



Microchip Application Maestro™ Software User's Guide

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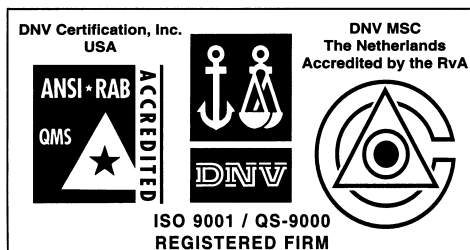
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Microchip received QS-9000 quality system certification for its worldwide headquarters, design and wafer fabrication facilities in Chandler and Tempe, Arizona in July 1999 and Mountain View, California in March 2002. The Company's quality system processes and procedures are QS-9000 compliant for its PICmicro® 8-bit MCUs, KEELOQ® code hopping devices, Serial EEPROMs, microperipherals, non-volatile memory and analog products. In addition, Microchip's quality system for the design and manufacture of development systems is ISO 9001 certified.

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Preface

This chapter contains general information about this manual and contacting customer support.

HIGHLIGHTS

Topics covered in this chapter:

- About this Guide
- Recommended Reading
- Troubleshooting
- The Microchip Internet Web Site
- Development Systems Customer Notification Service
- Customer Support

ABOUT THIS GUIDE

Document Layout

This document describes how to use the Microchip Application Maestro Software as a development tool for PICmicro[®] microcontrollers. The manual layout is as follows:

- **Chapter 1: Getting Started with the Application Maestro Software** – Describes what the Microchip Application Maestro Software is, what makes it a desirable development tool, how to install it, and the basic features of the interface.
- **Chapter 2: Using the Application Maestro Software** – Describes how to use the Application Maestro Software in creating modules for your applications.
- **Chapter 3: Working with Application Maestro Software Modules and Generated Code** – Describes the content of the Application Maestro Software module templates, and how to use the Application Maestro Software's generated code in applications.
- **Chapter 4: Troubleshooting** – Provides information on solving common problems.
- **Appendix A: Application Maestro Software Keyboard Command Summary** – Provides a list of keyboard shortcuts for Application Maestro Software.
- **Worldwide Sales and Service** – Lists Microchip sales and service locations and telephone numbers worldwide.

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Conventions Used in this Guide

This manual uses the following documentation conventions:

Documentation Conventions

Description	Represents	Examples
Code (Courier font):		
Plain characters	Sample code Filenames and paths	#define START c:\autoexec.bat
Angle brackets: < >	Variables	<label>, <exp>
Square brackets []	Optional arguments	MPASMWIN [main.asm]
Curly brackets and pipe character: { }	Choice of mutually exclusive arguments An OR selection	errorlevel {0 1}
Lower case characters in quotes	Type of data	"filename"
Ellipses...	Used to imply (but not show) additional text that is not relevant to the example	list ["list_option...", "list_option"]
0xnnn	A hexadecimal number where n is a hexadecimal digit	0xFFFF, 0x007A
Italic characters	A variable argument; it can be either a type of data (in lower case characters) or a specific example (in uppercase characters)	char isascii (char, ch);
Interface (Arial font):		
Underlined, italic text with right arrow	A menu selection from the menu bar	<u>File > Save</u>
Bold characters	A window or dialog button to click	OK, Cancel
Characters in angle brackets < >	A key on the keyboard	<Tab>, <Ctrl-C>
Documents (Arial font):		
Italic characters	Referenced books	<i>MPLAB IDE User's Guide</i>

Documentation Updates

All documentation becomes dated, and this user's guide is no exception. Since MPLAB® IDE, MPLAB C1X and other Microchip tools are constantly evolving to meet customer needs, some actual dialogs and/or tool descriptions may differ from those in this document. Please refer to our web site (<http://www.microchip.com>) to obtain the latest documentation available.

RECOMMENDED READING

The following documents contain current information on programming the specific microcontroller devices.

MPLAB® IDE User's Guide (DS51025)

Comprehensive guide that describes installation and features of Microchip's MPLAB Integrated Development Environment (IDE), as well as the editor and simulator functions in the MPLAB environment.

MPASM™ User's Guide with MPLINK™ and MPLIB™ (DS33014)

Describes how to use Microchip Universal PICmicro Microcontroller Assembler (MPASM), Linker (MPLINK), and Librarian (MPLIB).

Technical Library CD-ROM (DS00161)

This CD-ROM contains comprehensive data sheets for Microchip PICmicro® MCU devices available at the time of print. To obtain this disk, contact the nearest Microchip Sales and Service location (see back page) or download individual data sheet files from the Microchip web site (<http://www.microchip.com>).

Embedded Control Handbook (DS00711)

This handbook consists of several documents that contain a wealth of information about microcontroller applications. To obtain these documents, contact the nearest Microchip Sales and Service location (see back page).

The application notes described in these manuals are also obtainable from Microchip Sales and Service locations or from the Microchip web site (<http://www.microchip.com>).

*PICmicro™ Mid-Range MCU Family Reference Manual (DS33023) and
PICmicro® 18C MCU Family Reference Manual (DS39500)*

These manuals explain the general details and operation of the mid-range and advanced MCU family architecture and peripheral modules. They are designed to complement the device data sheets.

Microsoft® Windows® Manuals

This manual assumes that users are familiar with Microsoft Windows operating system. Many excellent references exist for this software program, and should be consulted for general operation of Windows.

TROUBLESHOOTING

See Chapter 4 for information on common problems.

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THE MICROCHIP INTERNET WEB SITE

Microchip provides easy access to our documentation and on-line support through our World Wide Web Site at www.microchip.com. You can download files from the web site or from our FTP site at <ftp://ftp.microchip.com>.

DEVELOPMENT SYSTEMS CUSTOMER NOTIFICATION SERVICE

Microchip started the customer notification service to help our customers keep current on Microchip products with the least amount of effort. Once you subscribe, you will receive email notification whenever we change, update, revise or have errata related to your specified product family or development tool of interest.

Go to the Microchip World Wide Web page (<http://www.microchip.com>) and click on Customer Change Notification under Items of Interest. Follow the instructions to register.

The Development Systems product group categories are:

- Compilers
- Emulators
- In-Circuit Debuggers
- MPLAB
- Programmers

Here is a description of these categories:

COMPILERS - The latest information on Microchip C compilers and other language tools. These include the MPLAB C17, MPLAB C18 and MPLAB C30 C compilers; MPASM and MPLAB ASM30 assemblers; MPLINK and MPLAB LINK30 object linkers; and MPLIB and MPLAB LIB30 object librarians.

EMULATORS - The latest information on Microchip in-circuit emulators. This includes the MPLAB ICE 2000 and MPLAB ICE 4000.

IN-CIRCUIT DEBUGGERS - The latest information on Microchip in-circuit debuggers. These include the MPLAB ICD and MPLAB ICD 2.

MPLAB - The latest information on Microchip MPLAB IDE, the Windows Integrated Development Environment for development systems tools. This list is focused on the MPLAB IDE, MPLAB SIM and MPLAB SIM30 simulators, MPLAB IDE Project Manager and general editing and debugging features.

PROGRAMMERS - The latest information on Microchip device programmers. These include the PRO MATE® II device programmer and PICSTART® Plus development programmer.

CUSTOMER SUPPORT

Users of Microchip products can receive assistance through several channels:

- Distributor or Representative
- Local Sales Office
- Field Application Engineer (FAE)
- Corporate Applications Engineer (CAE)
- Hotline

Customers should call their distributor, representative or field application engineer (FAE) for support. Local sales offices are also available to help customers. See the back cover for a listing of sales offices and locations.

Corporate Applications Engineers (CAEs) may be contacted at (480) 792-7627.

In addition, there is a Systems Information and Upgrade Line. This line provides system users a listing of the latest versions of all of Microchip's development systems software products. Plus, this line provides information on how customers can receive any currently available upgrade kits.

The Hotline Numbers are:

1-800-755-2345 for U.S. and most of Canada.

1-480-792-7302 for the rest of the world.

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NOTES:

Chapter 1. Getting Started with the Application Maestro Software

1.1 HIGHLIGHTS

This chapter covers the following topics:

- What the Microchip Application Maestro Software is (and what it is not)
- How to Install the Microchip Application Maestro Software
- The Microchip Application Maestro Software Interface

1.2 WHAT IS MICROCHIP APPLICATION MAESTRO SOFTWARE?

The Microchip Application Maestro Software is a stand-alone software tool that allows users to configure and incorporate a range of pre-written firmware modules into their applications. Its heart is a collection of modules developed by Microchip Technology for use with its PICmicro microcontrollers. Starting from a graphic interface, the user selects one or more available modules, then configures the parameters for each. When this is complete, the Application Maestro Software then generates code that can be incorporated into the user's application project, using MPLAB IDE or any compatible development environment.

It is important to note that the Application Maestro Software is not a plug-in or add-on to the MPLAB line of development tools; it is a separate item in its own right. Application Maestro Software also differs from other librarian systems, such as MPLIB, because it does more than archive and manage related files for a single software project. Instead, it manages a library of ready-to-configure modules that the user customizes to their needs, and creates the necessary files for inclusion in the user's projects on demand.

1.3 HOW MICROCHIP APPLICATION MAESTRO SOFTWARE HELPS YOU

Application Maestro Software is a repository of pre-written software solutions that lets you take better advantage of the many peripheral features of Microchip controllers. It is no longer necessary to spend hours digging through code archives or documentation, trying to find the source code for an RS-232 serial communication port or CAN engine, then manually adding it to a new project. Nor do you have to re-invent a block of application code when you can't find that one elusive archive. With the Application Maestro Software, it's all in one place.

1.4 INSTALLING THE MICROCHIP APPLICATION MAESTRO SOFTWARE

The Application Maestro Software is designed to run under any 32-bit version of Microsoft Windows. Users with Windows NT versions (NT 4.0, 2000 Professional Desktop or XP) should not require Administrator rights to their system to install the software. The minimum system requirements for the software are generally the same as Microchip's MPLAB IDE software:

- PC-compatible system with an Intel® Pentium® class or higher processor, or equivalent
- A minimum of 16 MB RAM (32 MB recommended)
- A minimum of 5 MB available hard drive space
- Any 32-bit version of Microsoft Windows (Windows 98, Windows NT, Windows 2000 or Windows XP)

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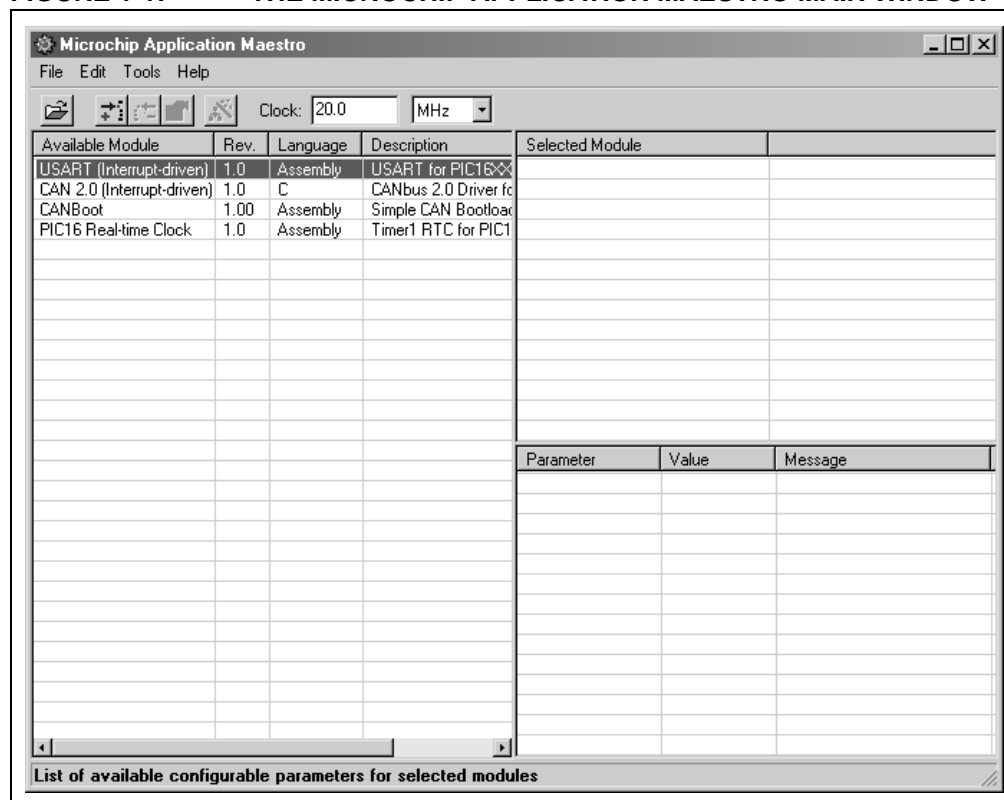
To install the Application Maestro Software, locate the installer file MpAMv1.x.x.exe and double-click on its icon. The installation program automatically extracts the files, creates the directory structure and installs all the necessary files.

By default, the program is installed in the directory C:\Program Files\MpAM. Users have the option to change the default location and the Program Group in the Start menu at the time of installation.

1.5 THE MICROCHIP APPLICATION MAESTRO SOFTWARE INTERFACE

The Microchip Application Maestro Software runs as a stand-alone application; all functionality is accessible from its single dialog. Selecting the Microchip Application Maestro option from the Start menu (*Start>Programs>Microchip Application Maestro*), or double-clicking on the Microchip Application Maestro icon in Explorer, launches the window (Figure 1-1).

FIGURE 1-1: THE MICROCHIP APPLICATION MAESTRO MAIN WINDOW



All of the program options are accessible from the menu bar at the top of the screen; the most common items are duplicated in the toolbar. The window itself is divided into three panes, which define the available modules and their configuration options.



Chapter 2. Using the Application Maestro Software

2.1 HIGHLIGHTS

This chapter covers the following:

- Adding and Removing Modules to an Application Maestro Software Project
- Configuring a Module
- Generating Code

2.2 ADDING AND REMOVING MODULES TO AN APPLICATION MAESTRO SOFTWARE PROJECT

When the Application Maestro Software is started for the first time, all of the modules shipped with the application are listed in the left pane. You can immediately select those modules needed for your application project and begin to configure them. For convenience, we'll refer to one or more open modules in the process of being configured as an "Application Maestro Software project". Making those configured modules a part of your application in the development environment will be discussed later.

Adding a module to your Application Maestro Software project can be done in several ways:

1. Click on its name and drag it into the right upper pane, OR
2. Click on its name to select it, then do one of the following:
 - a) Click on the "Add Module" button;
 - b) Choose the "Add" option from the Edit menu; or
 - c) Press the <Ins> key.

In any case, the module appears in the upper right pane; it also remains listed in the left pane. Additionally, a list of the configurable properties for that module appears in the lower right pane.

<p>Note: Only one instance of a module may be configured at a time. The Application Maestro Software will not permit multiple instances of a particular module to appear in the upper right pane.</p>
--

Similarly, removing a module from your Application Maestro Software project is done in several ways:

1. Click on its name in the upper right pane, and drag it back into the left pane; OR
2. Click on its name to select it, then do one of the following:
 - a) Click on the "Remove Module" button;
 - b) Choose the "Remove" option from the Edit menu; or
 - c) Press the key.

In all cases, the module disappears from the upper right pane, and its options disappear from the lower right pane.

2.2.1 Working with Multiple Items

It is not necessary to add or remove modules one at a time; several may be selected at once from either pane by clicking on individual names while pressing <Ctrl>.

To select all of the available modules, select "Highlight All" from the Edit menu (keyboard shortcut, <Ctrl-A>); this will highlight all modules in the left pane. To de-select individual modules, click on individual lines while pressing <Ctrl>.

When more than one module is added to the Application Maestro Software project at one time, the configurable options for the first module in the list appears in the lower right pane. To configure the options for any other open module, it is necessary to select that module.

2.3 CONFIGURING A MODULE

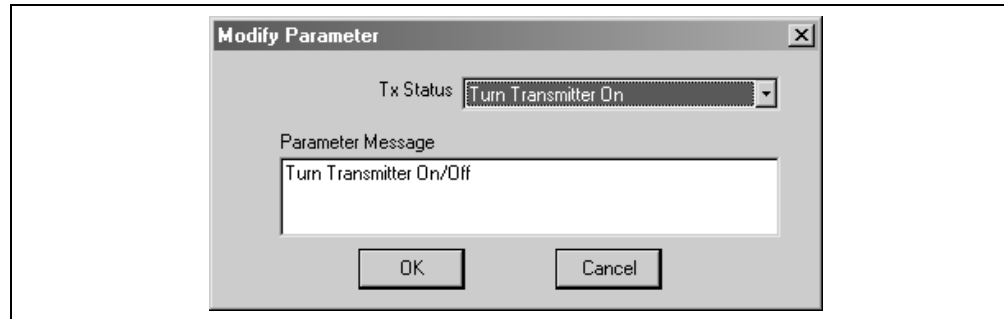
Once a module has been added to the Application Maestro Software project, it needs to be configured for the target application.

Each of the modules available through the Application Maestro Software has a pre-defined list of configuration options; when the module is selected, the list of available options appears in the lower right pane. To change a particular option, single-click on its line to select it, then select "Modify Params" from the Edit menu (or use the keyboard shortcut <Ctrl-M>). Alternatively, double-click on the option.

A dialog box (Figure 2-1) appears with the current value of the option and instructions. Change the value as required, then click "OK" to accept the change.

Each option has a defined valid range of values associated with it. Selecting a value outside of the range generates an error message.

FIGURE 2-1: TYPICAL CONFIGURATION OPTION DIALOG



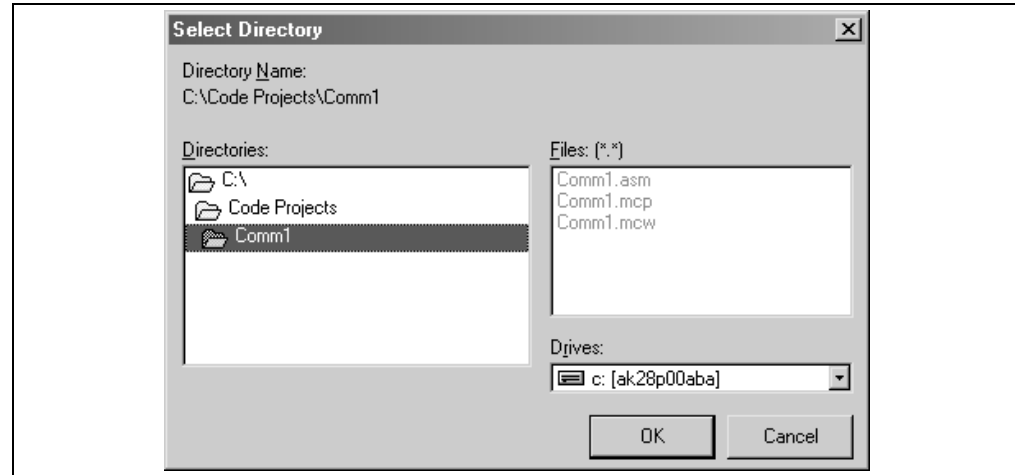
2.4 GENERATING CODE

Once the selected modules are configured, they can be saved to a project. At this point, the required files are actually created.

To create the files with the configuration changes, select the “Generate Code” button from the toolbar. Alternatively, select the “Generate Code” option from the Tools menu, or use the keyboard shortcut <Ctrl-G>.

The Application Maestro Software prompts for a directory to write the files to. You can select the directory where an existing software project resides, or any other convenient directory you choose.

FIGURE 2-2: SELECTING A DESTINATION FOR GENERATED FILES



The files that are actually created in the chosen directory vary from module to module. In general, they will include at least one .asm (or .c) file, one .def file, and several ASCII text files for code documentation. These are explained in Section 3.4 (“Working with Generated Files”).

Changing the configuration of an Application Maestro Software module through the lower right pane only reconfigures the generated code. The configuration of the original Application Maestro Software module remains unchanged.

2.5 EXITING THE APPLICATION MAESTRO SOFTWARE

When you are finished with the Application Maestro Software, exit the application by any of these three ways:

1. Click the main window’s “Close” button;
2. Select the “Exit” option from the File menu; or
3. Use the keyboard command <Alt-F>, X.

Because changes to the modules are saved to the application project that you specify when you generate code, there is no separate Save on Exit option for the Application Maestro Software. All configuration work that you perform on an Application Maestro Software project is lost if you don’t generate code.

2.5.1 Application Maestro Software Window Configuration

The configuration of the Application Maestro Software window (size on launch, default clock frequency, sizes of panes and their columns) is saved on exiting the application.

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NOTES:

Chapter 3. Working with Application Maestro Software Modules and Generated Code

3.1 HIGHLIGHTS

This chapter covers the following:

- Contents of the Microchip Application Maestro Software Module
- Adding and Removing Modules
- Working with Generated Code

3.2 WHAT'S IN A MODULE?

In order to create the customized code for applications, the Application Maestro Software uses a collection of files for each module. Each module has its own folder, located in the Modules folder in the Application Maestro Software directory. The exact number of files for each module varies, but includes at least one of each of the following:

- One or more assembly language files (either `.asm` or `.c`)
- An include file (`.inc`) or header file (`.h`)
- The Module definition file (`module_name.ReadMe.pdf`), which describes the logical structure of the module's code, interfaces and methods, as well how to integrate the code with an application
- The Example file (`module_name.Ex.txt`), which provides an example of how to integrate the generated code with the user's application

Additionally, there may be a `module_name.lkr.txt`, which provides an example of how to use the generated linker file. This will only be found when a linker file is required.

Most of the modules provided with the Application Maestro Software are written in assembly language. Some modules may include high-level language source files in C, as well as object and header files. In these cases, the compiler type will be noted.

The content of a module is defined in the Application Maestro Software script file named `module_name.cls`, which is located at the root level of the Modules folder. The Application Maestro Software uses this file to provide information for the Available Module pane (name, revision level, language format and descriptive comments), as well as define the valid range of the configurable parameters and the output for the module.

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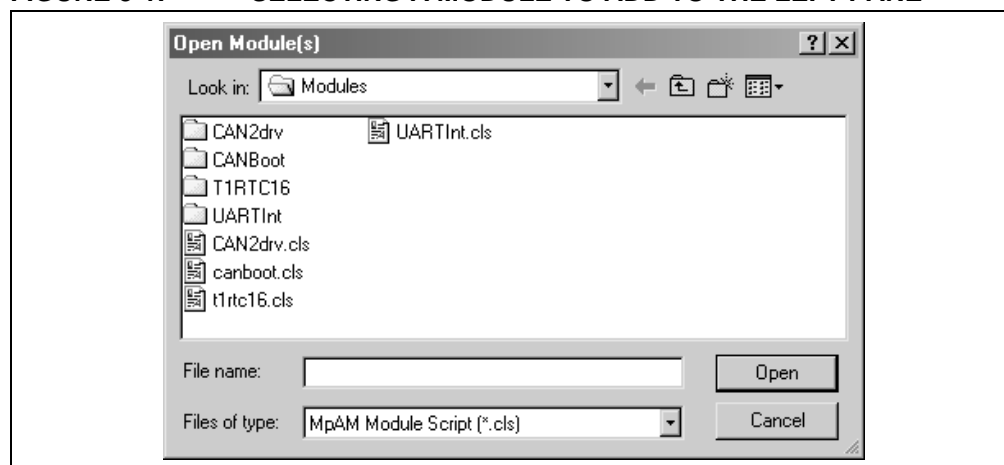
3.3 ADDING AND REMOVING AVAILABLE MODULES

On its initial launch, the Application Maestro Software will display those modules that were included with the software package at the time of its installation. New modules may be added as they become available, and old modules may be removed.

To Add a Module:

1. Copy the module folder and its associated `.cls` file into the Modules folder for the Application Maestro Software.
2. Launch the Application Maestro Software.
3. From the File menu, select Open Module(s); alternatively, use the keyboard shortcut <Ctrl-O>.
4. At the "Open Modules" dialog (Figure 3-1), browse to the Modules folder (if necessary) and select the script file (with the extension `.cls`) for the new module. Click **OK**.

FIGURE 3-1: SELECTING A MODULE TO ADD TO THE LEFT PANE



The module name and its information are now listed in the Available Module pane.

- Note 1:** You can place modules in locations other than the default Modules folder, and use them in the same manner as modules in the default folder. Keep in mind that the Application Maestro Software will remember the last location that a module was selected from and make that the new default location for opening new modules.
- 2:** It is possible to place copies of the same module in different folders and open each copy as a unique module, which is separately configurable. This is because the Application Maestro Software looks at the entire fully qualified path name of the module in determining if a module is unique. This does **not** mean, however, that you can generate code for each of these instances in a single Application Maestro Software project. Even though the instances are unique, they will generate output files with the same names. When you generate code from several identical instances at once, all of the output files will be written to the same directory. The end result will be only one set of files with the configuration of the last module in the Selected Modules list.

To Remove a Module:

1. Select the module from the list in Available Module pane.
2. From the File menu, select *Close Module(s)*.
3. At the following dialog box, click **Yes** to continue.

The module name and its information are removed from the Available Module pane.

Like other changes to the Application Maestro Software window, modules added to or removed from the left pane remain that way. Modules removed from the left pane cannot be used for projects until they are added to the list of available modules again.

If a module is being permanently removed, it may be helpful to delete its folder from the Modules folder. This prevents it from being added back to the list of available modules and used by accident.

3.3.1 Obtaining New Modules

In addition to the selection provided with the software distribution, other modules for the Application Maestro Software will be made available by Microchip from time to time. These will include new modules for additional peripherals, as well as updated versions of existing code (created as improved methods and as new ideas become available). For information on how to obtain new and updated modules, be sure to check the Microchip Technology web site (www.microchip.com) from time to time.

3.4 WORKING WITH GENERATED FILES

As mentioned before, the “Generate Files” command of the Application Maestro Software produces output to a specified location. This output consists of not one, but several files:

- One or more `.asm` (or `.c`) files containing the actual code
- `module_name.def`, which specifies the module configuration
- `module_name.inc` or `module_name.h`, the controller specific include or header file for the module (for assembler or C code, respectively)
- `module_name.Ex.txt`, which provides an example of how to integrate the generated code with the user’s application
- `module_name.ReadMe.pdf`, the module definition document

If you have already set up a project for the application being developed, it is probably simpler to have the Application Maestro Software write the generated files directly into the appropriate project directory. If a code project hasn’t been set up, the file output can be directed to any convenient location, then copied as needed to the appropriate directory.

3.4.1 The Final Step: Integrating the New Code

The method of including the generated files into the application code is a function of the development environment; the user should refer to the documentation for their chosen development tool for more information. The most important thing is that the generated Application Maestro Software files will not automatically find their way into an application on their own; you must still link the generated code to the project. Specifically, the application code that you have written and that will use the Application Maestro Software generated code must be modified by adding the `#include` compiler directive. Specific directions for using a particular module are located in the `ReadMe` definition and `module_name.Ex.txt` documents.

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Chapter 4. Troubleshooting

4.1 HIGHLIGHTS

This chapter discusses the following:

- Common issues with the Microchip Application Maestro Software, and how to solve them

4.2 COMMON PROBLEMS

1. When I attempt to add new modules, they aren't listed in the "Open Module(s)" dialog.

By default, library modules for the Application Maestro Software are located in the Modules folder inside the Microchip Application Maestro folder. This is the default location where Application Maestro Software looks for modules. It is possible that the default location has changed, perhaps while looking for another file; the Application Maestro Software will remember the last location browsed, and make that the default. Use the browse tools for the dialog box to locate the Modules folder.

If you are trying to locate a new module that you just downloaded from Microchip, it is possible that the files have been saved to the wrong location. The best solution is not to browse for the file from the Application Maestro Software, but search your system for any new files with the `.cls` extension. When you find that file, the chances are good that the new module's folder is somewhere close by in the same directory. When you locate the file and module folder, move them to the Modules folder (or whatever folder you are using for your modules).

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Appendix A. Application Maestro Software Keyboard Command Summary

A.1 HIGHLIGHTS

This chapter covers the following topics:

- Application Maestro Software Control-Key Commands
- Application Maestro Software Alt-Key Menu Shortcuts

A.2 CONTROL-KEY SHORTCUTS

<CTRL-A>	Select all modules in Available Module pane
<CTRL-G>	Generate code (Select Directory dialog)
<CTRL-M>	Modify configuration parameters of selected module
<CTRL-O>	Open module (Select Library Module dialog)

A.3 OTHER KEYBOARD SHORTCUTS

	Remove selected module in upper right pane from open Application Maestro Software project
<Ins>	Add selected module in Available Module pane to open Application Maestro Software project

A.4 ALT-KEY MENU SHORTCUTS

<Alt-E>	Select Edit Menu
<Alt-E>, A	Select all modules in Available Module pane
<Alt-E>, D	Remove selected module from project
<Alt-E>, M	Modify configuration parameters of selected module
<Alt-E>, S	Add highlighted module to open project
<Alt-F>	Select File Menu
<Alt-E>, C	Close selected module (remove from Available Module pane)
<Alt-E>, O	Open module (Open Module(s) dialog)
<Alt-E>, X	Exit Application Maestro Software (no Save Option)
<Alt-H>	Select Help Menu
<Alt-H>, A	Provides information on current Application Maestro Software revision
<Alt-T>	Select Tools Menu
<Alt-T>, G	Generates output code

Application Maestro Software User's Guide

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