

Technical Note

Adding User Libraries to MotionWorks IEC projects

Applicable Product: MotionWorks IEC and MotionWorks IEC PRO



Subject: Programming Note	Product: MotionWorks IEC	Doc#: TN.MCD.08.130
Title: Adding User Libraries to MotionWorks IEC projects		

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Application Overview

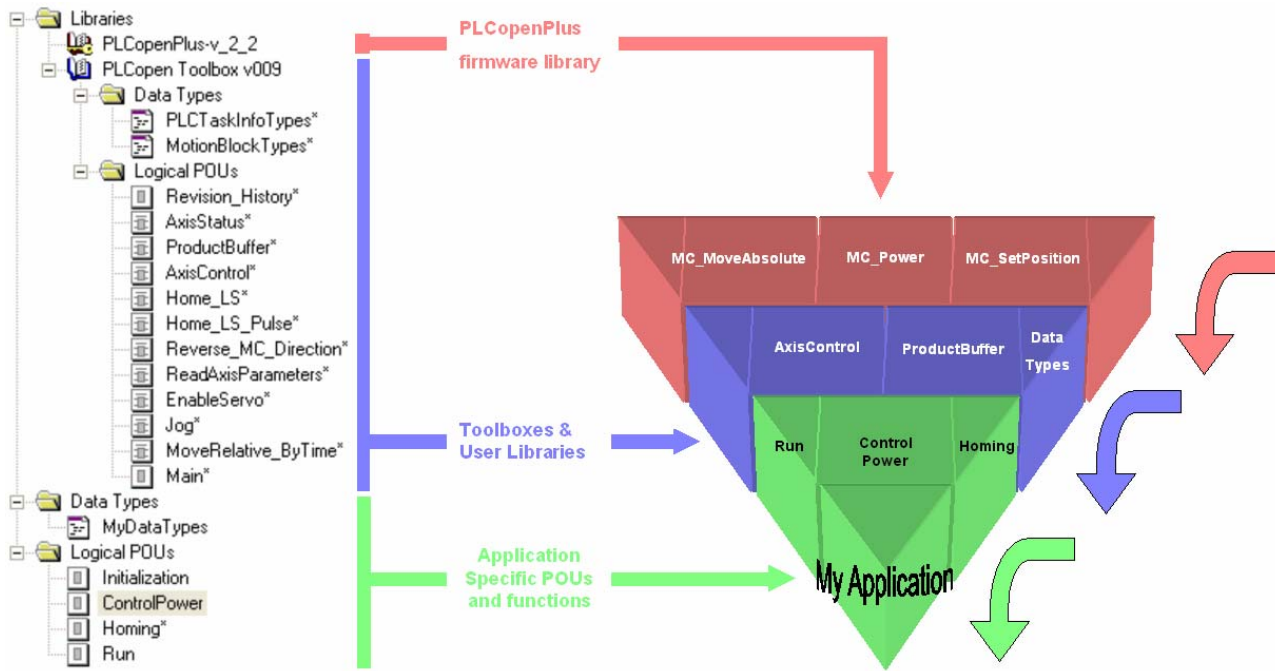
This paper will discuss how to create, distribute, and import a User Library, and provide advice about possible error conditions that may occur.

Application Highlights

User libraries are at the core of the “reusable code” concept. They contain functions, function blocks, and data types that are easy to organize and reuse from project to project. By maximizing the use of libraries, the application code remains compartmentalized, and easy to separate for the purposes of upgrading and reuse.

There’s an added benefit with this “Top Down” approach. The programmer and/or maintenance technician must only “Drill Down” into the code pyramid as far as necessary during development and debugging. Once the lower level code modules have been developed and tested, they are out of the way, tucked into a user library, reducing program clutter. Code in a library cannot be changed unless the library itself is opened as a project, ensuring against accidental changes.

Concept:



All Functions, Function Blocks, and DataTypes from the libraries are available for the application.

Function, Function Blocks, and Data Types provided in the firmware and user libraries speed code development for the application programmer. At the application level, the programmer can pull from the resources provided in the included libraries.

Note: A "Toolbox" supplied by Yaskawa is the same as any other User Library that you may create on your own. Also, do not confuse the [PLCopen Toolbox](#) with [PLCopenPlus](#). The former is a *User Library* and the latter is a *Firmware Library*. One of the differences is that the user library code can be opened and debugged, the firmware library cannot.

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Creating a User Library

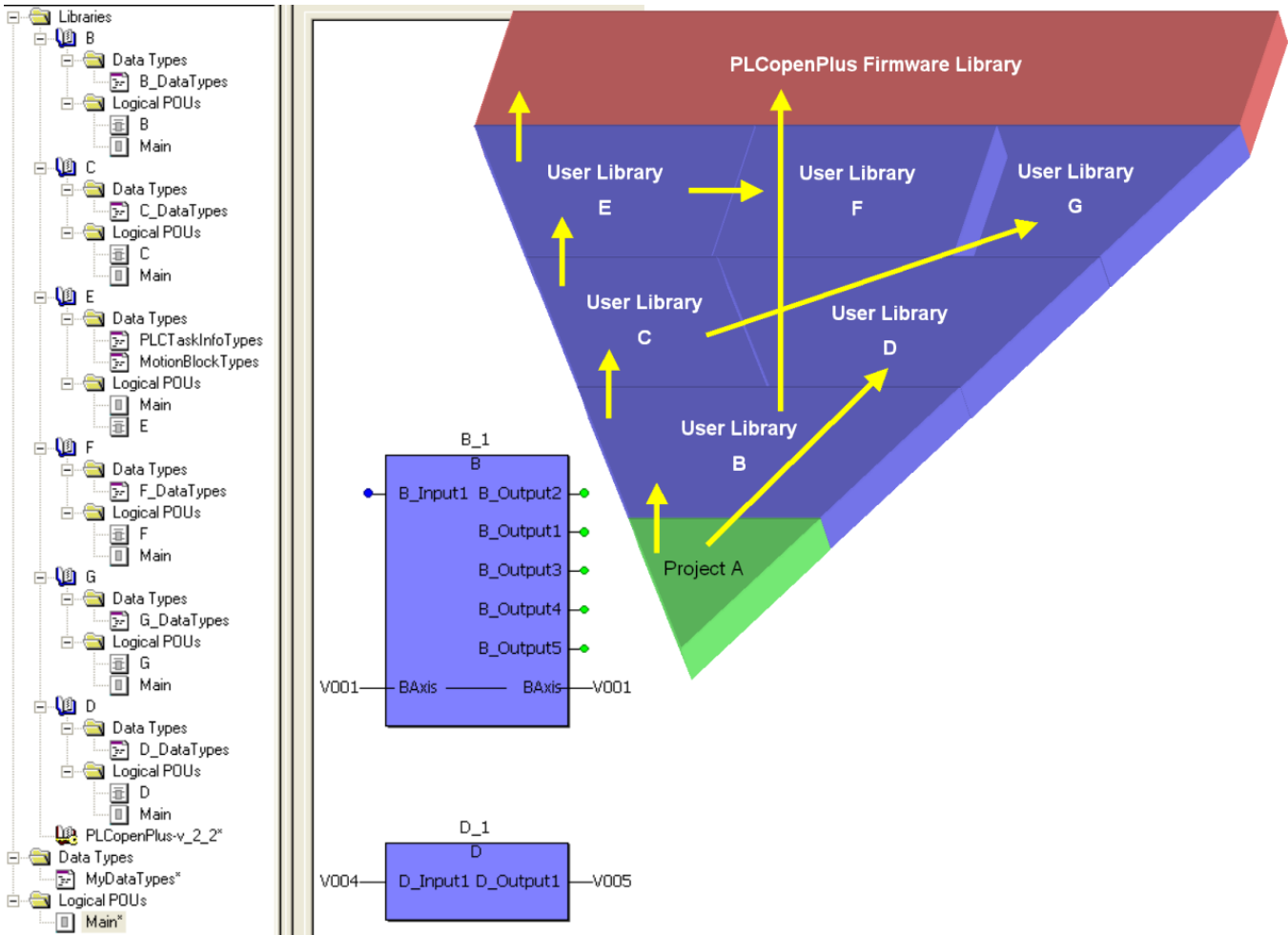
A User Library is simply a MotionWorks IEC project. Any project with a MWE or ZWT file extension can be imported as a library. When a project is imported as a library, none of the global variables or program POU's are available for individual editing. The Edit Wizard will only *display* a list of functions and function blocks in the library. Library code is completely separated from the physical hardware, and takes on the attributes of the project in which it is imported, such as the program task rate, physical I/O, etc.

Data Types

Any Data Types that are created in a library will be available in the main application. This is beneficial because typically libraries make use of data structures. Important Note: **Each data element must be unique within the entire project.** A common error that occurs when the PLCopen Toolbox is imported is *duplicate Data Type definitions*. Because the PLCopen Toolbox User Library uses PLCopenPlus firmware library, PLCopen Toolbox includes the Data Type files supplied with MotionWorks IEC's "New Project Template." Since all Data Types must be unique within a project, delete the Data Types files from the main project; they are already available via the User Library. *If you have added your own custom Data Types to the main project, do not delete them.*

Notes about using multiple libraries

Libraries can be cascaded as shown in the hypothetical project on the next page. However, if importing a User Library that accesses another library, the accessed libraries must be referenced in the main project, or a compile error will result. Notice main project "A" directly refers only to functions in "B" and "D." (Refer to the yellow arrows and also the functions B_1 and D_1.) Because "B" uses functions in "C," and "C" uses functions in "E," and "E" uses functions in the PLCopenPlus firmware library, these libraries must be declared in the main project, or a compile error will result. Additionally, if a library uses a Data Type declared in another library, the order in which the libraries appear in the tree is important. Compile errors will result if a library attempts to use a Data Type that is declared in a library that appears lower in the tree.



Important Note: A certain degree of strategy must be employed when designing User Libraries to avoid the problem of including two User Libraries that contain the same Data Types. Case in point: Yaskawa supplies PLCopen Toolbox (which uses PLCopenPlus and Data Types provided with the “New Project Wizard.”) If you decide to create your own User Library that also provides enhancements to PLCopenPlus standard functionality, you have two choices: Incorporate Yaskawa’s PLCopen Toolbox as a base library of your library to inherit the Data Types, or decide to never use PLCopen ToolBox, because a project that has two copies of the same Data Type definition will generate compile errors. In the example project diagram above, notice that only library “E” includes the two Data Type files as supplied with the New Project Template.

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Best Practices for Creating User Libraries

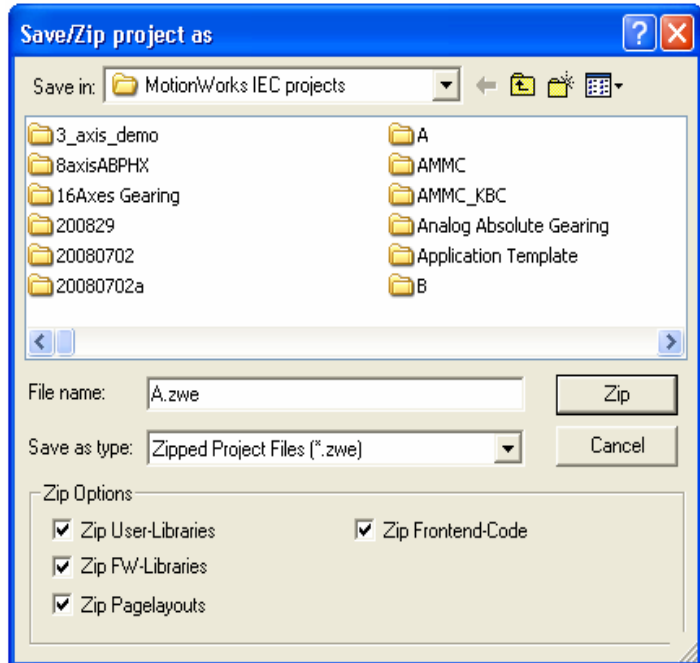
- Use a date code to identify the version of the User Library. Either append v001 or some other date code such as 20081230 to aid in tracking library versions.
- Create a program called “Revision_History” as a Structured Text program to document version changes and bug fixes.
- Always include inputs & outputs that reflect the characteristics of the PLCopen standard, such as Execute or Enable, and Busy, Done, Error, & ErrorID where possible. These I/O make functions easy to include into a program and debug. Yaskawa provides function block template code for both Ladder and Structured Text that provides the timing behavior of the PLCopen standards in a User Library called [Yaskawa Toolbox](#).
- Use the library functions in the Main POU of the User Library project as a testing method. This serves as an effective way to test the functions and view the I/O of the function block. It is possible to connect the User Library (when opened as a project) to hardware and declare global variables to fully test the functions before deployment. Neither the global variables nor the hardware configuration will affect the behavior of the project when used as a library, so they can remain in place for future testing.

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Distributing User Libraries

To distribute a library or store it for future use, simply save it as a ZWE or ZWT as normal for any project. The ZWE / ZWT format zips the entire project into a single file. Yaskawa recommends setting the checkboxes as shown.

- Zipping user libraries will include all sub libraries in the project.
- Zipping firmware libraries will do the same for firmware libraries. If the computer where the User library is extracted already has the firmware library, the user can choose to skip the unzipping of the firmware library.
- Zipping front end code will make it easier for the recipient of the User Library, because it will extract with compiled code, so the user will not have to recompile the library before use.

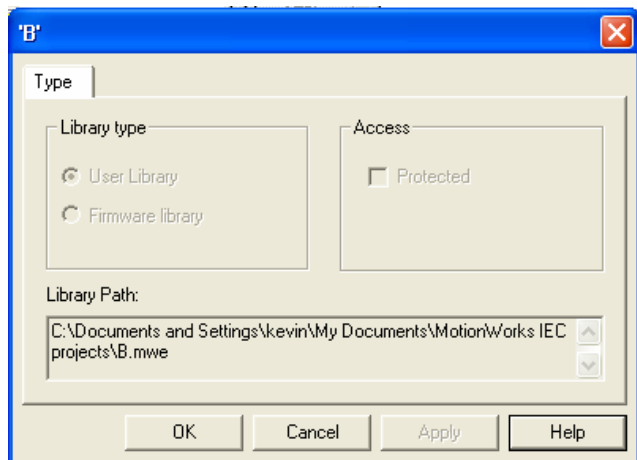
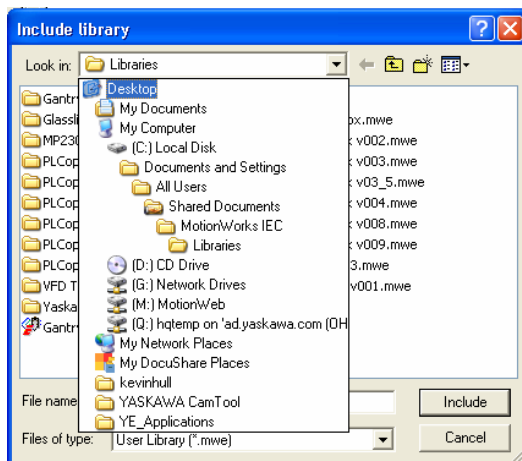


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Importing User Libraries

Unzipping a MotionWorks IEC project ZWE or ZWT that contains User Libraries will automatically extract them to the following location (for MotionWorks IEC):

This is the default location where MotionWorks IEC will look when the **Insert> User Library** function is invoked,



however User Libraries can be located anywhere on the computer. To see the location where the project is looking for a firmware or user library, right-click on the library name and click **Properties**, and a window as shown above on the right will indicate the directory path.

If you have already started a project and wish to include a library, perform the following simple steps:

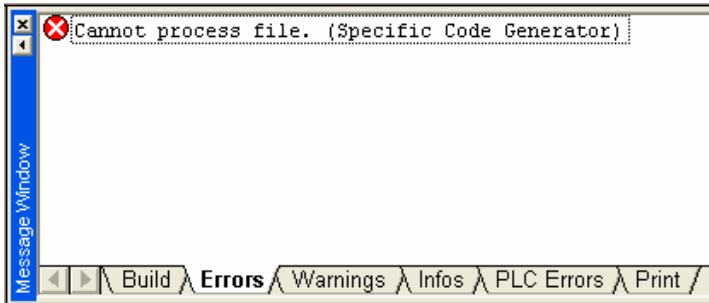
- 1) Open MotionWorks IEC
- 2) Locate and open the Library ZWE file to extract the project to a location of your choice (above mentioned directory path recommended.)
 - a. Note: ZWE files cannot be directly imported as a User Library
- 3) Open your project
- 4) In the Project Tree window, right-click on Libraries
- 5) Select Insert
- 6) Select User Library

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Compile Errors

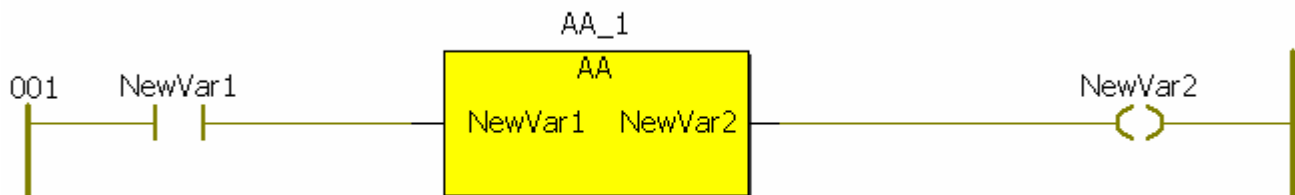
Cannot Process File

This error appears if there are no Global Variables declared. Add at least one global variable to the library.



Yellow function blocks

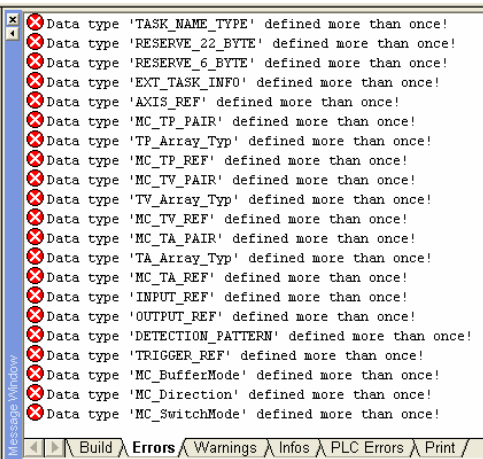
Yellow indicates that the source of the function cannot be located. Be sure that the library for this function is included in the project.



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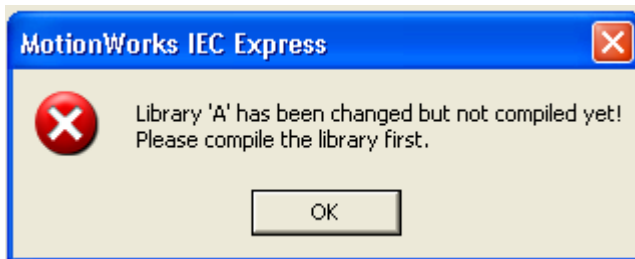
Data Type defined more than once

Data Types cannot be defined more than once in a project. If you have incorporated a User Library such as PLCopen Toolbox from Yaskawa, delete the Data Types files from your main project. (supplied with the “ New Project Template”)



Library Changed

This error will occur if the checkbox “ Zip Front End Code” is not set when saving the User Library as a ZWE or ZWT file. Refer to the section [Distributing User Libraries](#) for more information. If a User Library gives this error, find the location of the User Library, open it as a normal project, and compile it. After successful compilation, open the main project and compile once again.



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PLCopen Toolbox

This user library was created by Yaskawa to offer added functionality commonly needed in a wide variety of applications. For example, the function block called AxisControl incorporates the PLCopen elements MC_Power, MC_ReadAxisError, and MC_Reset into one function block and provides clearer errors and warnings based on the error code output from MC_ReadAxisError.

