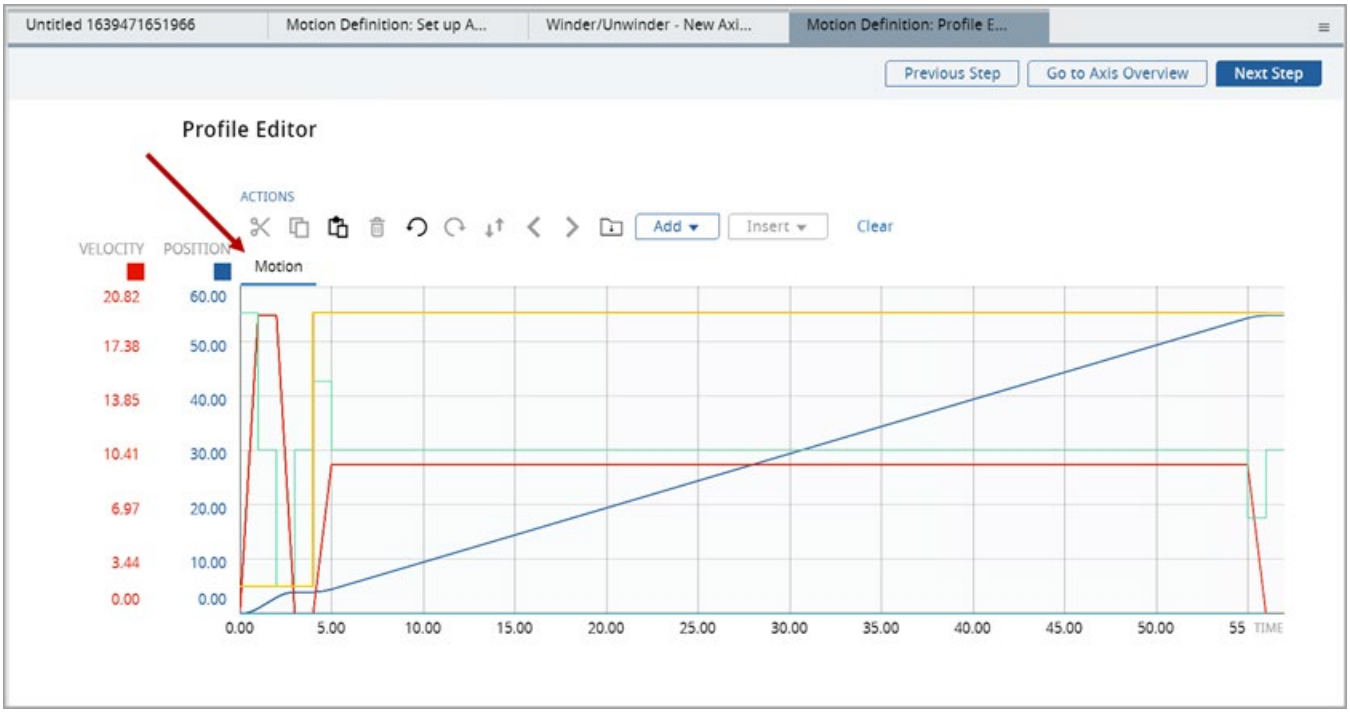
Table: Bus Context Menu

Options	Description
Winder/Unwinder Type	The type of the Winder/Unwinder: Center Driven or Surface Driven. • Center Driven: The roll is driven directly via a shaft at its center of rotation. For a Center Driven application, Rotary Load is selected, and the roll is modeled as Inertia and Torque in a Multi-segment profile. No further load information needs to be added. • Surface Driven: The roll is driven by the friction of rollers pressing onto the circumference of the web. For a Surface Driven application, Linear Load and Belt Drive are selected and the roll is modeled as Mass and Force in a Multi-segment profile. **Important**: The driving roll/rolls data should be added as Drive Roll and Idler Roll.
Motion Type	Select either Wind or Unwind for the application. This setting determines the direction of pull from the web tension.
Diameter	
Empty Diameter	Minimum reel diameter when the roll is completely unwound.
Full Diameter	Maximum reel diameter when the roll is completely wound.
Ratio	Ratio of the Maximum/Minimum diameter of the roll.
Inertia	
Empty Roll	Inertia of the reel when it is completely unwound.
Material Only	Inertia of the reel when it is at full diameter or completely wound.

Range	Ratio of Maximum/Minimum inertia values. A large inertia range value is more difficult to control.
Web Tension	
Min	Minimum web tension for the application. It is used to calculate the Tension Ratio.
Max	Maximum allowable web tension for the material. The value is used for sizing purposes.
Ratio	Ratio of the Maximum/Minimum tension values
Max Web Speed	Design speed of the material running through the machine.
Max Web Power	Maximum web tension multiplied by the maximum web speed. This power is regenerated continuously during unwind and should be catered for by suitably rated dump resistors or a regenerative power supply. Motion Analyzer software underestimates this rating by approximately 10%.
Motion Profile Parameter	
Acceleration Time	Shortest required acceleration time from zero to maximum web speed.
Deceleration Time	Shortest required deceleration time from maximum web speed to zero.
Jerk	This is the jerk for the acceleration/Deceleration of the profile segment.
Mirror	This option is used only when a Wind and Unwind axis share a DC power rail. The two axes are first sized as normal (for example, Profile Mirror is set to Off). The Winder is then set to Profile Mirror. This matches the two axis motion profiles as if they were connected by the web. This is necessary only to check the system sizing. In this mode the motor winding temperature of the Winder axis will be underestimated.

6. Click [Next Step] on the top right corner. Based on the provided parameters, the Motion Profile is defined on Profile Editor page.

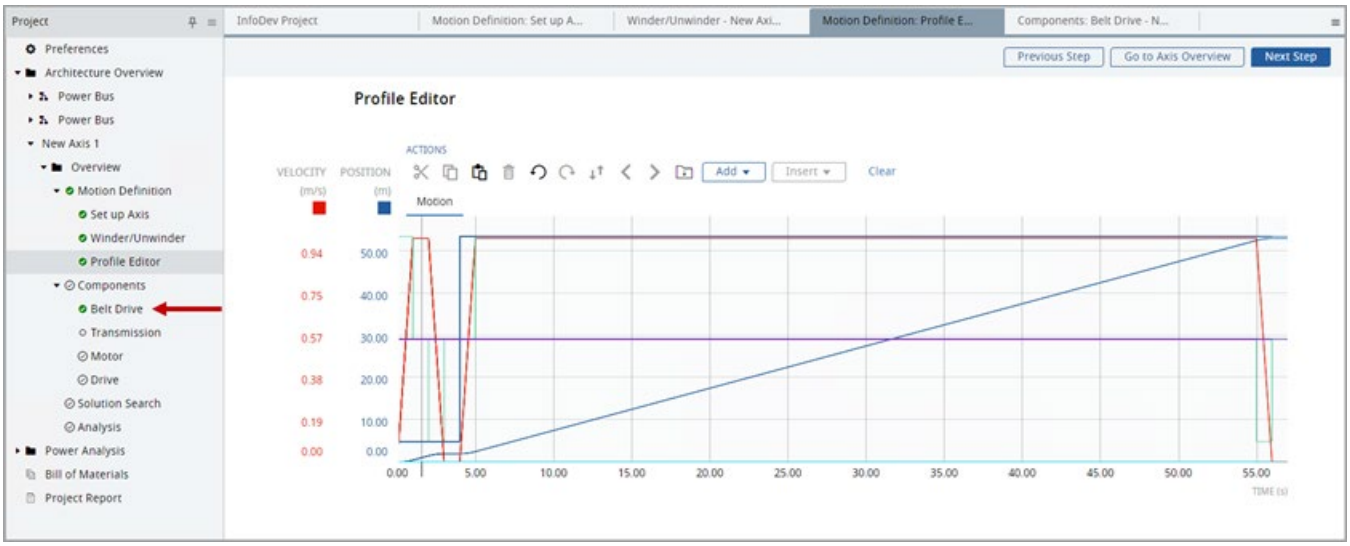
Figure: Motion Profile



7. If the user selects Surface Driven winder type, by default the Belt Drive is selected under the components.

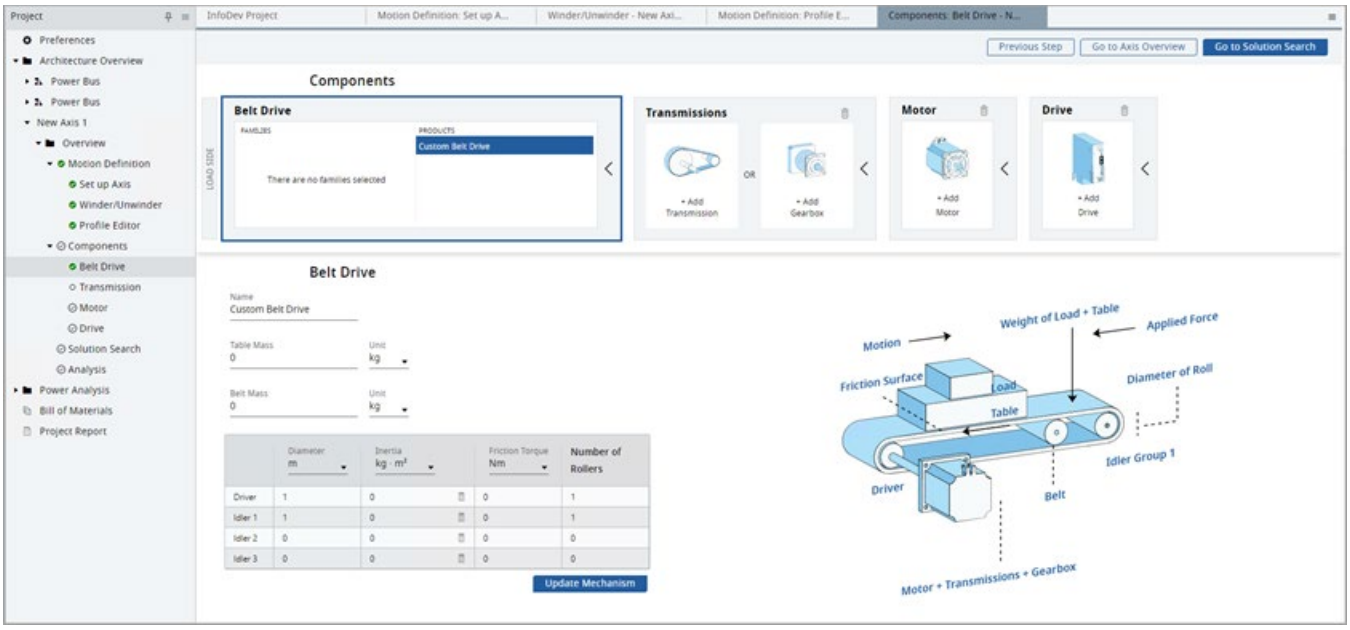
   Note: In this case, user cannot delete the Belt Drive.

Figure: Surface Driven Winder



8. Click [Belt Drive], the components page displays.

Figure: Belt Drive



9. User can update the parameters and click [Update Mechanism].

   Note: Ensure to provide valid parameters.

10. The updated values get reflected on the components section of the profile tree.
11. Refer to “Define your profile” section to proceed further.

Profile Editor Toolbar

The Profile toolbar contains buttons and pull-down menus to add, move and remove the profile segments or an entire motion profile.

Figure: Profile Toolbar Features

Table: Profile Editor Toolbar Features

Feature	Description
Cut	To remove the selected profile segment in order to place it in another location in the motion profile.
Copy	To create a copy of the selected profile segment in order to replicate the segment in another location in the motion profile.
Paste	To replace the selected profile segment with a cut or copied profile segment.
Remove	Deletes the selected profile segment. You can also click the drop-down arrow and select the Delete All option to delete all of the segments in your motion profile.
Invert Segment	To invert an index profile segment about the x-axis.
Undo	Undo last action
Redo	Redo last action
Previous Segment	Selects previous Segment
Next Segment	Selects next Segment
Add	To add profile segments to the end of your motion profile or selected segment.
Insert	To add profile segments to the start of your motion profile or before selected segment.
Clear	Clears profile

Action Toolbar

The Profile Editor Action Toolbar allows you to add, insert and modify plot profiles for Motion, Inertia, Torque and Friction. Modifications include cutting, copying, pasting, and deleting segments. You may also undo and redo recent actions, invert segments, and navigate forward and back through segments, and download your plot profile. Adding a segment to your plot profile will append the new segment to the end of your plot profile, while inserting a segment allows you to place a new segment in between existing segments.

Figure: Action Toolbar

Table: Action Toolbar

Icon	Name	Description
	Cut	Cut the selected segment from the plot profile.
	Copy	Copy the selected segment to the clipboard.
	Paste	Paste a cut or copied segment into the plot profile.
	Delete	Delete the selected segment.
	Undo	Undo last action.
	Redo	Redo last undone action
	Invert	Invert the plot profile.
	Back	Navigate back one segment.
	Forward	Navigate forward one segment.

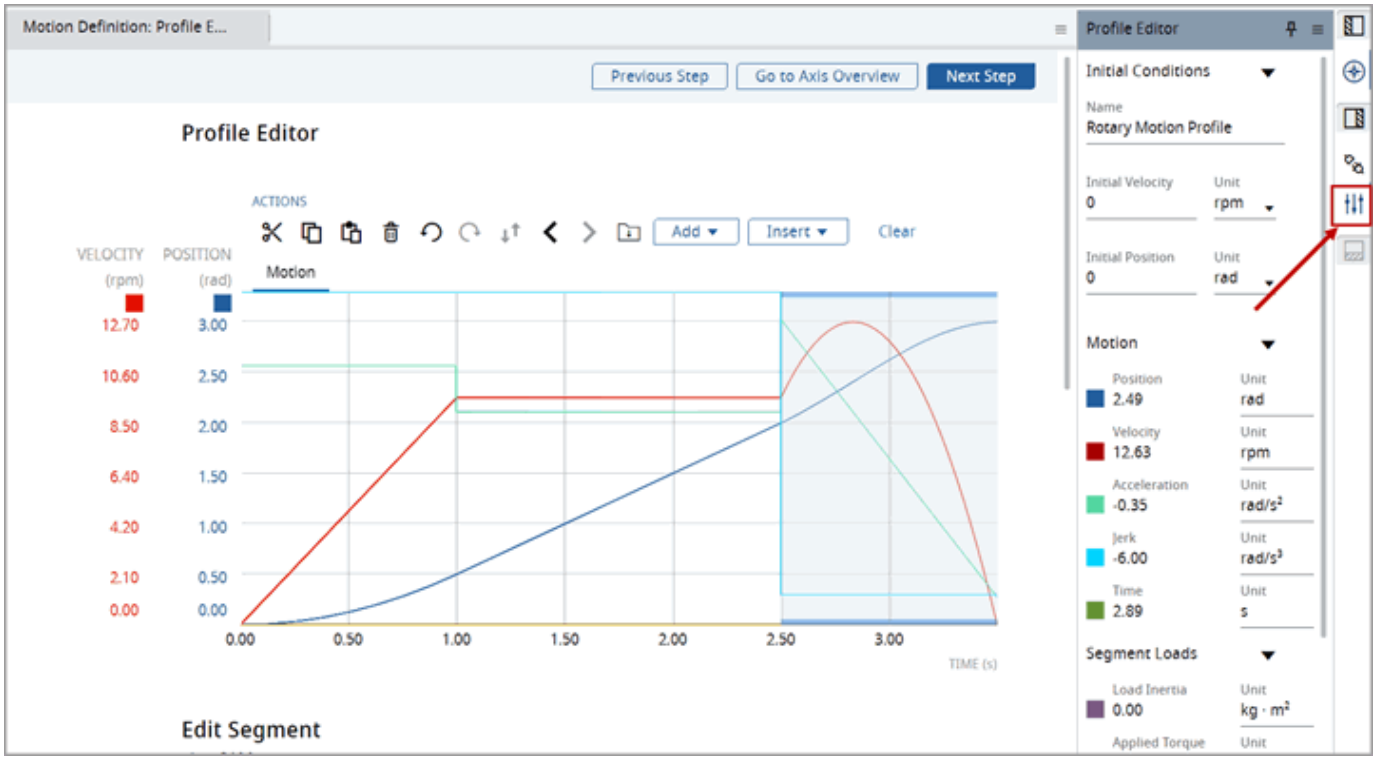
	Import Profile	To import a profile. Refer to Import Motion Profile on page 115 section to import a Motion Profile.
Add	Add	Add a new segment to the end of the plot profile. The following types of segments can be added: Acceleration/Deceleration Index Cruise/Dwell Cam Index Advance Inertia Torque Friction
Insert	Insert	Inserts a new segment between two existing segments. The segment types available in the 'Add' drop-down are also available in the 'Insert' drop-down.
Clear	Clear	Clear data from the plot profile.

NOTE: Use the mouse wheel to scroll up/down and zoom in/out within the Profile Editor.

Edit Graph

1. On the right pane, click the [ ] icon. The Profile Editor panel displays.

Figure: Edit Graph



2. Using the following options, the User can change units, toggle on/off the plots and the axes:

a. Initial Conditions: To edit the Profile name, initial velocity, and initial position along with their units.

b. Motion: To view the change in velocity, position, acceleration, jerk, and time while moving the cursor on the graph at a given time. The Profile Editor panel allows the User to change the

units, hide/show a parameter, and the Y-axis toggle button allows the User to toggle the Y-axis on/off on the plot and may also be used to gain space.

c. Segment Loads: To view the Load Inertia and Applied torque values. The Profile Editor panel allows the User to change the units, hide/show the parameter, and the Y-axis toggle button allows the User to toggle the Y-axis on/off on the plot and may also be used to gain space.

d. Additional Loads: To view the Inertia, torque, and friction values. The Profile Editor panel allows the User to change the units, hide/show the parameter, and the Y-axis toggle button allows the User to toggle the Y-axis on/off on the plot and may also be used to gain space.

NOTE: Only the initial condition can be edited. The other options are used to change the display options (hide/show, change UoM) and does not affect the profile. User can change the units, toggle on/off the plots and the axes, but cannot support swapping of axes.

3. Each colored line indicates a unique parameter in the motion profile.
4. Use the View option [] to hide/show the graph of a particular parameter.

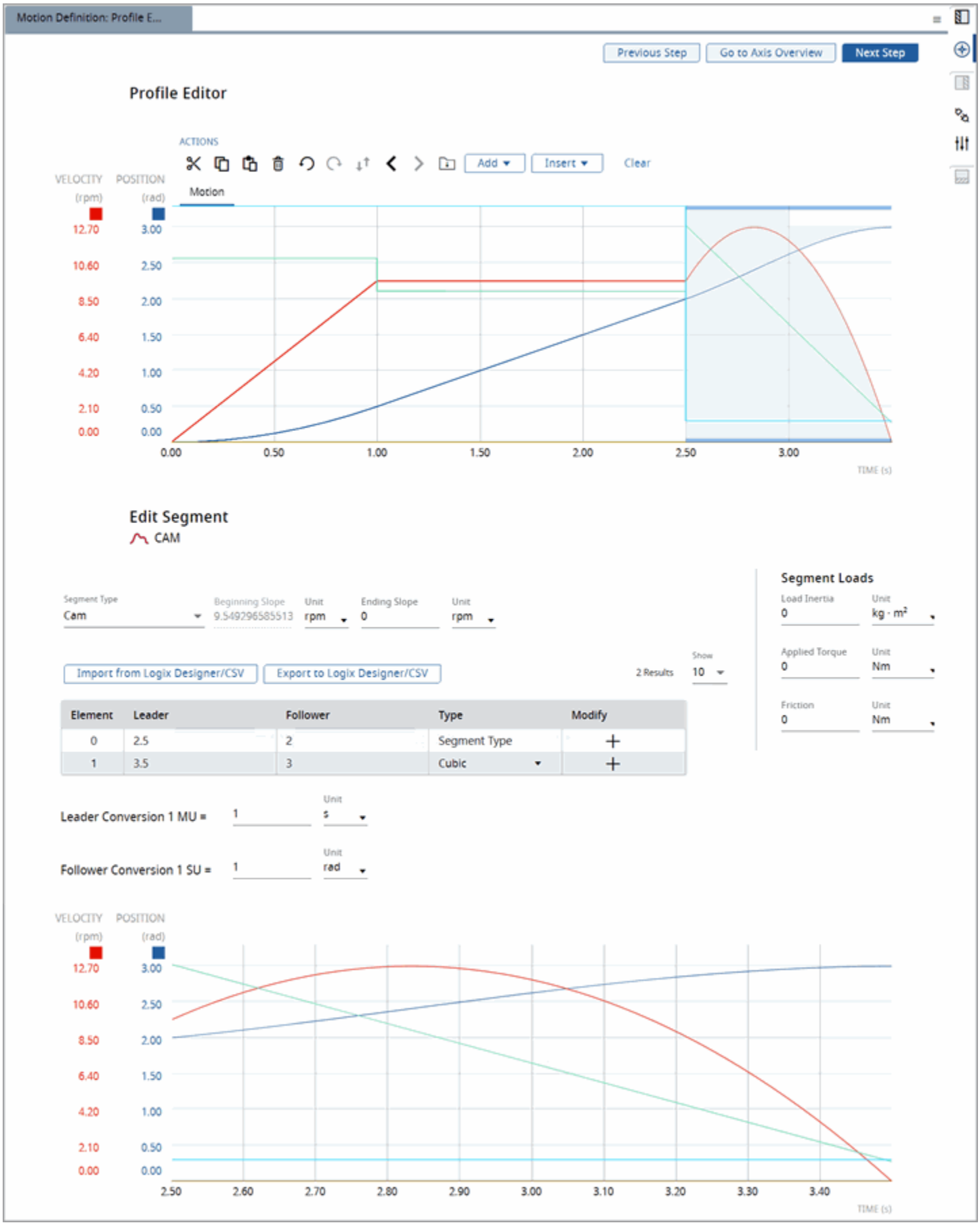
TIP: Use the mouse wheel to scroll up/down and zoom in/out within the Profile Editor.

Edit Segment

Perform the following steps to edit a segment:

1. Select the type of a segment, the selected segment gets highlighted, and the respective edit panel and the graph displays in the second plot as shown in the following image:

Figure: Edit Segment



2. Each Profile Segment Type has a different associated Segment Edit window:

Table: Edit Segment

Parameter	Description
Accel/Decel	Provides parameters for an Acceleration or Deceleration profile segment.
Index	Provides parameters for an Index profile segment. An Index profile segment consists of an Acceleration, a Cruise, and a Deceleration.
Cruise/Dwell	Provides parameters for a Cruise or Dwell profile segment. The profile segment is considered a Cruise if the velocity at the end of the previous profile segment is non-zero and is considered a Dwell if that velocity is zero.
Cam	Provides parameters for a Cam profile segment.
Index Advance	To select more advanced velocity, acceleration, and jerk profiles for an Index profile segment.

Segment Loads

Load Inertia	Load inertia for a given segment.
Applied Torque	Torque applied at the given position.
Friction	Torque loss due to friction.

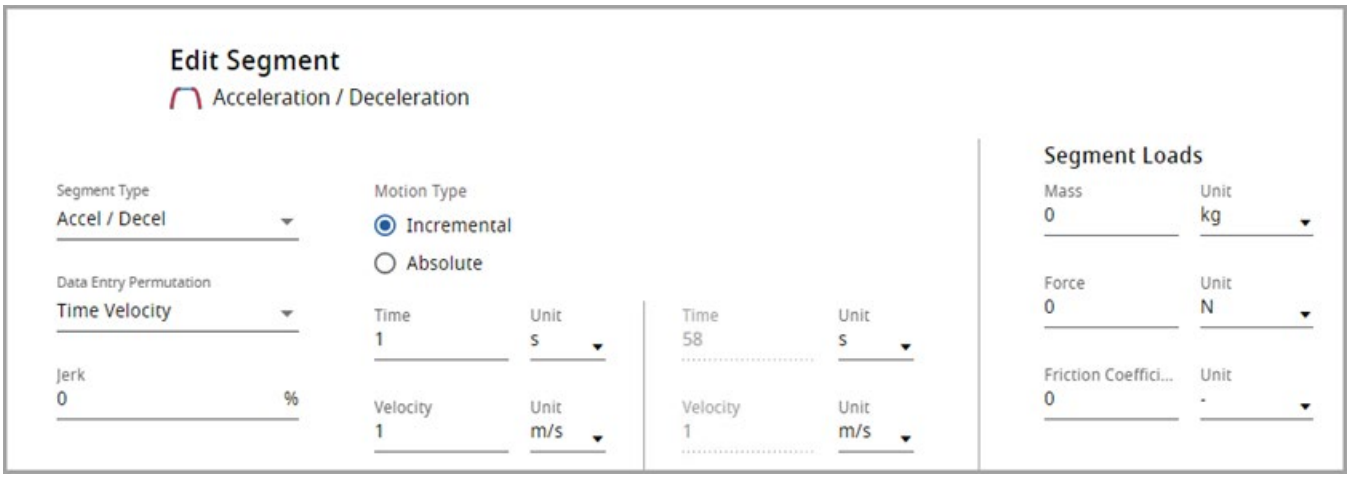
Accel/Decel

Provide the following parameters for Acceleration/Deceleration:

Table: Accel/Decel

Parameter	Description
Data Entry Permutation	Select an option to provide the profile segment parameters: • Time Distance • Time Velocity • Time Acceleration • Distance Velocity • Distance Acceleration • Velocity Acceleration
Jerk	Provide a value to set the amount of S-curve of the Acceleration/Deceleration profile segment. Increasing the percent jerk increases the amount of S-curve.
Motion Type	Select whether to input Incremental or Absolute parameter values. • Incremental values represent the change either in the distance or time that occurs during the profile segment. • Absolute values represent the total distance or time elapsed throughout the entire motion profile.
Distance/Time/Velocity/Acceleration	Provide the parameter for any one of the Distance/Time/Velocity/Acceleration based on the Data Entry Permutation selection to define the profile segment.

Figure: Accel/Decel



Index

Provide the following parameters for Index:

Table: Index

Parameter	Description
Index Type	**Triangle:** 1/2 acceleration and 1/2 deceleration motion profile. **Trapezoidal:** This index type allows the User to use sliders to provide the velocity and time axes of the motion profile. **Vertical Bar:** Adjusts the height/velocity component of the motion profile. As the value of the slider is increased, more time is spent accelerating and decelerating the load and less time is spent dwelling at a constant velocity. **Horizontal Bar:** Adjusts the ratio of the time spent accelerating to the time spent decelerating for the profile segment. A negative value on the slider indicates that more time is spent decelerating the load than accelerating it. A positive value on the slider indicates that more time is spent accelerating the load than decelerating it.
Smoothness	**Custom:** 0% Jerk (Trapezoidal) **Standard/Automatic:** 40% Jerk (Partial S-curve) **Maximum:** 100% Jerk (Full S-curve)
Acceleration Jerk/Deceleration Jerk	The percent of time for Acceleration/Deceleration Jerk increases the peak acceleration (and therefore current) above that of a trapezoidal motion profile. The acceleration of a trapezoidal motion profile is taken to be 100%.
Motion Type	Select whether to input Incremental or Absolute parameter values. Incremental values represent the change in either the distance or time that occurs during the profile segment Absolute values represent the total distance or time elapsed throughout the entire motion profile.
Distance/Time	Select and enter either the Distance or Time parameter to define the profile segment.
Positive/Negative Velocity Limit	When the User provide the Positive or Negative Velocity Limit for the profile, Motion Analyzer adjusts the acceleration and deceleration times required to reach the desired velocity limits.

Figure: Index

Table: Segment Loads

Parameter	Description
Load Inertia	Load inertia for the given segment.
Applied Torque	Torque applied at the given position.
Friction	Toque loss due to friction.

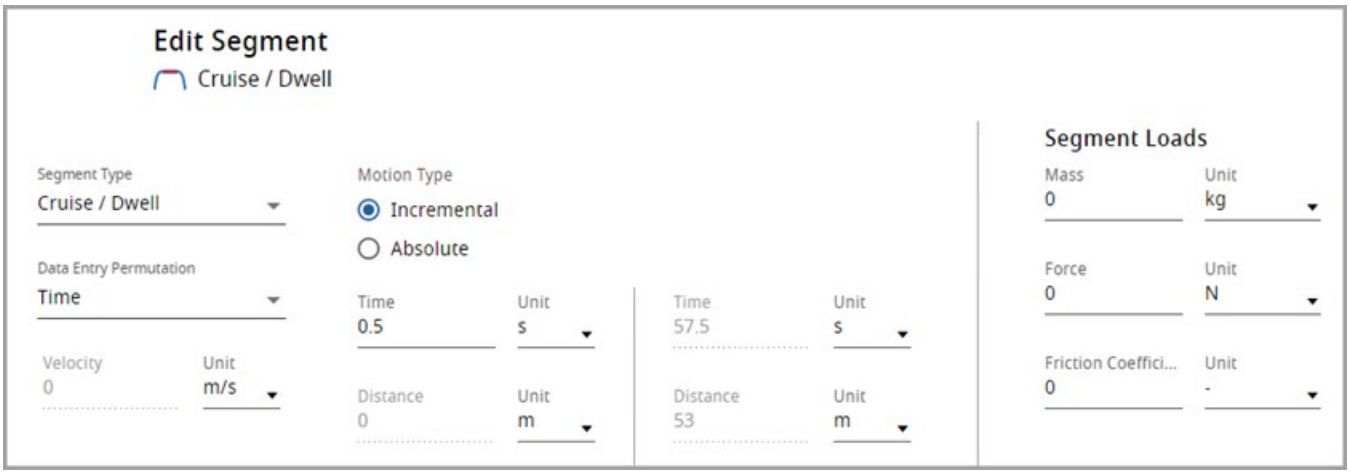
Cruise/Dwell

Provide the following parameters for Cruise/Dwell:

Table: Cruise/Dwell

Parameter	Description
Data Entry Permutation	Select an option to provide the profile segment parameters: • Time • Distance
Motion Type	Select whether to input Incremental or Absolute parameter values: • Incremental values represent the change either in the distance or time that occurs during the profile segment. • Absolute values represent the total distance or time elapsed throughout the entire motion profile.
Segment Loads	Provide the parameter for any one of the following: • Load Inertia • Applied Torque • Friction

Figure: Cruise/Dwell



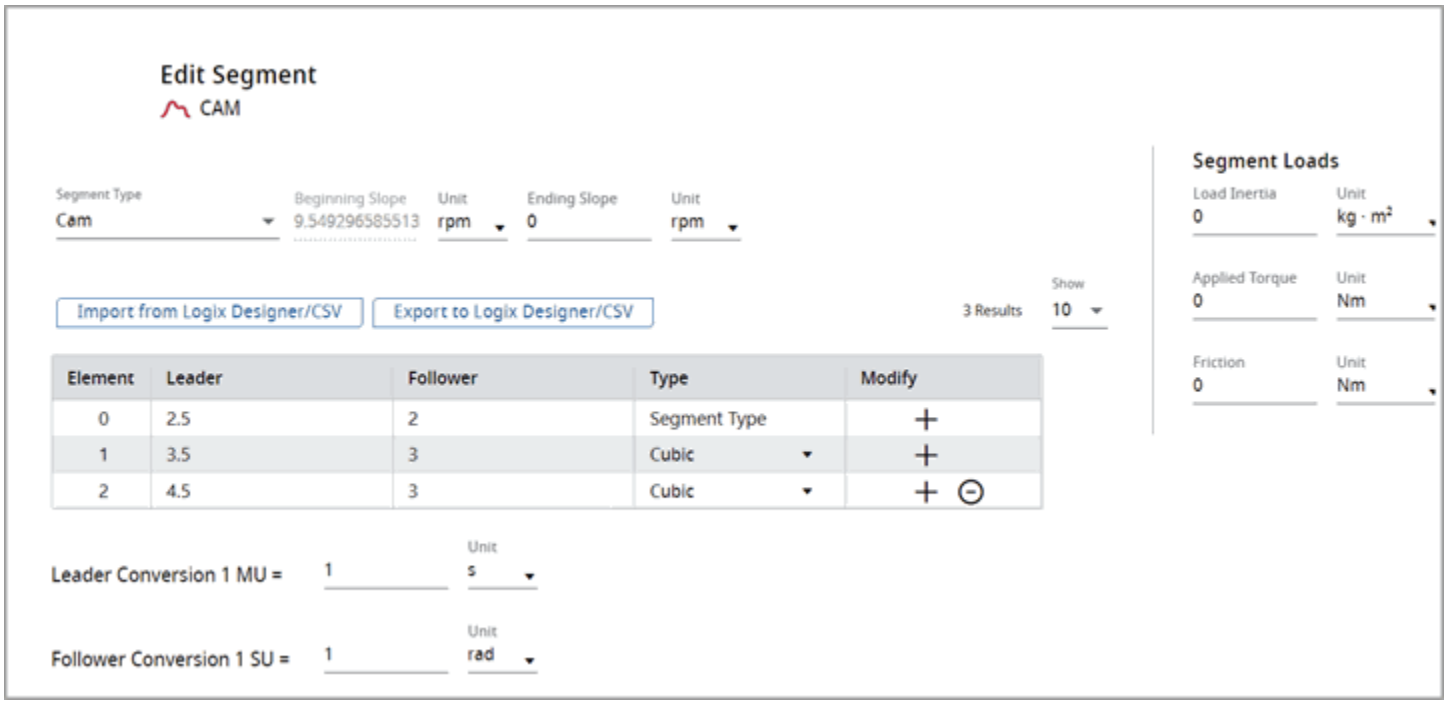
Cam

Provide the following parameters for Cam:

Table: Cam

Parameter	Description
Beginning Slope	Provide the slope value for the beginning of the segment.
Ending Slope	Provide the slope value for the end of the segment.
Import from Logix Explorer	Import data from Logix.
Export to Logix Explorer	Export data to a clipboard.
Master/Slave Elements	Use the [+] and [-] icon under the Modify column to add or remove Master and Slave elements or modify the segment type. The following segment types are available: • Linear • Cubic
Show	View the desired number of elements.
Master Conversion 1 MU	Specify the conversion factor and unit to be used in Master Conversion.
Slave Conversion 1 SU	Specify the conversion factor and unit to be used in Slave Conversion.
Segment Loads	Provide the parameter for any one of the following: • Load Inertia • Applied Torque • Friction

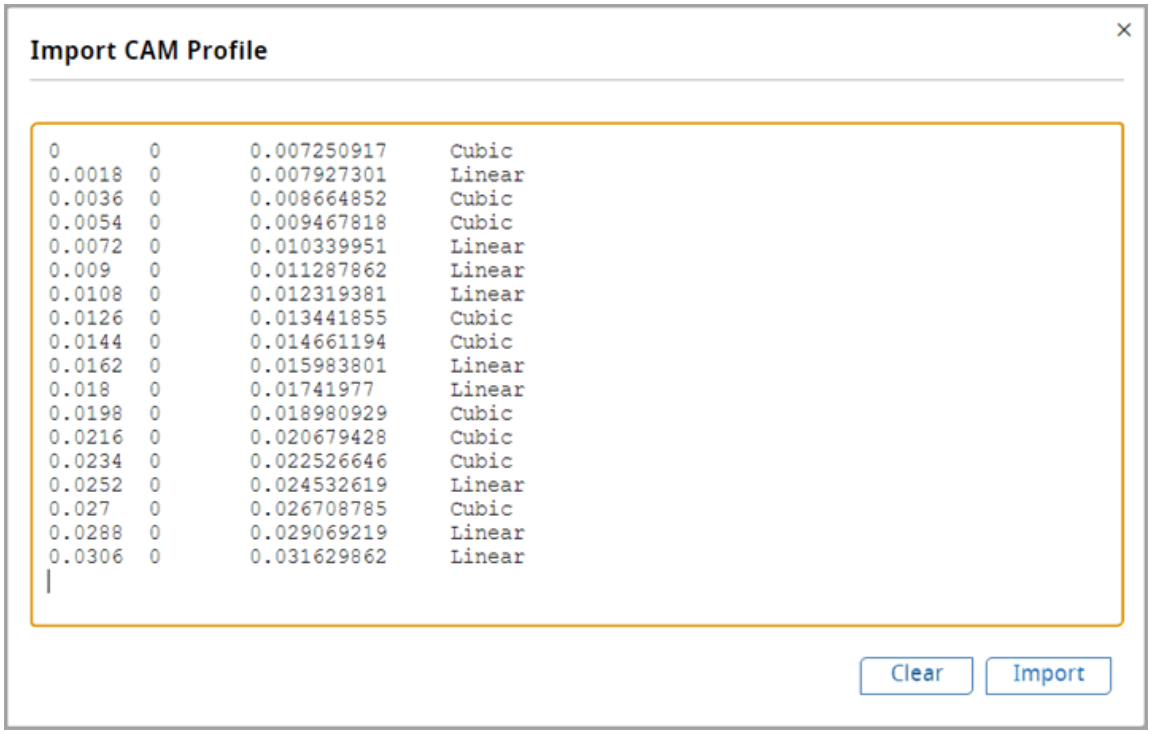
Figure: Cam



To import data from Logix:

1. Click [Import from Logix Explorer]. The Import CAM Profile dialog displays.

Figure: Import CAM Profile



2. Copy the data from a clipboard. The User has the privilege to edit the data on this editor.

NOTE: Ensure that the data provided is valid and is in ascending order. The maximum number of elements allowed is 300 and the minimum is 2. Segment name must be either cubic or linear.

3. Click [Clear] to clear the input data in the editor.
4. Click [Import]. The data is displayed in the table and the relevant changes are reflected in the graph.

Figure: Import

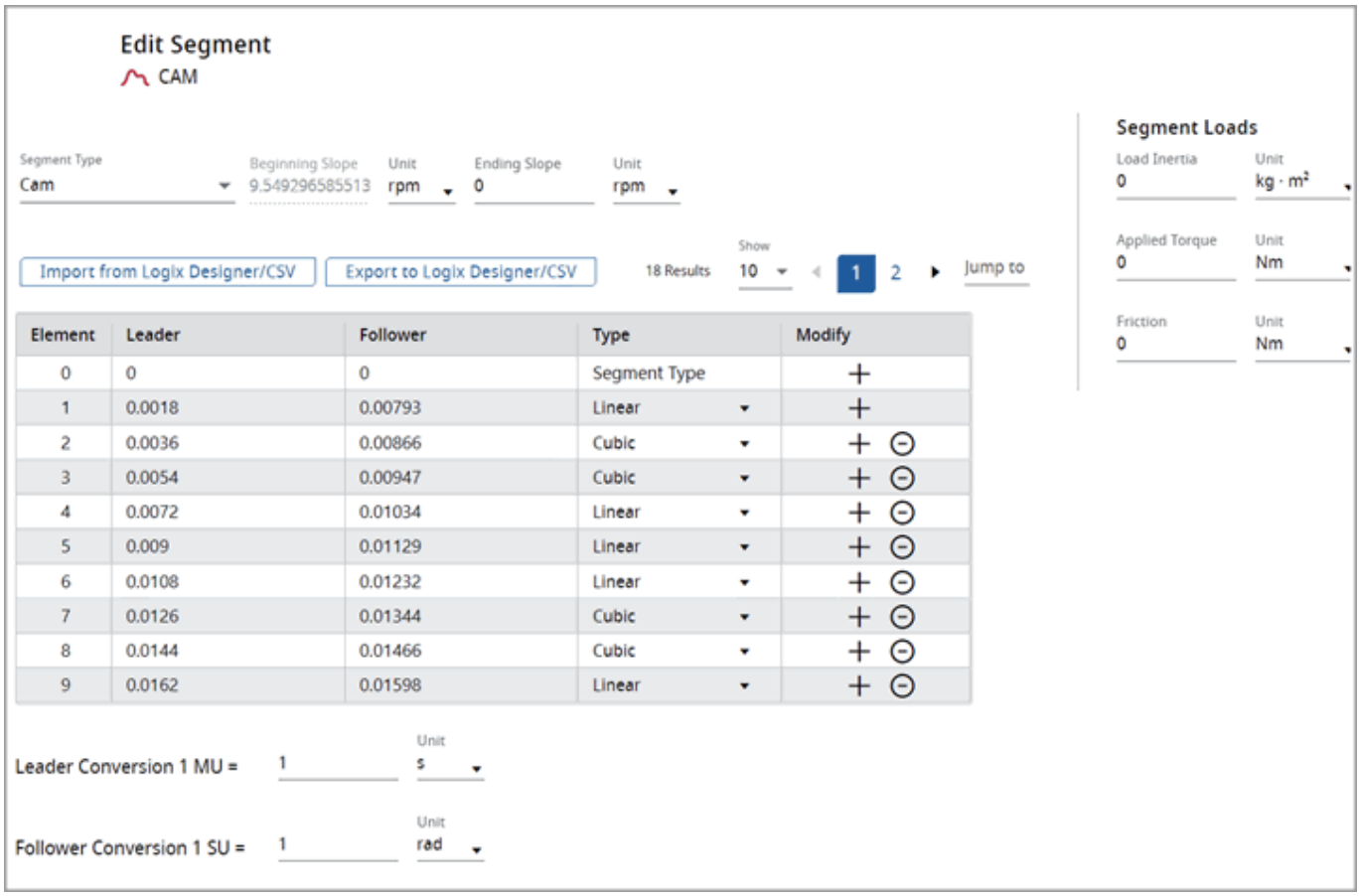
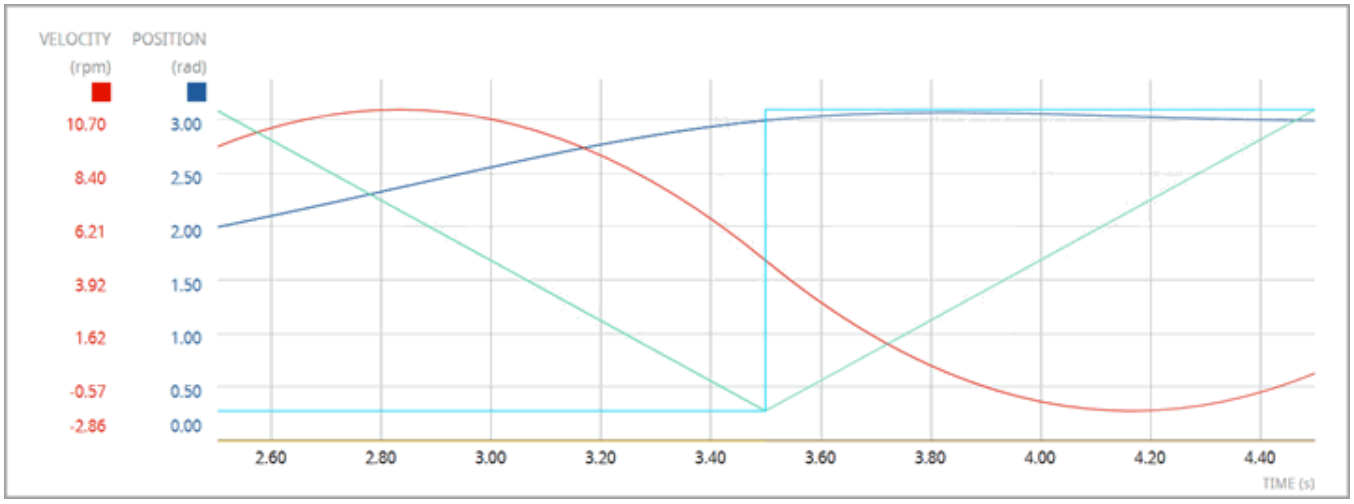
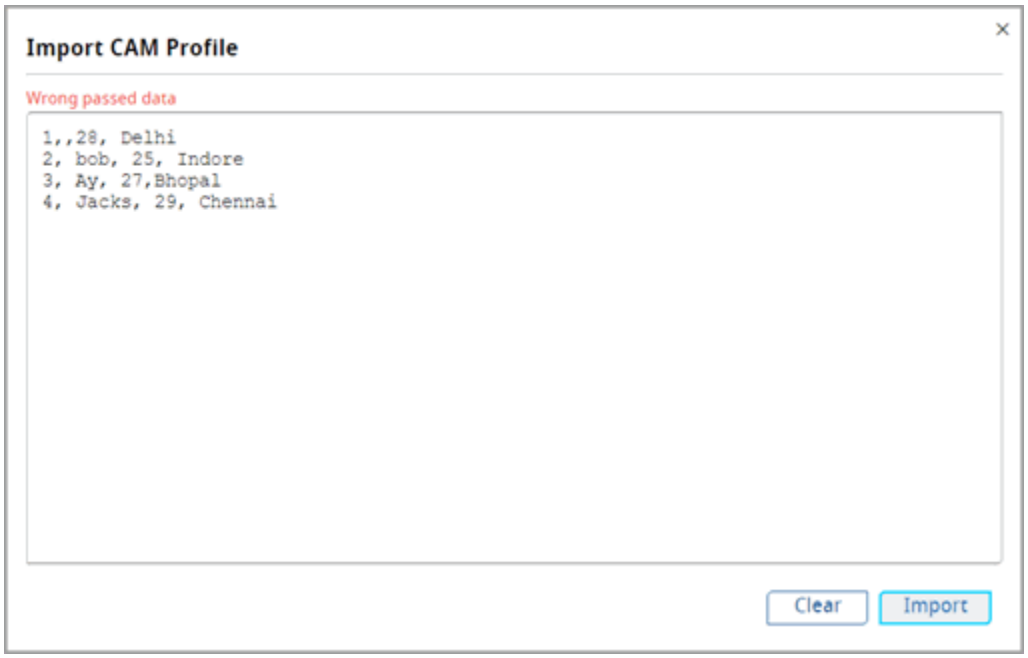


Figure: Import Graph



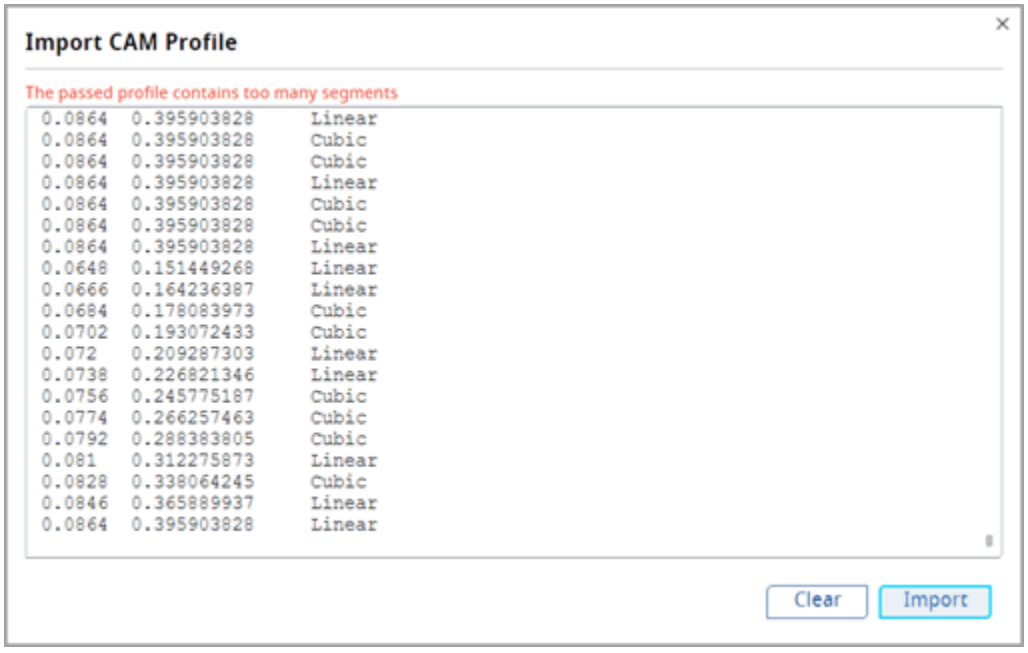
5. If the data being imported through the editor is invalid, a validation message will display.

Figure: Invalid Data



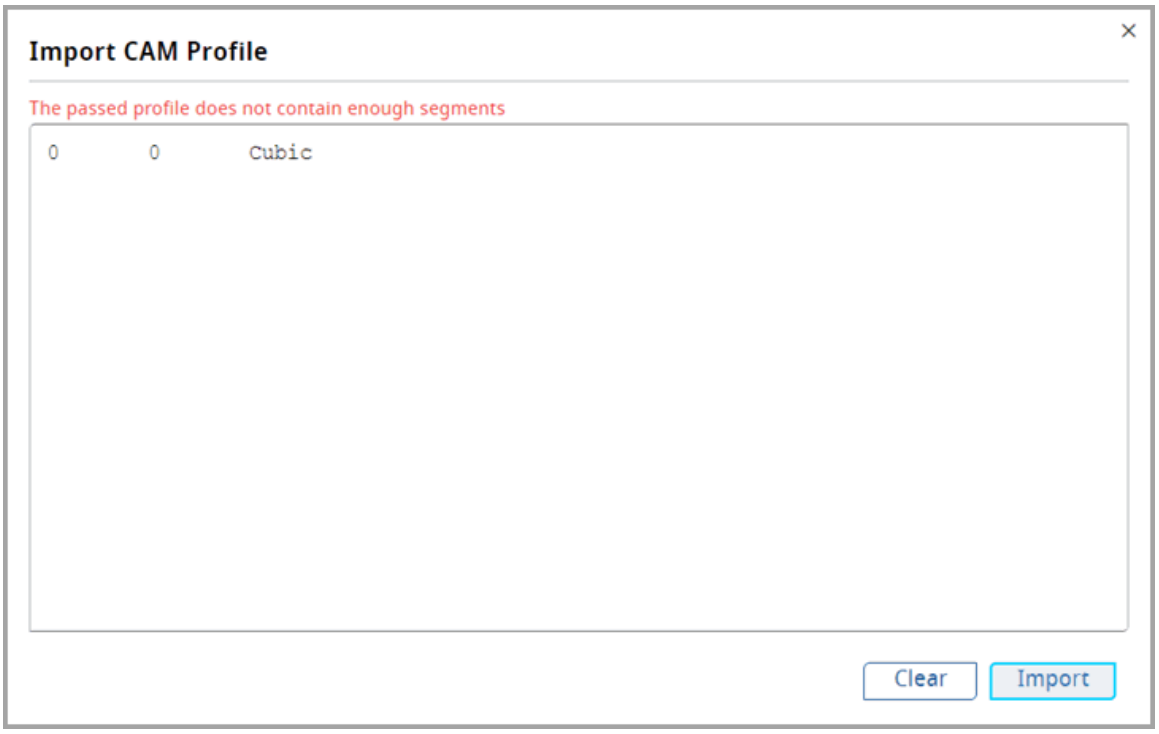
6. If the data being imported contains more than 300 segments, a message stating that *"the pasted profile contains too any segments"* will display.

Figure: Too Many Segments



7. If the data being imported contains less than 2 segments, a message stating that *"the pasted profile does not contain enough segments"* will display.

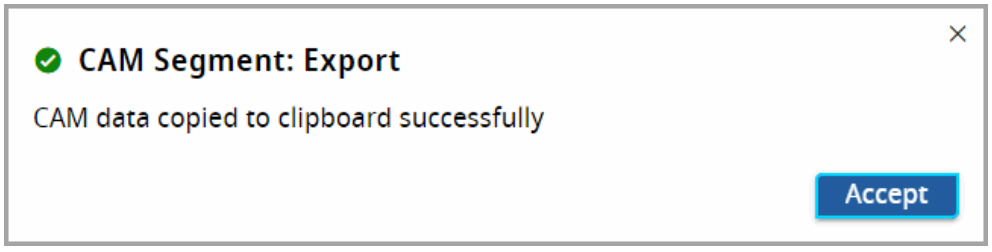
Figure: Not Enough Segments



To export the data to a clipboard:

1. Click [Export to Logix Explorer]. The Cam Segment Export dialog displays.

Figure: Export



2. Click [Accept]. The data will be copied to a clipboard. The exported data matches the data in the table.

Index Advance

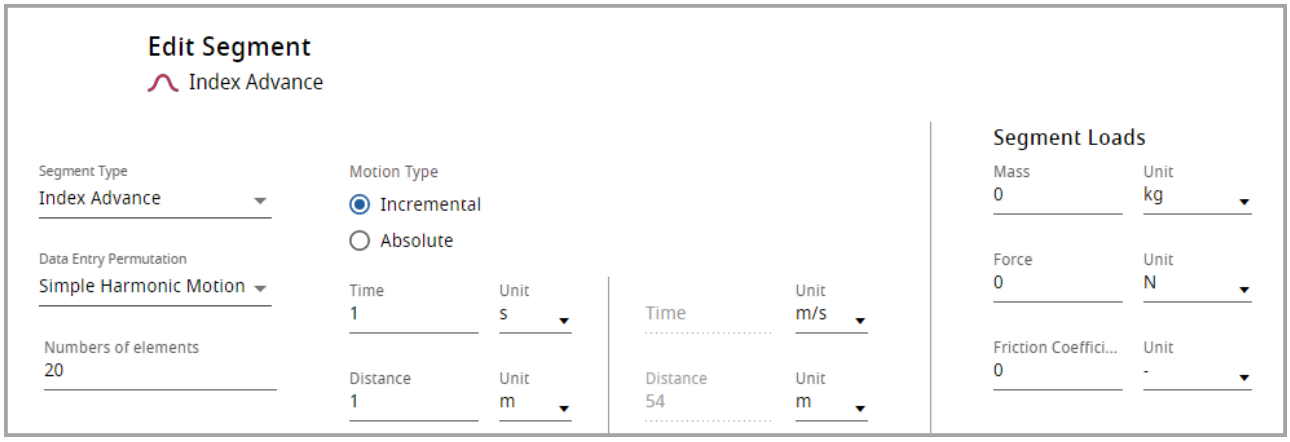
Provide the following parameters for Index Advance:

Table: Index Advance

Parameter	Description
Data Entry Permutation	Select the Data Entry Permutation. • Simple Harmonic Motion • 2-3 Polynomial • 3-4-5 Polynomial • 4-5-6-7 Polynomial • Modified Sine • Adjusted Sine • Modified Trapezoid

Parameter	Description
Number of Elements	Provide the desired number of elements.
Motion Type	Select whether to input Incremental or Absolute parameter values. • Incremental values represent the change either in the distance or time that occurs during the profile segment. • Absolute values represent the total distance or time elapsed throughout the entire motion profile.
Segment Loads	Provide the parameter for any one of the following: • Load Inertia • Applied Torque • Friction

Figure: Index Advance



Additional Loads

Edit Segment provides the User with the option to select additional loads, which include Inertia, Torque, and Friction. To select a load, click the ADD or INSERT buttons and click the desired load. Once the load segment is added, the User may edit the load parameters in the Additional Loads input pane and view the changes on the Segment Graph.

Inertia

Provide the following parameters for Inertia:

Table: Inertia

Parameter	Description
Permutation (Variable)	The following parameters can be defined for Variable Permutation: • Start Time: Define the start time and the desired unit of measurement. • End Time: Define the end time and the desired unit of measurement. • Start Inertia: Define the start inertia and the desired unit of measurement. • End Inertia: Define the end inertia and the desired unit of measurement.
Permutation (Constant)	The following parameters can be defined for Constant Permutation: • Full Load: Define the full load value and the desired unit of measurement.

Click Apply Changes when you are finished.

Figure: Inertia - Variable Permutation

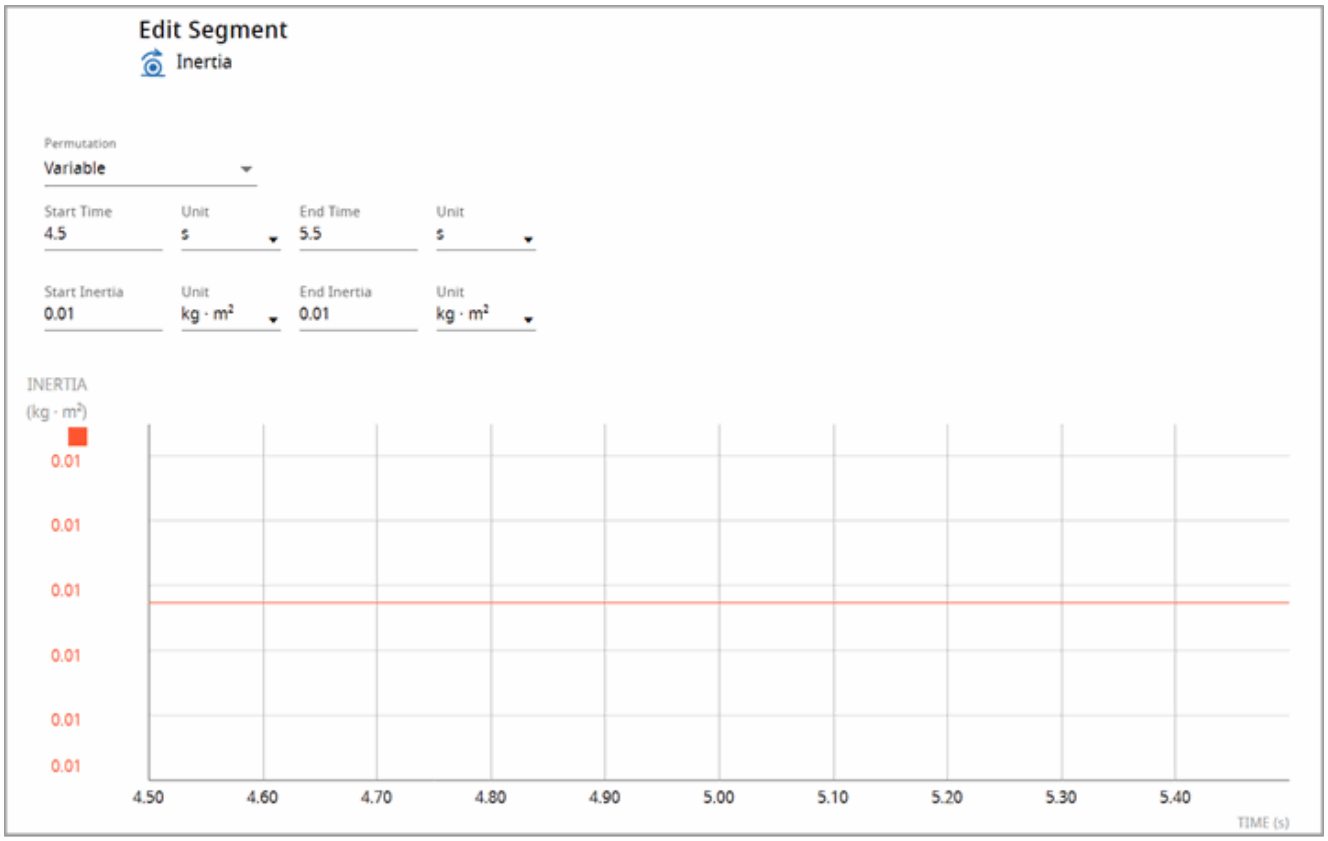
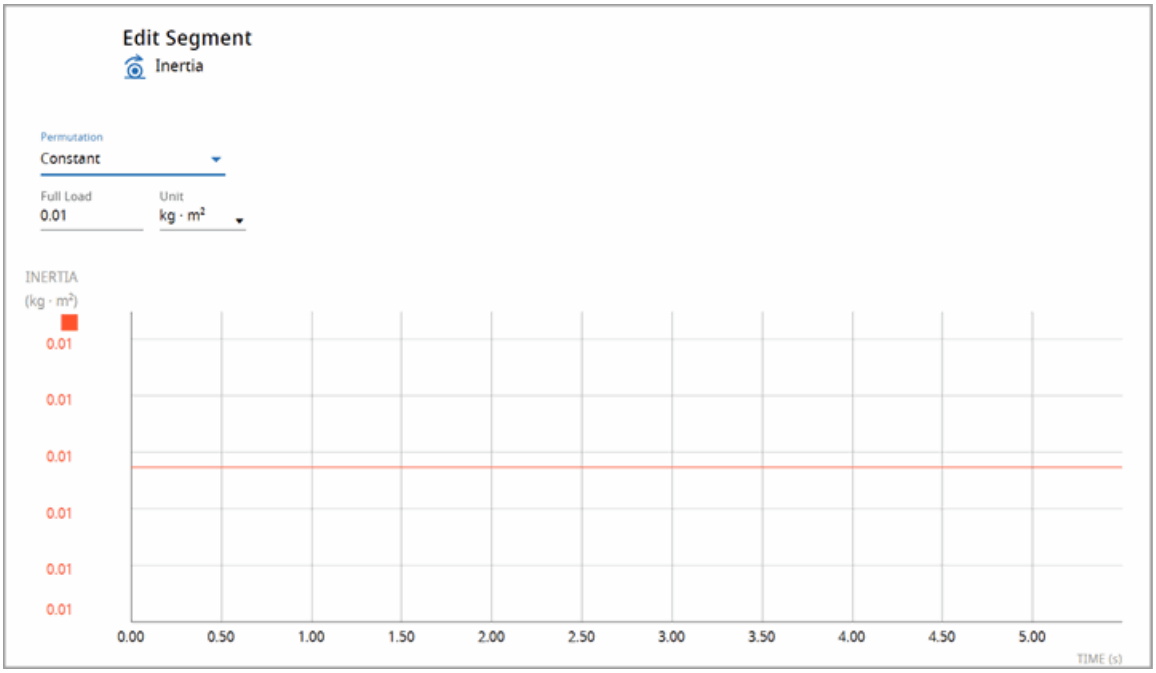


Figure: Inertia - Constant Permutation



Torque

Provide the following parameters for Torque:

Table: Torque

Parameter	Description
Permutation (Variable)	The following parameters can be defined for Variable Permutation: • Start Time: Define the start time and the desired unit of measurement. • End Time: Define the end time and the desired unit of measurement. • Start Torque: Define the start torque and the desired unit of measurement. • End Torque: Define the end torque and the desired unit of measurement.
Permutation (Constant)	The following parameters can be defined for Constant Permutation: • Full Load: Define the full load value and the desired unit of measurement.

Click Apply Changes when you are finished.

Figure: Torque - Variable Permutation

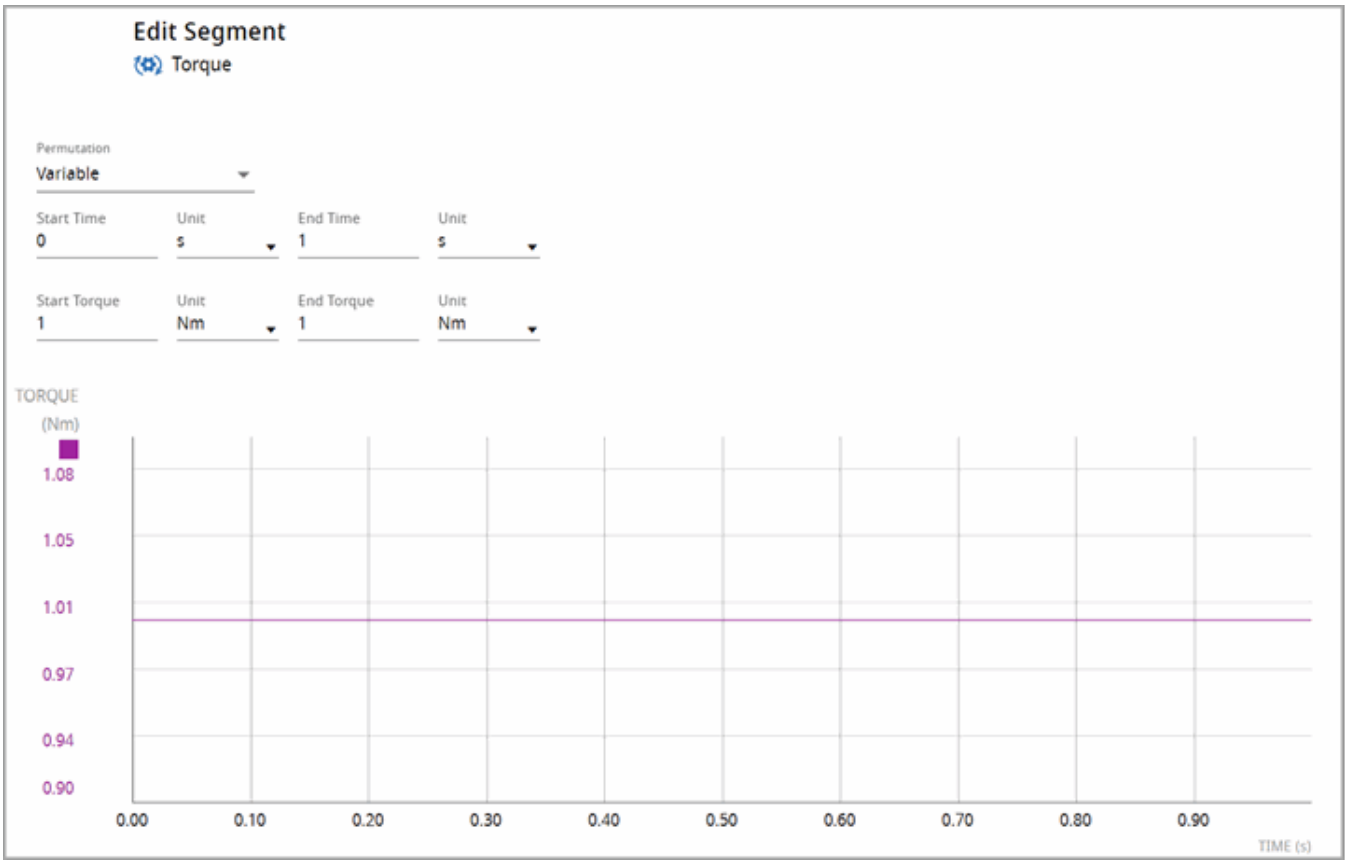
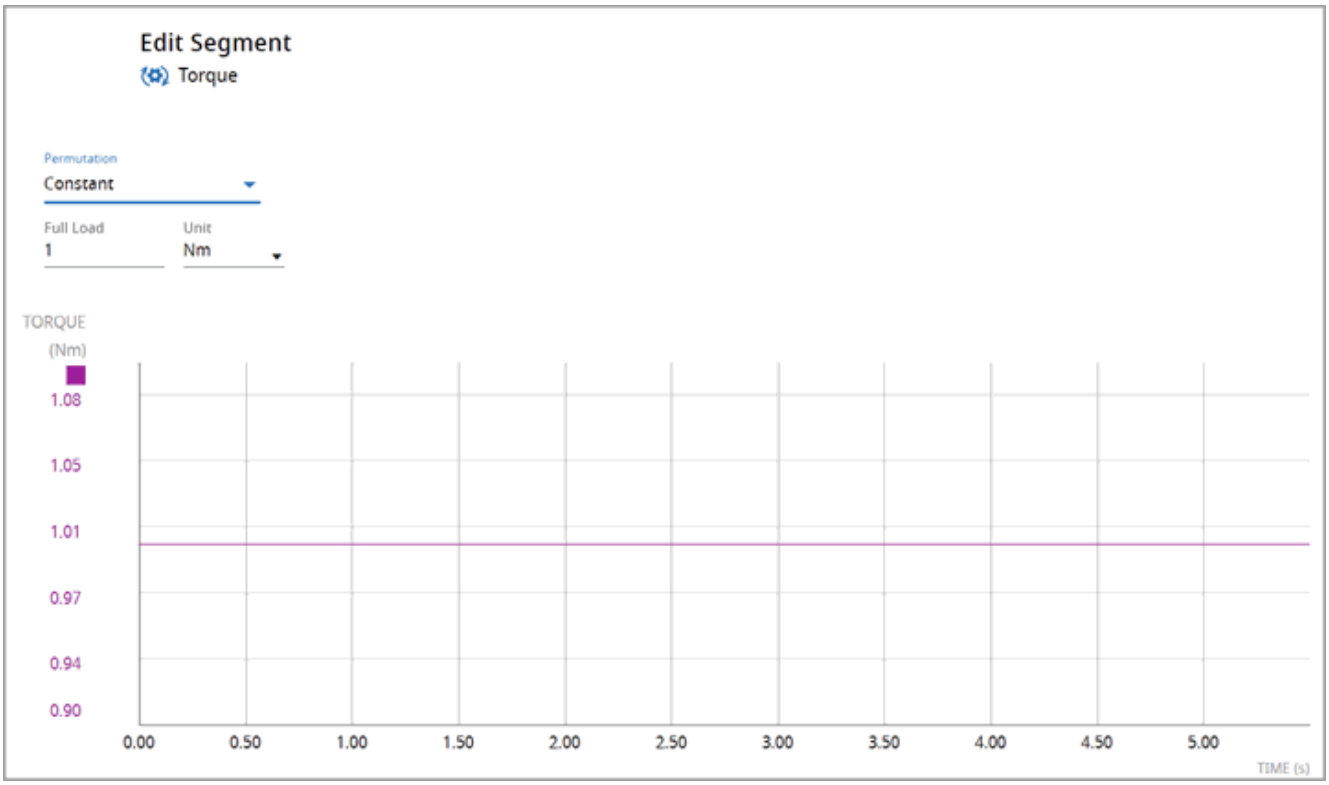


Figure: Torque - Constant Permutation



Friction

Provide the following parameters for Friction:

Table: Friction

Parameter	Description
Permutation (Variable)	The following parameters can be defined for Variable Permutation: • Start Time: Define the start time and the desired unit of measurement. • End Time: Define the end time and the desired unit of measurement. • Start Friction: Define the start friction and the desired unit of measurement. • End Friction: Define the end friction and the desired unit of measurement.
Permutation (Constant)	The following parameters can be defined for Constant Permutation: • Full Load: Define the full load value and the desired unit of measurement.

Click [Apply Changes].

Figure: Friction - Variable Permutation

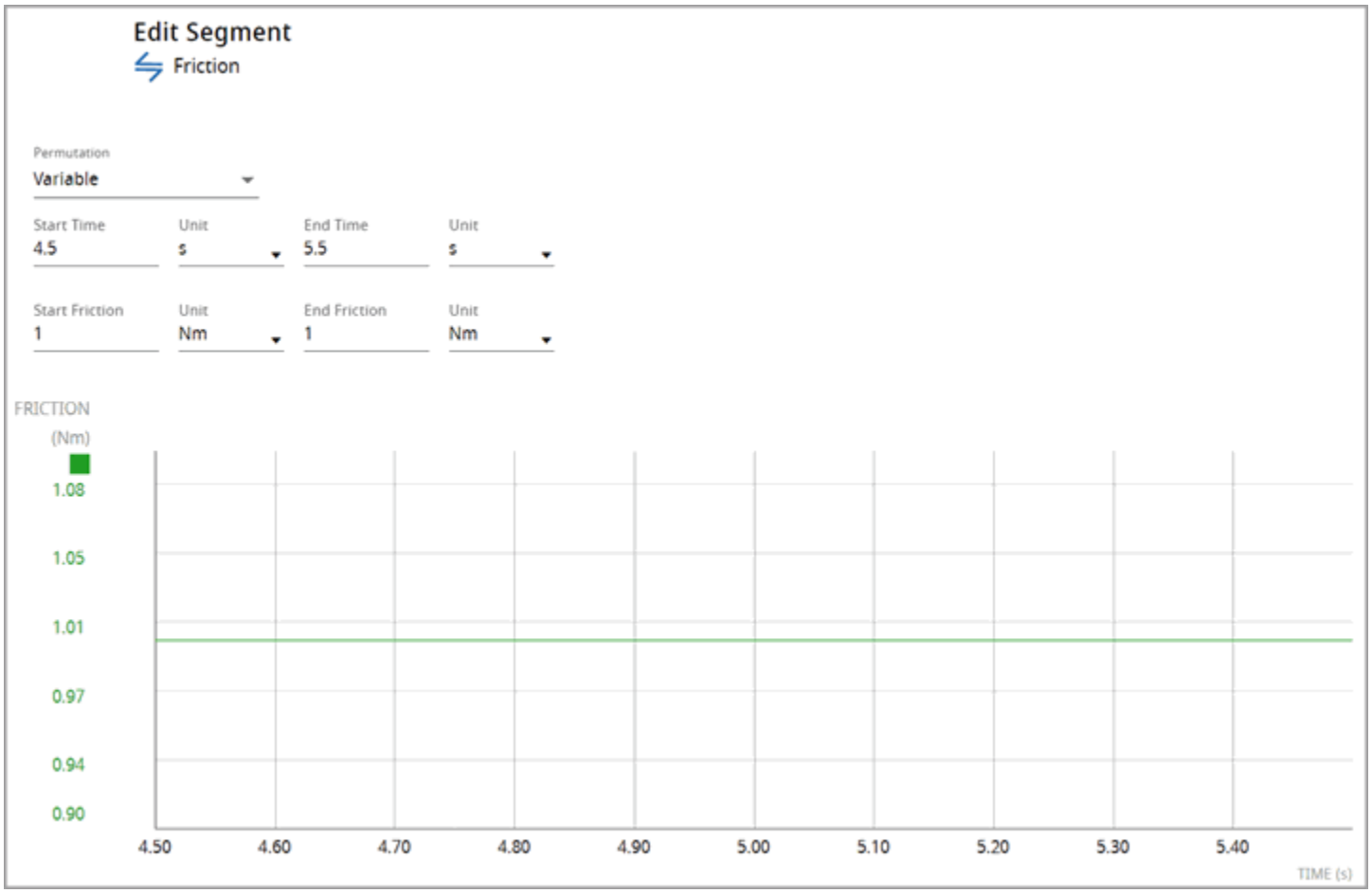
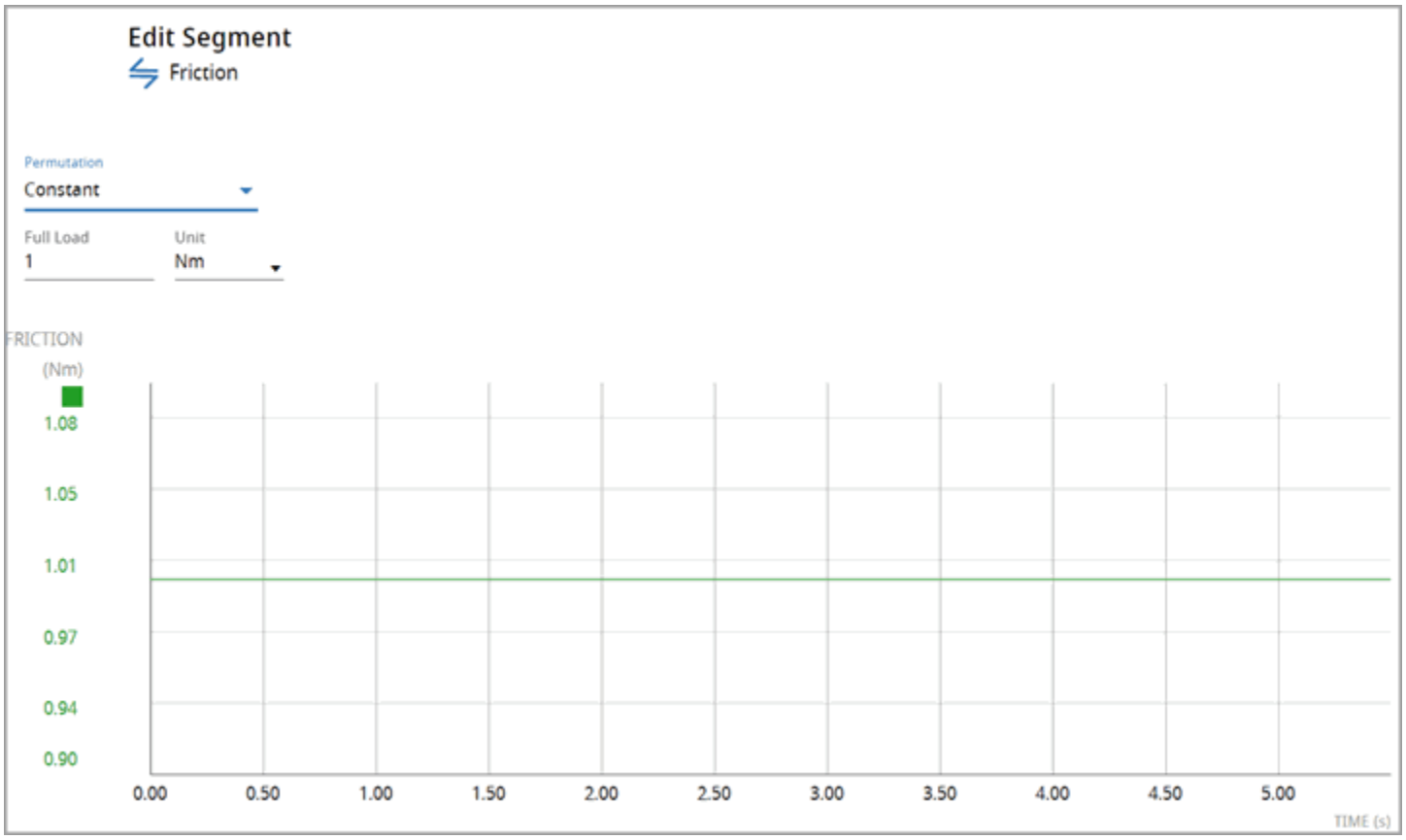


Figure: Friction - Constant Permutation



Import Motion Profile

This section describes the Excel format in which imported Motion Profile shall be defined. It covers several mandatory points how such file should be implemented along with screenshot examples attached to the explanations.

The document is split into chapters describing separate Excel worksheets, responsible for defining the Motion Profile data, the motion itself and loads.

Prerequisites

When importing Motion Profile using the excel template, one must remember that given profile can be imported only to the Axis with the same type, ex. Rotary profile can be imported only to the Rotary Axis. Profile imported to Axis with different type will result in error.

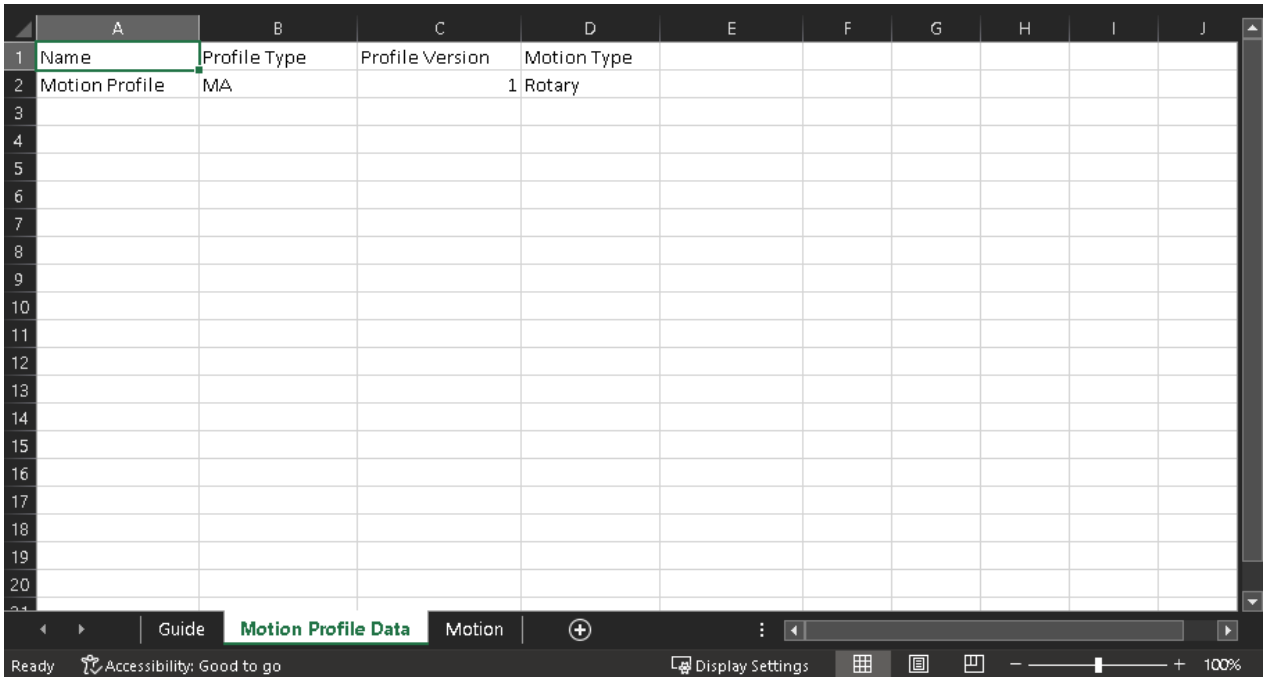
General Data

Under this term rely on such things as Name, Profile Type, Profile Version and Motion Type.

This data must be defined in a separate worksheet named as “**Motion Profile Data**”.

Each of these values must be defined as separate column, as shown on the example below.

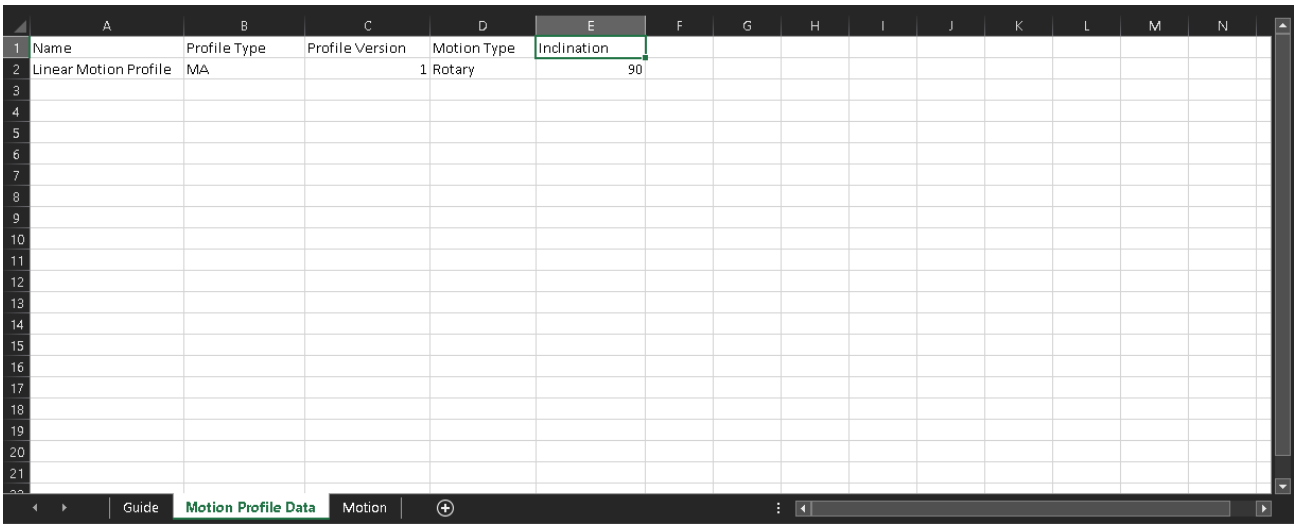
Figure: Example of Motion Profile Data Worksheet



Columns Explanation

- Name should contain single row with value representing the name of the Motion Profile,
- Profile Type – should have single row with MA value
- Profile Version - should have single row with 1 value, which represents the Motion Profile format version
- Motion Type - describes the type of the Motion Profile; this accepts values such as Rotary or Linear
- Inclination - column should be added if the Motion Profile is Linear type; the value must be provided in degrees

Figure: Linear Motion Profile Data Worksheet Example



Loads

The Motion Profile can have loads defined. These should be defined as separate worksheets, named as following:

For Rotary Motion Profiles:

- **Inertia**: The name of worksheet is **{Inertia}** in **[kg · m2]**
- **Torque**: The name of worksheet is **{External Force or Torque}** in **[Nm]**
- **Friction**: The name of worksheet is **{Friction}** in **[Nm]**

For Linear Motion Profiles:

- **Weight (mass)**: The name of worksheet is **{Weight}** in **[kg]**
- **Force**: The name of worksheet is **{Force}** in **[N]**
- **Friction Coefficient**: The name of worksheet is **{Friction Coefficient}**

Each of the worksheets representing the loads must be defined in specific format.

The first cell within the worksheet represents the **Name** of the Load.

Next in the second row there are Column Headers defined, where the first column represents the **Time (s)** and second column the **Load name**. The headers for second columns must be named correctly, according to given load.

External Force or Torque Worksheet Example

	A	B
1	Load external_force_torque 1	
2	Time (s)	External Force or Torque
3	0	-14.63490123
4	0.0018	-14.61974058
5	0.0036	-14.66887535
6	0.0054	-14.65726228
7	0.0072	-14.61549142
8	0.009	-14.66177951
9	0.0108	-14.82543418
10	0.0126	-14.99560003
11	0.0144	-15.18495334
12	0.0162	-15.28945228
13	0.018	-15.37524481
14	0.0198	-15.4541144
15	0.0216	-15.48004963
16	0.0234	-15.45161045
17	0.0252	-15.48513488
18	0.027	-15.53310114
19	0.0288	-15.54176557
20	0.0306	-15.5274996
21	0.0324	-15.49358801

Motion Profile Data | (External Force or Torque) - Lo | Motion

Ready | Accessibility: Good to go | Display Settings | 100%

Keep in mind that for given Motion Profile type, only selected Loads are available, otherwise the import will fail.

Motion

The Motion Profile depends on the Motion data itself. The Basic Motion Segments include **Accel/Decel, Index and Cruise Dwell**.

The individual segments data is defined based on **Time, Position, Velocity, Acceleration, Jerk** and **Smoothness**.

All these variables are defined in worksheet named **Motion** within separate columns, named accordingly to the Profile Type. The difference in headers between Linear and Rotary Profile Types comes down to the hardcoded units.

The column headers for **Linear Profile** are as following:

- **Time (s)** – the time
- **Position (m)** – position at given time
- **Velocity (m/s)** – velocity at given time
- **Acceleration (m/s^2)** – acceleration at given time
- **Smoothness (%)** – jerk percentage value, accepts values from range 0 to 1

For **Rotary Profile** the columns are as following:

- **Time (s)** – the time
- **Position (rad)** – position at given time
- **Velocity (rad/s)** – velocity at given time
- **Acceleration (rad /s^2)** – acceleration at given time
- **Smoothness (%)** – jerk percentage value, accepts values from range 0 to 1

Example of Motion Data Defined for Linear Profile

	A	B	C	D	E	F
1	Time (s)	Position (m)	Velocity (m/s)	Acceleration (m/s^2)	Jerk (m/s^3)	Smoothness (%)
2	0	0	0.007250917	0	0	
3	0.0018	0	0.007927301	0	0	
4	0.0036	0	0.008664852	0	0	
5	0.0054	0	0.009467818	0	0	
6	0.0072	0	0.010339951	0	0	
7	0.009	0	0.011287862	0	0	
8	0.0108	0	0.012319381	0	0	
9	0.0126	0	0.013441855	0	0	
10	0.0144	0	0.014661194	0	0	
11	0.0162	0	0.015983801	0	0	
12	0.018	0	0.01741977	0	0	
13	0.0198	0	0.018980929	0	0	
14	0.0216	0	0.020679428	0	0	
15	0.0234	0	0.022526646	0	0	
16	0.0252	0	0.024532619	0	0	
17	0.027	0	0.026708785	0	0	
18	0.0288	0	0.029069219	0	0	
19	0.0306	0	0.031629862	0	0	
20	0.0324	0	0.03440667	0	0	
21	0.0342	0	0.03741598	0	0	

Guide | Motion Profile Data | Motion

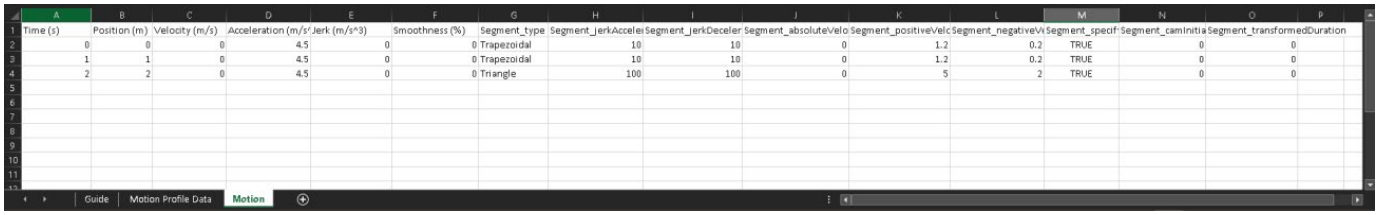
Index segments

The **Index** segments are defined in a unique way compared to others, meaning additional columns and data must be included so that the segments are correctly recreated.

The additional data is included in following columns:

- **Segment_type** – type of Index segment, accepts values **Trapezoidal** or **Triangle**
- **Segment_jerkAccelerationPercent** – this impacts the smoothness of acceleration in percentage (accepts values **0 – 100**)
- **Segment_jerkDecelerationPercent** – this impacts the smoothness of deceleration in percentage (accepts values **0 – 100**)
- **Segment_positiveVelocityLimit** – positive velocity limit (maximum) in **[m/s]** or **[rad/s]**
- **Segment_negativeVelocityLimit** – negative velocity limit (minimum) in **[m/s]** or **[rad/s]**
- **Segment_specifyVelocityLimit** – accepts values **TRUE** or **FALSE**, **IT MUST BE SET!**

Sample Index segments With All Necessary Data



Requirements

When defining segments, following conditions must be met:

1. Time must be positive.
2. The Positive velocity limit for Index segments must be larger than segment velocity.

CAM Segments

CAM Segments belong to Advanced Segments and require additional configuration. Because of that, they are defined in separate worksheet called **CAM Profiles**.

The CAM table values are defined in following columns:

- **Key** – this refers to the row number of Segment defined in Motion worksheet, which will be replaced by the **CAM** segment itself
- **MasterMU** - time when the subsegment ends in **[s]**
- **SlaveSU** – the final position achieved when subsegment ends in **[rad]**
- **SlopeSUMU** – the ending slope provided in **[rad/s]**
- **Type** – type of CAM segment, accepts values **Cubic** and **Linear**

Figure: Example of CAM Segments Define

d

	A	B	C	D	E	F	G
1	Time (s)	Position (rad)	Velocity (rad/s)	Acceleration (rad/s^2)	Jerk (rad/s^3)	Smoothness (%)	Segment_type
2	0	0	0	4.5	0	0	Trapezoidal
3	1	1	0	4.5	0	0	Trapezoidal
4	2	2	0	0	0	0	
5	3	2.5	1	1	0	0	
6	3.5	3	1	0	0	0	
7	4.5	3.5	0	-1	0	0	
8	6.5	4.5	1	0	0	0	
9							

Guide | Motion Profile Data | Motion | CAM Profiles

	A	B	C	D	E
1	Key	MasterMU	SlaveSU	SlopeSUMU	Type
2	4	1	1	0	Cubic
3	4	2	2	0	Cubic
4	8	3.5	2.5	1	Cubic
5	8	4.5	3.5	1	Cubic
6	8	5.5	3.5	1	Cubic
7					
8					
9					

Guide | Motion Profile Data | Motion | CAM Profiles

The CAM segments do not act as a standalone segment but rather replace provided one in **Motion**, based on **Key** property.

In the above example you can see two **CAM** segments defined, one defined in between different segments and the other one at the end of the Profile.

As you can see in **Motion**, the **Cruise Dwell** segment that starts at 2s is in the end being replaced by the **CAM** segment from **CAM Profiles** worksheet.

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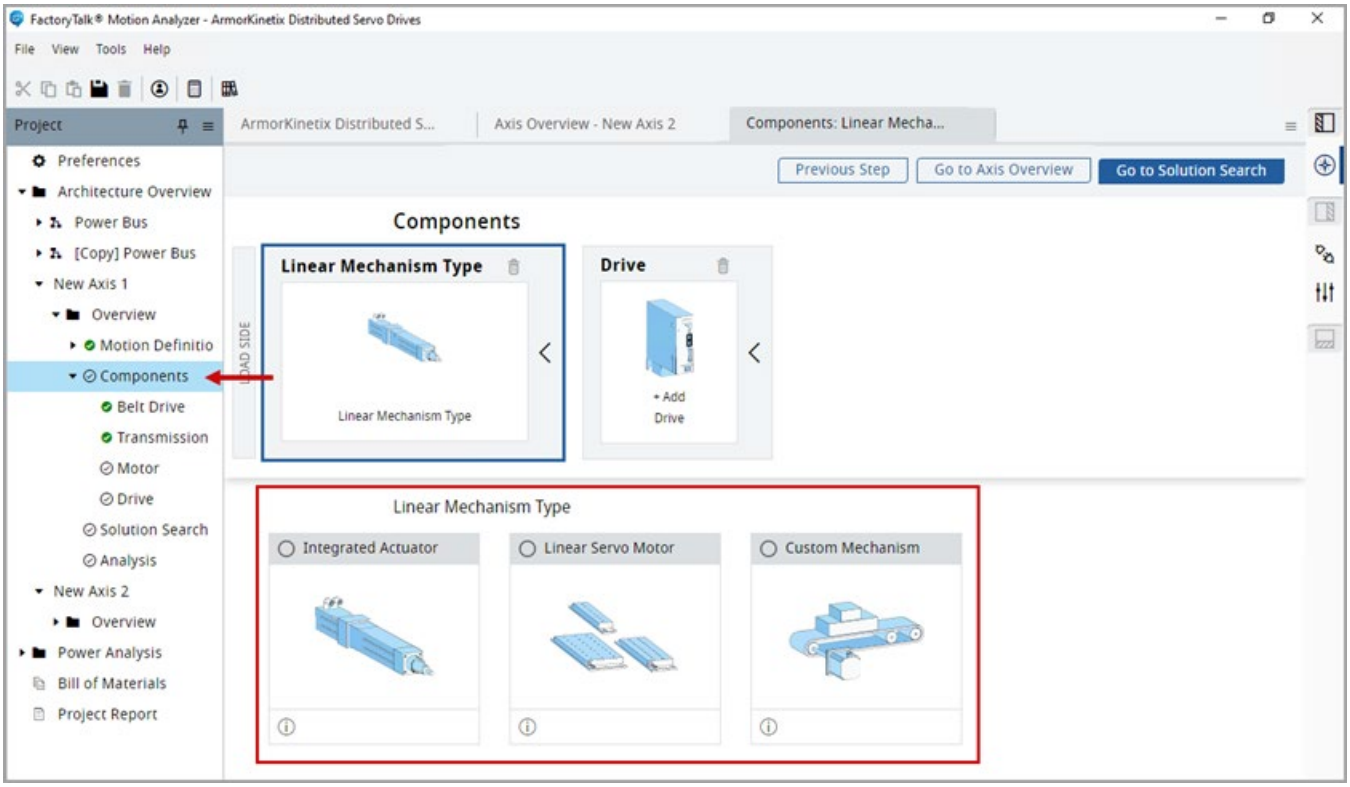
Components

The Components section allows user to select different types of Mechanisms, transmissions, drives and motors for an axis.

Mechanism

1. On the profile editor page, select a Linear axis type and click [Next].
2. Under components, the Linear Mechanism Component displays.

Figure: Linear Mechanism Types



3. Choose the following Linear Mechanism types:
   - Integrated Actuators
   - Linear servo Motors
   - Custom Mechanisms

Change Motion Type

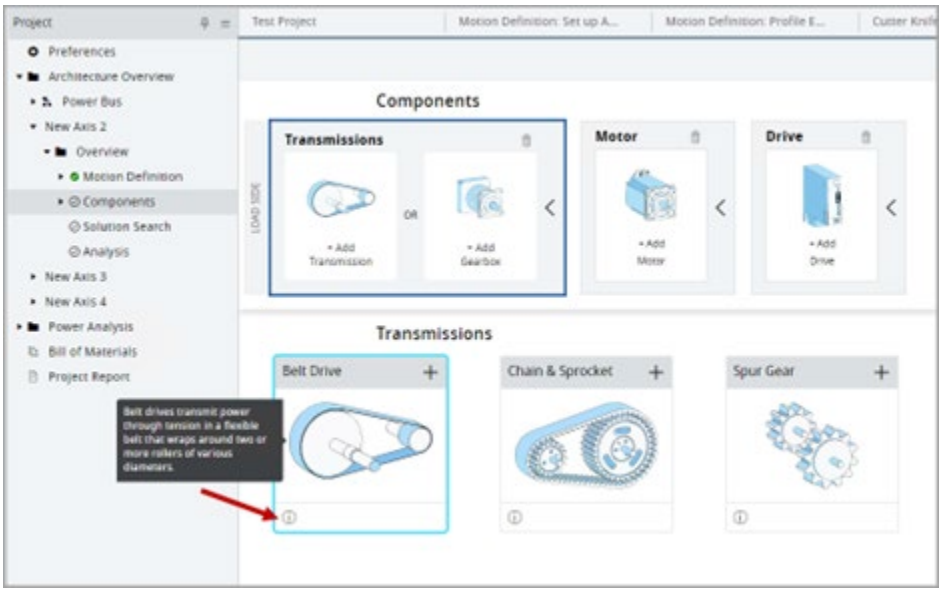
If the user defines a motion in Rotary motion type and configures motor, transmission and drive and wanted to change the motion type to linear:

1. Go to the Set-up Axis page, click [Linear] under motion type and click [Next].
2. The Confirm changes dialog displays.
3. Click [Confirm] to change the motion type.

NOTE: Ensure that the defined motor, transmission, and drive may get effected, if the motion type is changed in the defined profile and the warning signs display across the defined motion tree in the left panel.

NOTE: Click the [ⓘ] icon on any given component and the Component's description is displayed.

Component Description



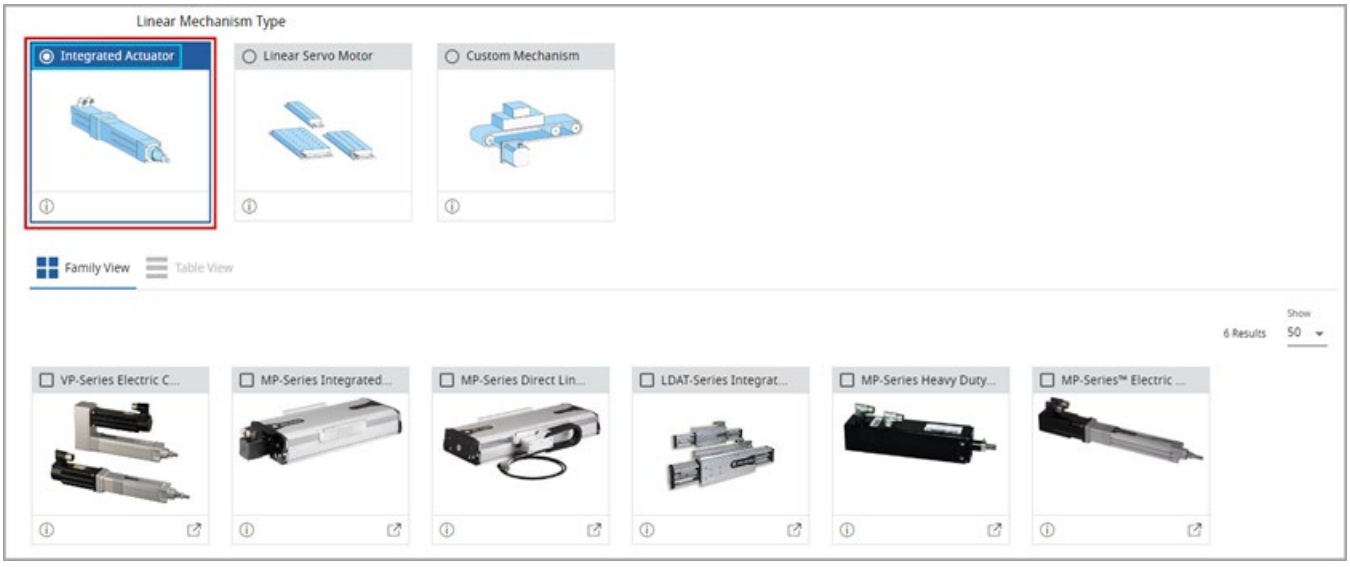
Integrated Actuators

Integrated actuators are complete direct-drive, ballscrew, or rollerscrew linear motion solutions from Rockwell Automation's Allen-Bradley product line. All components such as a transmission, gearbox, bearing, magnet, etc. are fully integrated into the product. Includes MPAR/MPAI Electric Cylinders, MPAS Linear Stages, and LDAT Linear Thrusters.

Perform the following steps to add a component from Integrated Actuator:

1. Under the Linear Mechanism, select the Integrated Actuator and the list of available Actuators display.

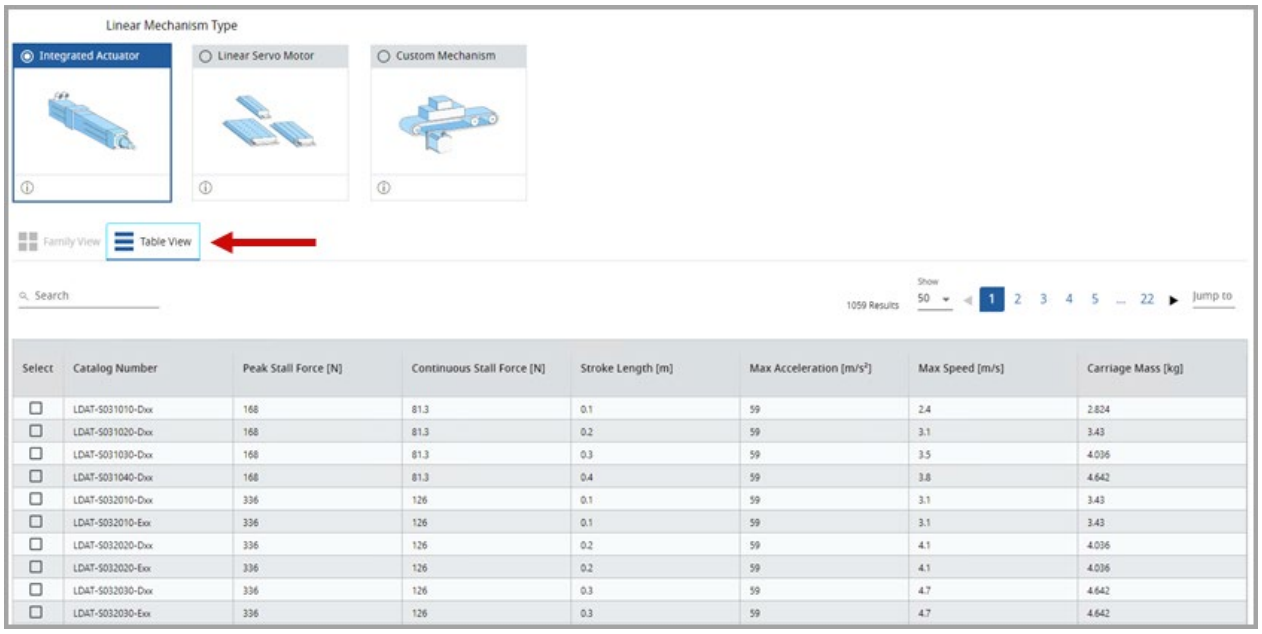
Figure: Integrated Actuator



User can select the Actuator from Family View or Table View:

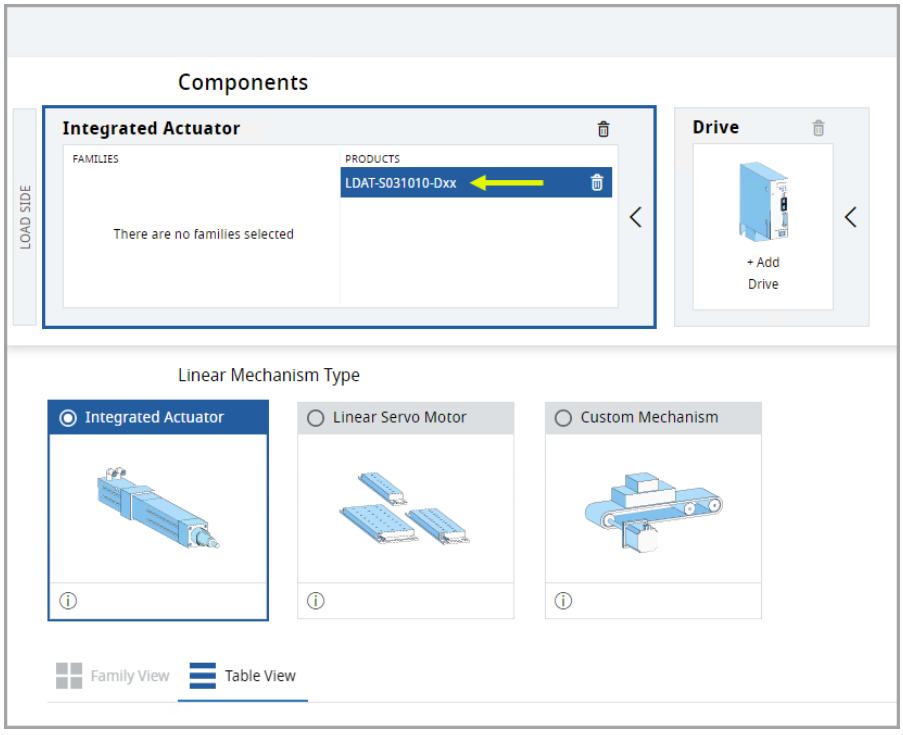
- The Family View tab displays a list of Actuator families which can be selected.
- The Table View tab displays a list of available Actuator. User can scroll down or use the Search option for a desired Actuator.

Figure: Table View



2. Select the required component and the respective Actuator displays under the Components section as shown in the following image:

Figure: Components



3. Click [Next Step].

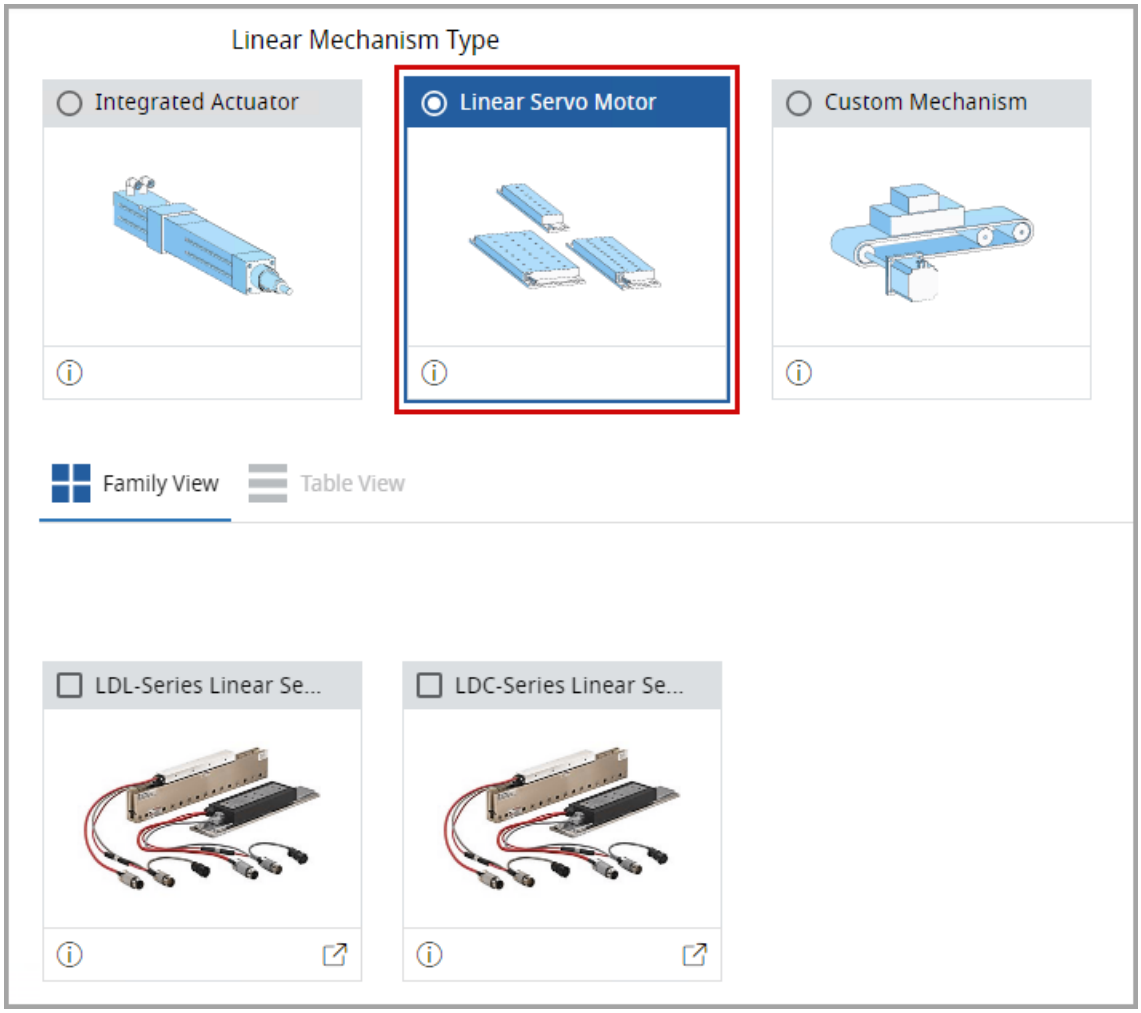
Linear servo Motors

High speed linear servo motors are direct-drive coil and magnet packages that allow you to fully customize your own linear solution. LDC iron core servo motors have high force density while LDL ironless servo motors provide smooth, zero-cog motion.

Perform the following steps to add a Linear Servo Motor:

1. Under the Linear Mechanism, select the Linear Servo Motor and the list of available motors display.

Figure: Linear Servo Motors



User can select the Motors from Family View or Table View:

- The Family View tab displays a list of Linear Servo Motor families which can be selected.
- The Table View tab displays a list of available Linear Servo Motors. User can scroll down or use the Search option for a desired Linear Servo Motor.

2. Select the required motor and the respective motor displays under the Components section as shown in the following image:

Figure: Components - Family

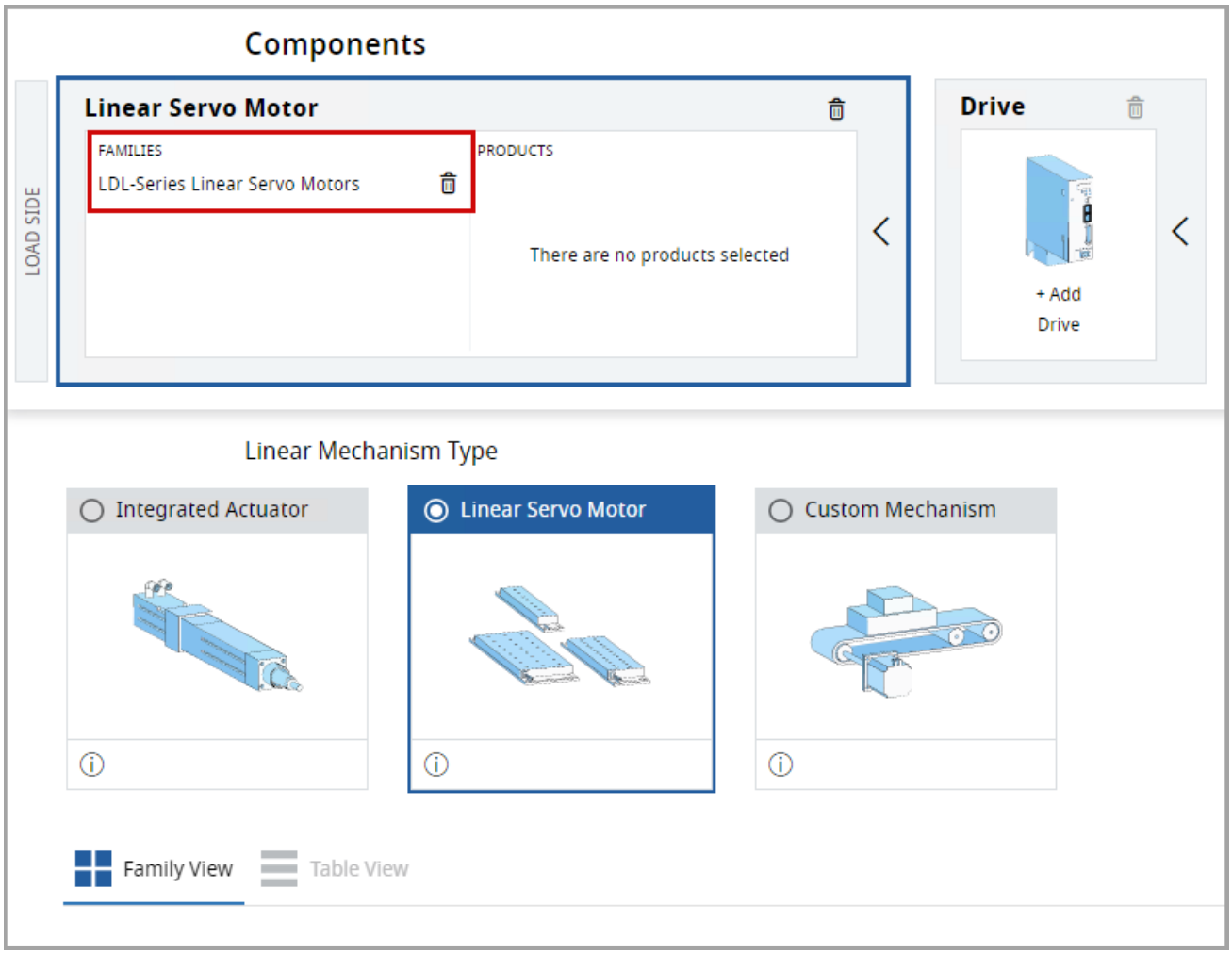
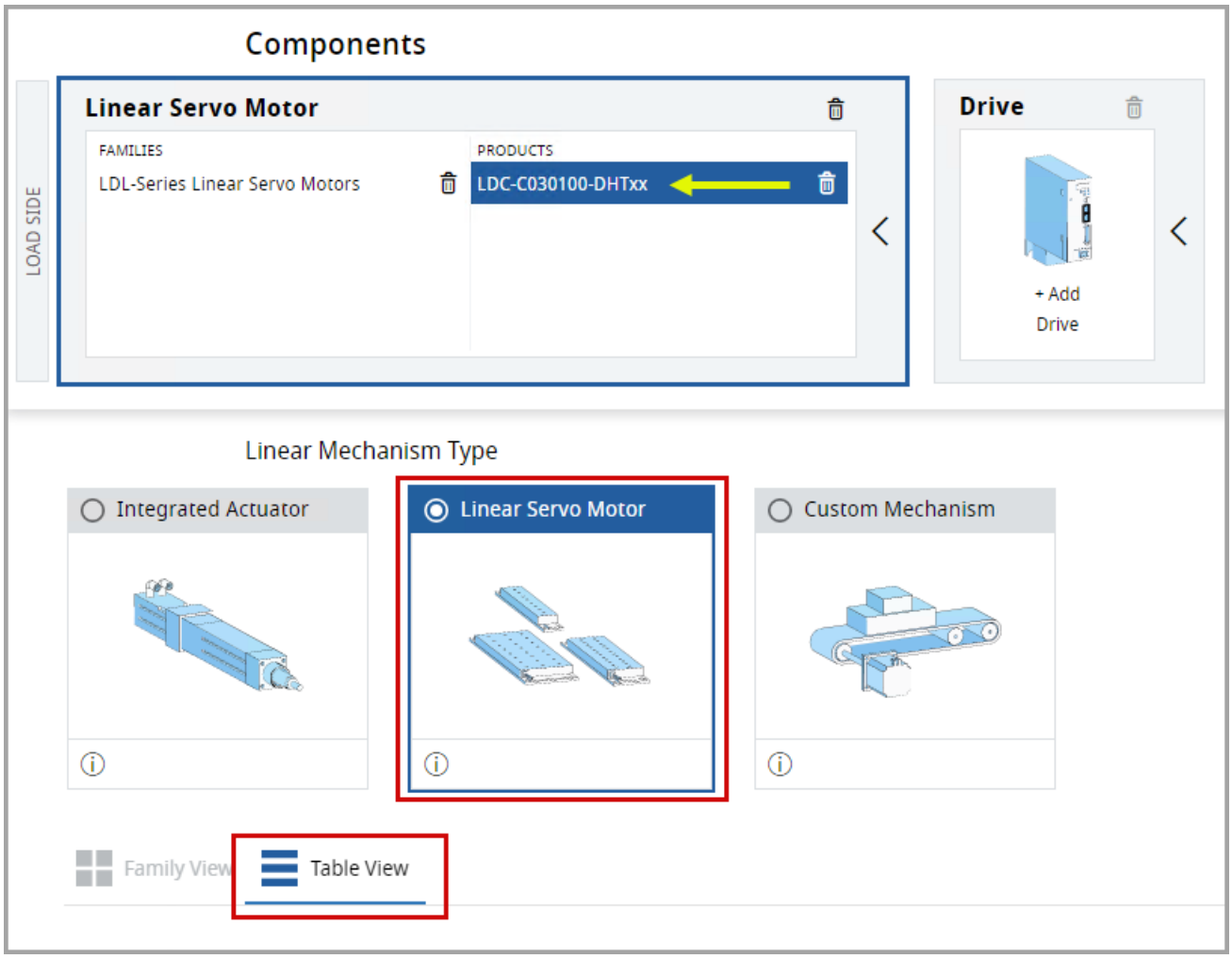


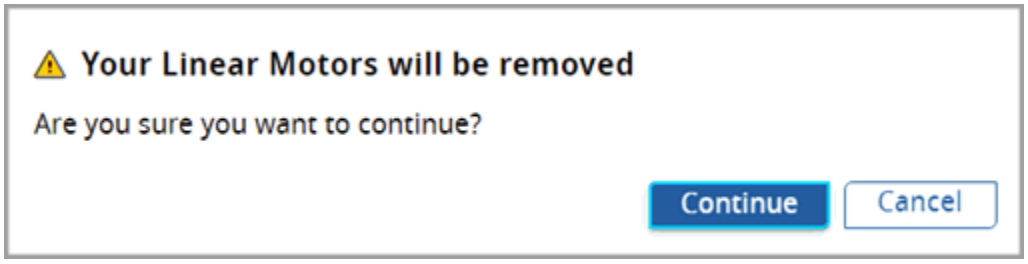
Figure: Components - Table



3. Click [Next Step].

   NOTE: If user switches between the Linear Mechanism types, a warning dialog displays. To proceed, click [Continue] and add the desired component.

Figure: Change Linear Mechanism types

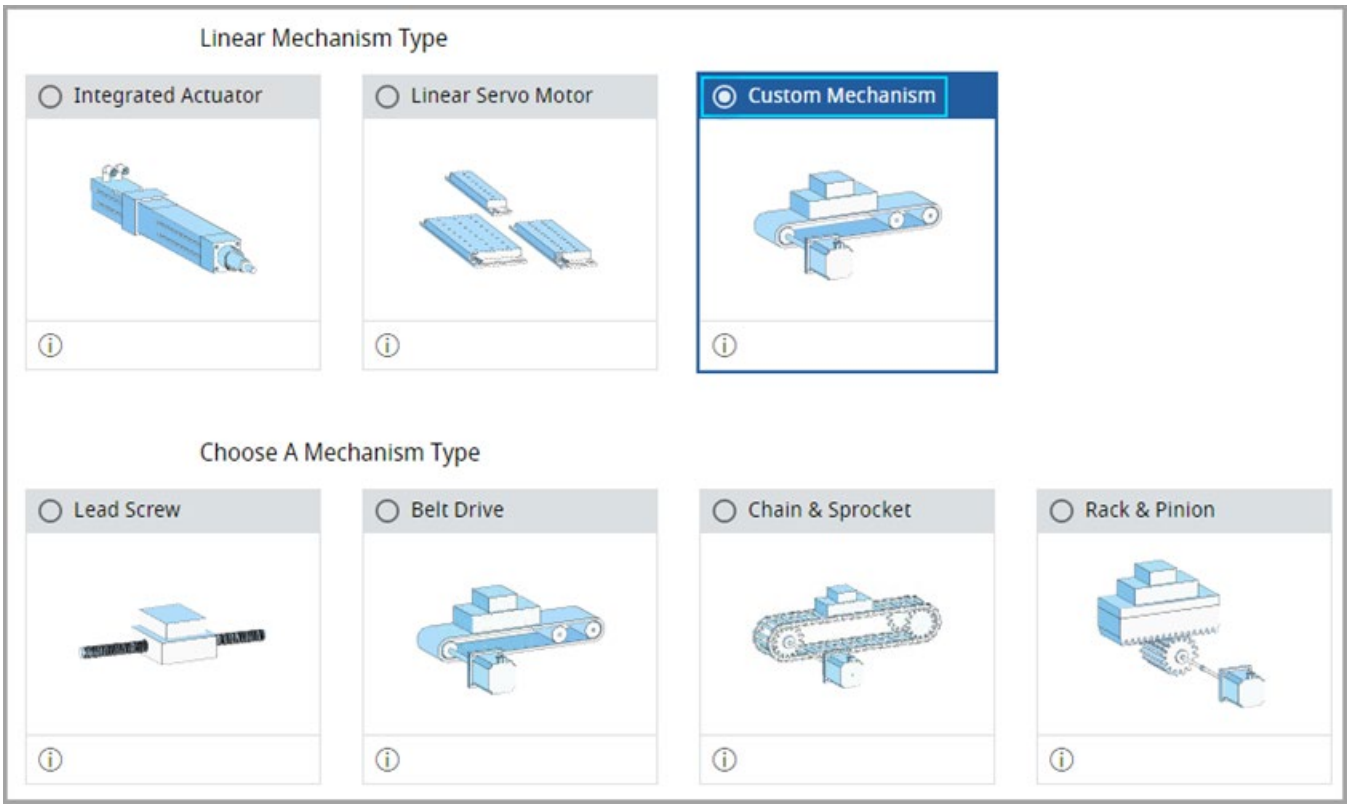


Custom Mechanisms

Select the Custom Mechanism and the following Linear Mechanism types display:

- Lead Screw
- Belt Drive
- Chain & Sprocket
- Rack & Pinion

Figure: Custom Mechanism



Lead Screw

A lead screw is coupled to a rotary motor and causes relative linear motion between a rotating screw and its non-rotating nut.

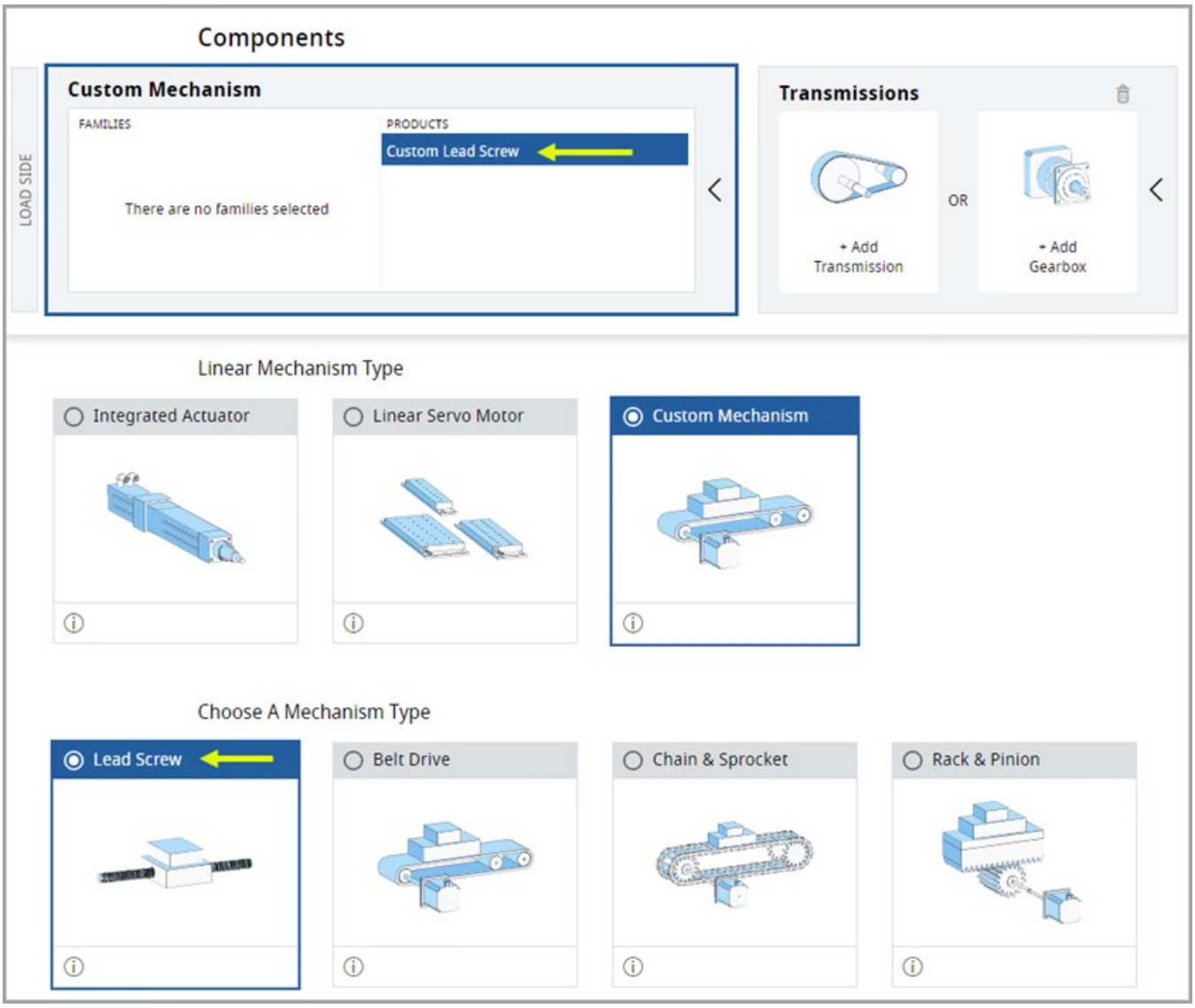
1. Select [Lead Screw] and provide the following parameters:

Field	Description
Name	Name for the Lead Screw type.
Lead	The distance that the slide moves per one full rotation of the screw shaft.
Inertia	The inertia of the lead screw if the lead screw rotates, and the nut is stationary. Provide the inertia of the nut when the Lead screw is stationary, and the nut rotates. Or If the user has the measurements and other details of the Lead screw, click the [ ] icon to calculate the inertia of the Lead screw. Refer to Inertia Calculator section.
Pre-Load	The friction torque produced by pre-loading the two nuts of a ball screw against each other. This is done to reduce backlash and increase stiffness in the system. Seal friction should be included in this value. This value can be obtained from the manufacturer's data and is normally quoted in datasheets.
Efficiency	The efficiency of the lead screw. The efficiency value depends on unit of measure, which can be % or none. If there is no unit selected, it is written as a decimal (between 0 and 1). If the % is selected, this value is multiplied by 100
Slide Mass	The mass of the slide travels along the lead screw. This mass is affected by gravity if the inclination in the Load Type Tab is non-zero.

NOTE: Ensure that these values are defined and should be greater than or equal to "0".

2. Click [Add Mechanism] and the customized Lead Screw linear mechanism is added to the components.

Figure: Add Mechanism



The same Lead Screw linear mechanism is added to the Architectural Overview and Axis Overview.

Figure: Architectural Overview

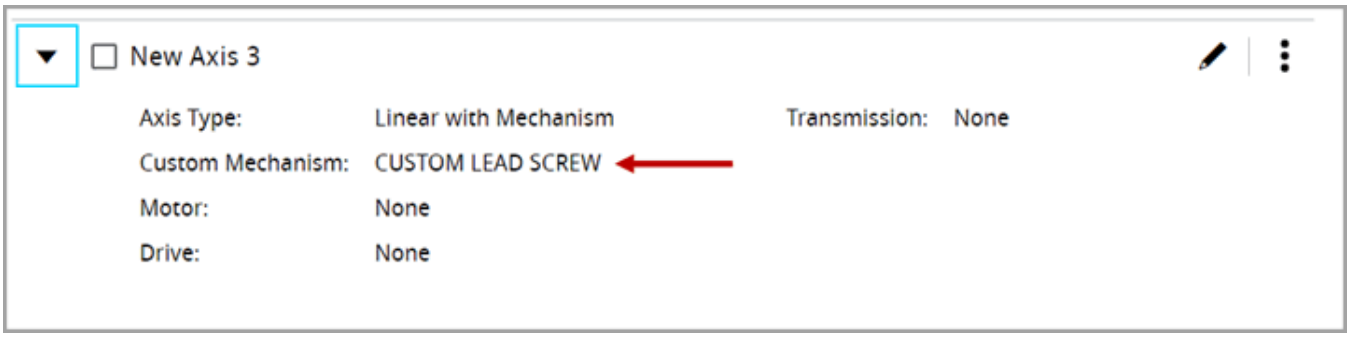
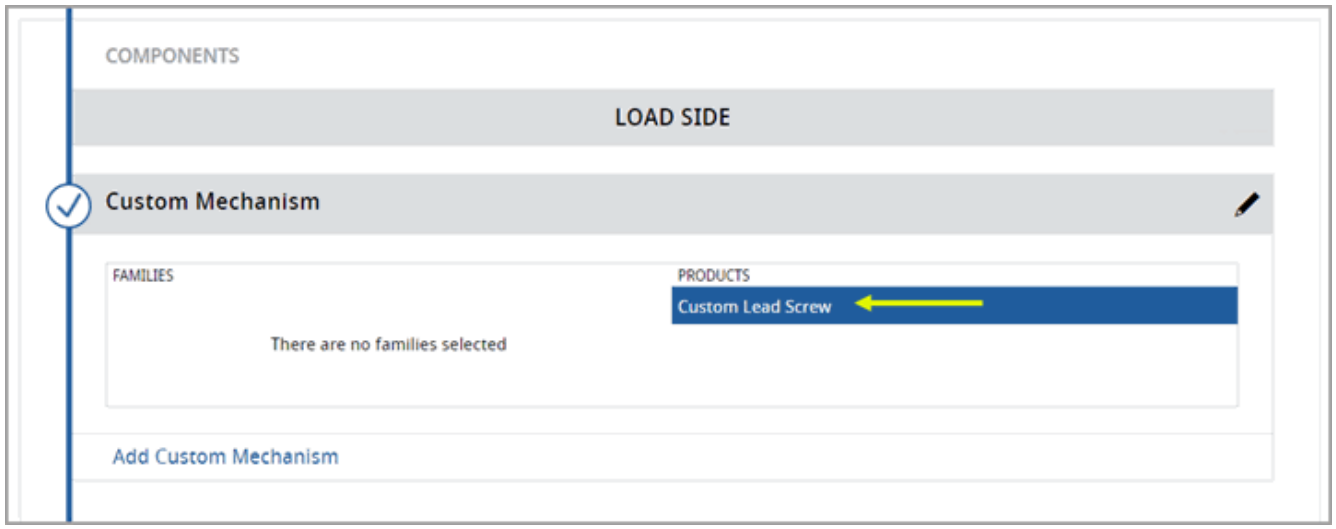


Figure: Axis Overview



3. Users can edit the parameters and click [Update Mechanism] to save the changes.

Rack & Pinion

A Rack and Pinion is a rotary motor coupled to a toothed pinion wheel that engages a toothed rack to create relative motion between the two elements.

1. Select [Chain & Sprocket] and provide the following parameters:

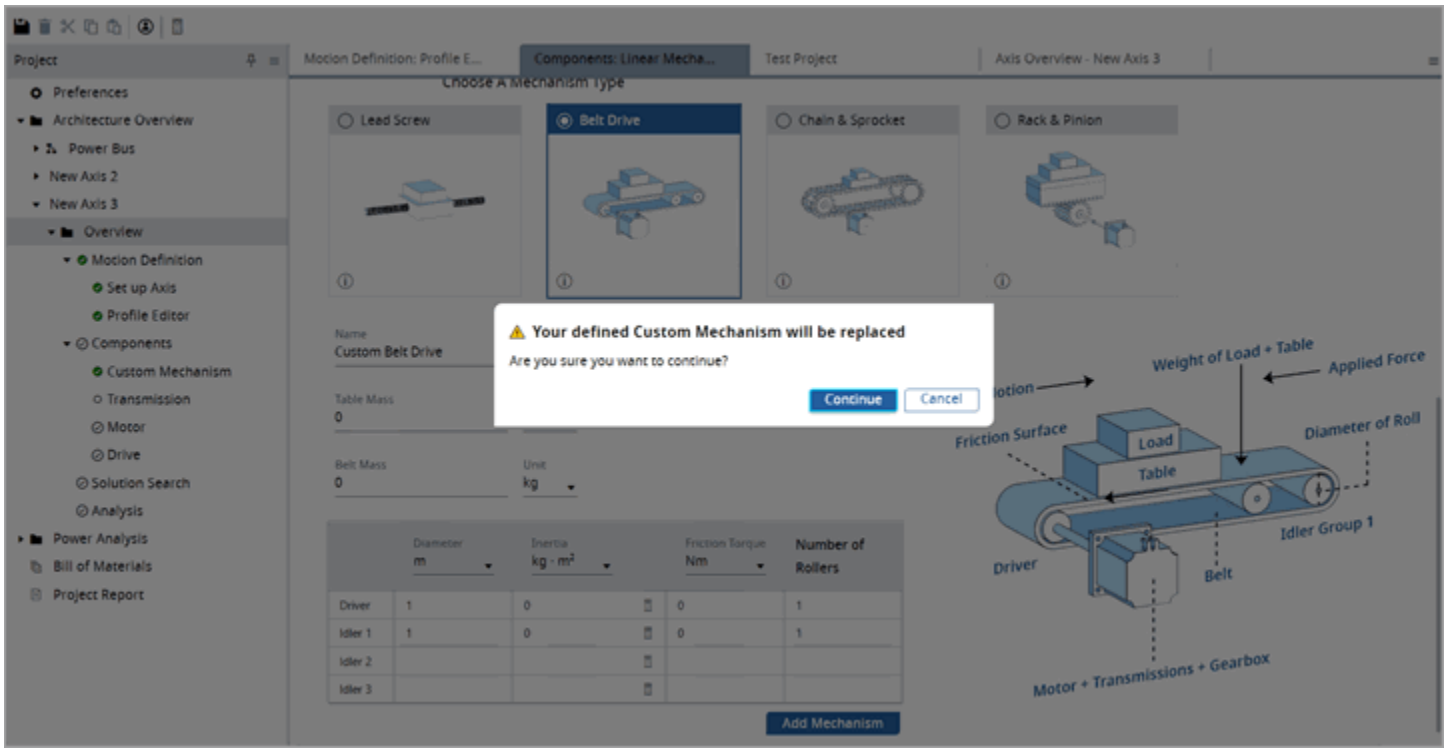
Field	Description
Name	Provide a name for the Lead Screw type.
Pinion PCD	Pinion Pitch Circle Diameter. The pitch circle diameter value can be obtained from standard catalogue data. The value can also be calculated by multiplying the tooth pitch by the number of teeth on the sprocket and dividing by pi.
Pinion Inertia	The inertia of the Pinion. Or If the user has the measurements and other details of the pinion, click the [ ] icon to calculate the inertia of the pinion. Refer to Inertia Calculator section.
Friction Torque	The torque loss due to friction at the pinion shaft. This value can be obtained from the supplier or Engineering tables.
Table Mass	The mass of the linear load table.

NOTE: Ensure that these values are defined and should be greater than or equal to “0”.

2. Click [Add Mechanism] and the customized Rack & Pinion linear mechanism is added to the components and the same linear mechanism is added to the Architectural Overview and Axis Overview.
3. Users can edit the parameters and click [Update Mechanism] to save the changes.

   NOTE: If the user switches between the Linear mechanism after adding it to the Components, a warning dialog displays as shown in the following image:

Figure: Warning Message



4. Click [Continue] to change the Linear Mechanism type and the previous customized Linear mechanism will be replaced with the new one.

Belt Drive

A Belt drive is a rotary motor coupled to a sprocket wheel that drives a belt, with its coupled load, back and forth between the idler sprocket guides.

1. Select [Belt Drive] and provide the following parameters:

Field	Description
Name	Provide a name for the Belt Drive type.
Table Mass	The mass of the linear load table.
Belt Mass	The mass of the Belt. This mass is not affected by gravity.
Diameter	The diameter of the Driver and the Idler(s)
Inertia	The inertia of the Driver and the Idler(s). Or the user can calculate the inertia using the [ ] icon. Refer to Inertia Calculator section.
Friction Torque	The torque loss due to friction at the driver or idler shaft. This value can be obtained from the supplier or Engineering tables.
Number of Rollers	The numbers of rollers for each Idler group. Provide the number in Integers.

NOTE: Ensure that these values are defined and should be greater than or equal to “0”.

2. Click [Add Mechanism] and the customized Belt Drive linear mechanism is added to the components and the same linear mechanism is added to the Architectural Overview and Axis Overview.
3. Users can edit the parameters and click [Update Mechanism] to save the changes.

Chain & Sprocket

A Chain and Sprocket is a rotary motor coupled to a sprocket wheel that drives a linked chain, with its coupled load, back and forth between idler sprocket guides.

1. Select [Chain & Sprocket] and provide the following parameters:

Field	Description
Name	Provide a name for the Chain & Sprocket type.
Table Mass	The mass of the linear load table.
Chain Mass	The mass of the Chain. This mass is not affected by gravity.
Diameter	The diameter of the Driver and the Idler(s)
Inertia	The inertia of the Driver and the Idler(s). Or the user can calculate the inertia using the [ ] icon. Refer to Inertia Calculator section.
Friction Torque	The torque loss due to friction at the driver or idler shaft. This value can be obtained from the supplier or Engineering tables.
Number of Sprockets	The numbers of sprockets for each Idler group. Provide the number in Integers.

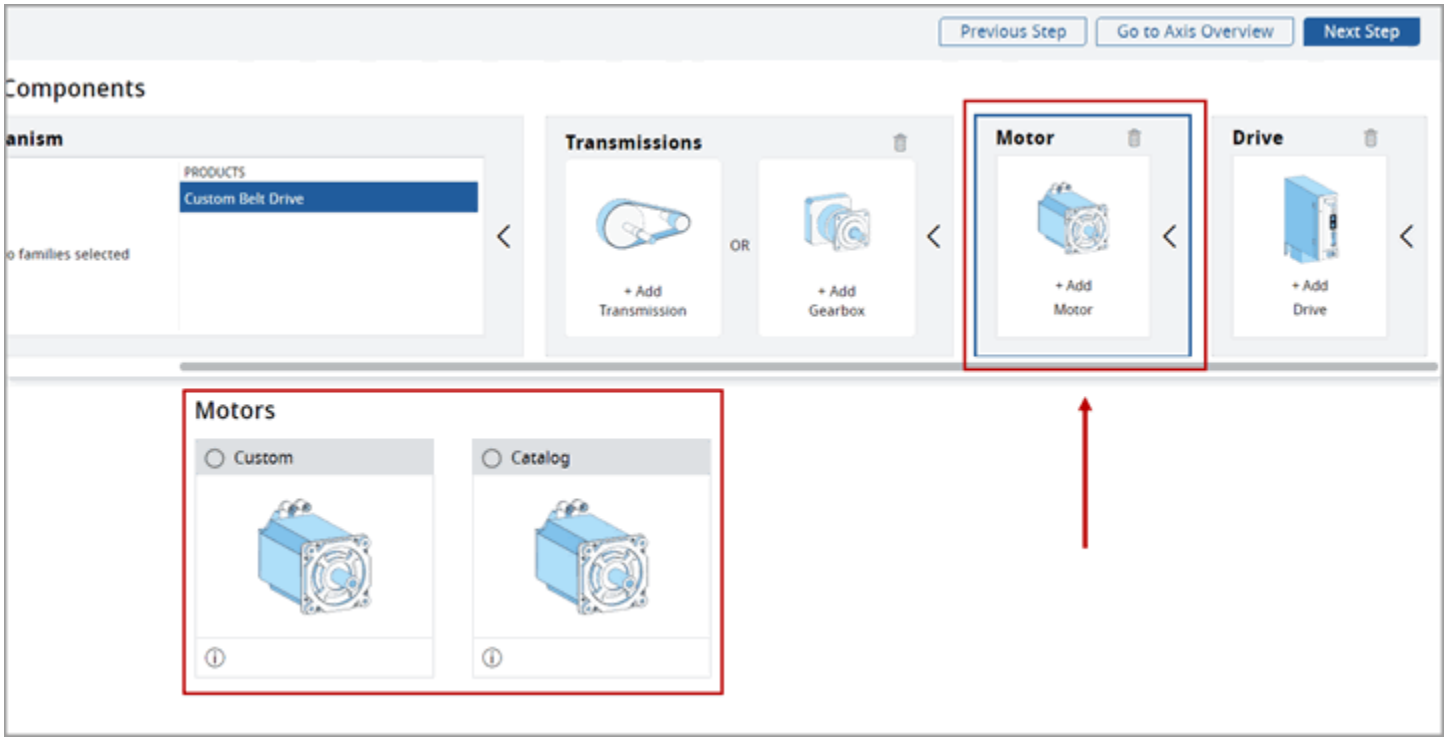
NOTE: Ensure that these values are defined and should be greater than or equal to “0”.

2. Click [Add Mechanism] and the customized Chain & Sprocket linear mechanism is added to the components and the same linear mechanism is added to the Architectural Overview and Axis Overview.
3. Users can edit the parameters and click [Update Mechanism] to save the changes.

Choose Your Motor

User can either select the motors from the catalog or user can define the custom motor parameters.

Figure: Components: Motor tab



Custom Motor

1. Select the Custom Motor and provide the following details:

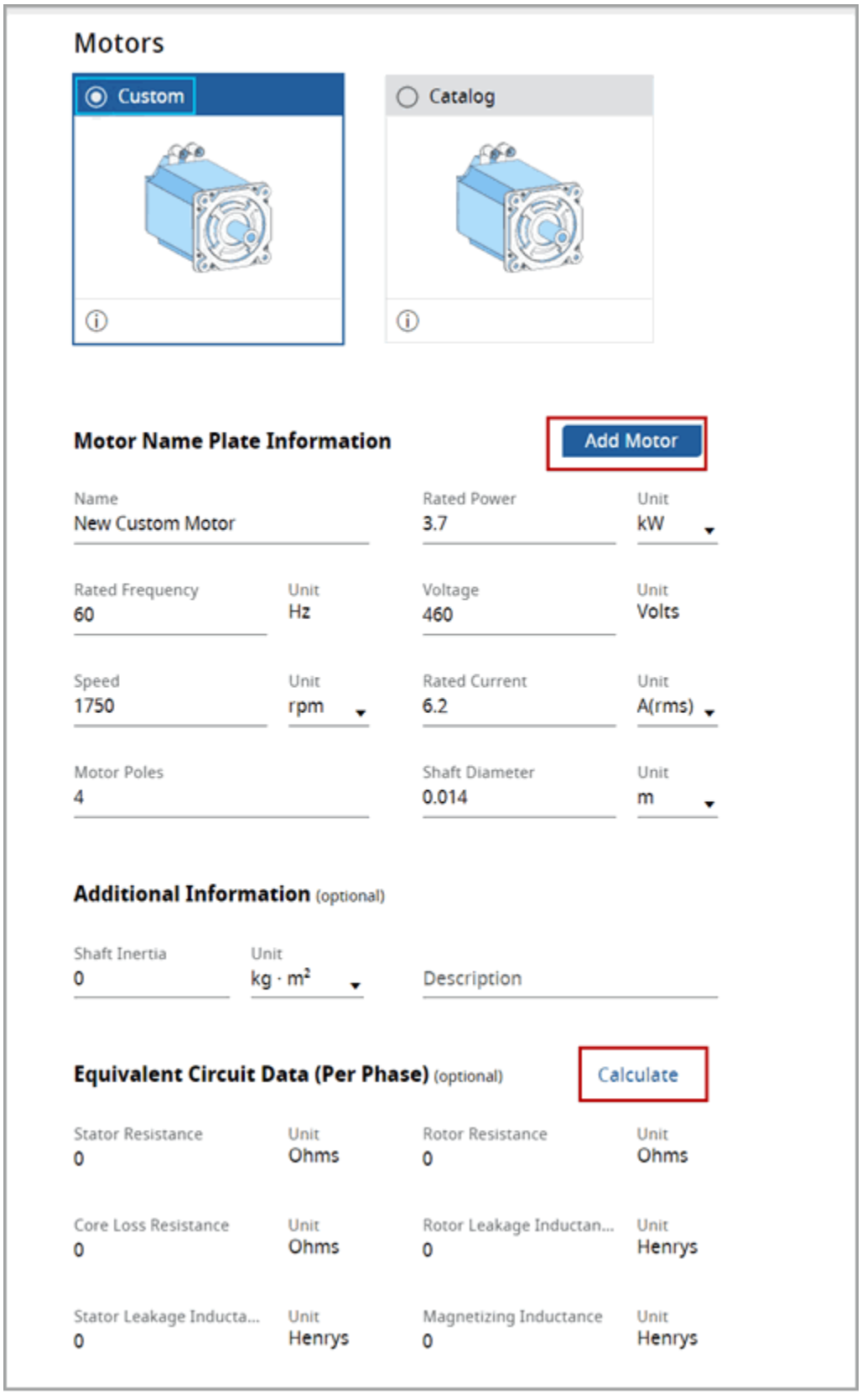
Table: Inertia Table

Field	Description

Motor Name Plate Information	
Name	Name of the custom motor
Rated Power	The motor power output under full load conditions of rated current, speed, and voltage
Rated Frequency	The motor rated frequency at synchronous speed.
Voltage	The phase-to-phase voltage applied to the motor required to reach rated speed at full load
Speed	The Motor rotary rated speed, rated speed (rpm) or Linear Motor Rated Speed (m/s)
Rated Current	The current applied to the motor under full-load conditions at rated speed and voltage
Motor Poles	Number of Motor poles
Shaft Diameter	The diameter of the shaft
Additional Information (Optional)	
Shaft Inertia	The Inertia of the shaft
Description	To add any additional information of the shaft.
Equivalent Circuit Data (per Phase)	
Stator Resistance	The winding resistance of the stator in the motor
Rotor Resistance	The winding resistance of the rotor in the motor
Core Loss Resistance	The resistance of the energy loss
Rotor Leakage Inductance	The leakage inductance of the rotor winding in the motor
Stator Leakage Inductance	The leakage reactance of the stator winding in the motor
Magnetizing Inductance	The self-inductance of an induction motor with magnetic core

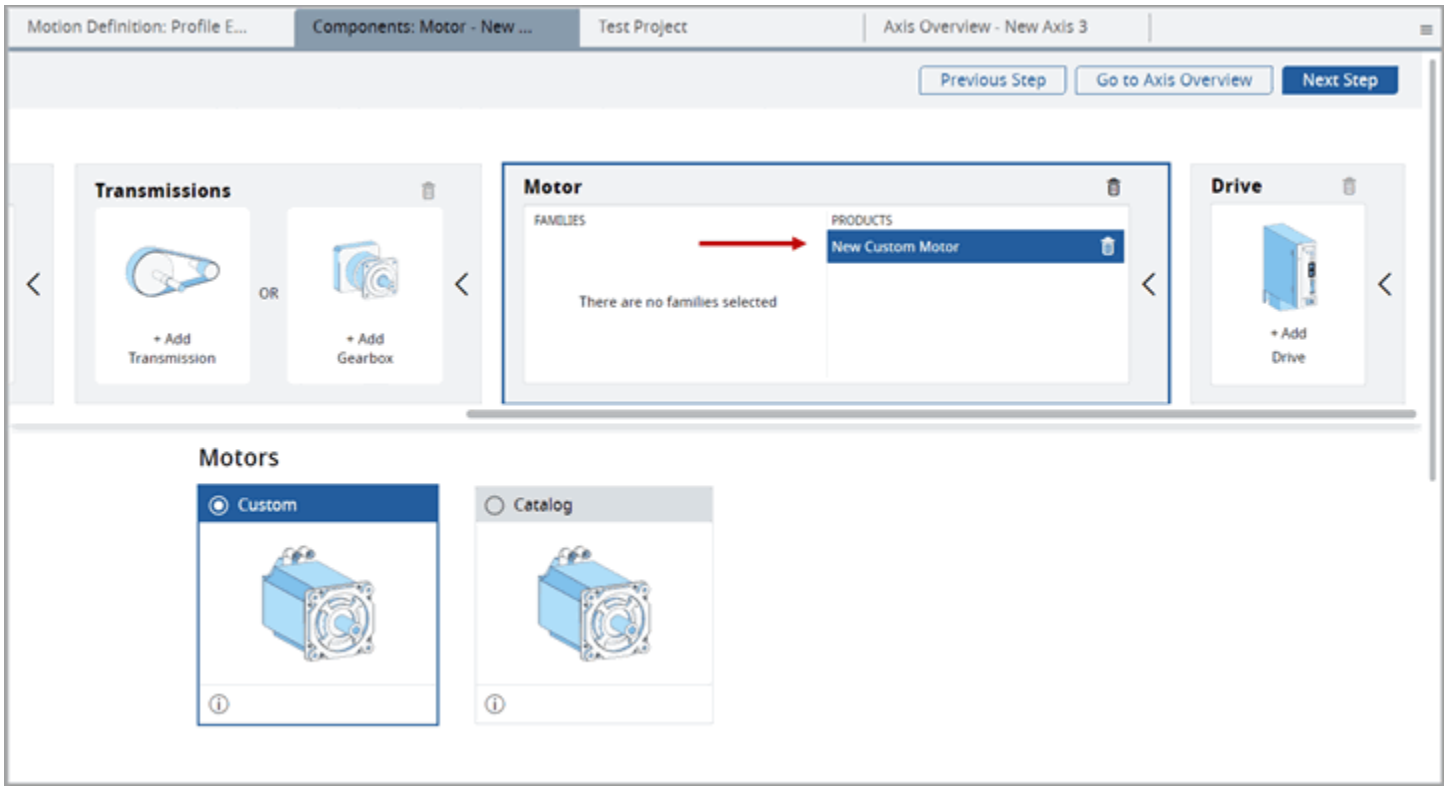
2. Click [Calculate] to manually calculate the equivalent circuit data.
   NOTE: Ensure to provide a valid parameters to calculate.

Figure: Custom Motor



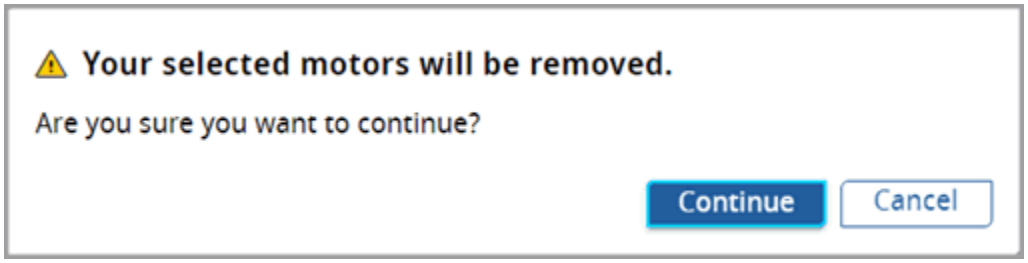
3. Click [Add Motor] and the Custom motor is added to the profile.

Figure: New Custom Motor



4. User can update the custom motor and click [Update Motor] to update the changes.
5. If user change from catalog to custom or from Custom motor to a Catalog motor, the following warning dialog displays.

Figure: Change Motor



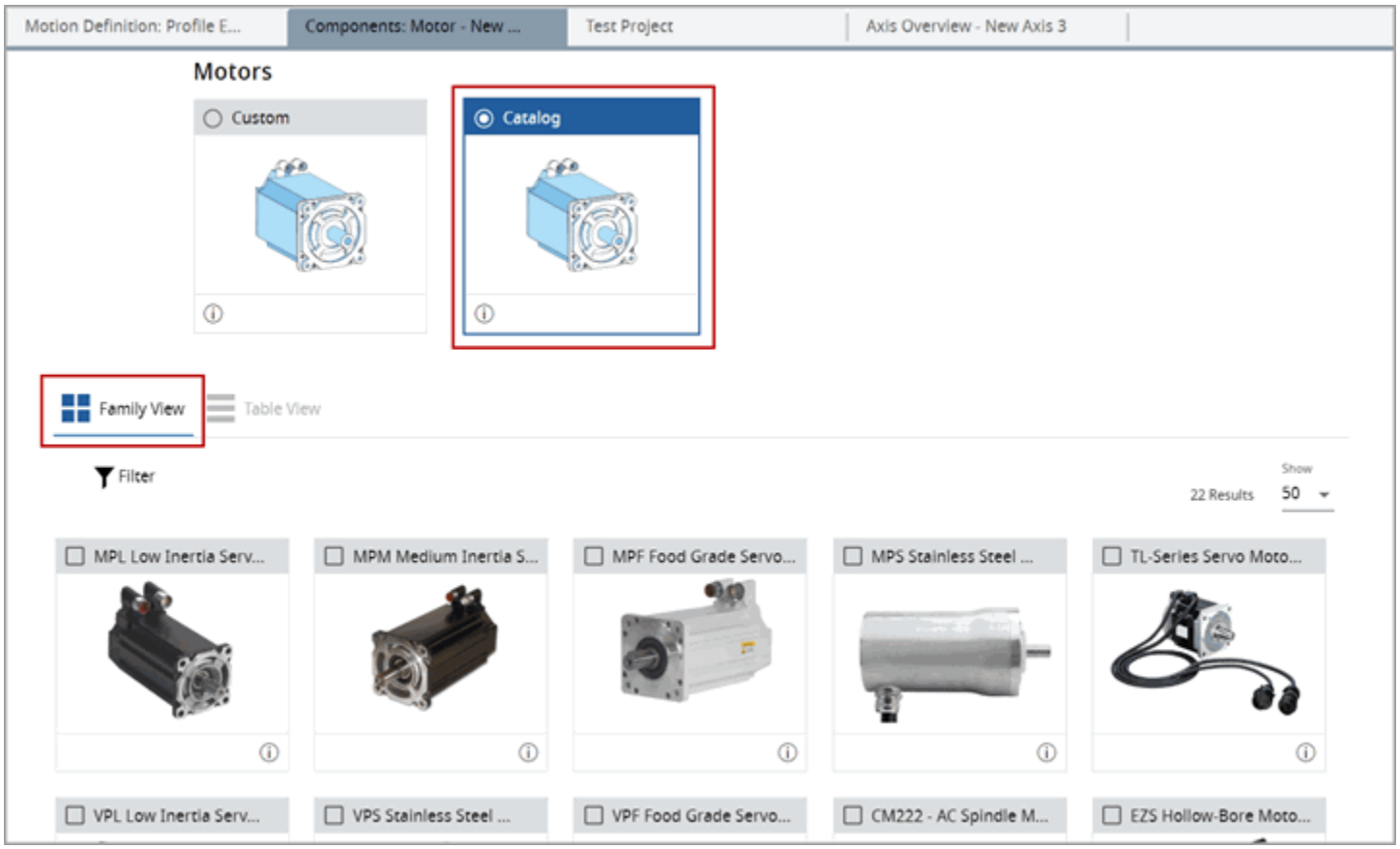
6. If user chose to continue, the custom motor will be deleted, and user can select the Catalog Motors.

Catalog Motors

User can select the motor from Family View or Table View:

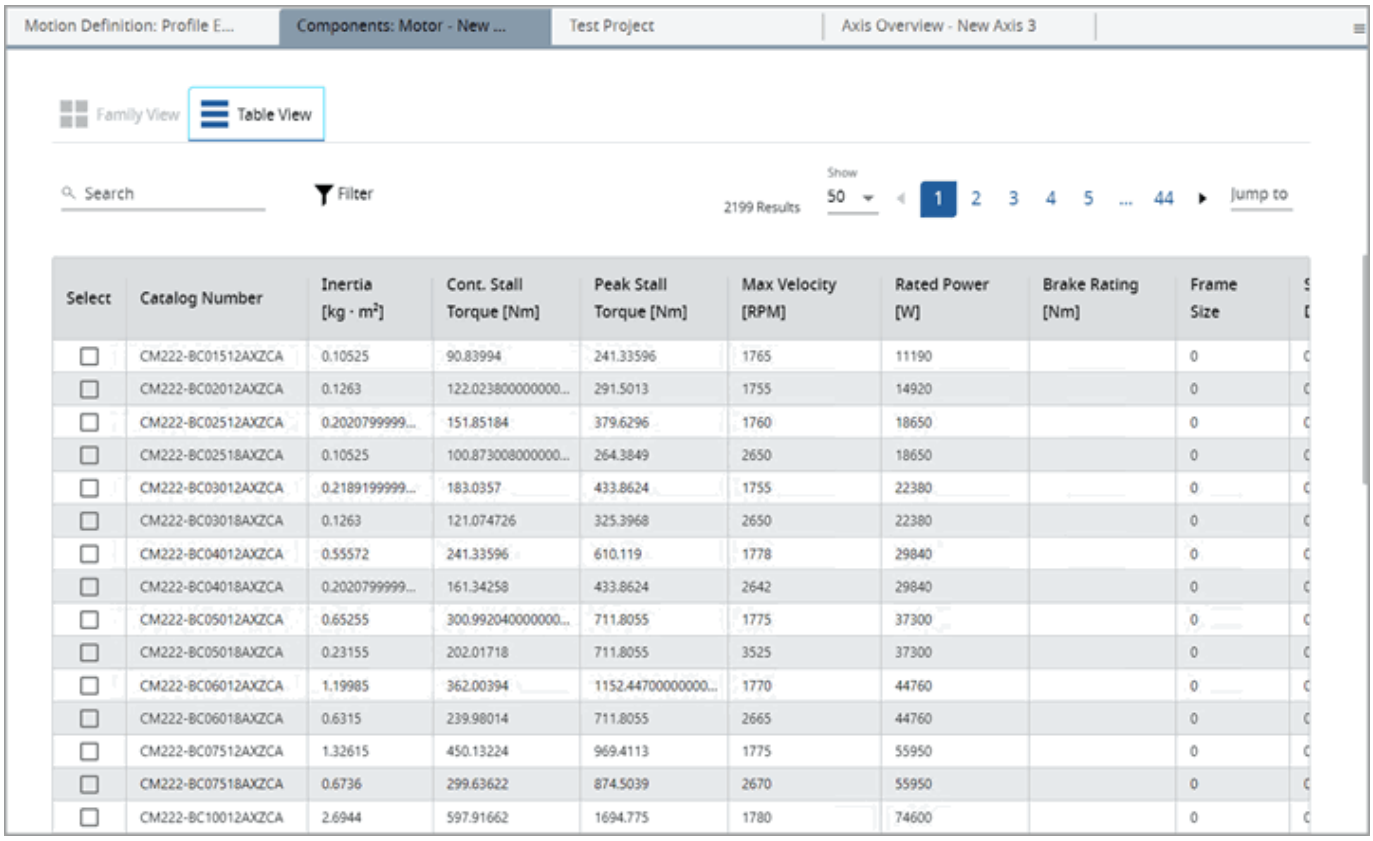
- The Family View tab in the Motors section displays a list of available Motor families which can be selected.
- Click [Table View] to open the Table View tab.

Figure: Catalog Motors



The Table View tab in the Motors section displays a list of available Motor products. When user selects a motor, Motion Analyzer validates the power requirements of axis.

Figure: Table View in Motor section

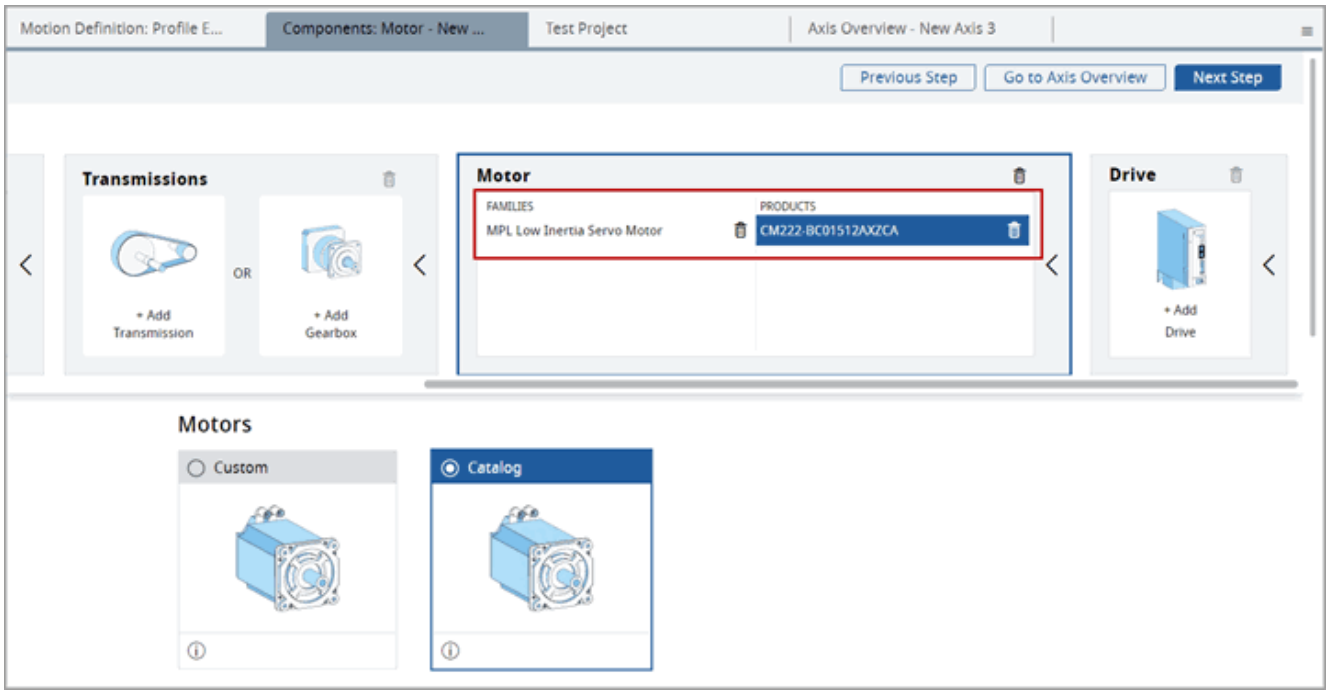


Select	Catalog Number	Inertia [kg · m²]	Cont. Stall Torque [Nm]	Peak Stall Torque [Nm]	Max Velocity [RPM]	Rated Power [W]	Brake Rating [Nm]	Frame Size
☐	CM222-BC01512AXZCA	0.10525	90.83994	241.33596	1765	11190		0
☐	CM222-BC02012AXZCA	0.1263	122.023800000000...	291.5013	1755	14920		0
☐	CM222-BC02512AXZCA	0.2020799999...	151.85184	379.6296	1760	18650		0
☐	CM222-BC02518AXZCA	0.10525	100.873008000000...	264.3849	2650	18650		0
☐	CM222-BC03012AXZCA	0.2189199999...	183.0357	433.8624	1755	22380		0
☐	CM222-BC03018AXZCA	0.1263	121.074726	325.3968	2650	22380		0
☐	CM222-BC04012AXZCA	0.55572	241.33596	610.119	1778	29840		0
☐	CM222-BC04018AXZCA	0.2020799999...	161.34258	433.8624	2642	29840		0
☐	CM222-BC05012AXZCA	0.65255	300.992040000000...	711.8055	1775	37300		0
☐	CM222-BC05018AXZCA	0.23155	202.01718	711.8055	3525	37300		0
☐	CM222-BC06012AXZCA	1.19985	362.00394	1152.44700000000...	1770	44760		0
☐	CM222-BC06018AXZCA	0.6315	239.98014	711.8055	2665	44760		0
☐	CM222-BC07512AXZCA	1.32615	450.13224	969.4113	1775	55950		0
☐	CM222-BC07518AXZCA	0.6736	299.63622	874.5039	2670	55950		0
☐	CM222-BC10012AXZCA	2.6944	597.91662	1694.775	1780	74600		0

Use the Search option to find a specific Motor product or to filter Motor products with partial text. Click [Family View] to open Family View back.

All selected Motor families and products will be displayed in the Motor tile in the Components section.

Figure: Components section



When the user tries to calculate Solution Search without selecting Drive family or product, warning icons will be displayed on the page as well a proper message will show up.

Figure: Missing Drive

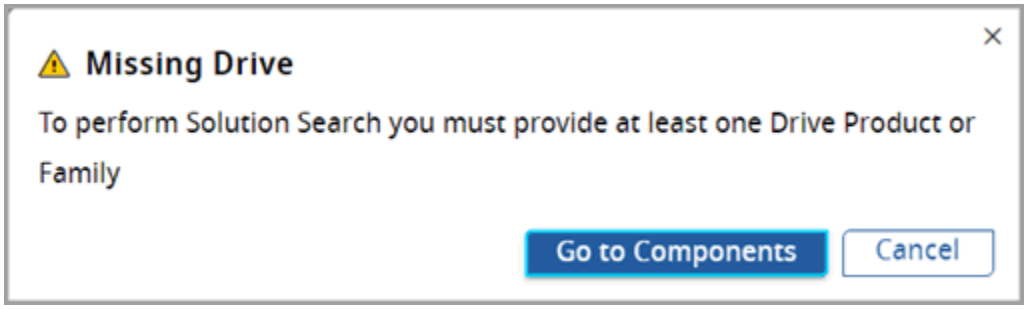
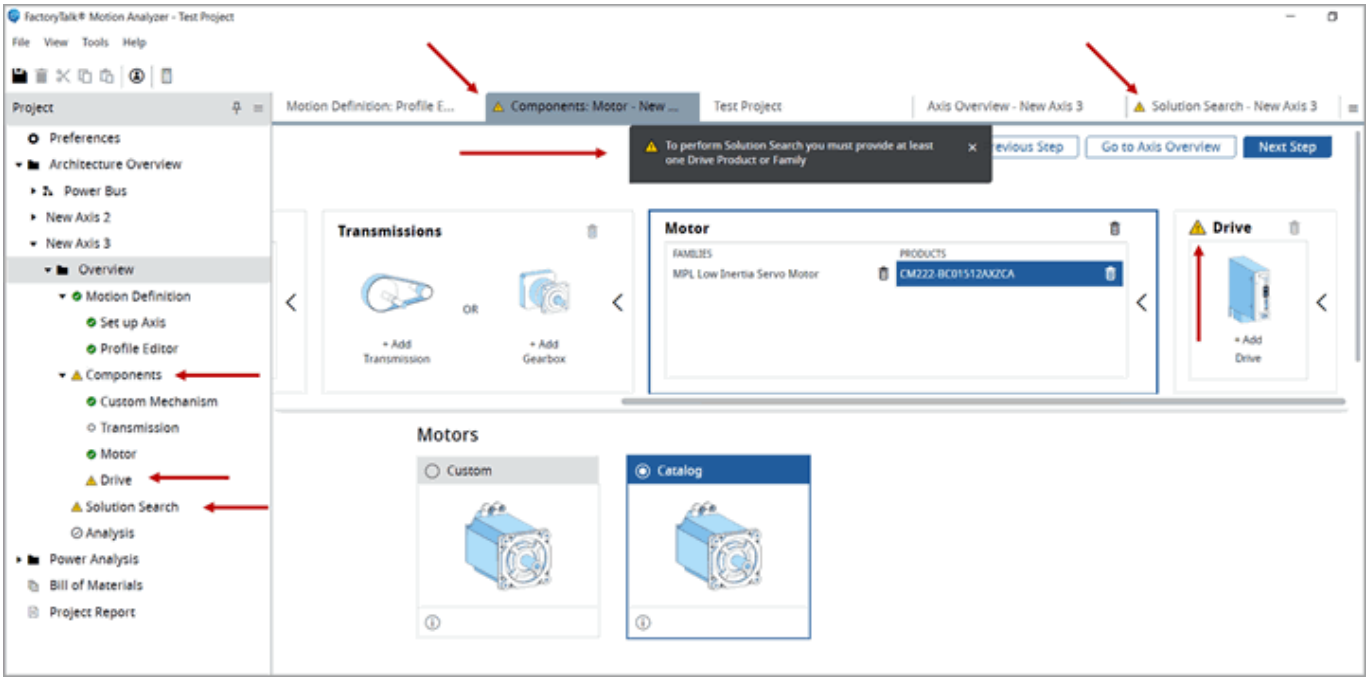


Figure: Warning icons for Motor



DSM Motor

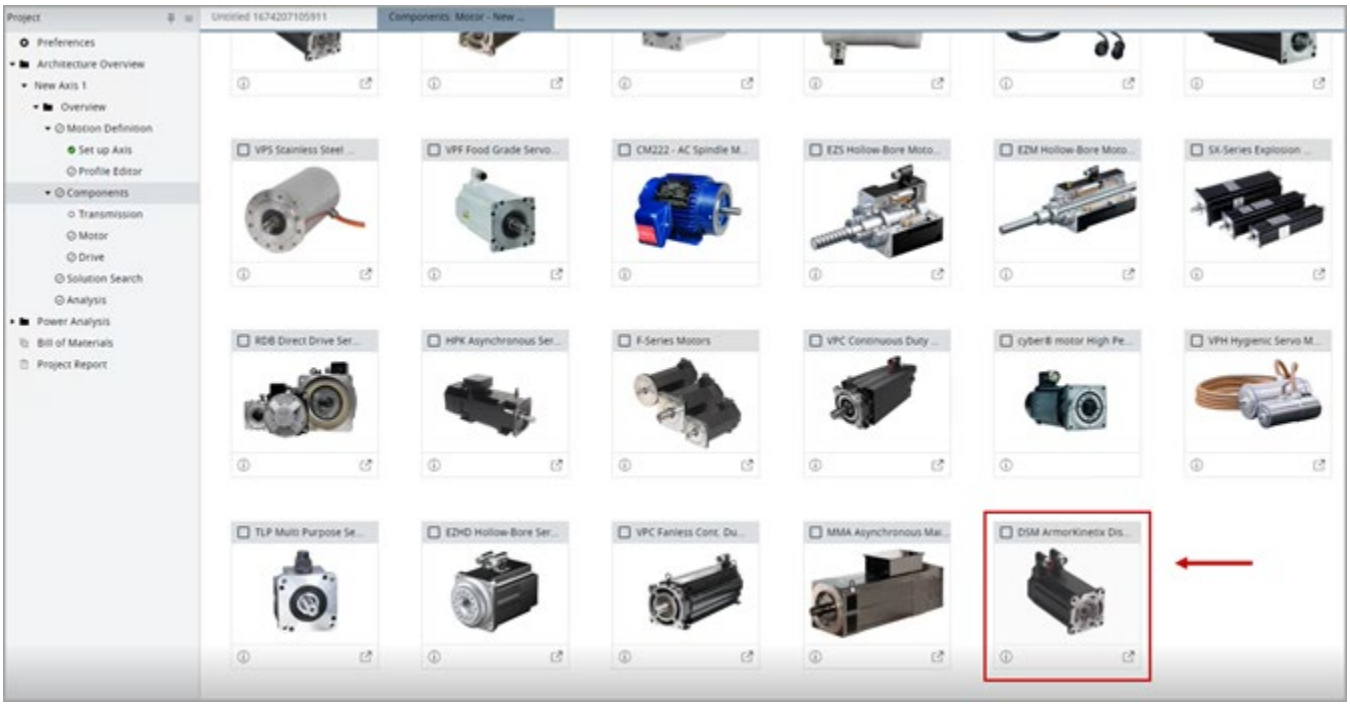
ArmorKinetix® Distributed Servo Motors (DSM) integrate the proven technologies of Kinetix® 5700 Servo Drives and VP Low Inertia Servo Motors into an On Machine™ decentralized motion solution supporting Integrated Motion on EtherNet/IP. This Kinetix® 5700/VPL combo is designed to be mounted out on the application rather than in an electrical enclosure. This decentralized approach simplifies design architectures by minimizing cabling requirements, reducing electrical enclosure requirements, decreasing enclosure climate control requirements, and enabling a modular/expandable solution. The simplified approach helps reduce overall installation and commissioning time while simplifying the architecture and potentially reducing overall machine size.

Add DSM Motors

Perform the following steps to add DSM Motors:

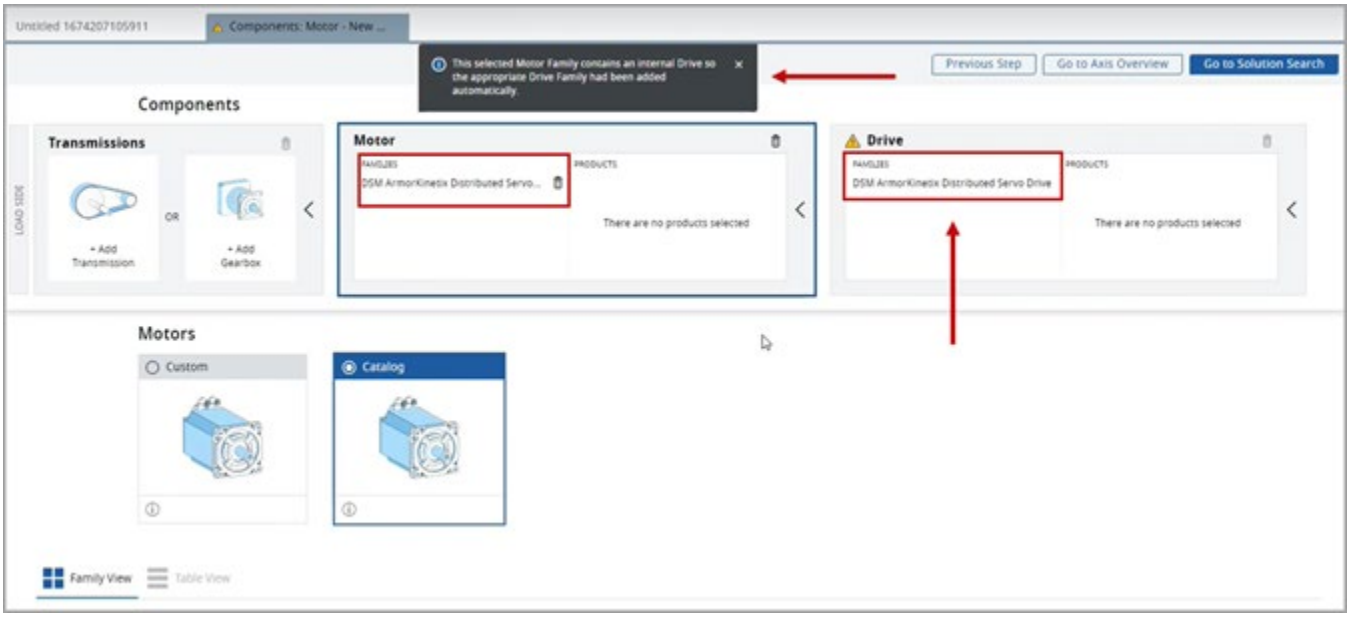
1. Under the Family view, select the DSM Motor family.

Figure: DSM Motor



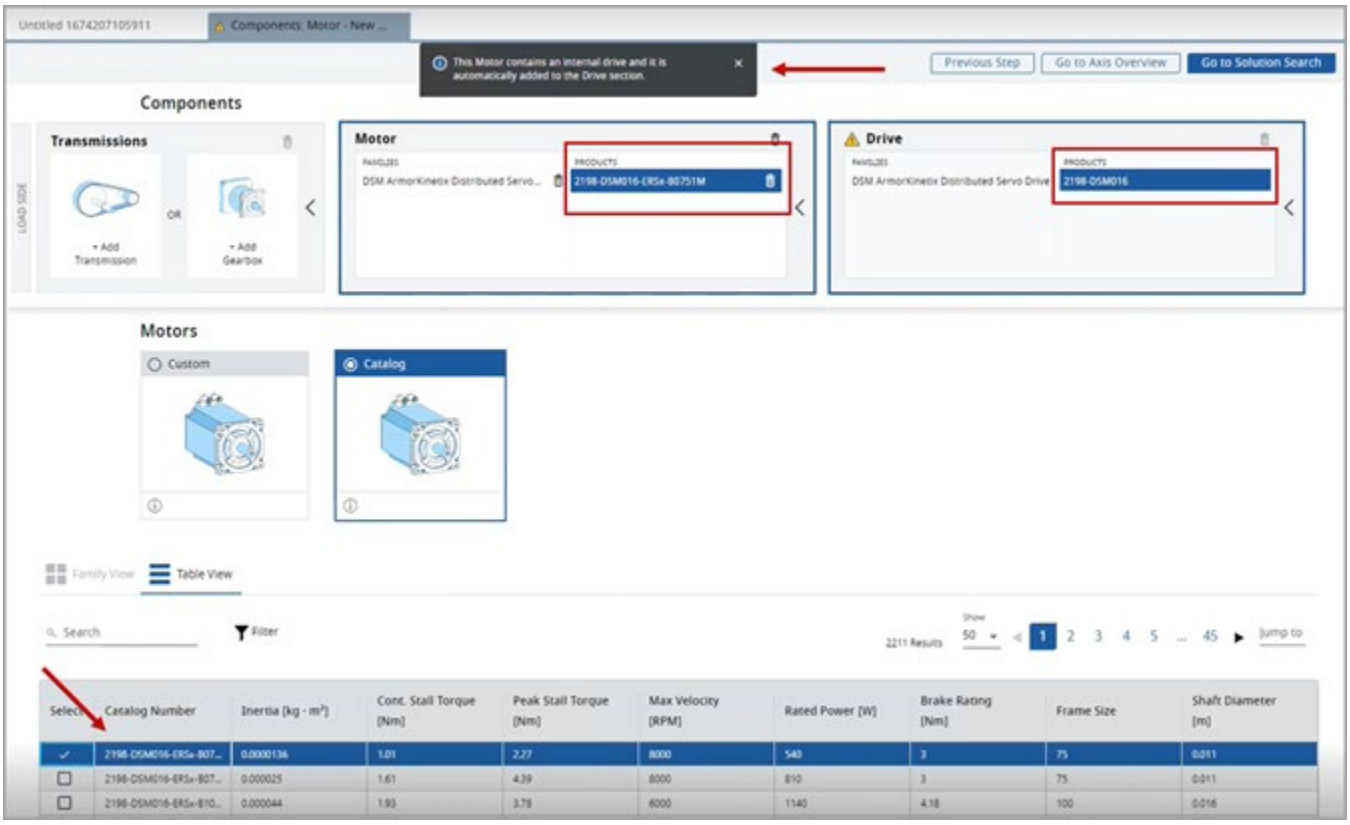
2. The DSM motors is added to the axis workflow. By default, the DSM motors contain a drive inside and the drive is automatically added as shown in the following image:

Figure: Internal Drive



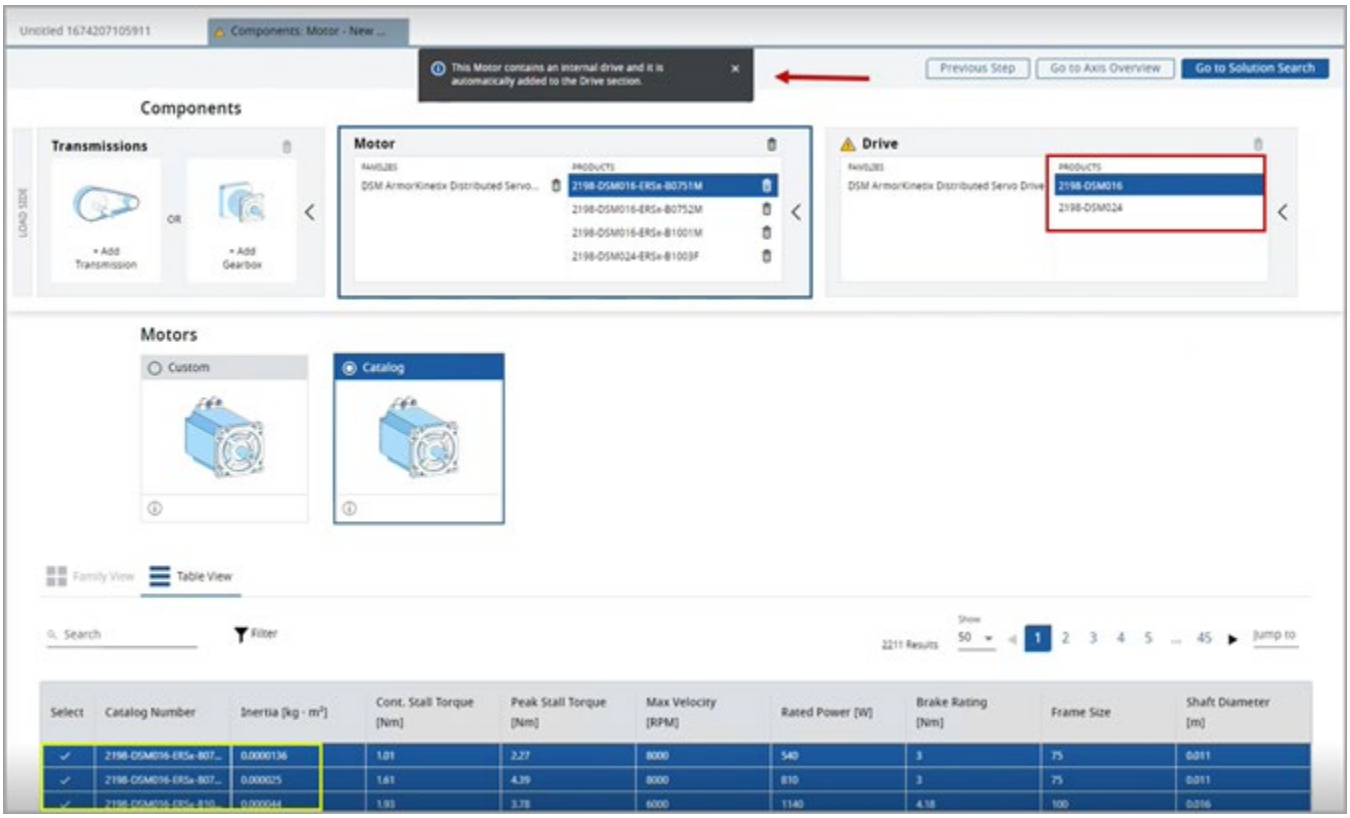
3. User can select the specific DSM Motors under the Product view. The respective drive is automatically added and the user cannot delete the drive, hence the delete icon is disabled.

Figure: Drive Delete Icon



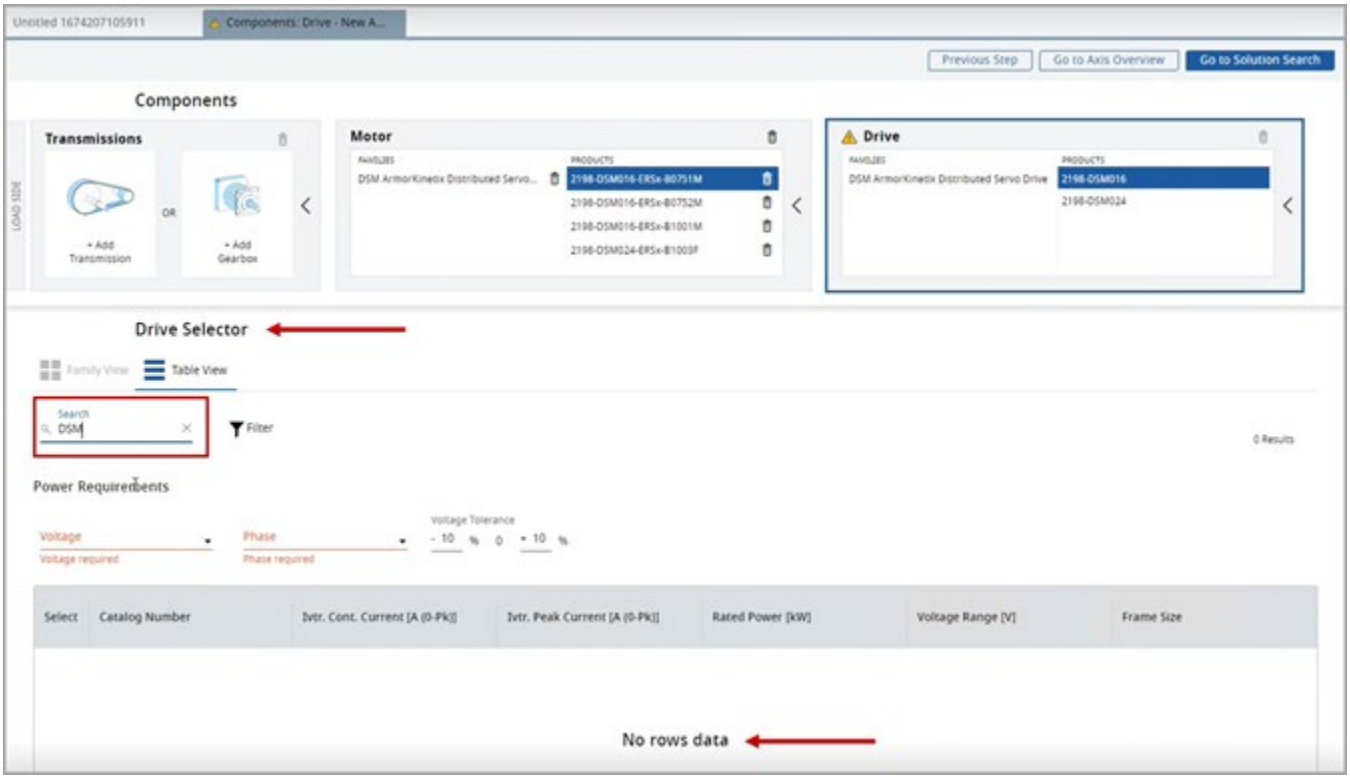
- If multiple DSM motors are added, then the respective drive(s) are automatically added as shown in the following images:

Figure: Multiple Motors



Hence a user cannot add any other DSM drives to these DSM motors manually. If required, user can add drives other than the DSM.

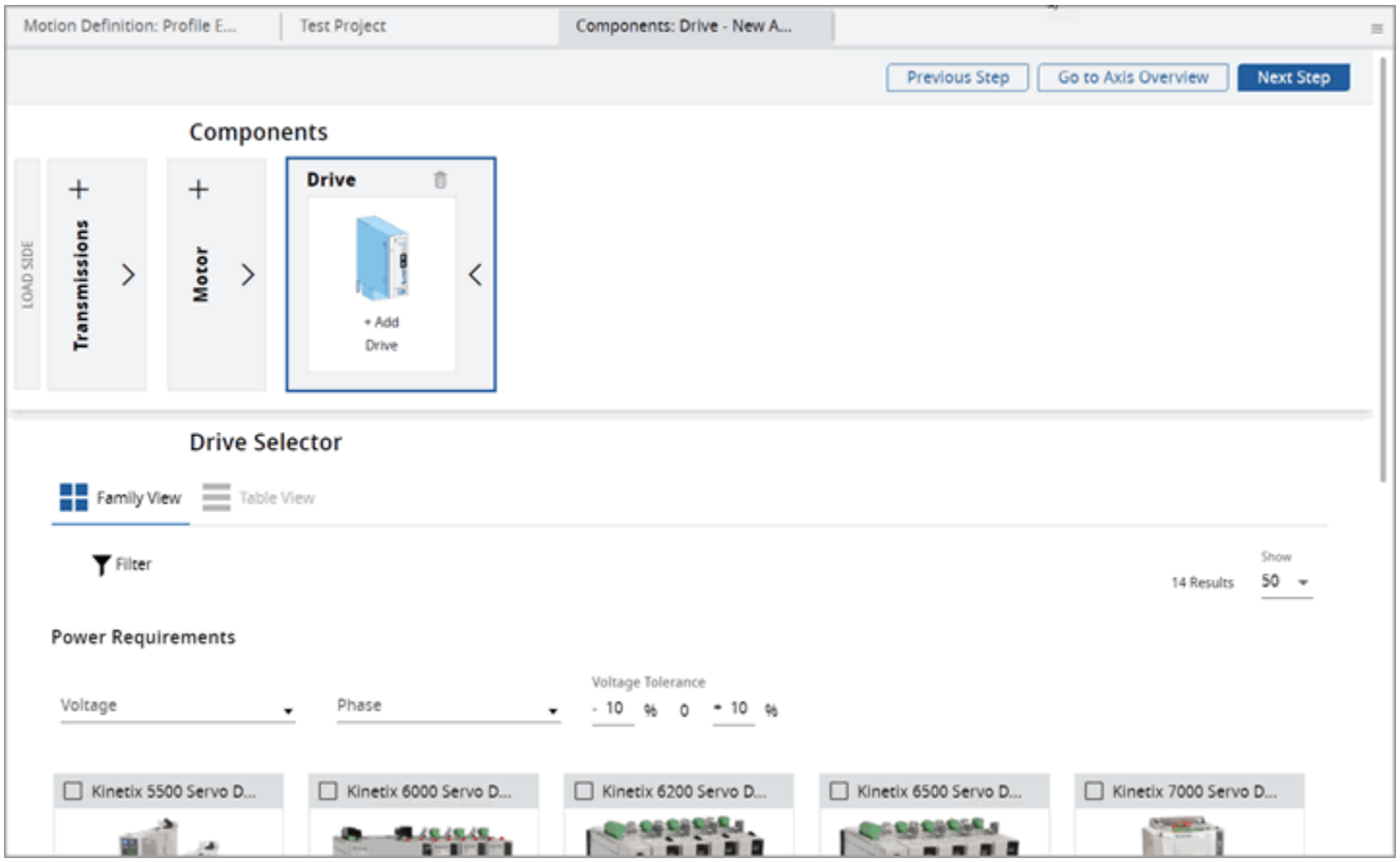
Figure: Drive Selector



Choose Your Drive

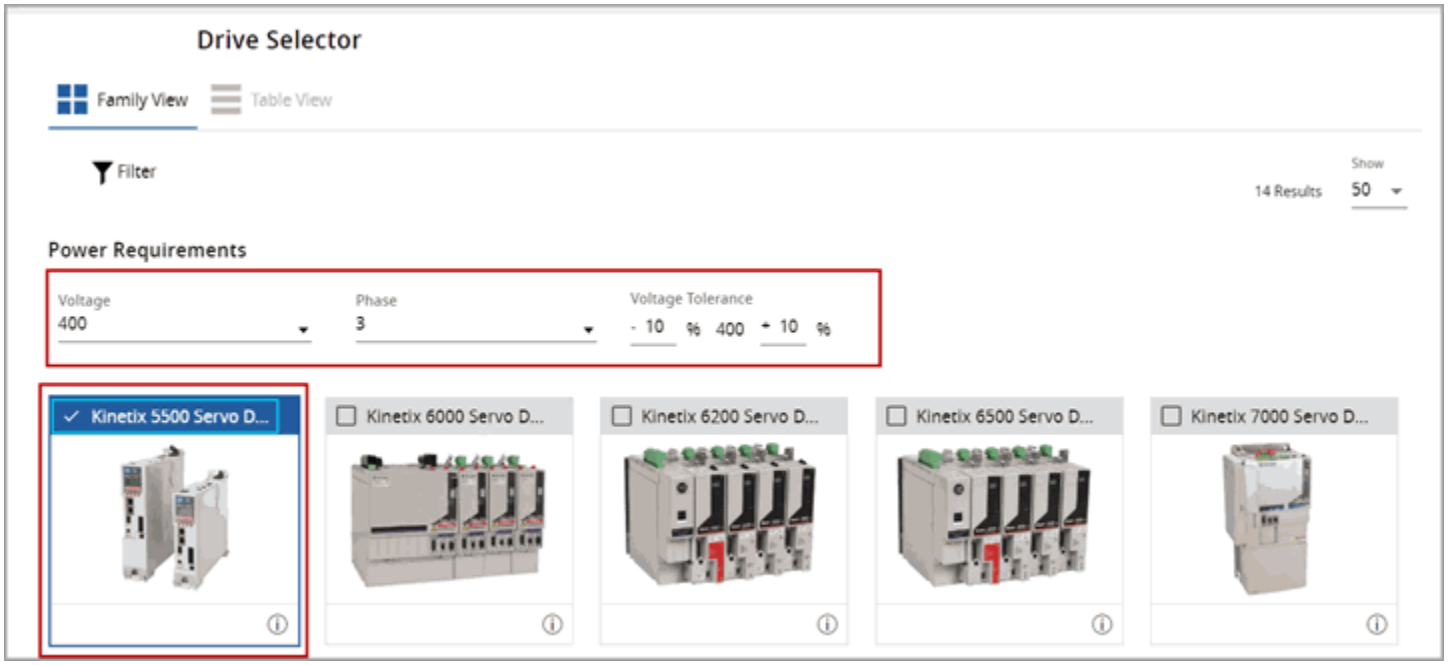
Use the Components: Drive tab to select a preferable Drive family or product.

Figure: Components: Drive tab



The Family View tab in the Drive Selector section displays the list of available Drive families which can be selected.

Figure: Family View in Drive section



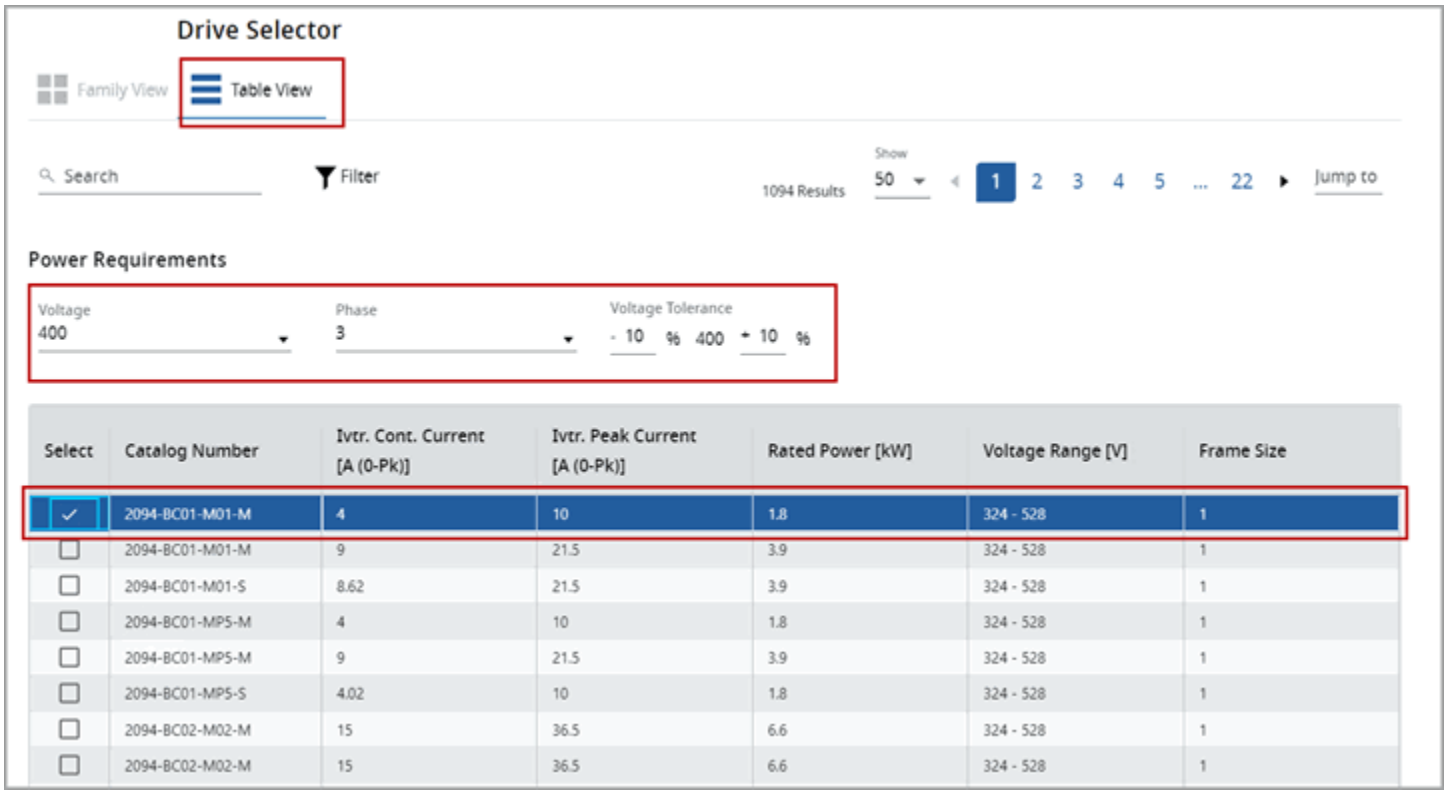
Enter the following parameters to further narrow the drive family options and help the user to decide which drive is best for the application.

Table : Additional parameters for Drives

Parameter	Description	
Power Requirements	Voltage	Select Voltage from the drop-down menu
	Phase	Select Phase from the drop-down menu, available phases depend on the chosen voltage
	Voltage Tolerance	Insert the high and low tolerance for the voltage using input fields

Click [Table View] to open the Table View tab. The Table View tab in the Drive Selector section displays a list of available Drive products which can be selected.

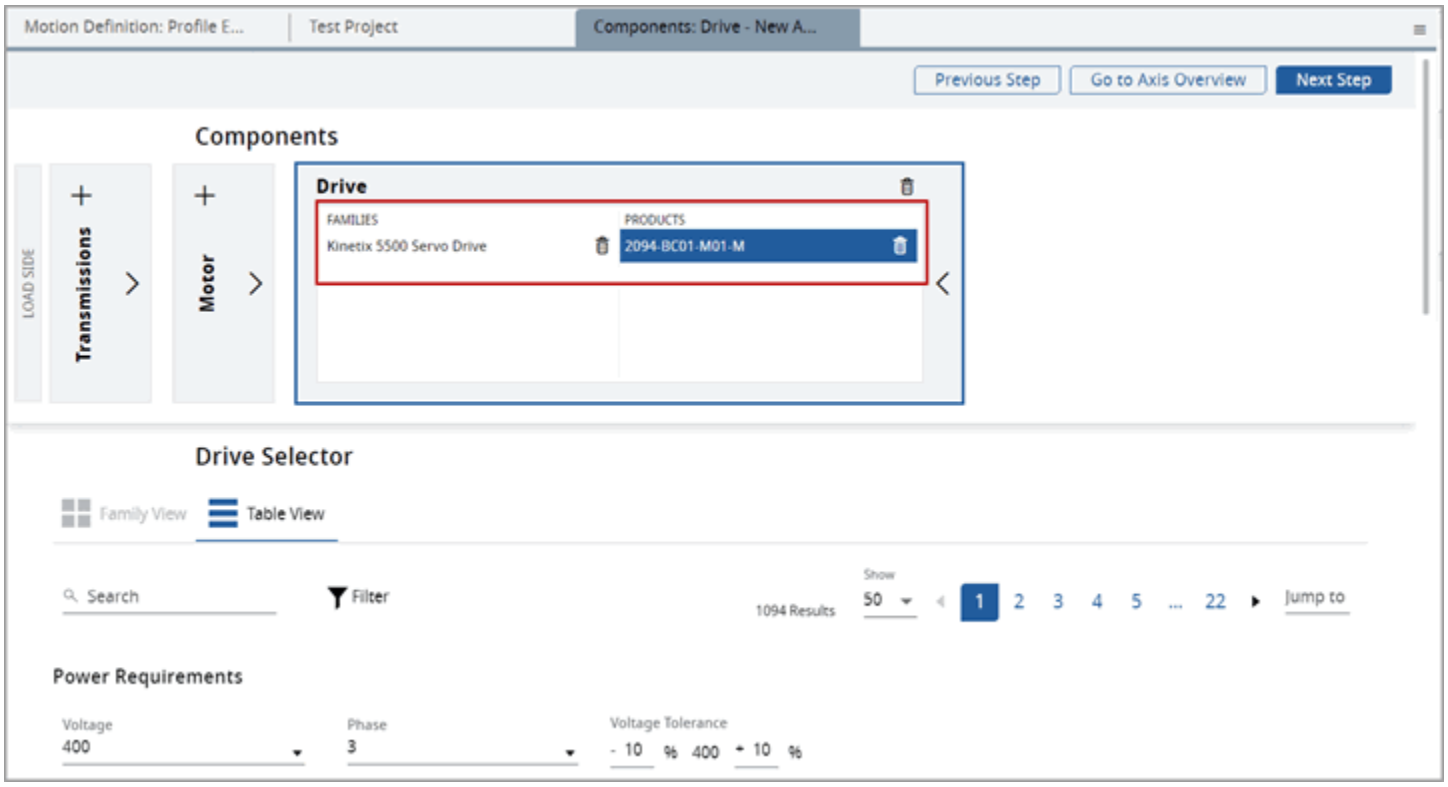
Figure: Table View in Drive Selector section



Use the Search option to find specific Drive products or to filter Drive products with partial text. Click [Family View] to open Family View back.

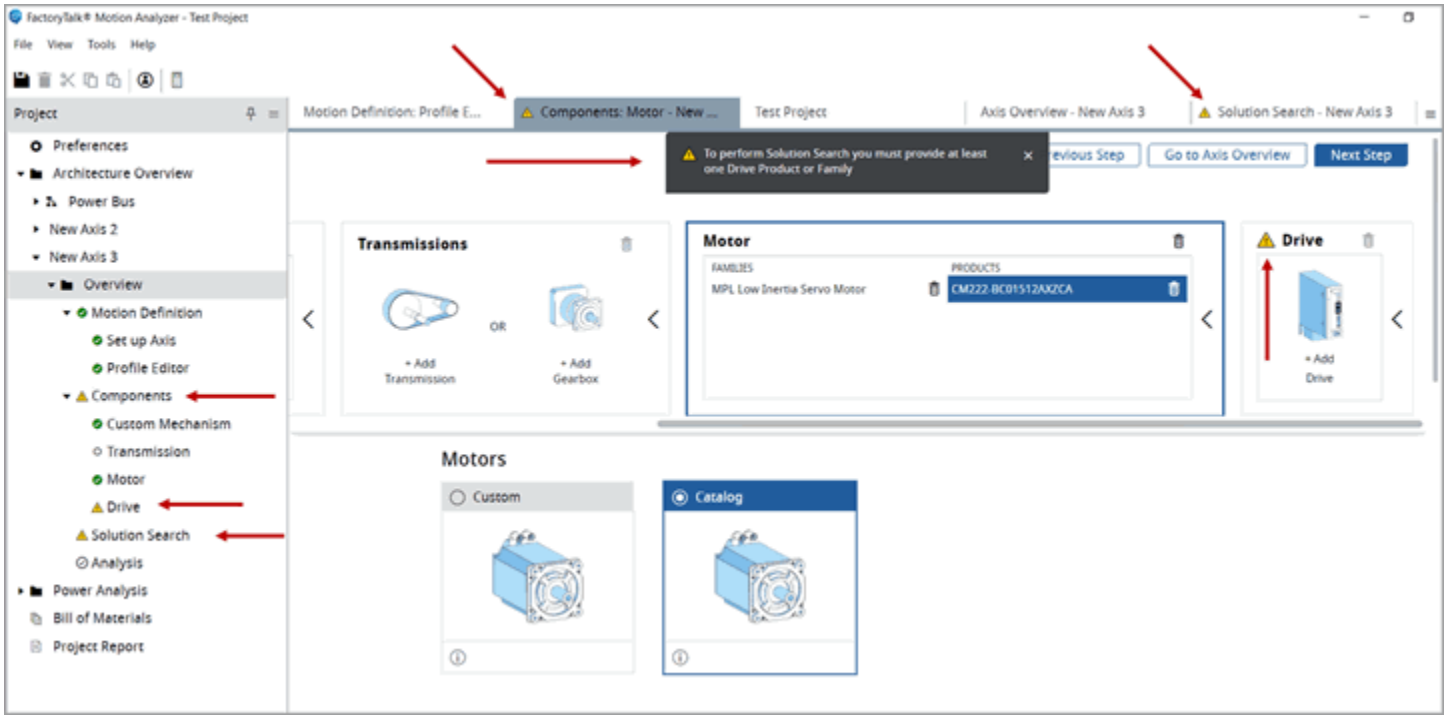
All selected Drive families and products will be displayed in the Drive tile in the Components section.

Figure: Components section



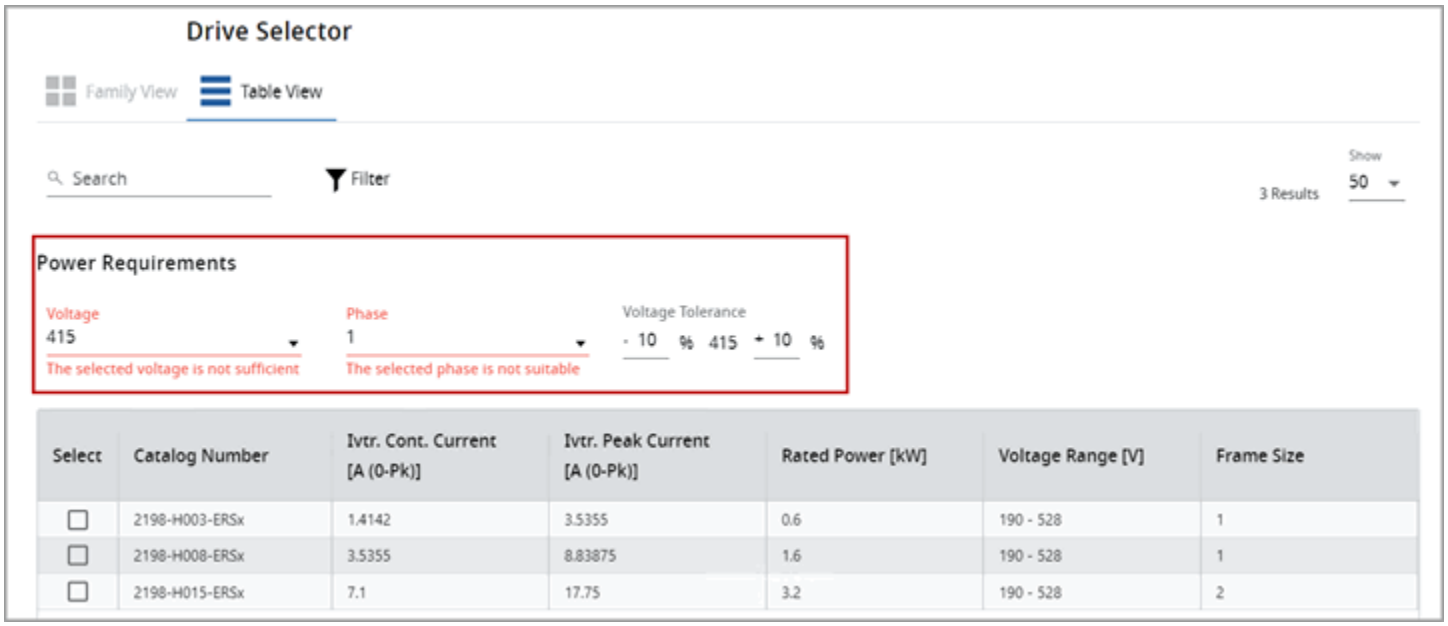
When the user tries to calculate Solution Search without selecting Drive family or product, warning icons will be displayed on the page as well a proper message will show up.

Figure: Warning icons for Drive



If the power requirements of the bus are not valid, a warning icon displays on the respective component(s) as shown in the following image:

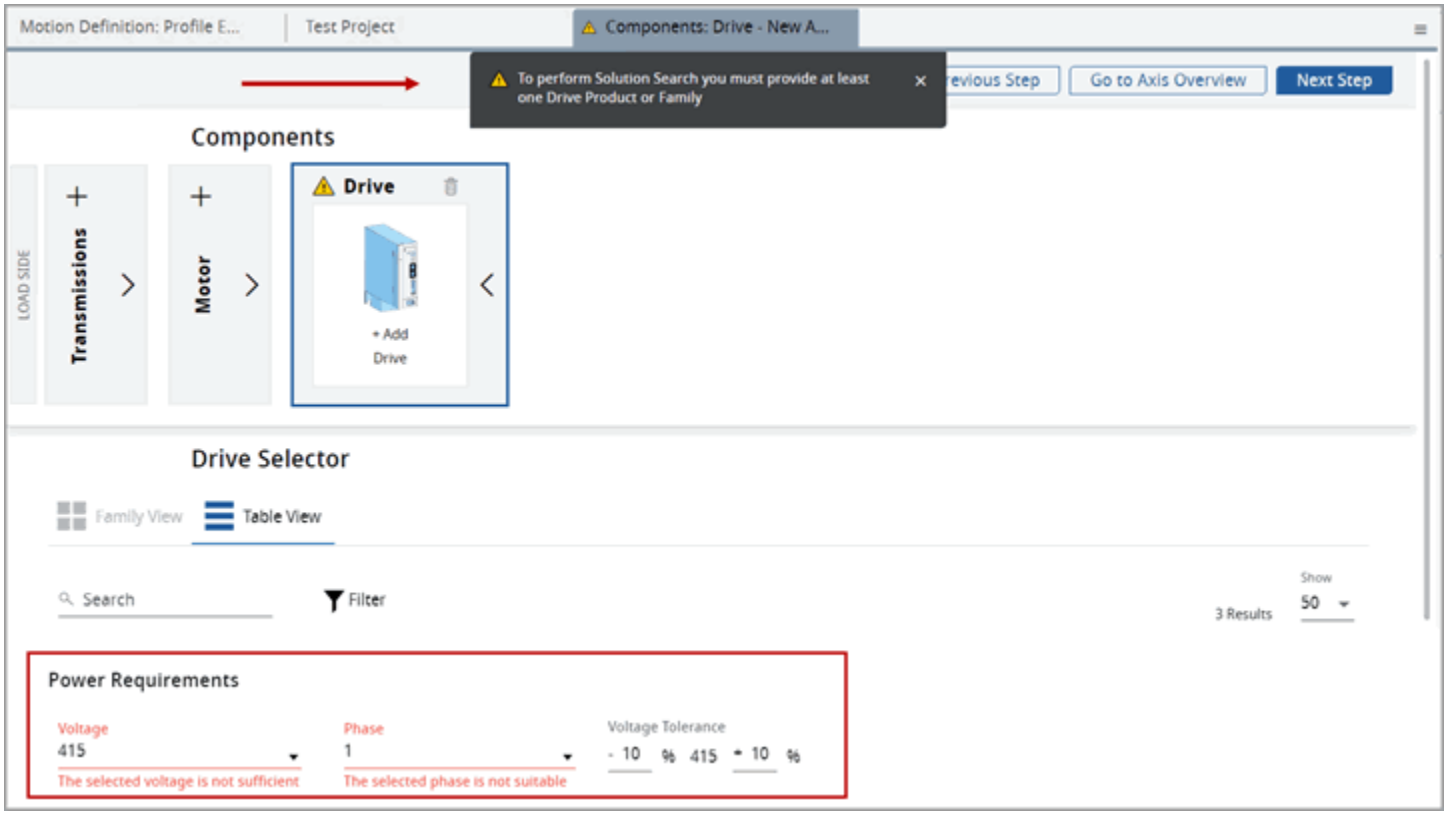
Figure: Warning Icons - Components



Important: The Power requirement validation depends on selected voltage, phase and the selected drive and motor.

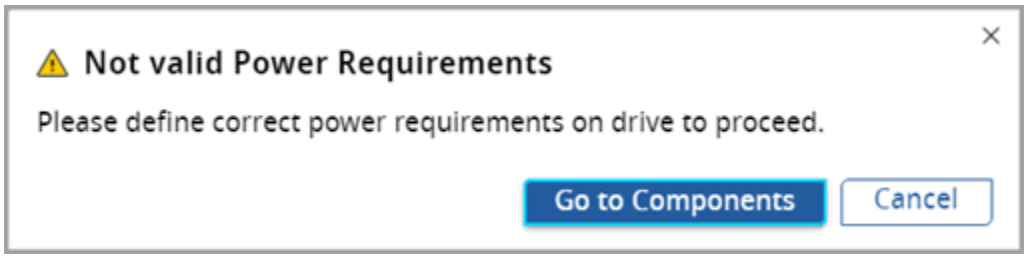
If the power requirements are not valid, an error message displays as shown in the following image:

Figure: Error Message – Power Requirements



If the user tries to move to next step (Solution search), an error dialog displays to define the correct power requirements.

Figure: Error Dialog



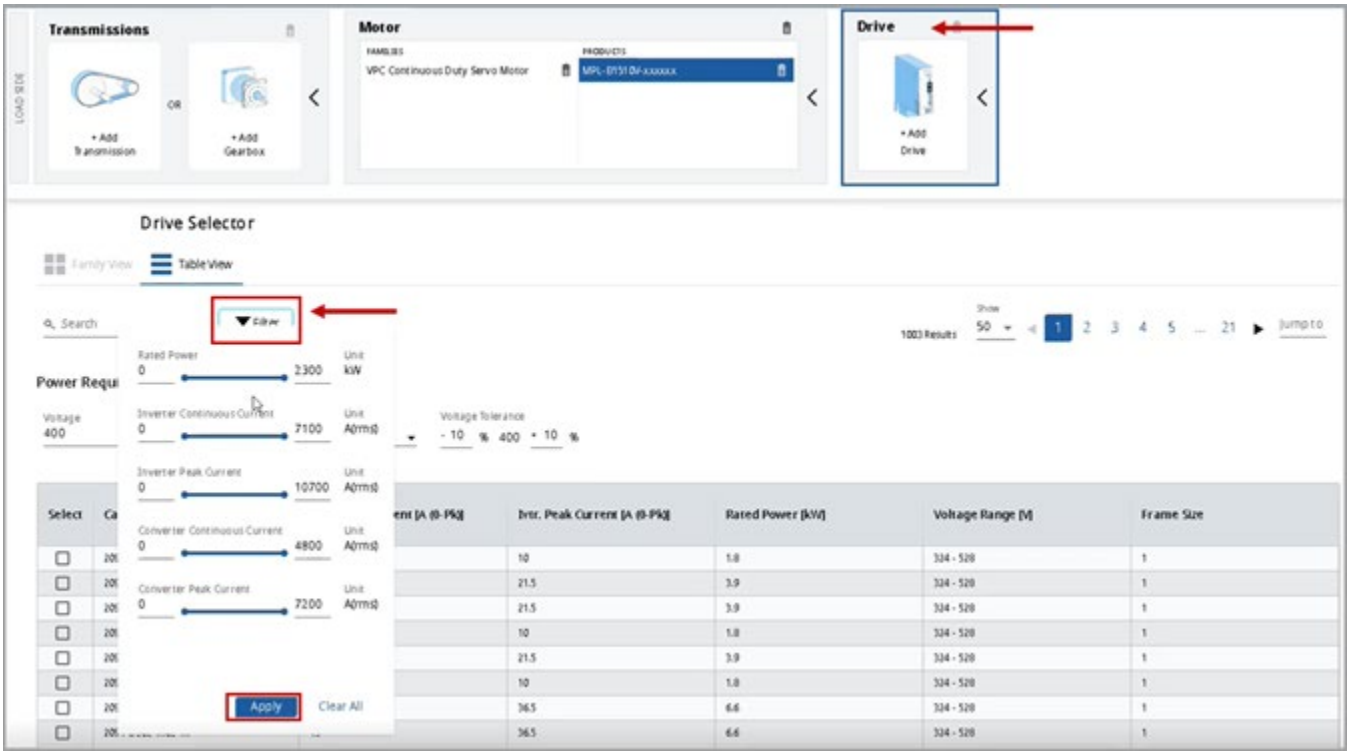
Ensure to provide valid power requirements to proceed further.

Pre-filter Drives

By default, during a workflow, if a motor(s) is selected either from the families or from the products, then the Motion Analyzer application automatically filters and displays the drives that are compatible with that motor(s).

Under the drive selector, user can use the [Filter] option to filter the drives as shown in the following image:

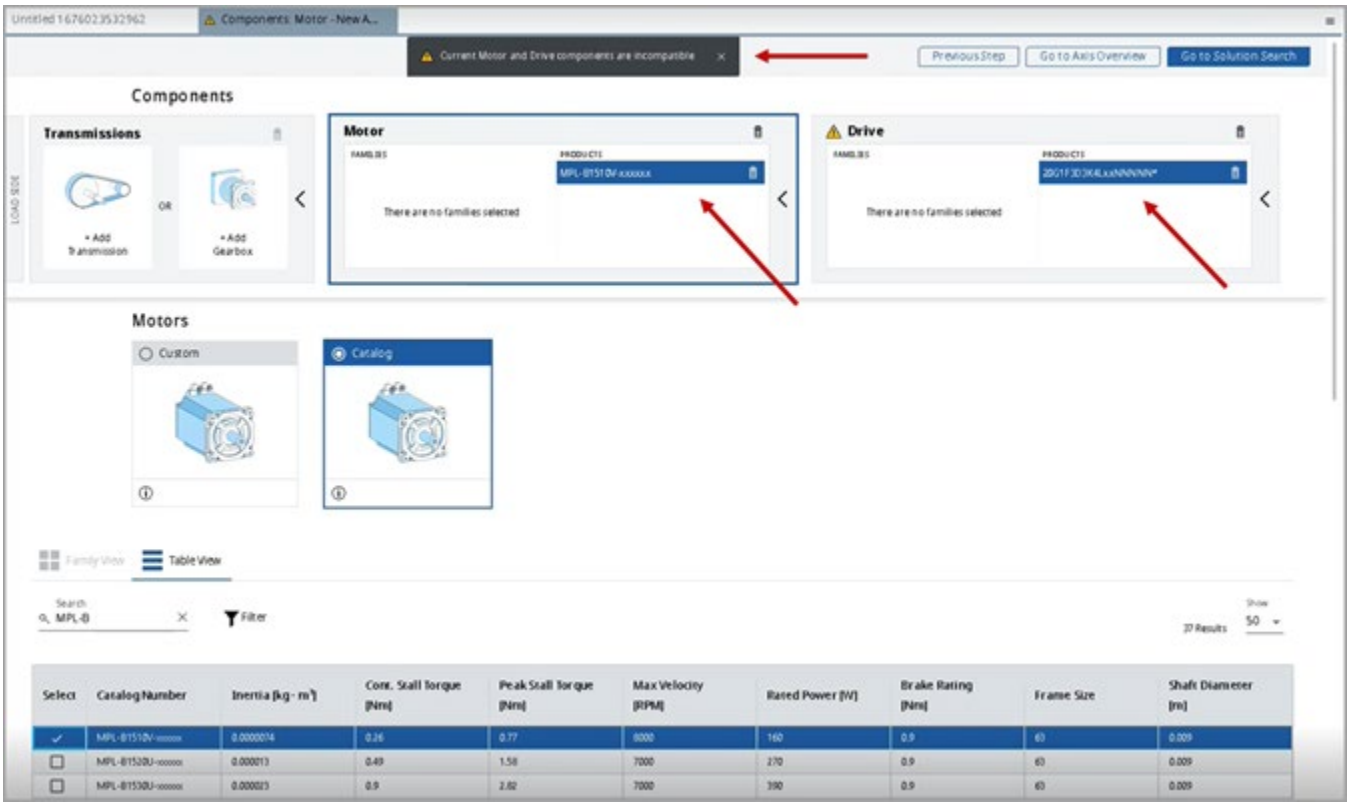
Figure: Drive Selection



Based on the requirements, user can give the minimum and the maximum power values, and the application display the compatible drives.

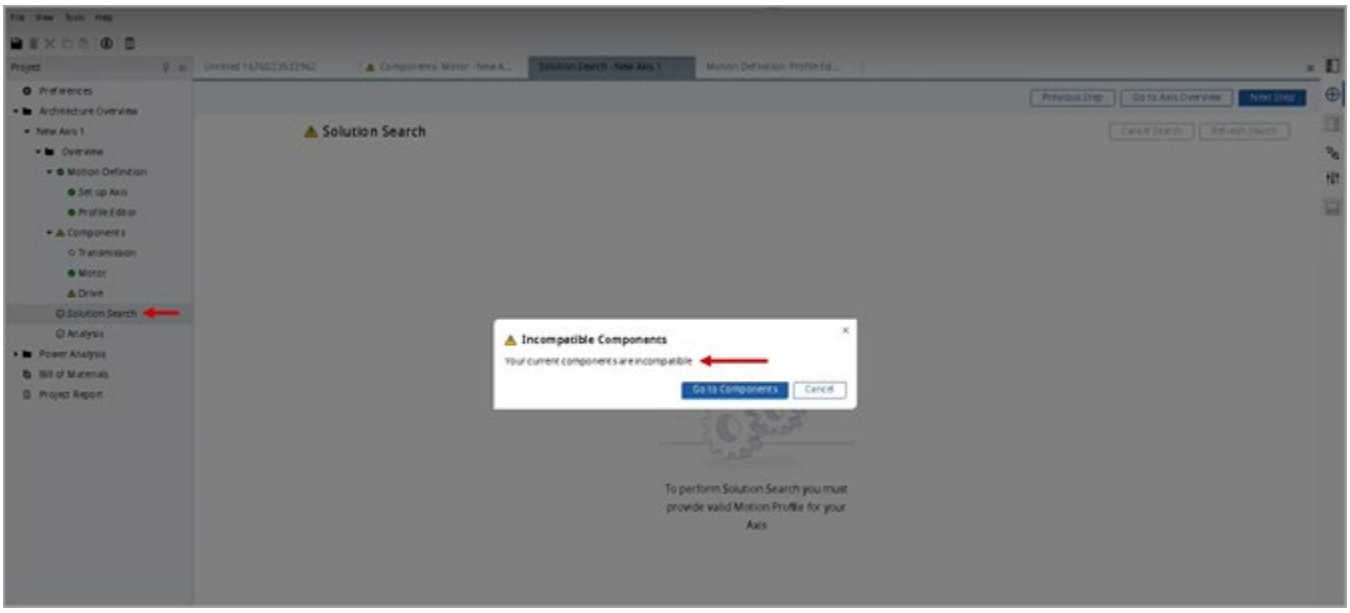
NOTE: In a workflow, if a user tries to select a drive first, even then the application displays all the available motors. In this case, if the user selects a motor that is not compatible with the selected drive, then the “Current Motor and Drive components are incompatible” error message is displayed:

Figure: Available Drives



It also displays warning icons on the project tree. If the user proceeds to Solution Search, a warning dialog displays to return back to the Component section to fix the component configuration as shown in the following image:

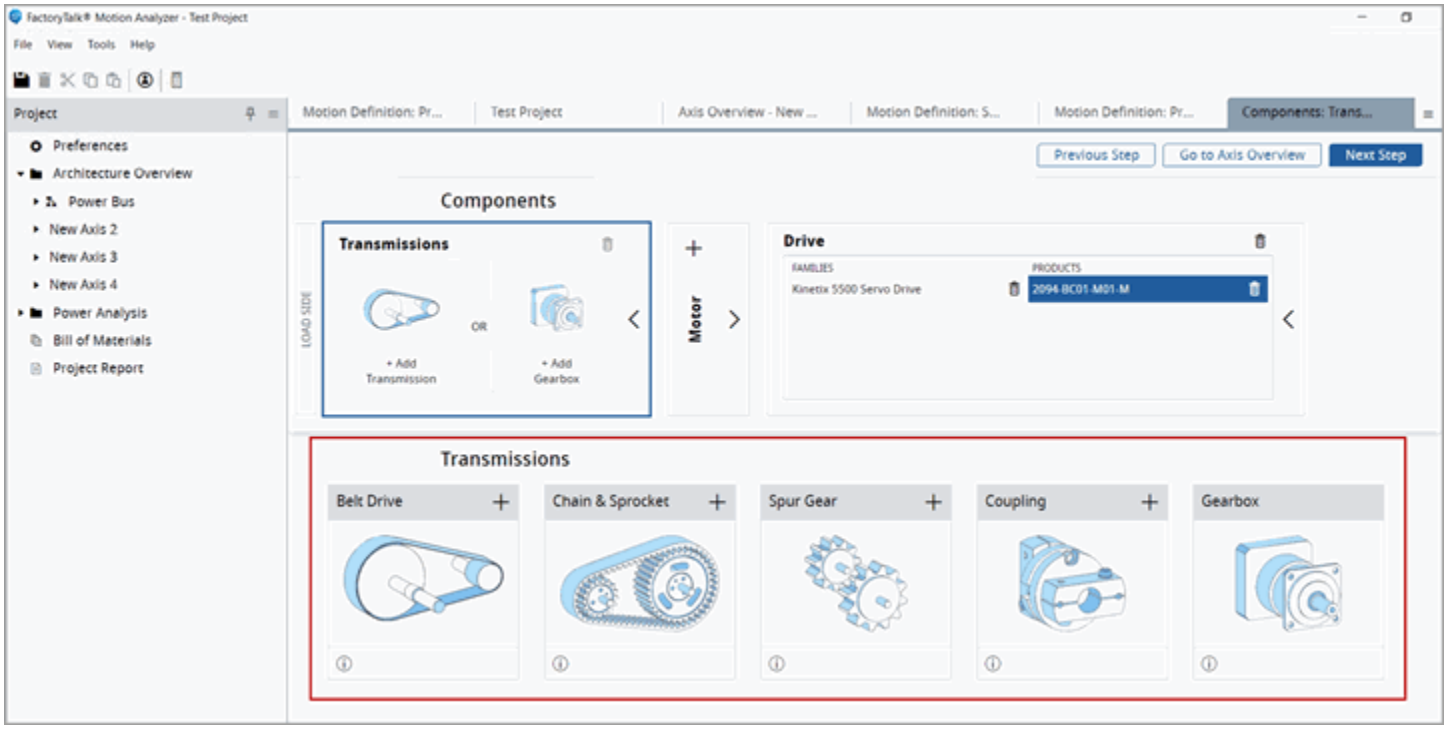
Figure: Incompatible Components



Transmission

A transmission helps to provide a speed-torque conversion, such as a gear reduction or speed reduction, from a higher speed to a slower, more forceful output.

Figure: Components - Transmission Tab



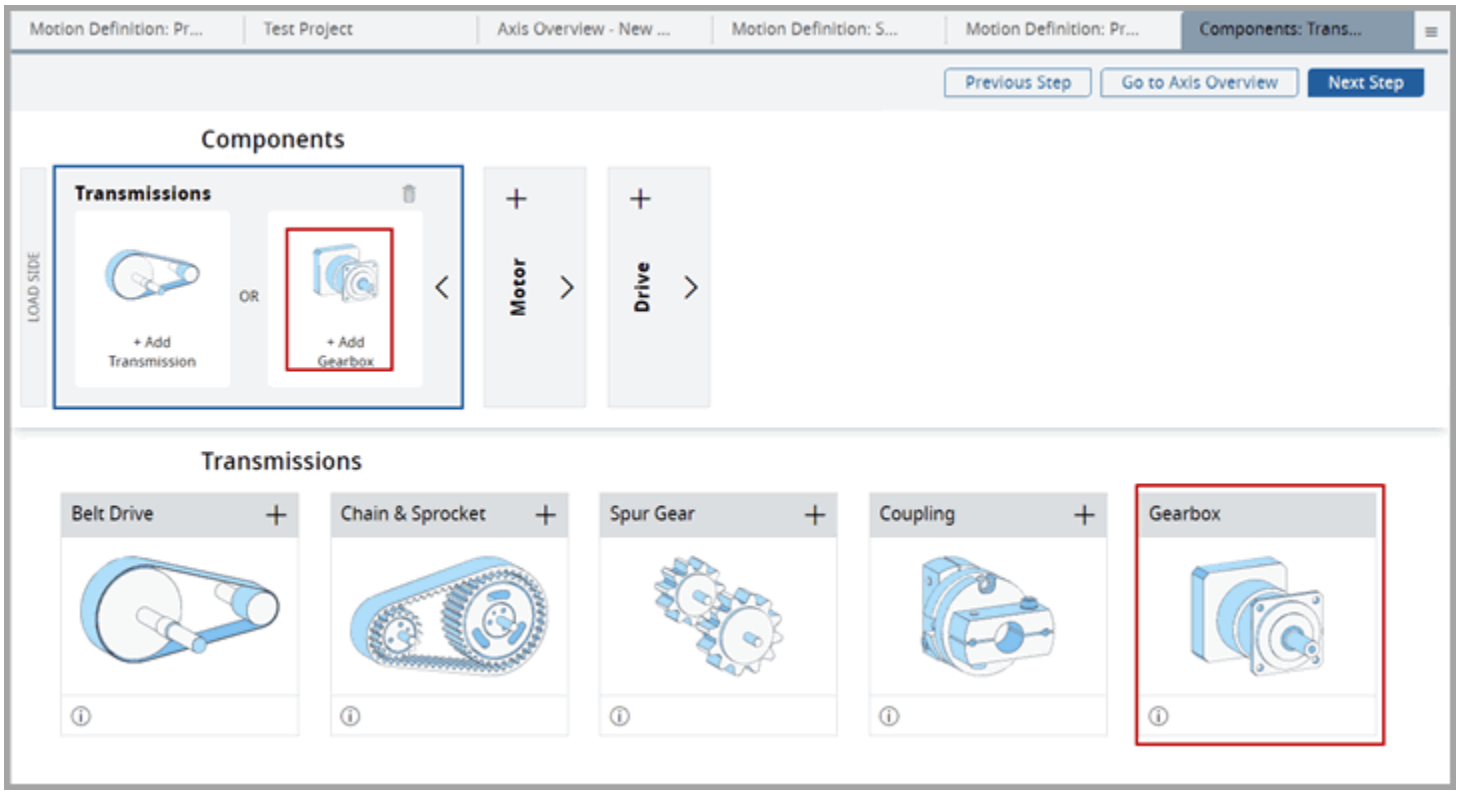
The user may add up to four transmission components, click the [+] icon for the appropriate component.

Table: Transmission types

Transmission type	Description
Belt Drive	A belt drive consists of a loop of flexible material that is used to mechanically link two or more rotating shafts with pulleys.
Chain & Sprocket	A sprocket is a profiled wheel with teeth that mesh with a chain.
Spur Gear	A spur gear consists of a rod or disk with the teeth extruding radially. These gears can mesh together correctly only if they are fitted to parallel shafts.
Coupling	A coupling is a device used to connect two shafts together at their ends to transmit power. The inertia, stiffness, and backlash of couplings can be found in Manufacturers Data Sheets.

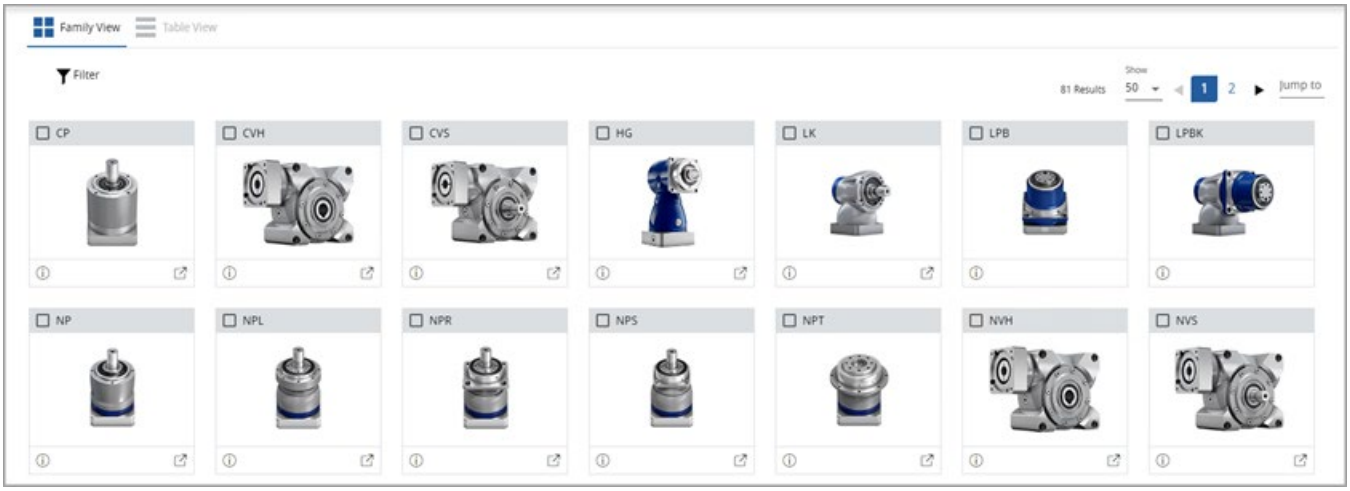
The user may also add gearbox families or products. Click [Add Gearbox] or Gearbox tile to open the Family View tab.

Figure: Family View tab for Gearboxes



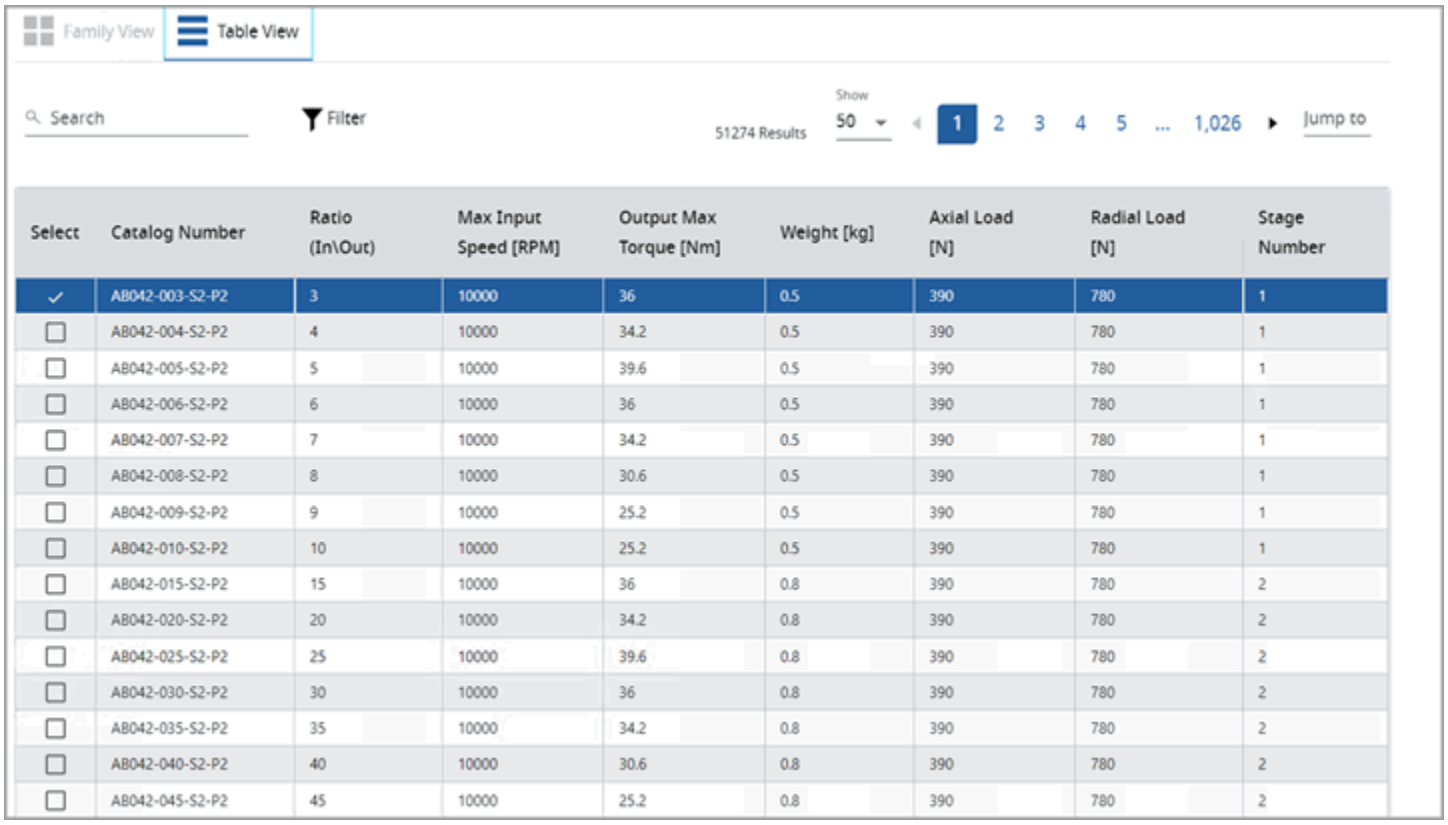
The Family View tab displays a list of available Gearbox families which can be selected.

Figure: Family View for Gearboxes



Click [Table View] to open the Table View tab which displays a list of available Drive products which can be selected.

Figure: Table View for Gearboxes

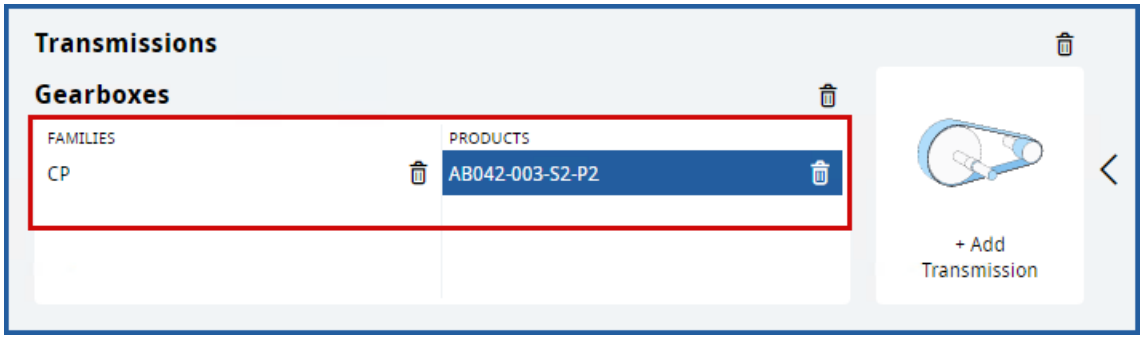


Select	Catalog Number	Ratio (In\Out)	Max Input Speed [RPM]	Output Max Torque [Nm]	Weight [kg]	Axial Load [N]	Radial Load [N]	Stage Number
✓	AB042-003-S2-P2	3	10000	36	0.5	390	780	1
☐	AB042-004-S2-P2	4	10000	34.2	0.5	390	780	1
☐	AB042-005-S2-P2	5	10000	39.6	0.5	390	780	1
☐	AB042-006-S2-P2	6	10000	36	0.5	390	780	1
☐	AB042-007-S2-P2	7	10000	34.2	0.5	390	780	1
☐	AB042-008-S2-P2	8	10000	30.6	0.5	390	780	1
☐	AB042-009-S2-P2	9	10000	25.2	0.5	390	780	1
☐	AB042-010-S2-P2	10	10000	25.2	0.5	390	780	1
☐	AB042-015-S2-P2	15	10000	36	0.8	390	780	2
☐	AB042-020-S2-P2	20	10000	34.2	0.8	390	780	2
☐	AB042-025-S2-P2	25	10000	39.6	0.8	390	780	2
☐	AB042-030-S2-P2	30	10000	36	0.8	390	780	2
☐	AB042-035-S2-P2	35	10000	34.2	0.8	390	780	2
☐	AB042-040-S2-P2	40	10000	30.6	0.8	390	780	2
☐	AB042-045-S2-P2	45	10000	25.2	0.8	390	780	2

Use the Search option to find specific Gearbox products or to filter Gearbox products with partial text. Click [Family View] to open Family View back.

All added Transmissions and Gearbox families and products will be displayed in the Transmission tile in the Components section.

Figure: Components Section



The user may modify the parameters of every added transmission on its respective tile.

Table: Transmission Parameters

Parameter	Description
Ratio	Transmission component ratio. If a straight-through coupling is being modeled, set Ratio = 1
Inertia	Inertia on the motor side (the rotor inertia and if a gearbox is present, the inertia of the pinion attached to the rotor).

Efficiency	Efficiency is widely misused. It refers to the ratio of output power to input power for a single operating condition, but a servo system typically operates over a wide range of operating conditions. A gearbox supplier normally specifies the efficiency at an optimum point such as full load and full speed. For example, a gearbox that has an output rating of 100 Nm (885 lb. in.) and an efficiency of 98%. This means that the losses at full load are 2 Nm (18 lb. in). But because most of the losses in a gearbox are due to shaft seal friction and churning of the lubricant, this would not reduce significantly at a lower load torque. In using this gearbox, a well-matched servo motor only has a continuous rating of around one-third of the peak torque, and it is quite likely that the average torque over the motion cycle would be even lower, for example about 20 Nm (177 lb in) at the gearbox output. The losses of 2 Nm (18 lb in) amount to 10% of the load on the motor, which can have a significant effect on the temperature rise of the motor. Motion Analyzer software overcomes this problem by dynamically computing the real losses throughout the motion cycle, and thereby avoids underestimating the effect of losses on the motor.
Friction	This is the torque caused by friction on the motor side between the rotor and the transmission component. This value can be obtained from the supplier or Engineering tables.

The user can use the Inertia Calculator to calculate the Inertia for a transmission. Each Transmission has its own Inertia Calculator, and it can store the definitions for each transmission.

Click the [] icon and define the parameters. Refer to Inertia Calculator section.

Solution

To organize the solutions, click on the table header. The column data is now sorted in descending order. Click on the table header again and column data is sorted in the ascending order. Click column heading for a third time restores the default sorting.

By default, 50 results are displayed on each page. To navigate to each page use the pagination control available above the table. Click the page number link or directly typing the page number in the “Jump to” input box. Usercan also use chevrons navigating to previous or next page. The number of displayed results can be changed to one of (10, 20, 50) by using the drop-down menu.

Solution Search Results

The results can be adjusted by using the checkbox filter. A checkbox filter is a filter trigger that enables users to add and remove filters by checking and unchecking boxes next to following filter criteria.

1. Full Matches
2. Partial Matches
3. Not Recommended

The Refresh Search button allows to re-calculate solution search results. The Cancel Search allows to terminate ongoing calculation.

Figure: Solution Search Tab

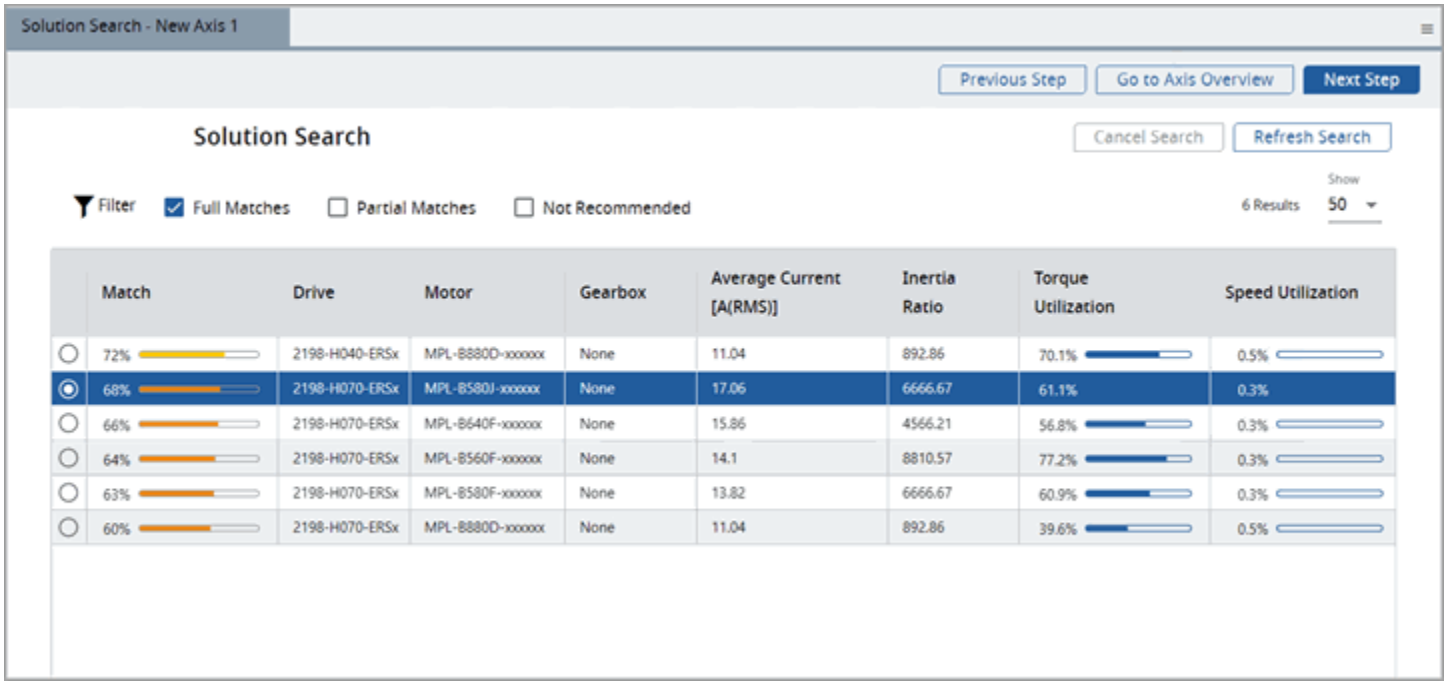


Table: Solution Search Tab Properties

Property	Action

Previous Step	Click to open the Components selection tab
Go to Axis Overview	Click to open the Axis Overview tab
Next Step	Click to open the View Solution tab

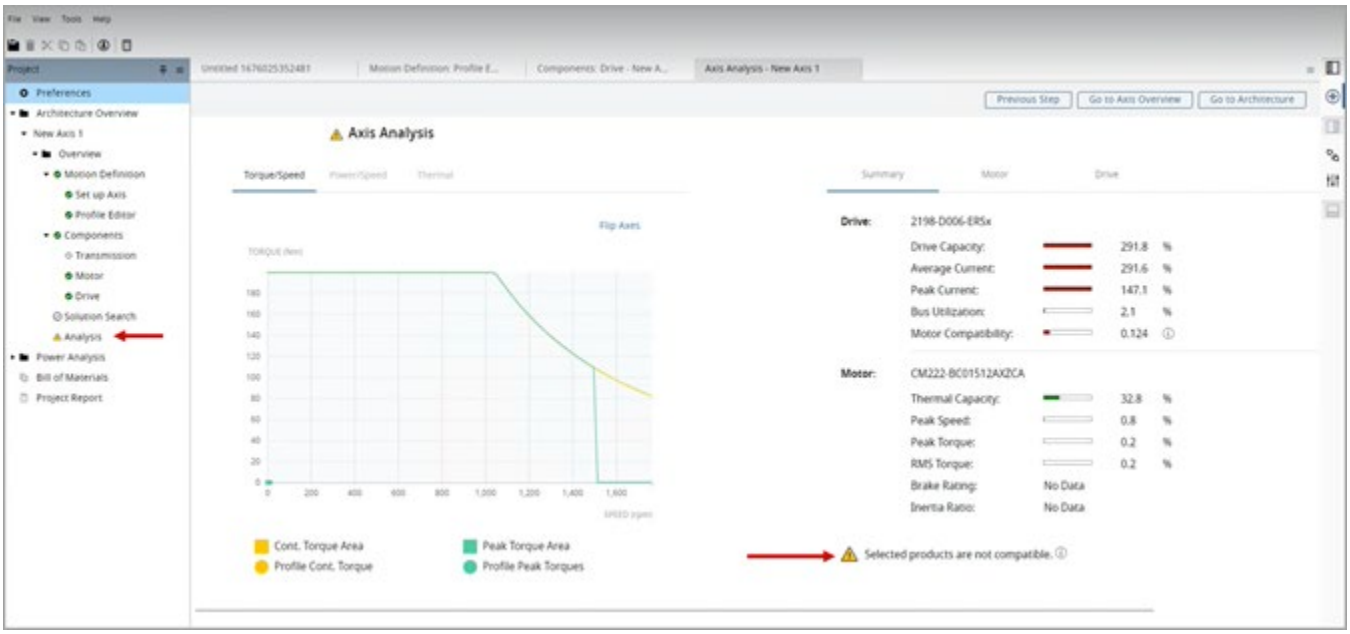
Axis Analysis

The Axis Analysis tab contains information and tools that you can use to evaluate system performance and efficiency.

Figure: Axis Analysis Tab

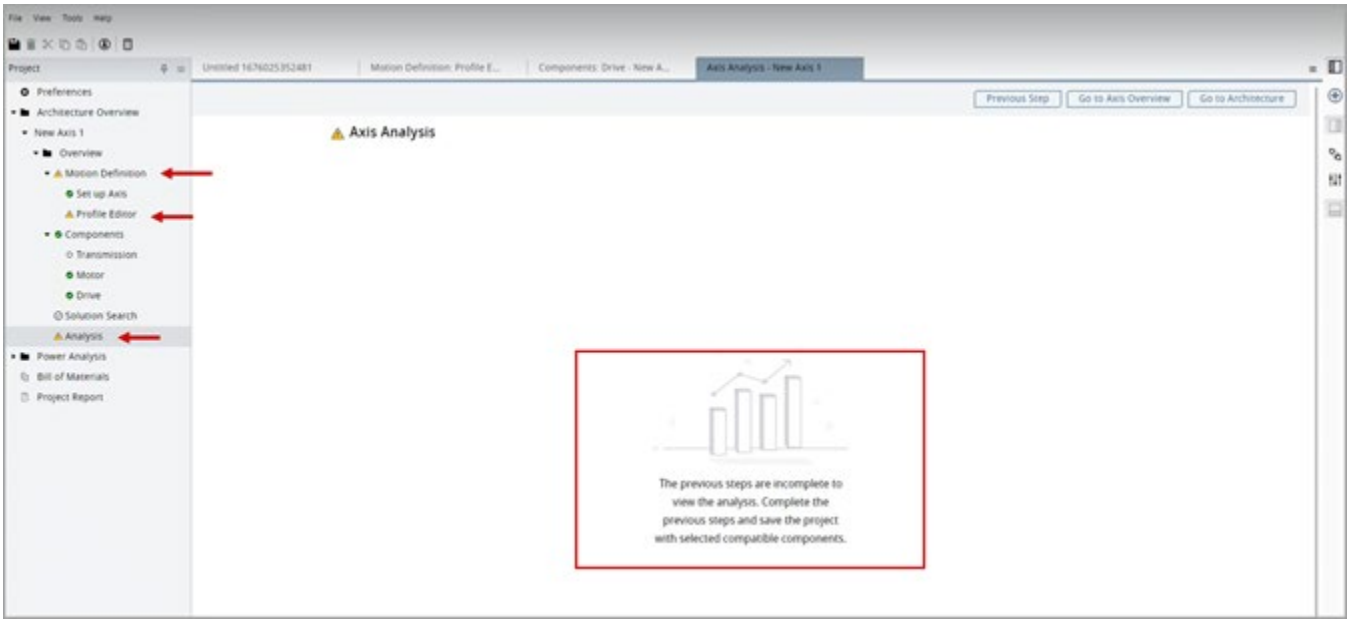
NOTE: If the selected motor and the drive are incompatible, then the warning icon will be displayed in front of the Analysis menu and also under the Torque/Speed Summary page.

Figure: Incompatible Products



NOTE: In case of any incomplete configuration of Motion Profile, if the user proceeds to Axis Analysis, then the application displays a warning icon(s) in front of the respective menu and also an empty Axis Analysis page along with an instruction to complete the previous steps with compatible components to proceed further.

Figure: Incomplete Profile



View the following parameters for your solution. The Summary portion of the Axis Analysis view provides an overall summary of the performance characteristics for the various components of the system.

When a solution includes a gearbox, the inertia ratio is not simply the Reported Application Inertia divided by the Reported Motor Inertia (rotor inertia), as with systems that do not include a gearbox.

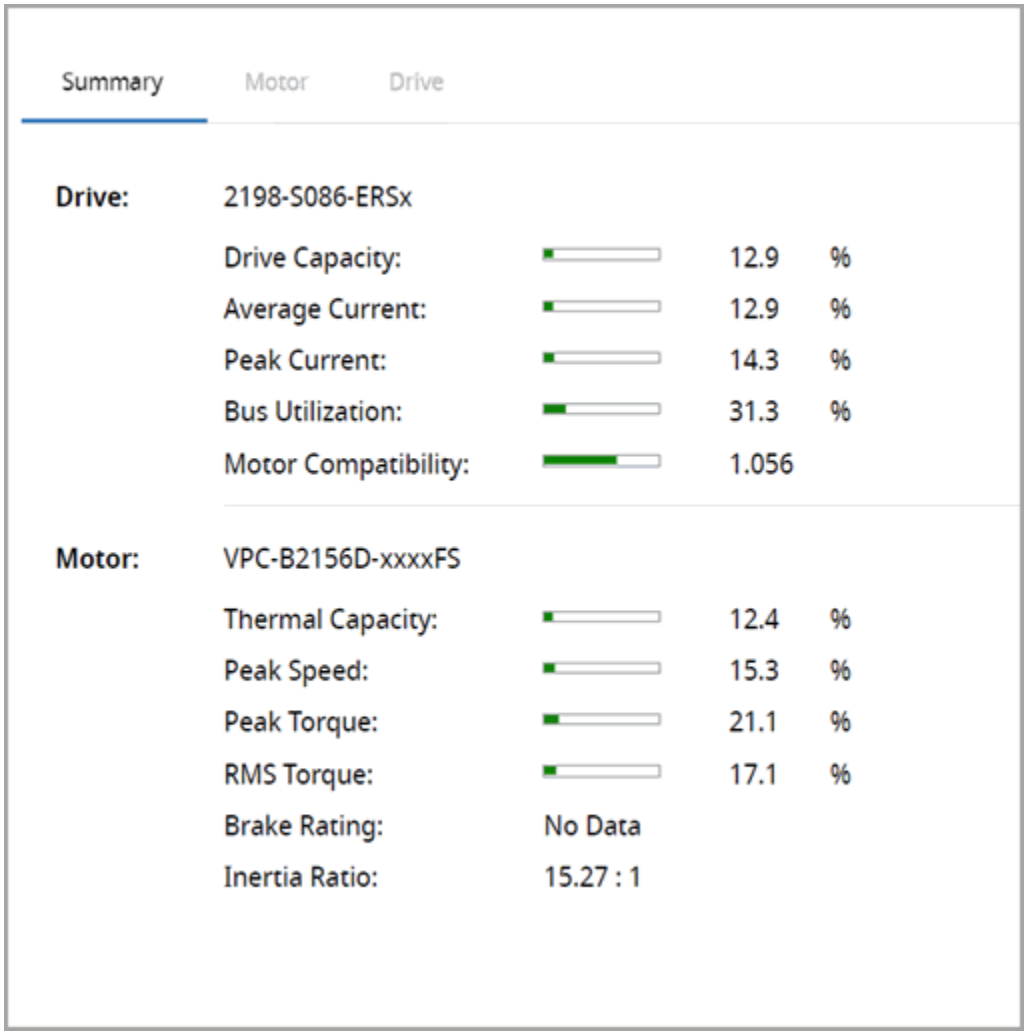
When a system includes a gearbox, the Input Pinion of the gearbox is rigidly attached to the rotor, while the rest of the gears in the gearbox remain connected to the application. Most of the backlash in the system occurs between the input pinion and the rest of the system.

To correctly calculate the inertia ratio, the Input Pinion Inertia must be removed from the Reported Application Inertia and added to the Reported Motor Inertia.

$$\frac{\text{Reported Application Inertia - Input Pinion Inertia}}{\text{Reported Motor Inertia + Input Pinion Inertia}} = \text{Inertia Ratio}$$

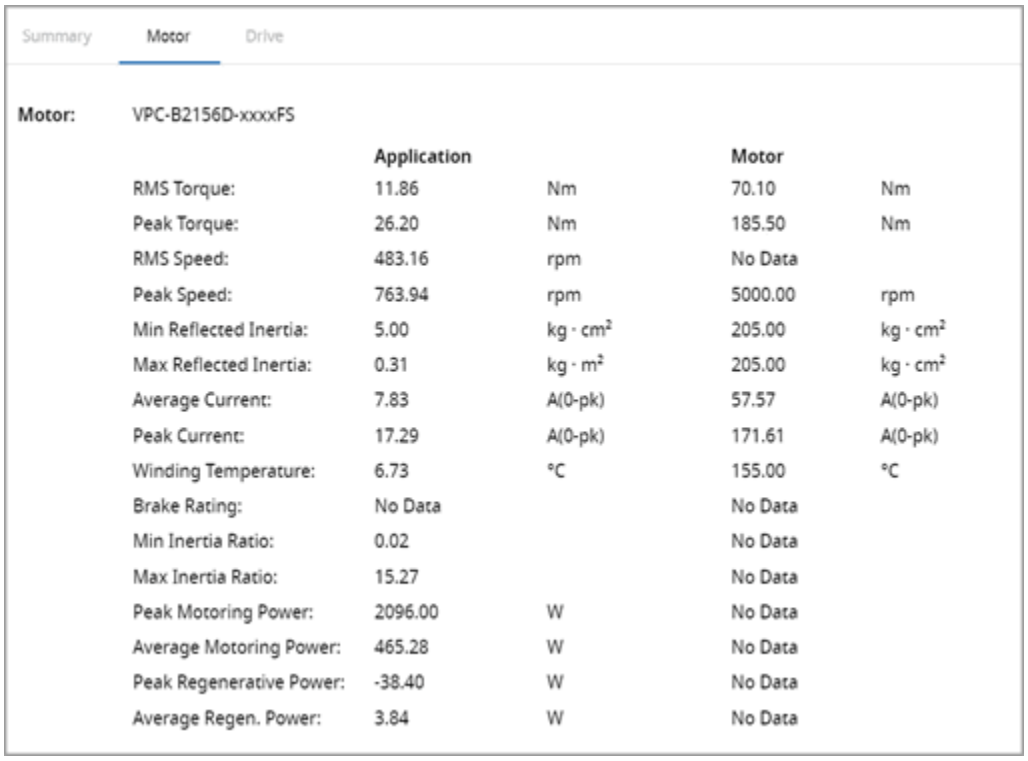
For example, the system in the following image with an VPL-B1001M motor and a VRT-200C-28-F3-28 gearbox has a 1.19:1 inertia ratio.

Figure: Summary Tab



Click the Motor tab to view the Reported Application Inertia and the Reported Motor Inertia.

Figure: Motor Tab



Summary | Motor | Drive

Motor: VPC-B2156D-xxxxFS

	Application		Motor	
RMS Torque:	11.86	Nm	70.10	Nm
Peak Torque:	26.20	Nm	185.50	Nm
RMS Speed:	483.16	rpm	No Data	
Peak Speed:	763.94	rpm	5000.00	rpm
Min Reflected Inertia:	5.00	kg · cm²	205.00	kg · cm²
Max Reflected Inertia:	0.31	kg · m²	205.00	kg · cm²
Average Current:	7.83	A(0-pk)	57.57	A(0-pk)
Peak Current:	17.29	A(0-pk)	171.61	A(0-pk)
Winding Temperature:	6.73	°C	155.00	°C
Brake Rating:	No Data		No Data	
Min Inertia Ratio:	0.02		No Data	
Max Inertia Ratio:	15.27		No Data	
Peak Motoring Power:	2096.00	W	No Data	
Average Motoring Power:	465.28	W	No Data	
Peak Regenerative Power:	-38.40	W	No Data	
Average Regen. Power:	3.84	W	No Data	

The Motion Analyzer database contains the Input Pinion Inertia for every available gearbox. To obtain a correct inertia ratio, Motion Analyzer software adds the Input Pinion Inertia to the Reported Motor Inertia, which decreases the application inertia and increases the motor inertia.

(Reported Application Inertia - Input Pinion Inertia)/(Reported Motor Inertia + Input Pinion Inertia)=Inertia Ratio

In this example, division produces the correct inertia ratio of 1:19:1.

The individual component tabs (for example, Motor, Drive, Gearbox and Transmission) provide detailed performance information.

Figure: Motor Tab

Summary | Motor | Drive

Motor: VPC-B2156D-xxxxFS

	Application		Motor	
RMS Torque:	11.86	Nm	70.10	Nm
Peak Torque:	26.20	Nm	185.50	Nm
RMS Speed:	483.16	rpm	No Data	
Peak Speed:	763.94	rpm	5000.00	rpm
Min Reflected Inertia:	5.00	$kg \cdot cm^2$	205.00	$kg \cdot cm^2$
Max Reflected Inertia:	0.31	$kg \cdot m^2$	205.00	$kg \cdot cm^2$
Average Current:	7.83	A(0-pk)	57.57	A(0-pk)
Peak Current:	17.29	A(0-pk)	171.61	A(0-pk)
Winding Temperature:	6.73	°C	155.00	°C
Brake Rating:	No Data		No Data	
Min Inertia Ratio:	0.02		No Data	
Max Inertia Ratio:	15.27		No Data	
Peak Motoring Power:	2096.00	W	No Data	
Average Motoring Power:	465.28	W	No Data	
Peak Regenerative Power:	-38.40	W	No Data	
Average Regen. Power:	3.84	W	No Data	

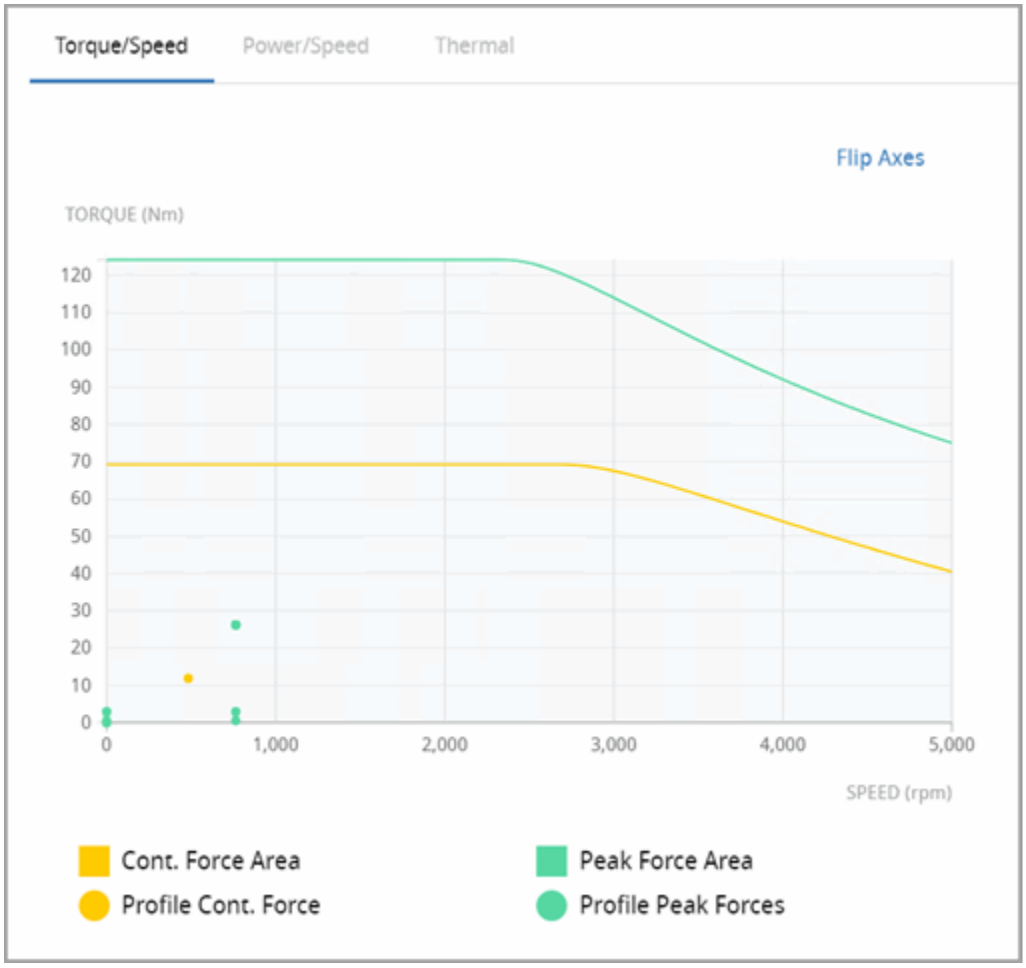
In the Motor tab, the brake rating compares the maximum static torque that can be applied to the brake with the quoted holding torque of the brake. This normally occurs when the drive is disabled with the motor/load stationary. This static torque arises from any applied load torques or forces, including gravitational effects. It does not consider friction. If a high proportion of the brake torque (or force) is used for static loads, then little may be left in case the brake is required to stop motion suddenly. Brakes reduce performance if operated during motion. The motor brake is intended as a holding brake applied when motion is stopped and cannot be relied upon to stop a moving load when the drive fails or loses power. An independent method of stopping is recommended for all emergency situations where there is a gravitational load or applied force/torque. A resistive brake module provides some braking but will never stop a mechanism with a gravitational load or applied force/torque.

The Axis Analysis tab provides graphical representations of the performance characteristics for the system.

The Torque-Speed tab contains the torque/speed graph for the selected motor/drive combination. This graph is created dynamically, which

means that if the supply voltage changes in the Motor or Drive tab, the graph will change accordingly.

Figure: Torque-Speed Graph

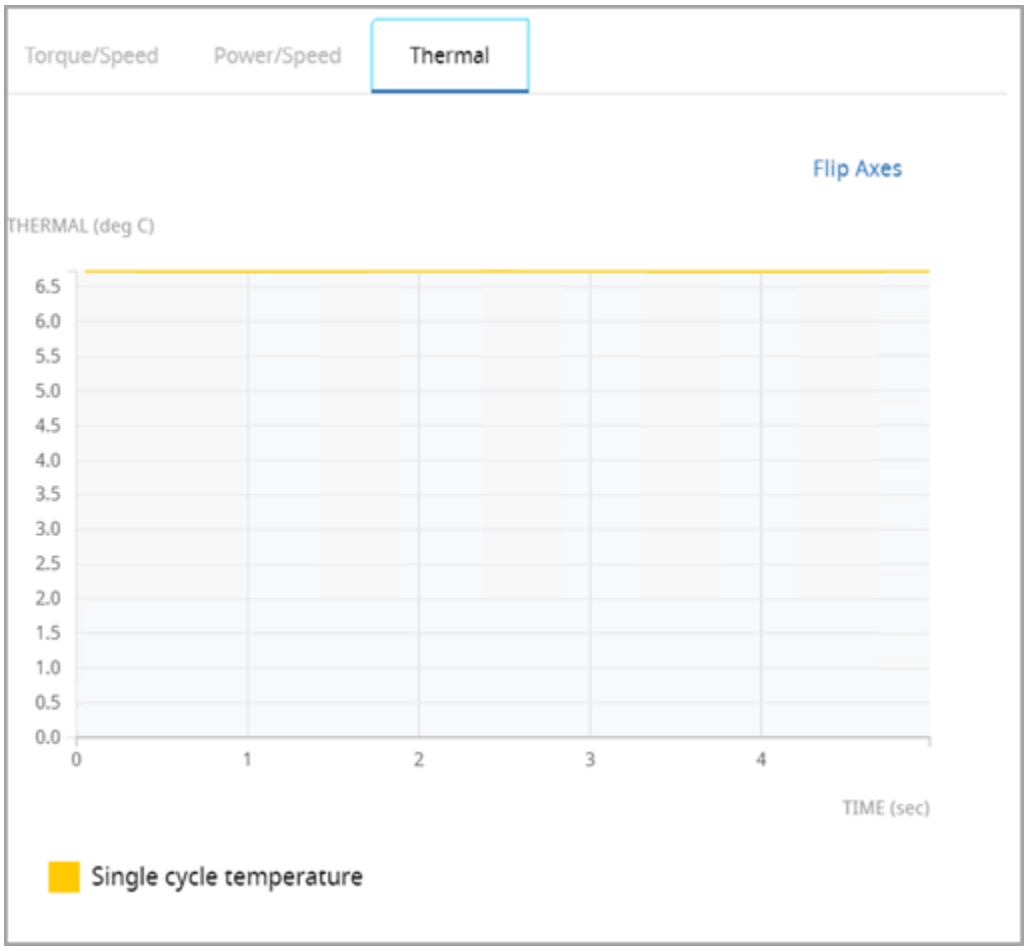


The Power-Speed tab contains the power/speed graph for the selected motor and drive combination. This graph is typically used for Variable Frequency Drive (VFD) applications where power is more appropriate than torque as a measure of performance.

Figure: Power-Speed Graph

The Thermal tab displays the output of drive and motor thermal models that reside in the drive firmware.

Figure:Thermal Graph



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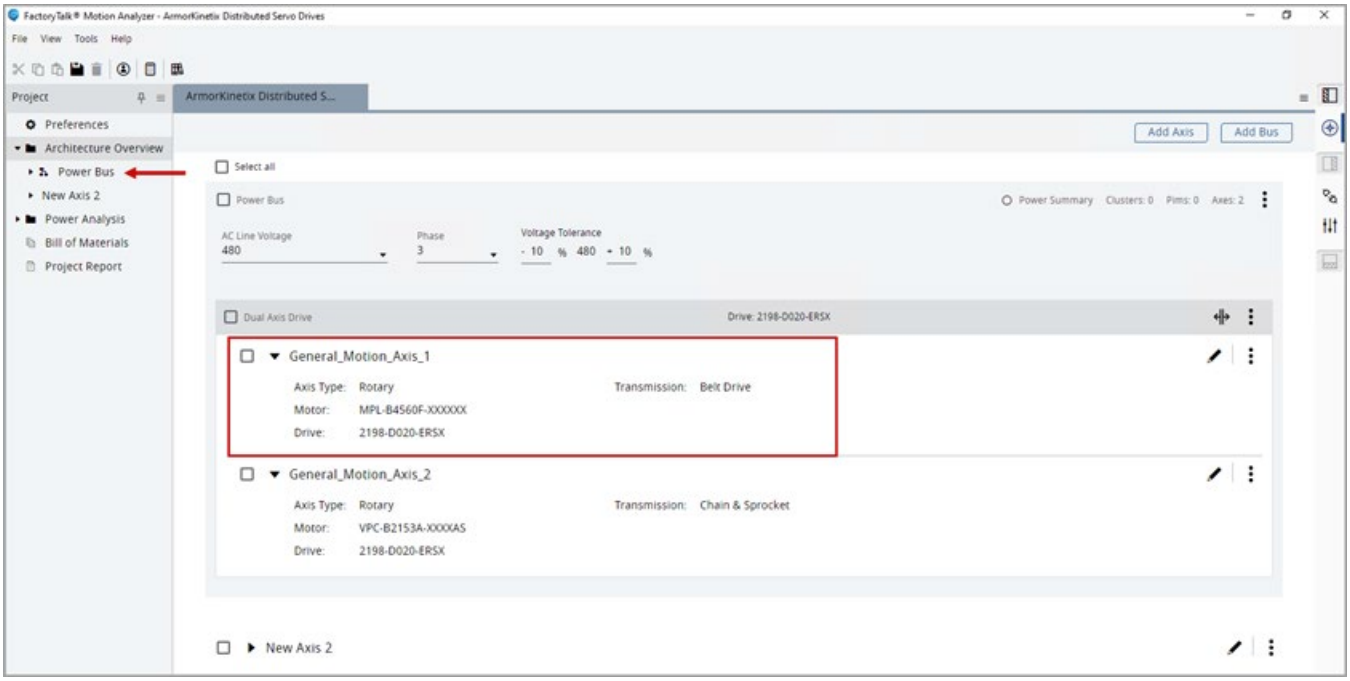
Power Analysis

Motion Analyzer allows the user to calculate the detailed power analysis for a power bus based on the axes, bus configuration (selected Motion Profile and other components) and selection of power accessories (selected manually or automatically by the program).

User can calculate the Power Analysis for any Power bus that contains valid axes with a drive, motor, valid phase information, valid voltage, valid Motion Profile, and the solution search selected; else an error message displays while calculating the Power Analysis.

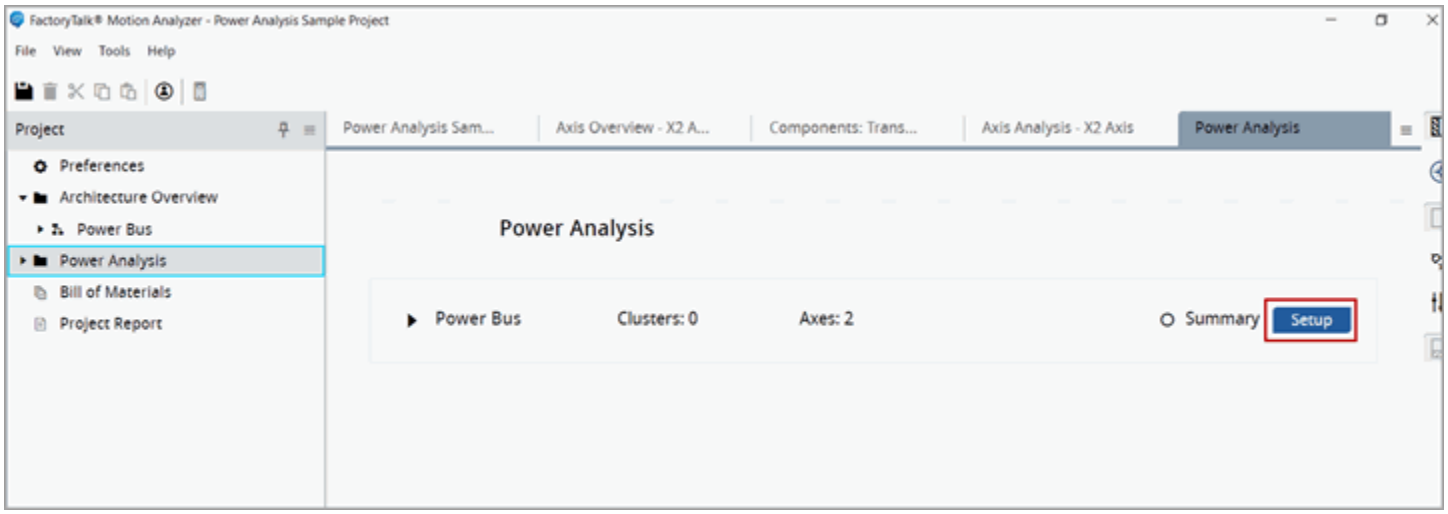
Figure: Power Bus



Perform the following steps to setup Power Analysis:

1. On the left panel, click the Power Analysis menu. The list of available Power buses display.
2. Choose your Power Bus and click [Setup]. The Power Analysis Setup page displays.

Figure: Power Analysis



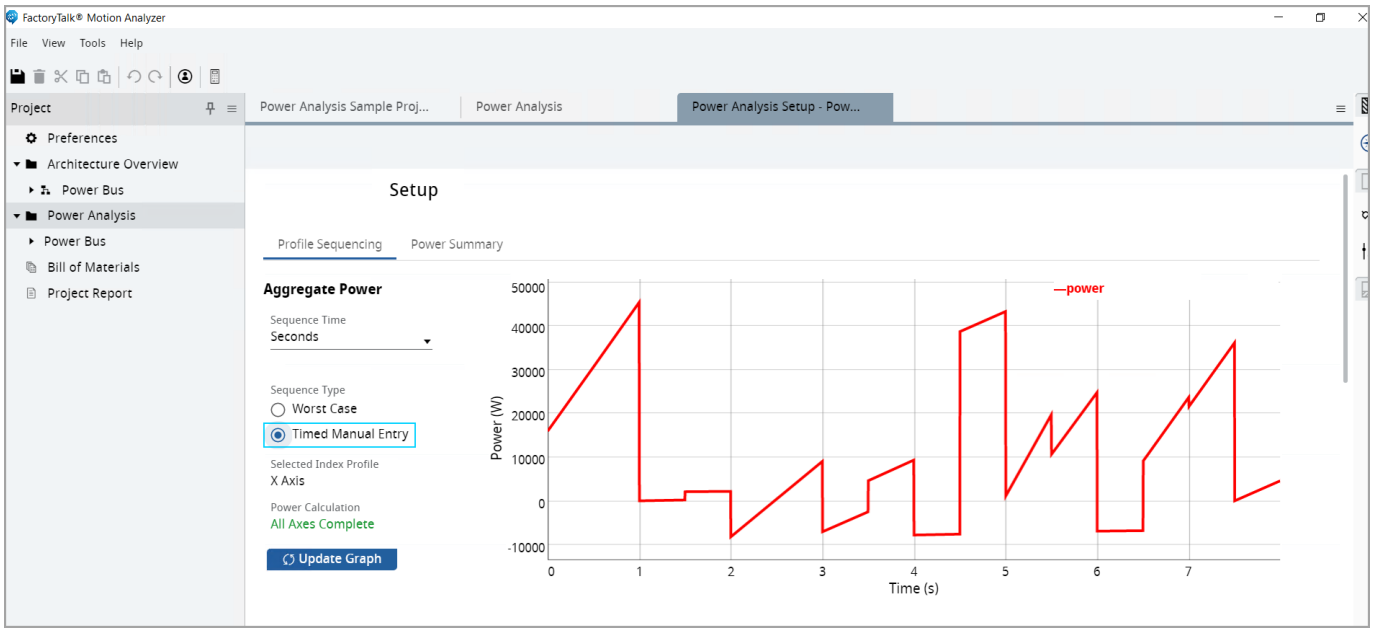
NOTE: This may a take few seconds to fetch the Power aggregation data.

Power Analysis Setup

This section allows the user to update the Power-Time graph by performing the sequencing and choose a Power Supply, multiple Capacitors, and multiple Shunts for the selected power bus (or the default selections using the Auto mode) and perform the calculation for power analysis. This connects the power analysis accessories with calculations and displays the power analysis results.

NOTE: In the Auto mode, after the calculation, the application selects the power accessories such as power supply, Capacitors, and shunts.

Power Analysis Setup



The setup section contains two tabs:

- Profile Sequencing
- Power Summary

Profile Sequencing

Allows the user to update the graph by performing the sequencing. Under the Profile Sequencing tab, the Power-Time graph displays along with the axes available in the power bus.

1. Under the Aggregate Power section, provide the following details:

a. Sequence Time: Time in Milliseconds or Seconds or Minutes.

b. Sequence Type: Type of the Sequence

- Timed Manual Entry: By default, this option is selected. This option allows user to defined time offset for power consumption of each axis separately.
- Worst Case: Used if the User predicts that the power reaches its peak stage.

c. Selected Index Profile: Displays the Index profile selected.

- Scroll down the Aggregate Power section and select the desired axis as the Index Profile. By default, the offsets will be zero, if all the axis profiles have the same length and start at their correct respective positions. User can define new offset to align the profiles correctly.

d. Power Calculation: Displays the status of the Power calculation for the axes that are available in the power bus.

2. Click [Update Graph] to update the graph based on the sequencing.

Project Summary

Allows the user to calculate the Power Analysis results based on the selected components and Motion Profile. If the Auto mode is selected, the Power accessories such as power supply, capacitors and shunts are selected after the calculation.

The Power summary tab contains two sections:

- Calculate
- Power Analysis Result

Calculate

Allows the user to define the following parameters and calculate the power analysis for a power bus:

- Power Supply
- Power Supply Options
- Shunts
- Capacitors

NOTE: User can select one Power Supply and multiple Shunts and Capacitors for calculation.

NOTE: Not all the Power buses have these options to select. The availability of these power components (accessories) depends upon the axis configurations and available bus features.

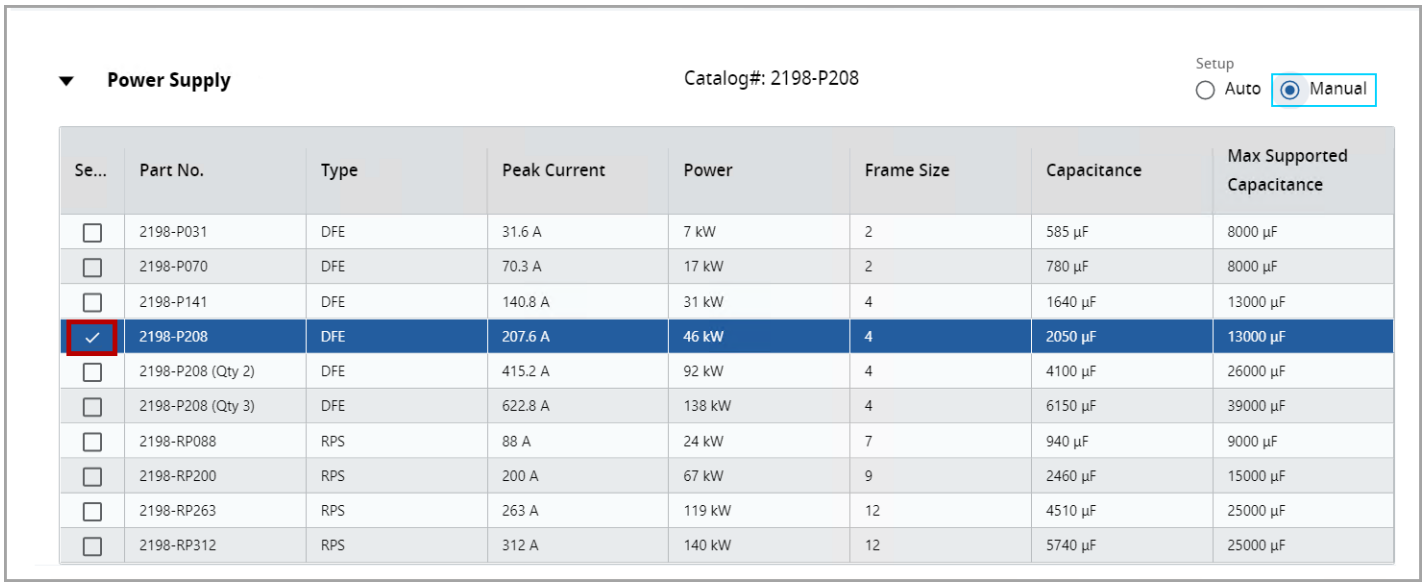
Perform the following steps to calculate the Power Analysis:

1. Click the [▸] icon to expand the Power Supply and the list of available Power supplies display. User can switch between the power supplies to calculate as required.

- By default, the Power Supply setup is set to Manual mode. User can choose the Auto mode to define the Power Supply automatically.

NOTE: Some of drives has power supply built-in, so re-selection of power supply can affect to selection of drive component.

Figure: Power Supply Setup



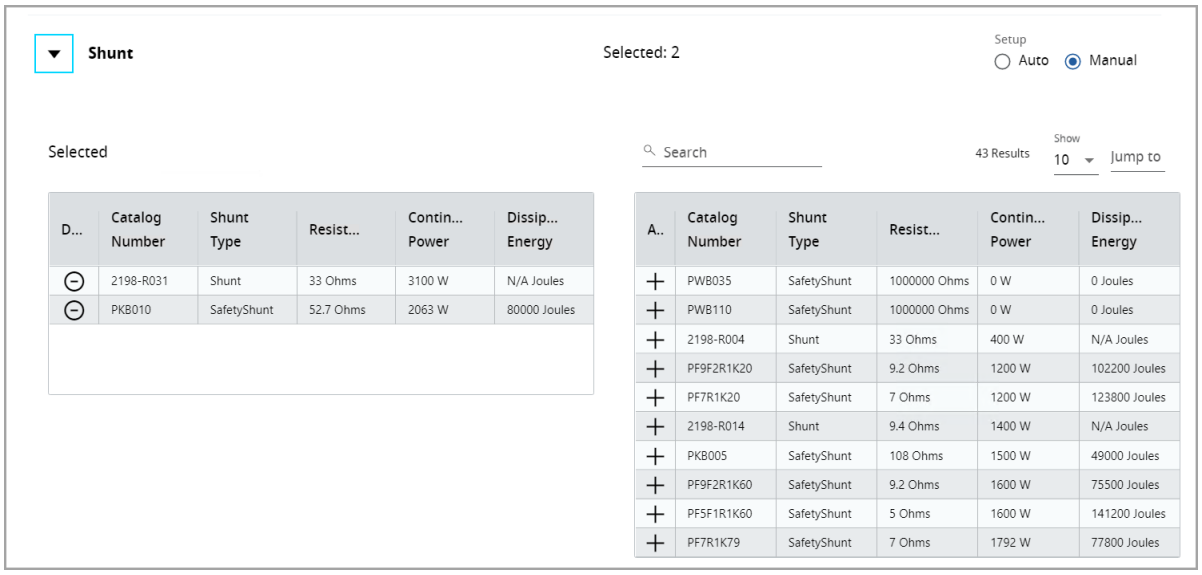
Se...	Part No.	Type	Peak Current	Power	Frame Size	Capacitance	Max Supported Capacitance
☐	2198-P031	DFE	31.6 A	7 kW	2	585 µF	8000 µF
☐	2198-P070	DFE	70.3 A	17 kW	2	780 µF	8000 µF
☐	2198-P141	DFE	140.8 A	31 kW	4	1640 µF	13000 µF
☑	2198-P208	DFE	207.6 A	46 kW	4	2050 µF	13000 µF
☐	2198-P208 (Qty 2)	DFE	415.2 A	92 kW	4	4100 µF	26000 µF
☐	2198-P208 (Qty 3)	DFE	622.8 A	138 kW	4	6150 µF	39000 µF
☐	2198-RP088	RPS	88 A	24 kW	7	940 µF	9000 µF
☐	2198-RP200	RPS	200 A	67 kW	9	2460 µF	15000 µF
☐	2198-RP263	RPS	263 A	119 kW	12	4510 µF	25000 µF
☐	2198-RP312	RPS	312 A	140 kW	12	5740 µF	25000 µF

2. Under the Power Supply Options section, user can select the converter Type and select the [Power Supply In Standalone Cluster] option.
   - Converter Type: Select the type of Converter used. This option is only available, if the Power Supply is set to Auto mode. By default, the DFE type is selected. If the RPS converter type is selected, user can define VDC Set point and enable the regulation.
   - Power Supply In Standalone Cluster: Check this box 'Yes' if you plan to run cables from the power supply to your drive clusters. This means that no driver modules are connected directly to the power supply. This standalone cluster will also require an additional capacitor module.

Figure:Power Supply Options

3. Under the Shunt section, user can select the required shunts to be calculated. for which power analysis will be calculated or select Auto option to select shunts automatically.
   - The left pane displays the selected shunts. Click the [⊖] icon to delete the shunts.
   - The Right pane displays the list of available shunts. Click the [+] icon to add the shunts.

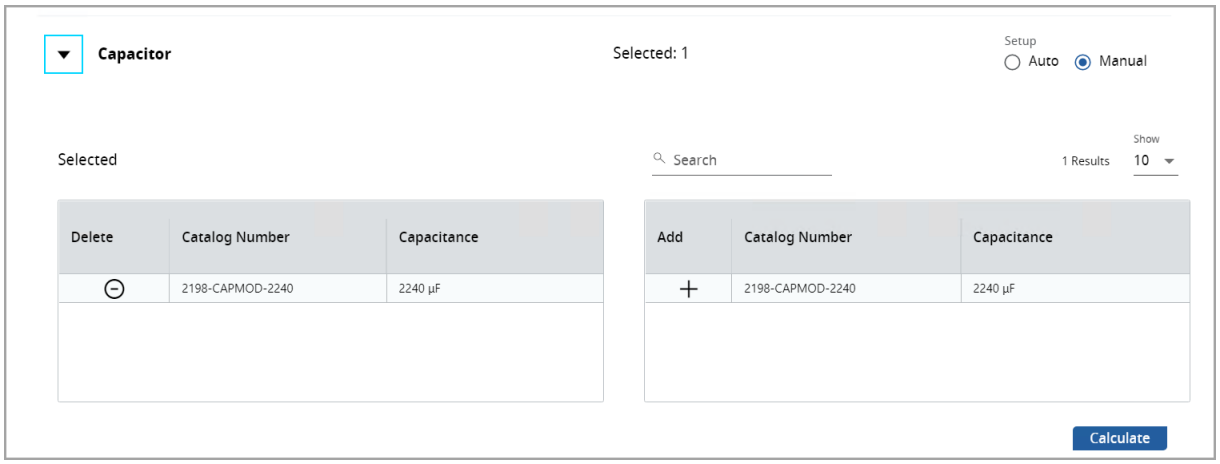
Figure: Shunt



By default, the Shunt selection is set to Manual mode. User can choose the Auto mode to select the Shunts automatically.

4. Under the Capacitor section, user can select the required capacitors for which power analysis will be calculated or select Auto option to select Capacitors automatically.

Figure: Capacitor

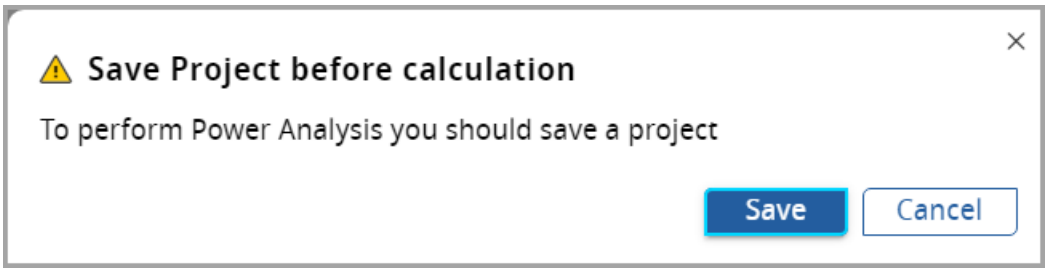


By default, the Capacitor selection is set to Manual mode. User can choose the Auto mode to select the Capacitor automatically.

5. Click the [ ] icon on the Quick Access Toolbar to save the project.
6. Click [Calculate] the results display under the Power Analysis Result section.

NOTE: If user does not save the project and proceeds to calculate, then the ‘Save Project before Calculation’ dialog displays. Click [Save] and the calculation begins.

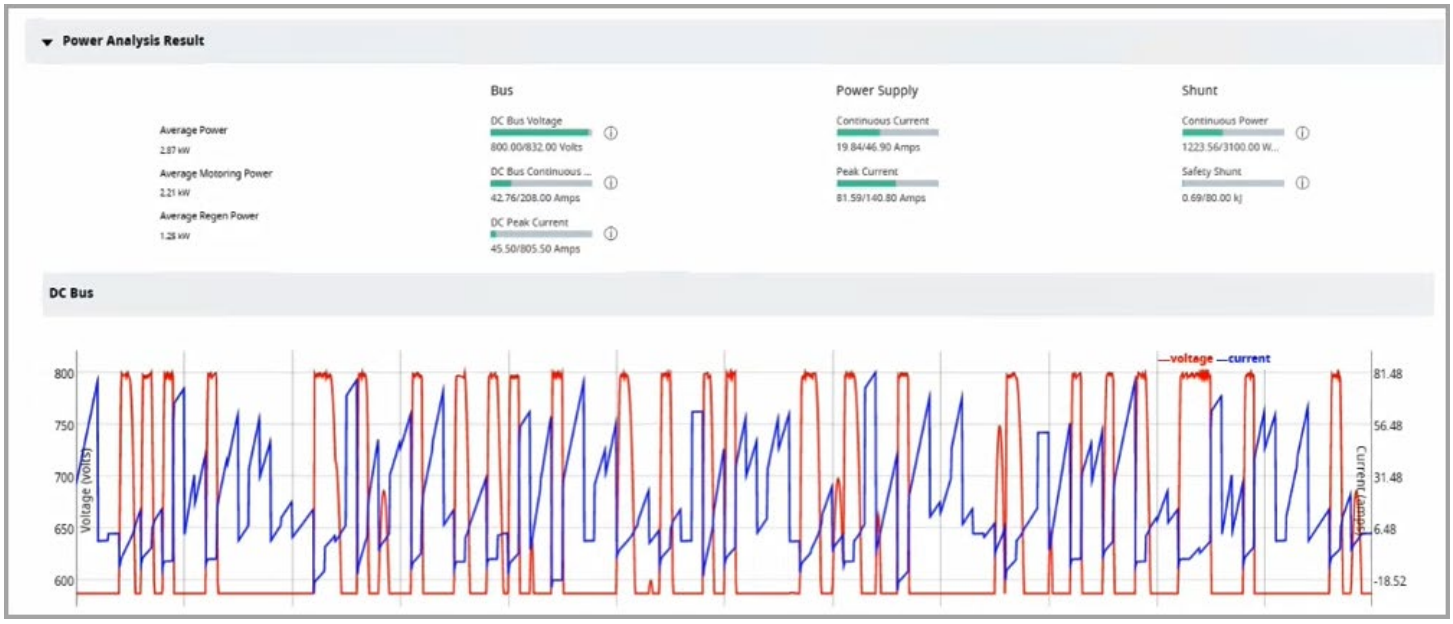
Figure: Save Project



Power Analysis Result

The calculated Power Analysis Result displays in values along with the Voltage-Current graph.

Figure: Voltage Current Graph



These results are displayed based on the selected accessories and the type of parameters are displayed based on the response dynamically. Hover the mouse on the labels for more details.

Figure: Power Analysis Result

After the calculation, if the user changes any of the above parameters, a warning pop-up displays to re-calculate.

Power Sharing

This feature is available only for families that support AC and DC power sharing (Kinetix 5500 drives). If the drivers are selected from the Kinetix 5500 family, then the user must define a valid power sharing configuration during the Power Analysis.

- **DC Sharing**: To support common DC bus configuration supplied by one or more shared AC inputs. Use the DC Sharing configuration to group axes to share a common DC bus and input AC supply (optional).
- **AC Sharing Only**: To support one or more shared AC inputs. 3-phase AC input power can be shared among drives with the same power rating. No DC bus connections are allowed in this configuration. Use the AC Sharing Only configuration to group axes to share input AC supply only, with no DC bus sharing.
- **Clear All**: To clear the power-sharing selection.
- **Power Sharing Table**: This table displays the list of Axes from a given bus along with their drive Catalog Numbers, Frame Size, Power in Kilowatts, and power-sharing from DC or AC line. User can manually enable or disable the sharing options.

NOTE: If neither DC Sharing nor AC Sharing Only is selected, then [Shares DC] and [Shares AC] checkboxes will be disabled.

Limitations

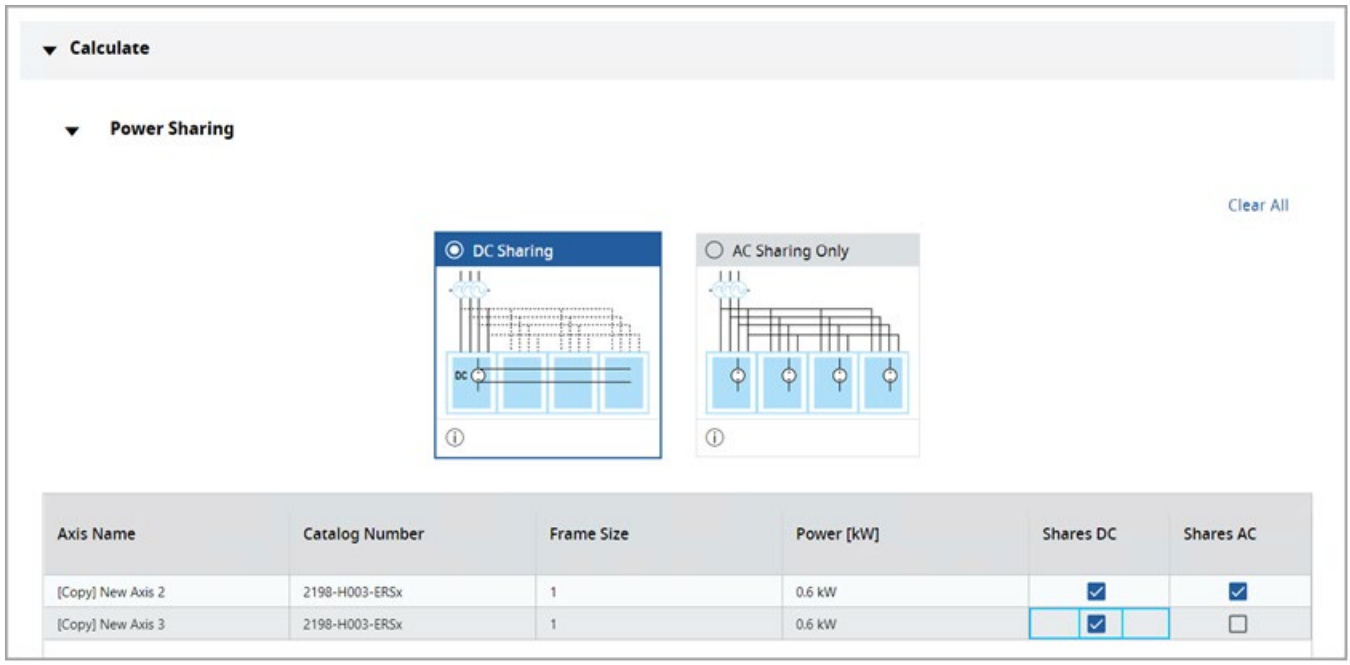
The following restrictions are imposed on the number of drives allowed in common bus or shared AC/DC configurations:

1. **Common AC/DC Sharing**:

a. The most powerful driver acts as a leader and should share the power with other drives in the DC line.

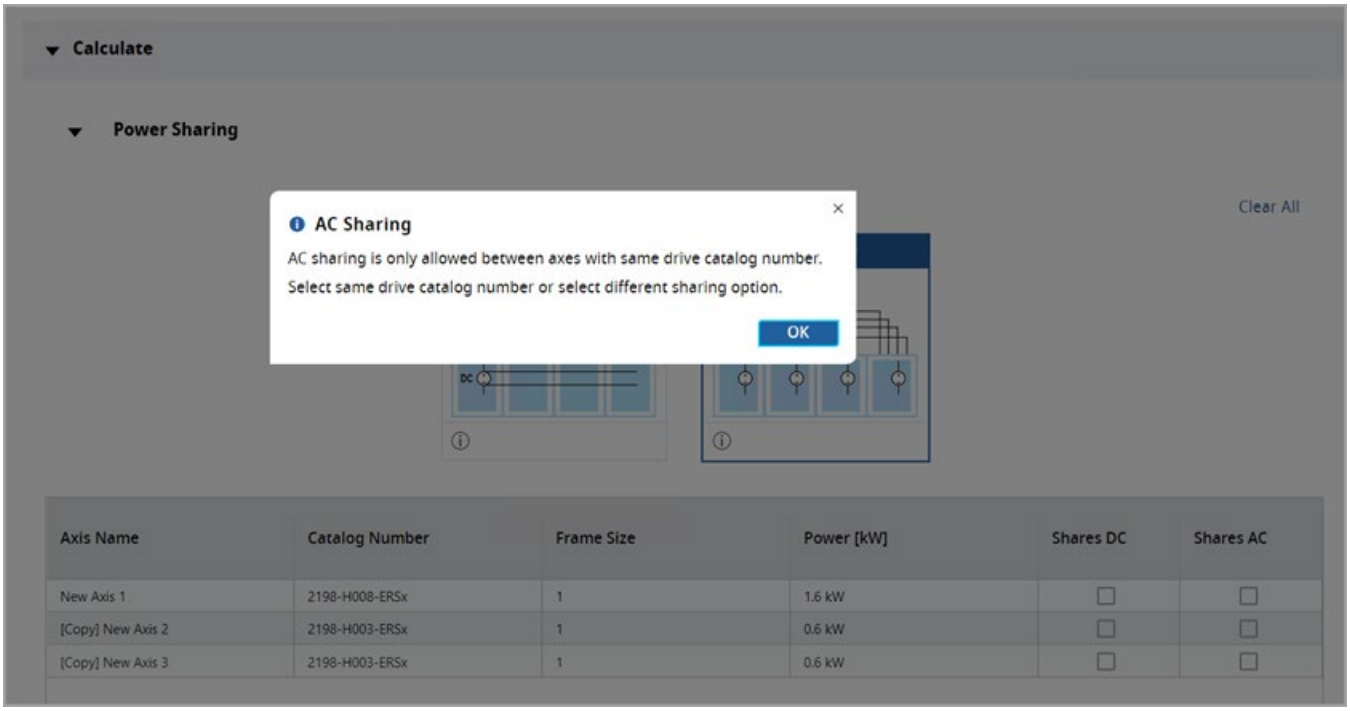
NOTE: Ensure that the powerful drive is created at the top of the list.

Figure: Power Sharing



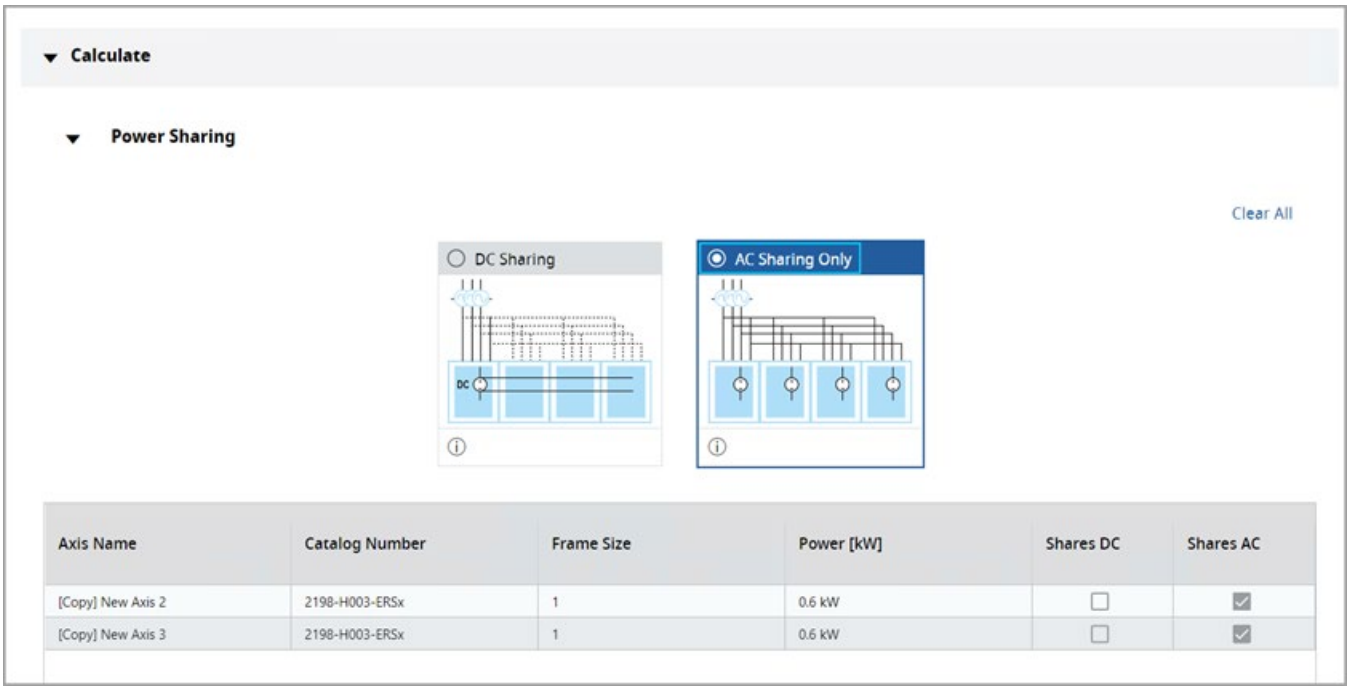
b. AC sharing is only allowed between axes with the same drive catalog number. If user tries to enable the [AC Sharing Only] option with different drivers, then a warning message displays as shown in the following image:

Figure: AC Sharing



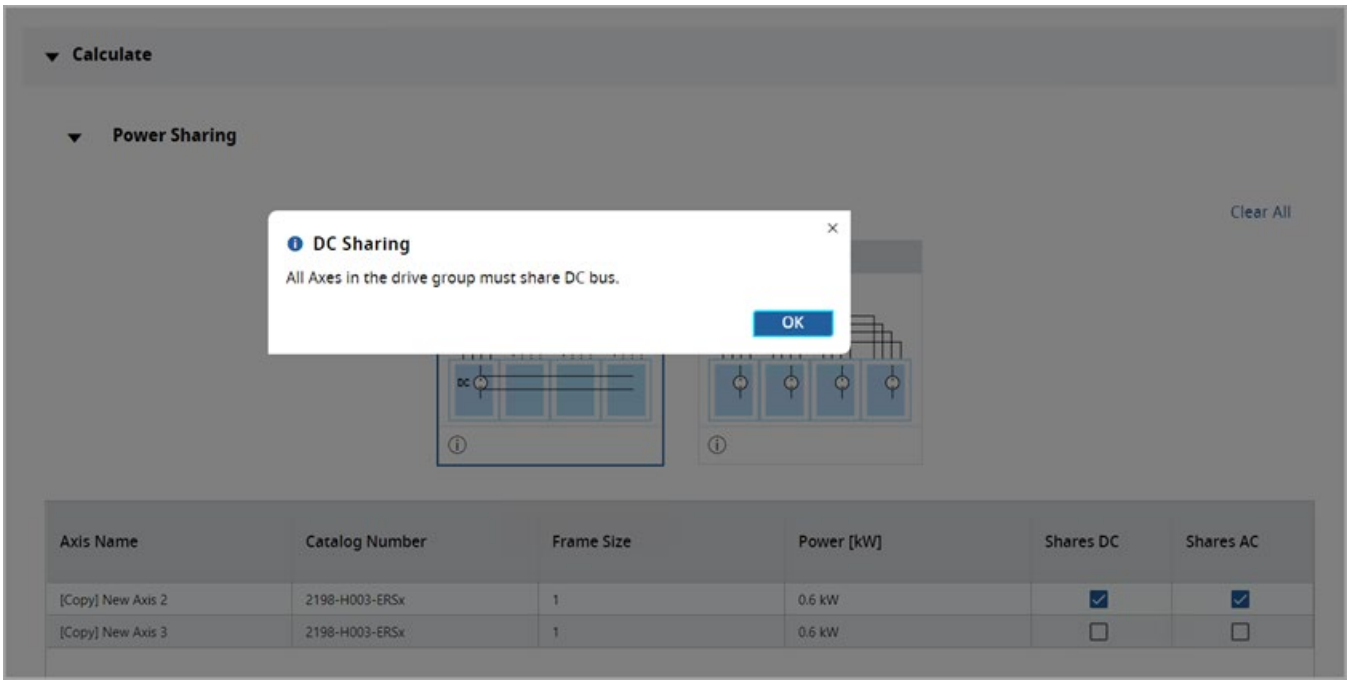
NOTE: Ensure to select same drive catalog number in the given bus or select a different sharing option.

Figure: AC Sharing Only



c. If the [Shares DC] checkbox is disabled manually for any axis from the same bus, then a warning message displays as shown in the following image:

Figure: DC Sharing



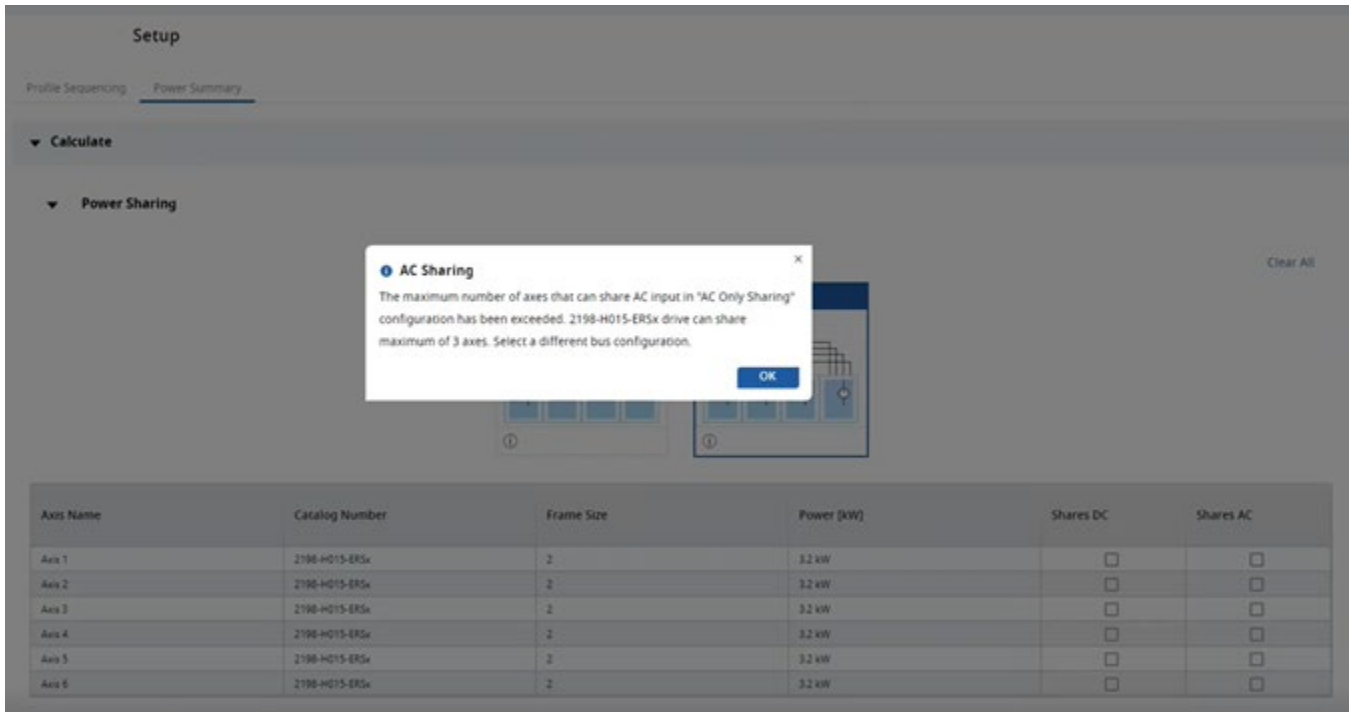
Note: Ensure that all Axes in the drive group must share the DC line.

2. **None K5500 family**: If the drive selection is not from the Kinetic 5500 family, then the Power Sharing section is not available in the Power Analysis.
3. **Single Axis Bus**: The Power sharing is only available for multiple axes sharing single bus.
4. **None Sorted Axis**: The Power Sharing is sorted from the most powerful driver to the least powerful driver irrespective of the axis created.

Figure: None Sorting Axis

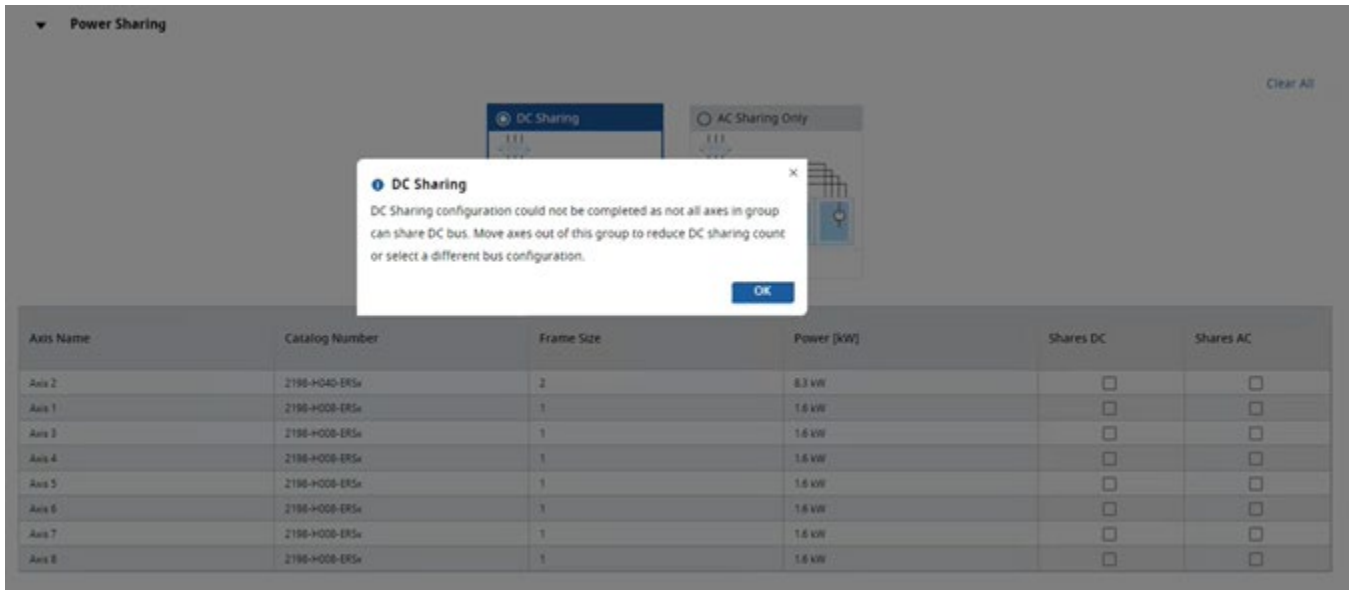
5. **AC Sharing Limitations**: The maximum number of axes that can share AC Inputs is based on the driver configurations. If the driver is shared across multiple axes beyond its configuration limits then a warning message displays as shown in the following image:

Figure: AC Sharing Limitations



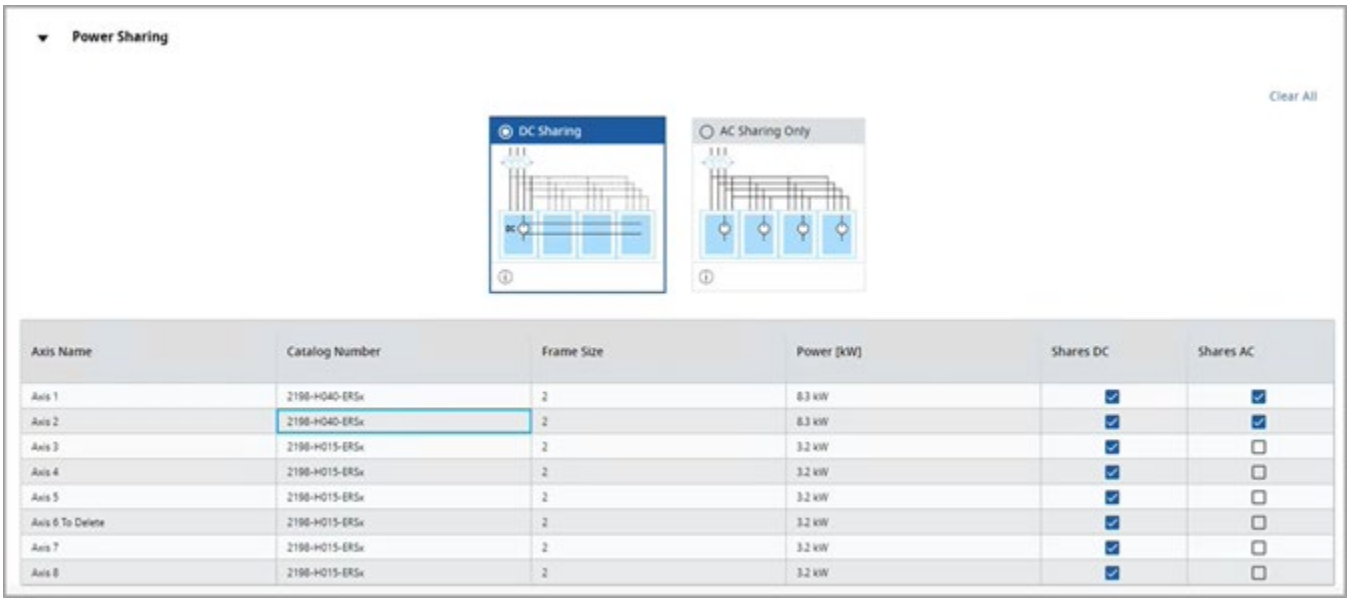
6. **DC Follower Limits**: In a given group of axes with a powerful axis acting as the leader with other axes acting as followers and they share different DC bus or it exceeds DC power sharing, a warning message displays as shown in the following image:

Figure: DC Follower Limits



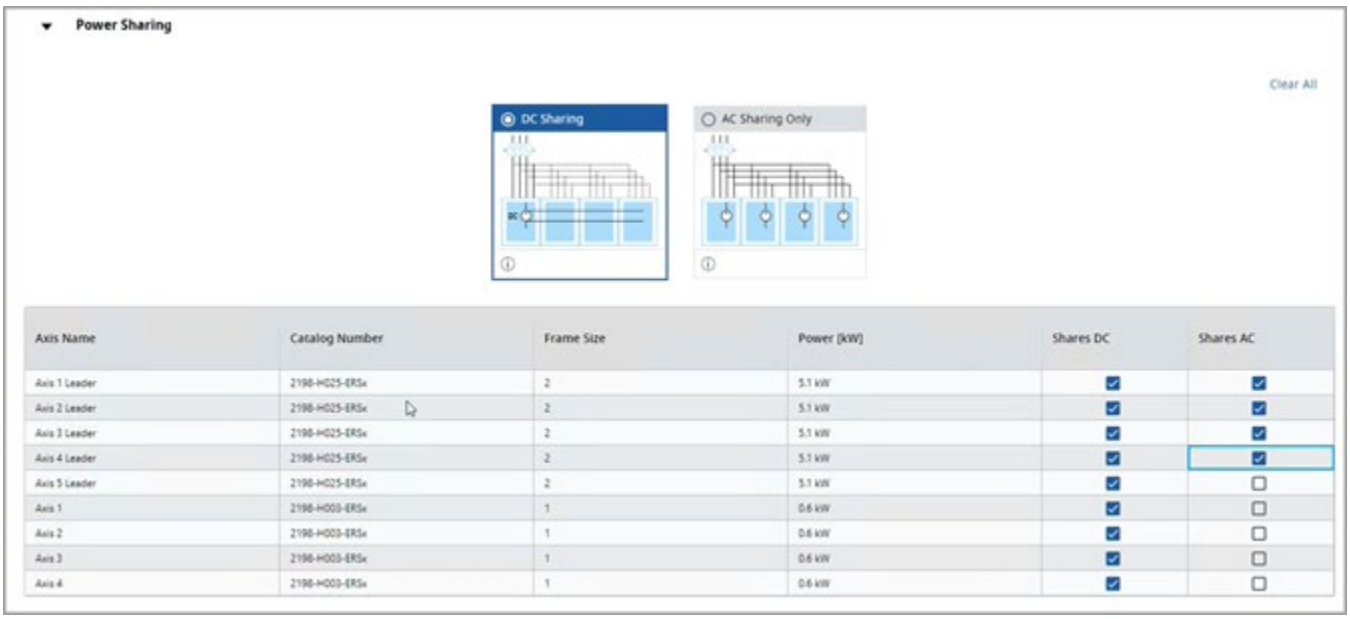
7. **DC Limits**: If a group contains 2 powerful drivers and more than 6 follower drivers, then the 1st driver acts as a leader for the second drive and the second driver will act as the leader for the other follower drivers.

Figure: DC Limits



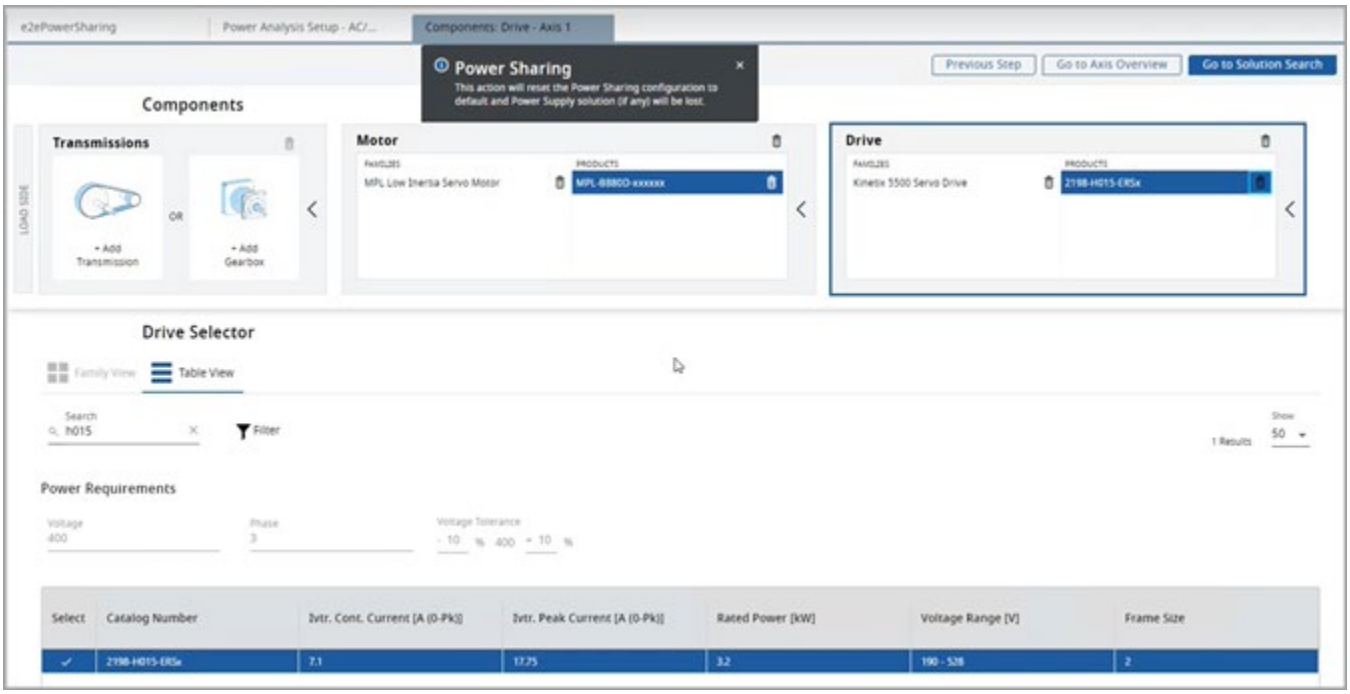
8. **AC Limit in DC Sharing Manual (Hybrid sharing)**: If a group of axes contains shares same Driver, then both DC and AC sharing can be enabled beyond its configuration limits as shown in the following image:

Figure: Hybrid sharing



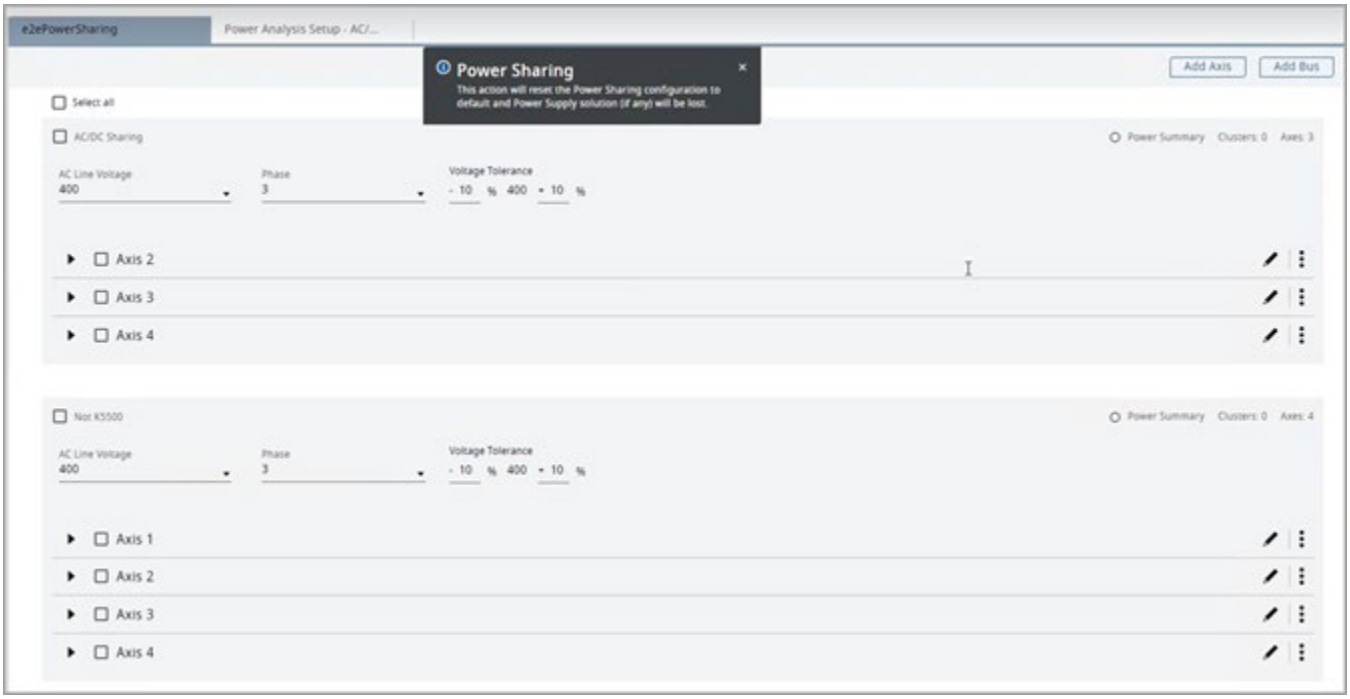
9. If the Power sharing is configured and the user deletes the drive from the components list, then a warning message displays, and the power-sharing is reset to none and the user must configure the Power sharing.

Figure: Power Sharing Warning



10. If the axis is deleted from the power bus, then a warning message displays, and the power-sharing is reset to none and the user must configure the Power sharing.

Figure: Power Sharing



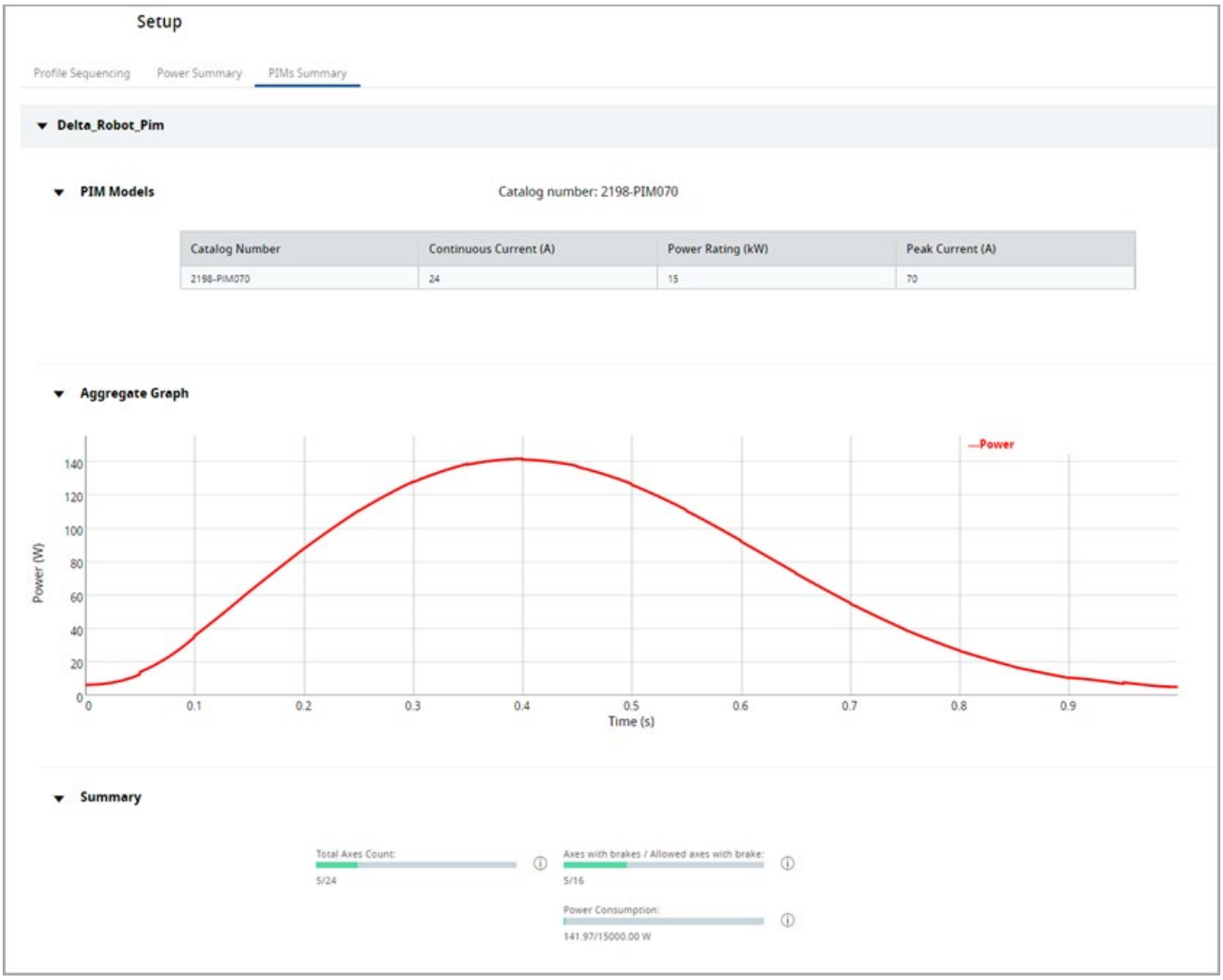
PIM Summary

The section provides information about the list of PIM Modules and their summary. Each PIM summary contains the PIM details along with the number of axes with brakes, and the details about the power consumption. This tab is only available for the bus containing PIM modules. Users can expand/collapse the section view.

The PIM Summary consists of 3 sections:

- PIM Name: Displays the information about the details of the PIM Module. List of PIM used along with the Catalog Number, Power Rating, and Continues Current and Peak Current details.
- Aggregation Graph: Displays the Aggregation Graph of the axes inside the PIM module. Users can hover the mouse on the graph line to view the Power values against the time.
- Summary: Display the total number of axes inside the PIM, the number of brakes used, and the Power consumption.

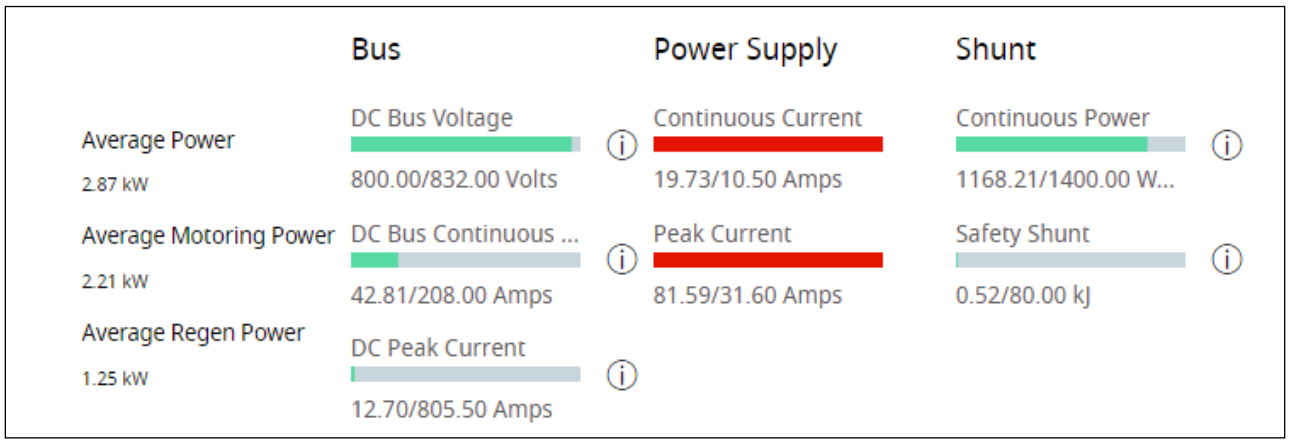
PIMs Summary



Operation Range Error

If the Power Analysis parameters exceed their normal operating range, it will be marked as red progress-bar as shown in the following image (for Continuous Current and Peak Current):

Figure: Invalid Results



To view these invalid or excess results, perform the following steps:

1. Open your Power Analysis Sample Project, select the power supply manually to first option.

   For example: In this case 2198-p031 (or second 2198-p070)

2. Change the Setup option of Shunts and Capacitor to ‘Auto’ mode and click [Calculate] to calculate the Power Analysis.

Bill of Materials

The Bill of Materials menu displays the total list of Axes, and components that configured in the Project. User can view them in two tabs:

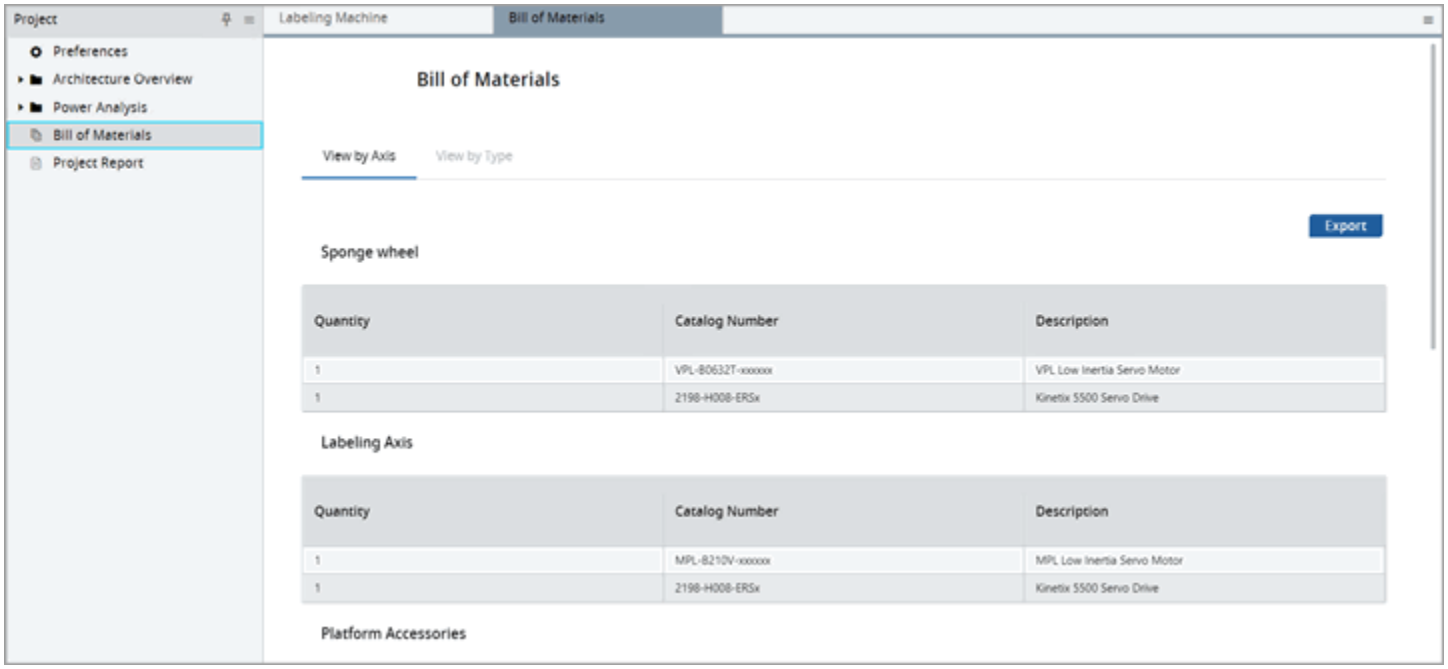
- View by Axis
- View by Type

View by Axis

Displays the list of components that are divided by:

- Axes configured in the project.
- Platforms (if some bus is in a project, or drive needs some special components assigned to platform).
- Power Components and accessories which displays power components (based on selection in Power Analysis of buses)

Figure: View by Axis



View by Type

Displays the list of components in the project grouped by each type such as Drives, Motors, Gearboxes, Linear mechanisms, Actuators, Platform Accessories and Power Buses.

Figure: View by Type

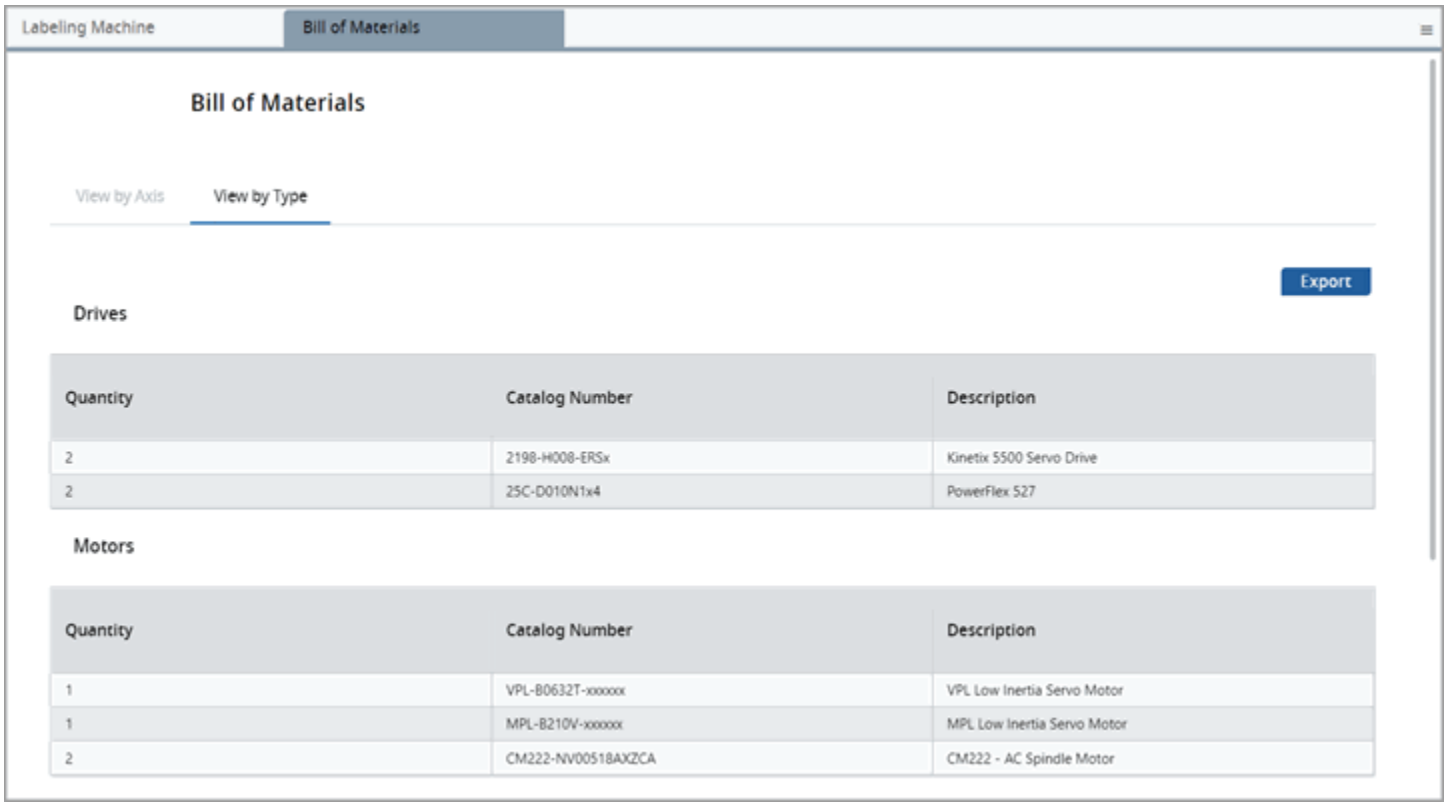


Table: View by Type

Column	Description
Quantity	Number of components.
Catalog Number	The component's catalog number.
Description	The Family name of the component.

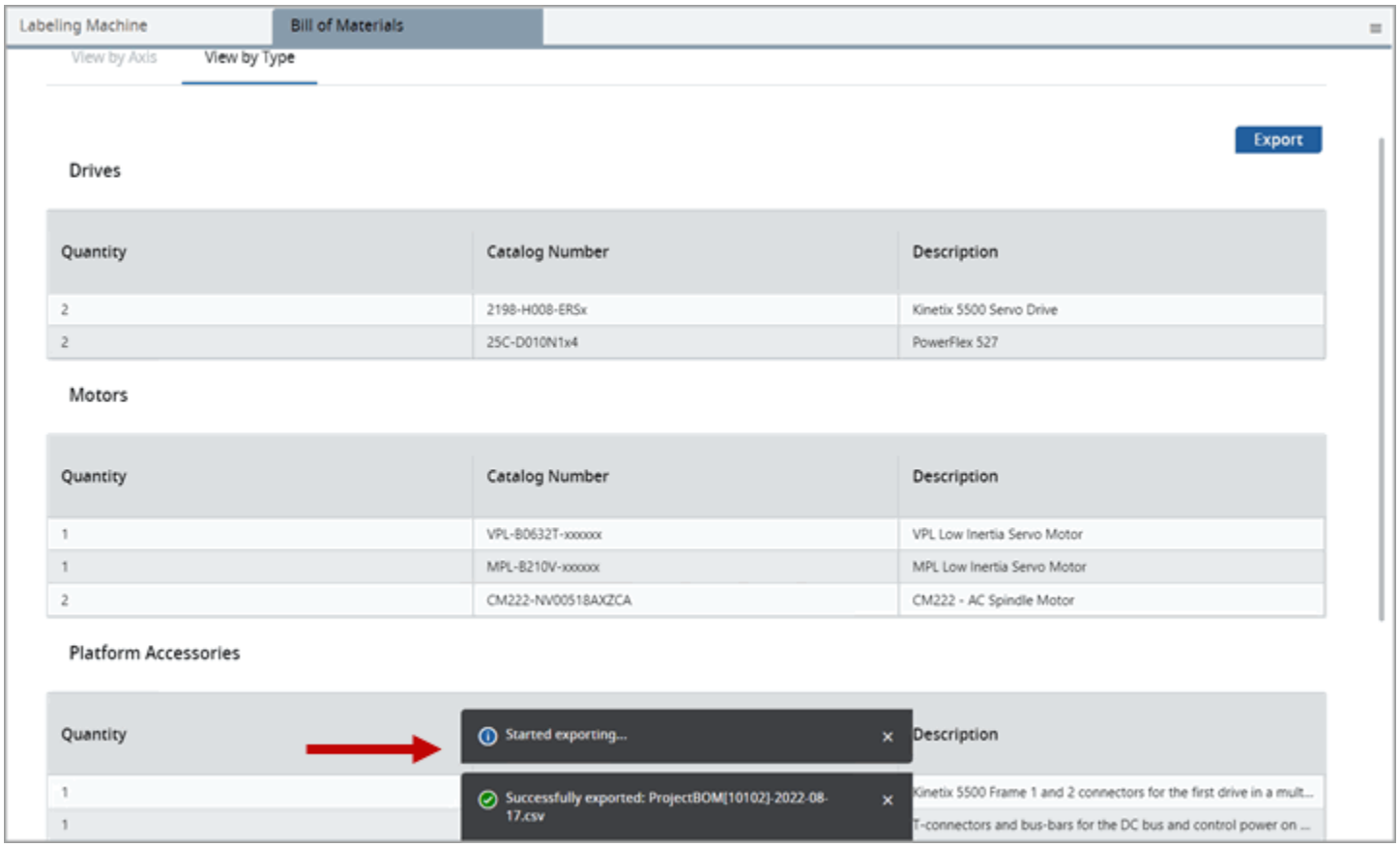
Export Bill of Materials

User can export the Bill of Materials in both tabs: View by Axis and View by Type.

1. Click [Export] and the provide the path to save the exported file.

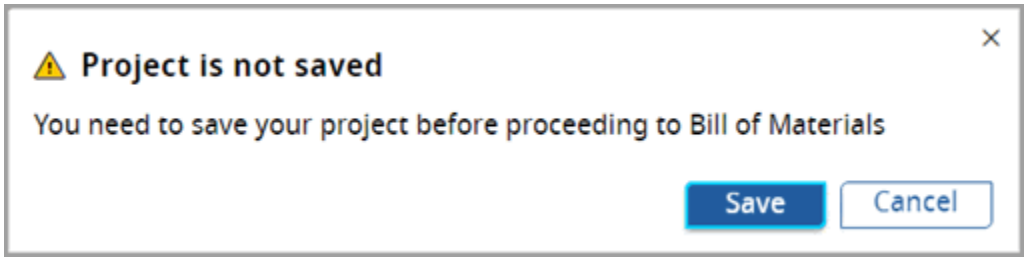
   The file format is .csv. After exporting, a success message displays.

Figure: Successfully Exported



If the user edits any components in the project and proceeds to Bill of Materials without saving, a warning dialog displays. Click [Save] to save the project and the updated Bill of Materials display.

Figure: Save Project



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Project Report

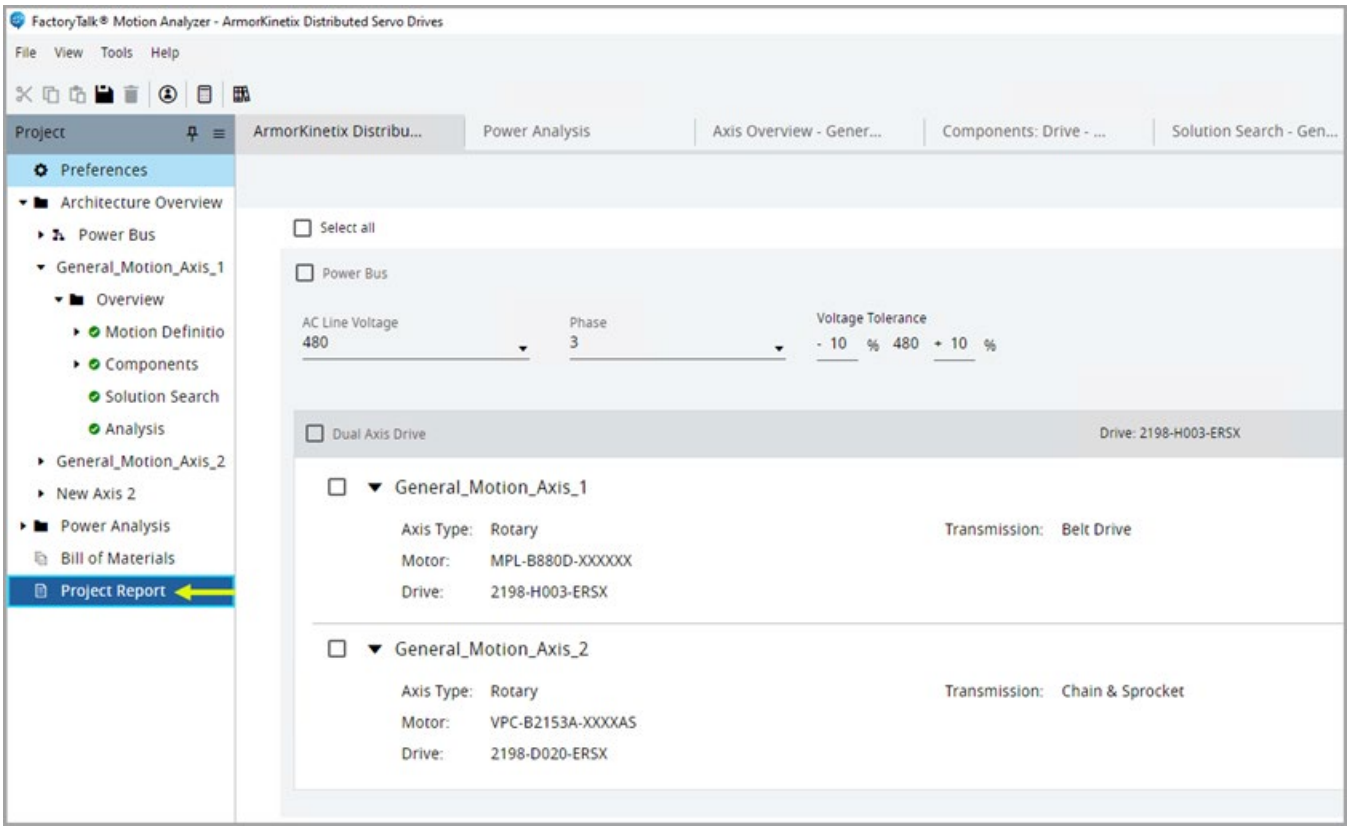
The Project report allows the user to generate the information related to the project in one place including all axes, motion profiles, components, solution search results, BOM, power analysis results, and other information. This report is updated based on the changes that the user makes in the development process. This feature also allows user to save the report in PDF.

Generate Project Report

Perform the following steps to generate the Project Report:

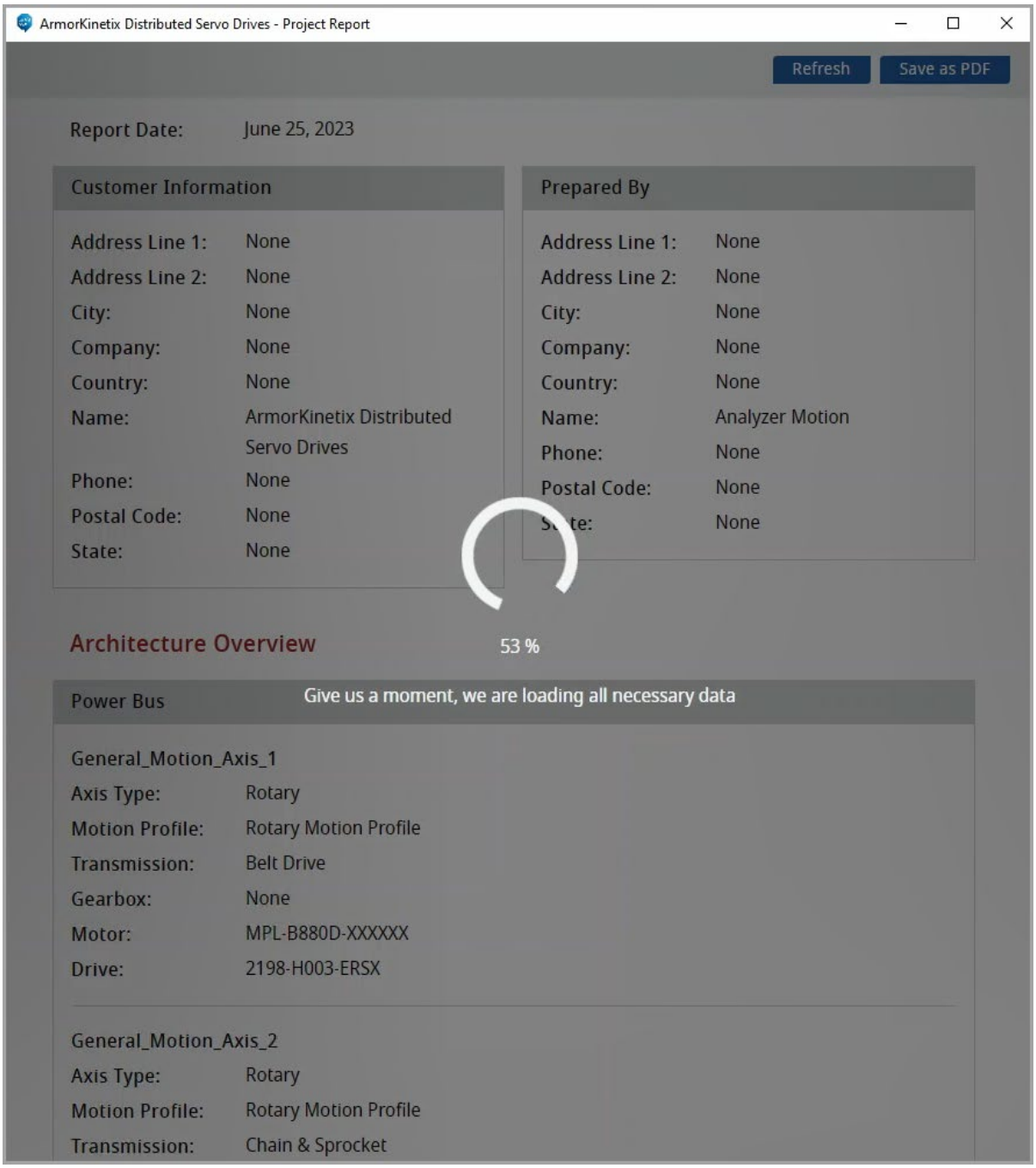
1. On the left pane, double-click the Project Report menu.

Figure: Project Report Menu



2. A new window displays the Project details. This may take a while to load the necessary data.

Figure: Generating Project Report

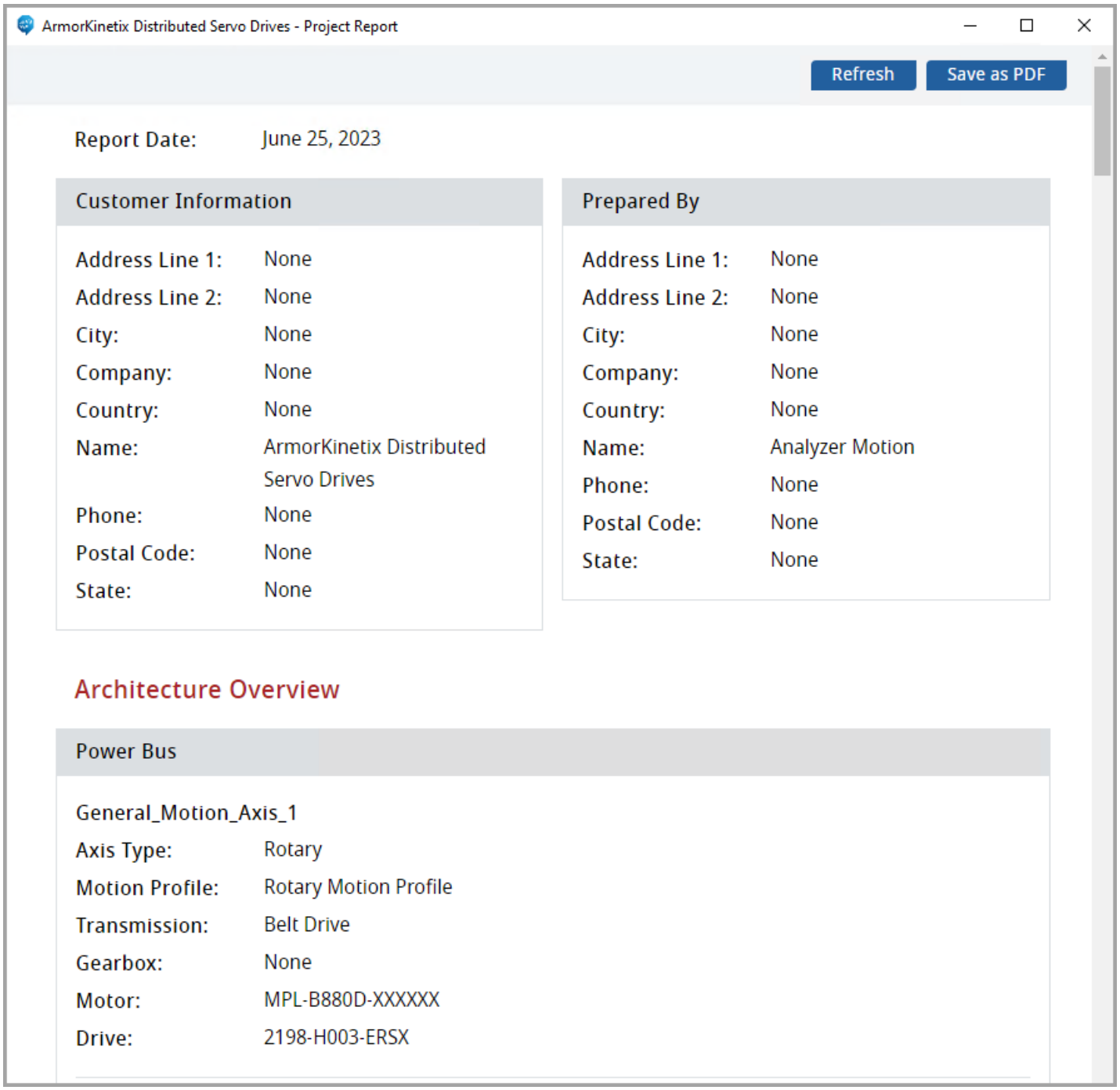


The Project Report displays the following project details:

Table: Project Report

Label	Description
Report Date	The Date when this report is generated.
Customer Information	The customer information as mentioned in the Preferences menu.
Prepared By	The information about the report publisher.
Architectural Overview	The information about the list of available power bus, List of Axes / Dual-axis along with their components (Motor, Driver, Transmissions) and the Cluster details, if available.
Details | <Axis Name>	The information about the Axis/Dual-Axis/Bus such as Axis Type, Motion Profile, and the detailed information about the components along with the graphs.

Figure: Project Report



Refresh

To refresh the Project report.

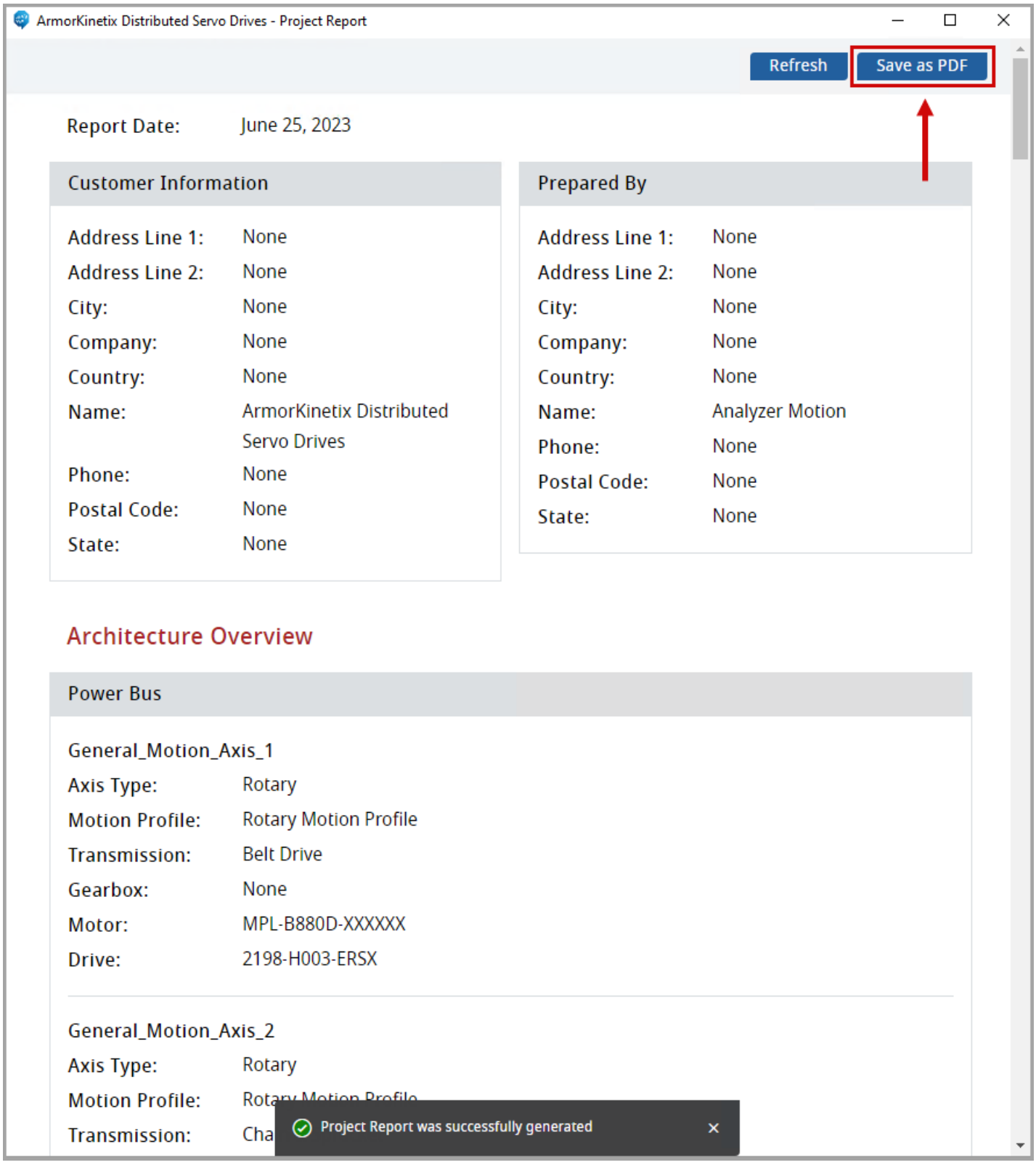
If user does any changes to the project and the Project Report window is open in another tab, click [Refresh] for the changes to take effect.

Save the report

To save the Project Report as PDF output:

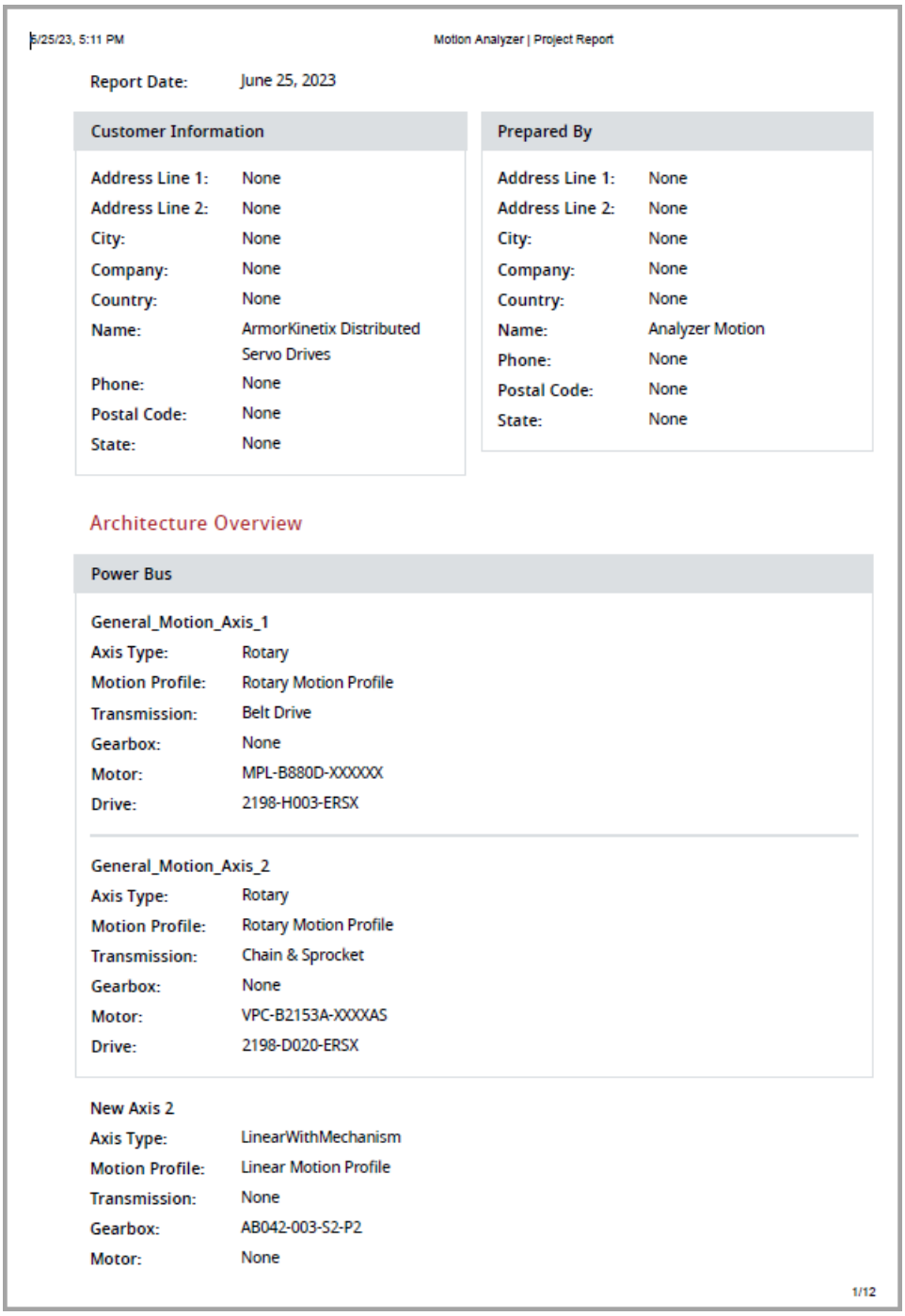
1. Click [Save as PDF] the Save As dialog displays.
2. Select the desired location and provide the file name.
3. Click [Save]. A success message displays as shown below.

Figure: Save as PDF



Open the published PDF and the Project Report displays along with the Publisher name in the page footer as shown in the following image:

Figure: PDF



6/25/23, 5:11 PM Motion Analyzer | Project Report

Report Date: June 25, 2023

Customer Information

Address Line 1:	None
Address Line 2:	None
City:	None
Company:	None
Country:	None
Name:	ArmorKinetix Distributed Servo Drives
Phone:	None
Postal Code:	None
State:	None

Prepared By

Address Line 1:	None
Address Line 2:	None
City:	None
Company:	None
Country:	None
Name:	Analyzer Motion
Phone:	None
Postal Code:	None
State:	None

Architecture Overview

Power Bus

General_Motion_Axis_1

Axis Type:	Rotary
Motion Profile:	Rotary Motion Profile
Transmission:	Belt Drive
Gearbox:	None
Motor:	MPL-B880D-XXXXXX
Drive:	2198-H003-ERSX

General_Motion_Axis_2

Axis Type:	Rotary
Motion Profile:	Rotary Motion Profile
Transmission:	Chain & Sprocket
Gearbox:	None
Motor:	VPC-B2153A-XXXXAS
Drive:	2198-D020-ERSX

New Axis 2

Axis Type:	LinearWithMechanism
Motion Profile:	Linear Motion Profile
Transmission:	None
Gearbox:	AB042-003-S2-P2
Motor:	None

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Rockwell Automation support

Use these resources to access support information.

Technical Support Center	Find help with how-to videos, FAQs, chat, user forums, and product notification updates.	rok.auto/support
Knowledgebase	Access Knowledgebase articles.	rok.auto/knowledgebase
Local Technical Support Phone Numbers	Locate the telephone number for your country.	rok.auto/phonesupport
Literature Library	Find installation instructions, manuals, brochures, and technical data publications.	rok.auto/literature
Product Compatibility and Download Center (PCDC)	Get help determining how products interact, check features and capabilities, and find associated firmware.	rok.auto/pcdc

Documentation feedback

Your comments help us serve your documentation needs better. If you have any suggestions on how to improve our content, complete the form at rok.auto/docfeedback.

Waste Electrical and Electronic Equipment (WEEE)

At the end of life, this equipment should be collected separately from any unsorted municipal waste.

Rockwell Automation maintains current product environmental information on its website at rok.auto/pec.

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