MPLAB Code Configurator v3.xx User's Guide

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Preface

> **Important: Notice to customers:**
>
> All documentation becomes dated, and this manual is no exception. Microchip tools and documentation are constantly evolving to meet customer needs, so some actual dialogs and/or tool descriptions may differ from those in this document. Please refer to our website (www.microchip.com) to obtain the latest documentation available.
>
> Documents are identified with a "DS" number. This number is located on the bottom of each page, in front of the page number. The numbering convention for the DS number is "DSXXXXXA", where "XXXXX" is the document number and "A" is the revision level of the document.
>
> For the most up-to-date information on development tools, see the MPLAB® IDE online help. Select the Help menu, and then Topics to open a list of available online help files.

Introduction

This document describes how to install, configure and use the MPLAB® Code Configurator (MCC) software tool before starting or during the development process of an embedded software application designed with PIC® microcontrollers.

Recommended Reading

This user's guide refers to MCC operation only. Other useful documents are listed below. The following Microchip documents are available and recommended as supplemental reference resources:

- Release Notes for the MPLAB Code Configurator
- MPLAB X IDE User's Guide

Table of Contents

1. Introduction

The MPLAB® Code Configurator (MCC) generates driver code using a Graphical User Interface (GUI). The generated drivers control the peripherals on PIC® microcontrollers. The GUI provides an easy means for setting up the configuration of the peripherals. MCC is a plugin for the MPLAB® X IDE.

Additionally, the MCC is used to configure and generate libraries, which allows you to configure and generate code for software libraries and external components.

The generated drivers or libraries can be used in any Microchip PIC device application program. MCC requires a MPLAB X IDE project to be created, or an existing project opened, before launching the MCC plugin. This is necessary as the MCC needs to know the device used in the project, to have access to device-specific information like registers, bits and configurations, and to set up the MCC GUI.

The MCC generates source and header files based on selections made in the GUI. The generated files are added to the active project of MPLAB X IDE.

2.   Installation

The MPLAB Code Configurator can be installed in two ways: via the Microchip Plugins Update Center, or from the Microchip website. The following chapters describe these procedures and also the MCC update process.

2.1   Installing MPLAB Code Configurator from the Microchip Plugins Update Center

MCC is not installed together with the MPLAB X IDE by default, so you must download it separately and install it. One way to do so is via the Microchip Plugins Update Center:

1.   In the MPLAB X IDE, go to **Tools -> Plugins**.
2.   Go to the **Available Plugins** tab.
3.   Select MPLAB Code Configurator and click the **Install** button. See figure below.
4.   The Plugin installer opens. Click **Next** and check the Terms and Agreements. After this step, the Plugin installer begins downloading the MCC plugin.
5.   When the MCC plugin download is complete, MPLAB X IDE will ask to be restarted. Upon restart, the plugin is installed.
6.   You can now open MCC on a new or already existing MPLAB X IDE project. See

Figure 2-1.   Installing MPLAB Code Configurator
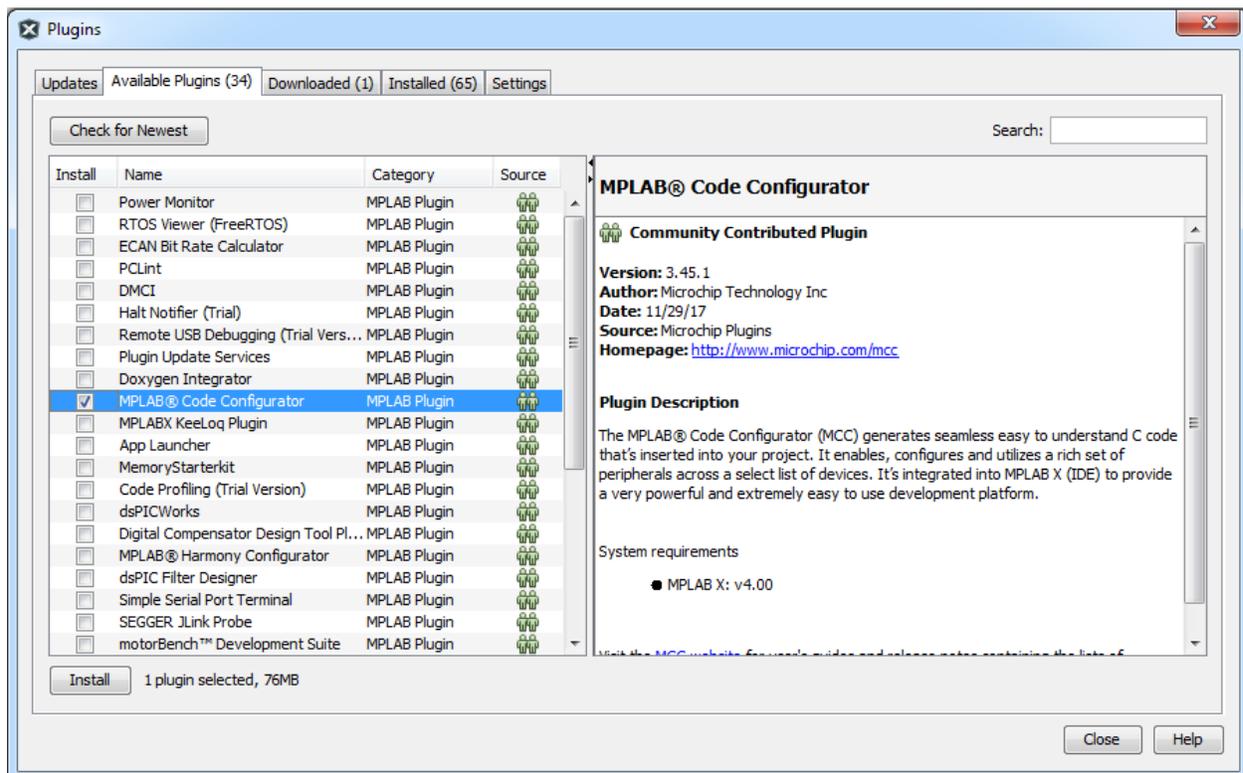
2.2 Installing MPLAB Code Configurator from the Microchip Website

The MCC plugin can also be downloaded from the Microchip website by typing the address www.microchip.com/mcc in a web browser, selecting the **Current Download** tab and downloading the Current Version `.zip` file. See Figure 2-2.

Figure 2-2. Downloading MCC from the Microchip Website

Title	Version	Date Published	Release Notes	D/L
Current Version				
MPLAB® Code Configurator	3.45.1	12/1/2017		

Once downloaded, extract the archive which contains the MCC plugin to a location of your preference. To install the plugin you downloaded, complete the following instructions:

1. Open MPLAB X IDE.
2. Go to **Tools -> Plugins**.
3. Select the **Downloaded** tab and click on the **Add Plugins...** button.
4. Navigate to the folder where you extracted the downloaded `.zip` file and select the MCC plugin. It should have a `.nbm` file extension.
5. Click on the **Install** button. MPLAB X IDE will ask to be restarted. Upon restart, the plugin is installed. See figure below.
6. You can now open MCC on a new or already existing MPLAB X IDE project. See Section 4.1 "Setting Up MPLAB X IDE and Launching MCC."

Figure 2-3. Installing MCC from Downloaded File
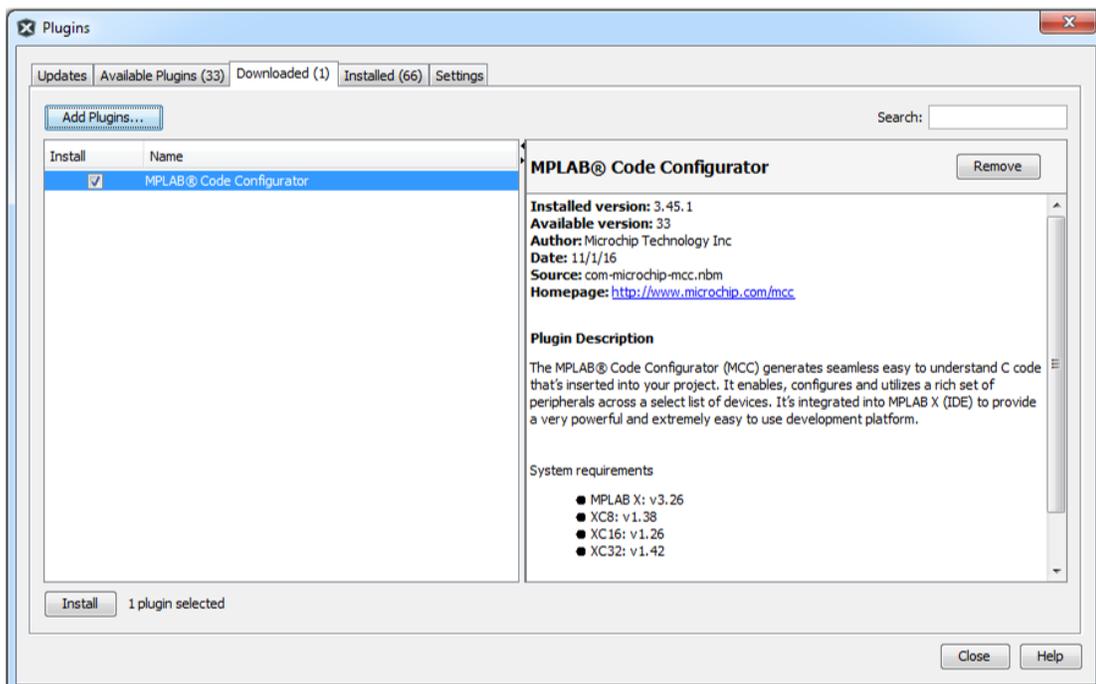
2.3   Updating MPLAB Code Configurator

When a MCC version newer than the one installed is available, the MPLAB X IDE will display a notification in the bottom right corner of the IDE window. By clicking on it, the plugin update wizard is launched. In the wizard, simply click on the **Install** button, which will download and install the new MCC plugin version. See figure below.

Figure 2-4. Updating MPLAB Code Configurator
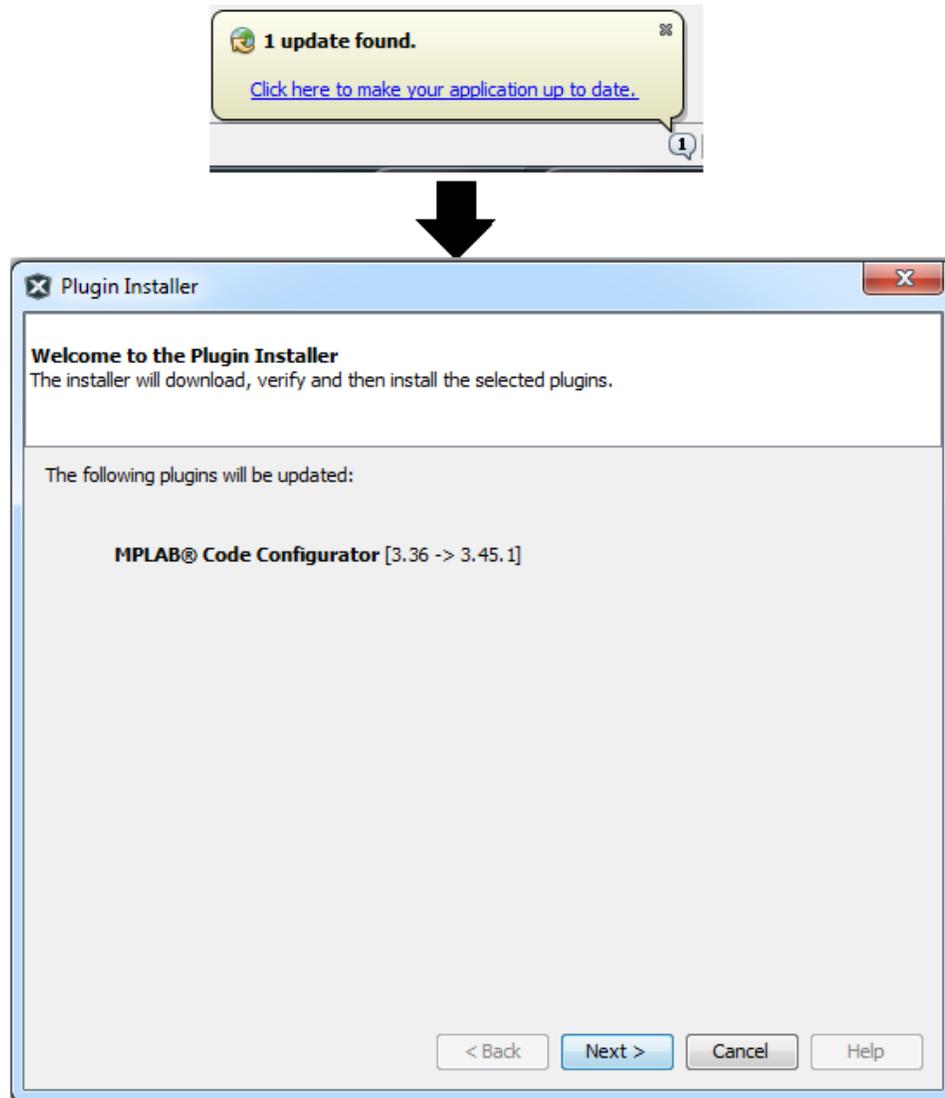
2.4   Older MPLAB Code Configurator Versions

Older MCC versions are available at the same www.microchip.com/mcc address, under the **Archive Download** tab.

3. Operating Areas

The MCC user interface consists of six main operating areas, as shown in Figure 3-1.

1. **Project Resources Area:** displays the complete list of peripherals, libraries and external components available for the selected device, based on the loaded libraries in the Versions Area.

2. **Device Resources Area:** displays the peripherals, libraries or external components selected for the current project. Selection is done via the Project Resources Area. The System Module, Pin Module and Interrupt Module are selected by default. Configuration for each of the selected modules is done through the Composer Area. Selecting a component from this area will move the component to the Project Resources area.

3. **Versions Area:** shows the complete list of MCC Cores, Peripheral Libraries and Software Libraries which can be used with the selected device. Some of these are installed together with MCC, others are available for download. Depending on the selected device, some core and library versions are interchangeable.

4. **Composer Area:** this is the main area in which a peripheral or library driver can be configured. It displays the possible configurations of the peripheral/library.

5. **Pin Manager Grid View Area:** contains three inner tabs: Notifications (errors, warnings and general information regarding the current selections), Pin Manager - Grid View (a table version of the Pin Module Package View) and Output (MCC Log & MPLAB X IDE Log).

6. **Pin Manager Package View Area:** graphic interface for pin selection and configuration. Bidirectional operation with the Pin Manager Grid View.

Figure 3-1. MCC Operating Areas
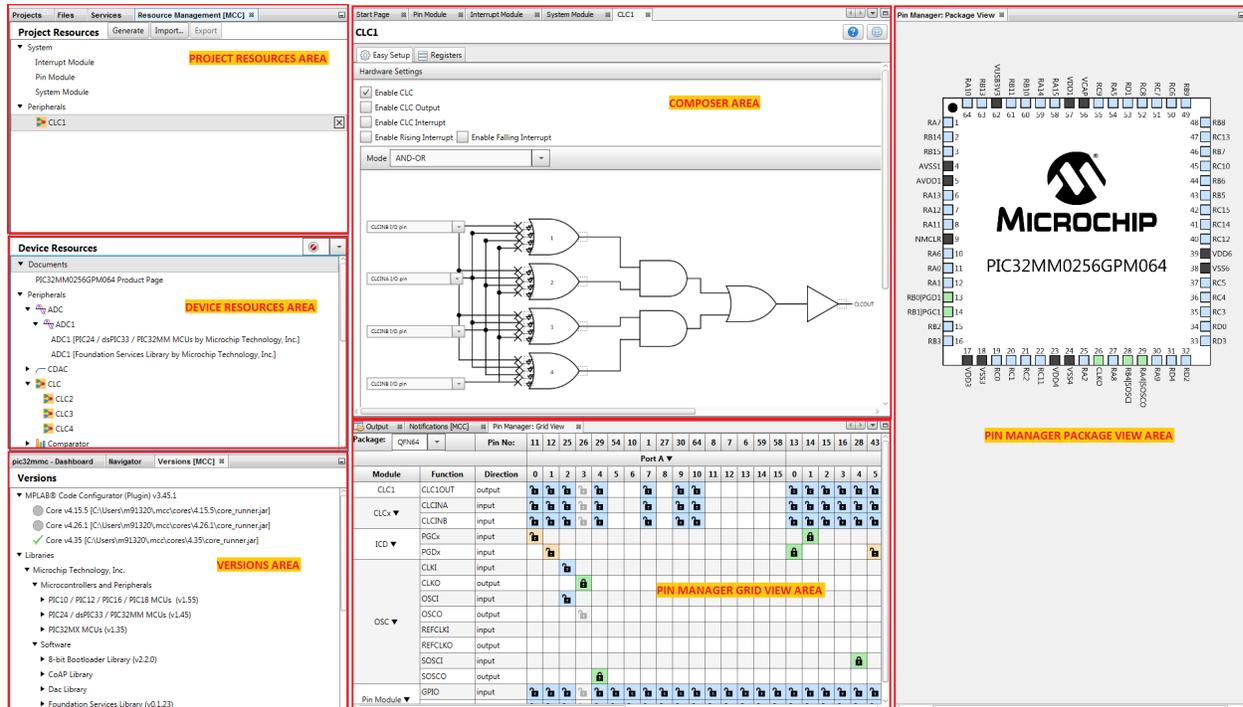
Note: All operating areas are dockable. Each can be dragged and dropped into another position, even out of the MPLAB X IDE main window (closing the IDE however will close all MCC windows, including the ones moved outside the IDE).

3.1 Project Resources Area

The Project Resources Area (Figure 3-2) displays the list of on-chip peripherals, external components and libraries that have been configured for the MCC project. The peripheral and libraries are added to the project by selecting them from the Device Resources Area. To add a peripheral or library to the Project Resources Area, double-click on its name in the Device Resources Area. Configuration can then be done via the corresponding GUI in the Composer Area.

A module in the Project Resources window can be removed from the project by clicking the **X** button to the right of the module name in the Project Resources Area. The module will be removed from the MPLAB X IDE project. When a module is removed from the Project Resources, all of the unsaved configuration information for that module is lost.

There are three system modules that are always available in the Project Resources Area. These modules cannot be removed. The modules are:

1. **Interrupt Module:** configures the interrupts for the device.
2. **Pin Module:** configures the pins for the device.
3. **System Module:** configures the system clock, Configuration bits, and other device-level functions for the device.

At the top of the window, there are three buttons:

- **Generate:** once the project configuration has been completed, clicking this button will trigger the code generation process for that specific configuration.
- **Import:** an MCC configuration file (`.mc3` extension) can be imported into the current project. If the selected configuration has been created for another device than the one used in the current project, an alert message will pop up offering the possibility of an experimental configuration migration (See Section 6 "MCC Device Migration") or canceling the import process. See Figure 3-3.
- **Export:** allows the export of partial configurations. Any loaded module in the Project Resources except System modules can be selected for a partial configuration by right-clicking on the module and selecting "Mark for config export". See Figure 3-4. All modules marked for export are shown in bold. Clicking the **Export** button creates an MCC configuration consisting only of the modules marked for export. To remove selection use "Unmark from config export" for a specific module or "Unmark all for config export" for all modules/components selected for export.

The Project Resources tree shown in Figure 3-2 can also be navigated and handled by using the following keys:

1. **Up and down arrow keys:** for moving up and down in the tree, respectively
2. **Right arrow key:** for expanding a node
3. **Left arrow key:** for collapsing a node

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Figure 3-2. Project Resources Area
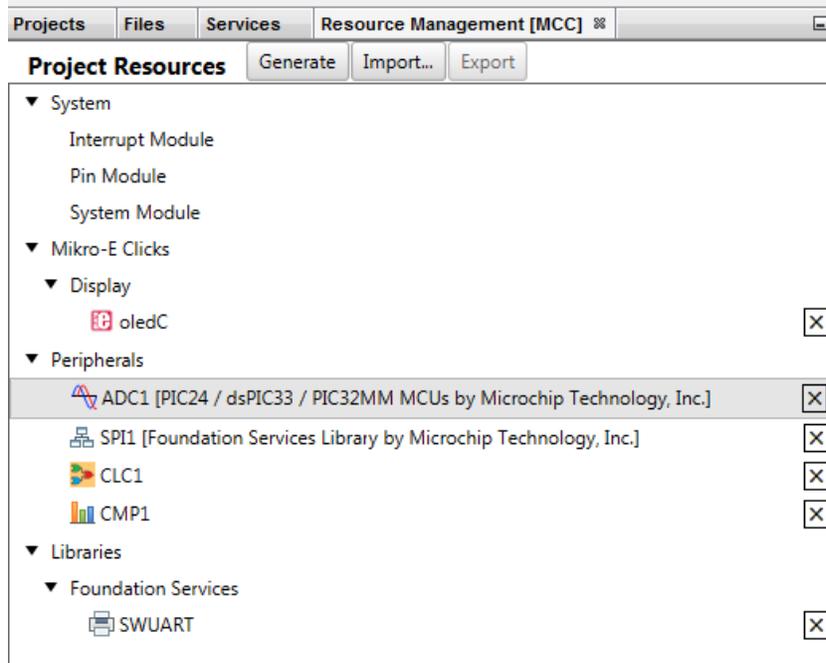
Figure 3-3. Importing a Configuration Created for a Different Device
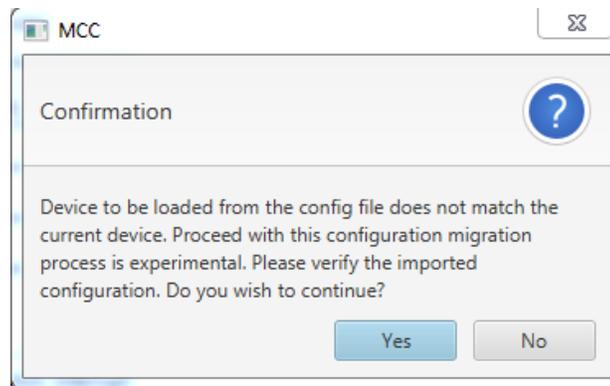
Figure 3-4. The Context Menu of the Project Resources Area
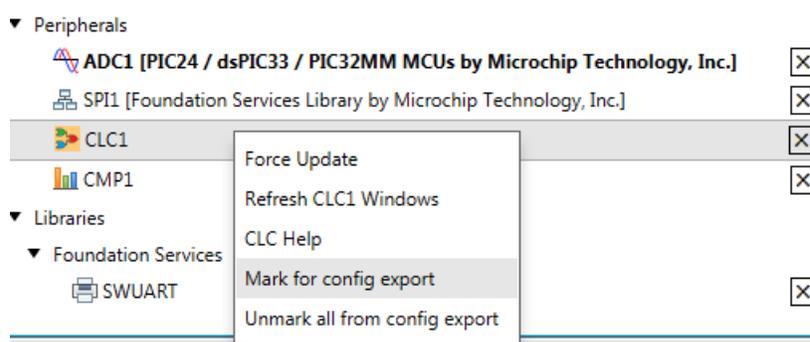
Besides the partial configuration export mechanism, the Context menu of the Project Resources Area (Figure 3-4) includes several other operations on the loaded components or modules such as:

- **Force Update**: regenerates code for all the selected modules/components, even if there were no modifications added to their configuration. See Section 4.3 "Generating Code".

- **Refresh [module_name] Windows:** reopens the configuration window of the selected module if that window has been closed previously. If the Context menu is invoked by right-clicking under the Resources list, with no module/component selected, this option will be available as Refresh Module Windows and its effect will be global - all previously closed MCC windows will be reopened.

- **[module_name] Help:** opens the help content for the user interface of the selected module/component, if available.

3.2   Device Resources Area

The Device Resources Area (see figure below) lists data sheet, external components and libraries available for the device configured in the MPLAB X IDE project. When the name of a peripheral or library is double-clicked, it is moved from the Device Resources Area to the Project Resources Area, simultaneously invoking the Pin Manager with all associated I/O pins.

Note: The **Documents** section of the Device Resources Area provides a link to the data sheet of the selected device on www.microchip.com.

Figure 3-5. Device Resources Area
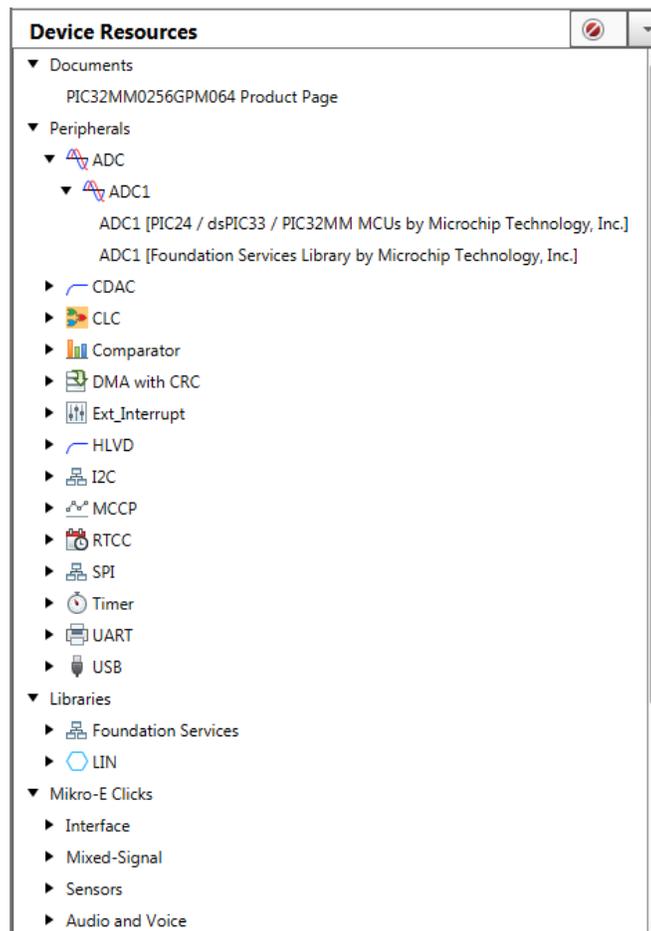
The Device Resources tree shown in the previous figure can also be navigated and handled by using the following keys:

1. **Up and down arrow keys:** for moving up and down in the tree, respectively
2. **Right arrow key:** for expanding a node
3. **Left arrow key:** for collapsing a node

Right-clicking on a module or component in this tree shows the Device Resources Context menu through which the help content of the selected module can be invoked.

The Device Resources list can be filtered via the top combo box (see the figure below). Available filters are: all supported and tested modules, all supported modules (including untested ones), all modules (including unsupported ones).

Figure 3-6. Resource Filtering in Device Resources Area
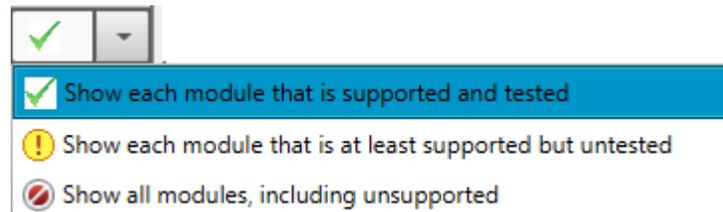
3.3 Versions Area

The Versions Area provides information about the versions of each MCC Core, Peripheral Library, Software Library or other component installed on the local machine. Over time, multiple versions of the libraries may be available. MCC can be configured to use a specific version of a Library for the current MCC project.

Loaded versions are displayed with a green tick, compatible but not loaded versions are displayed with a grey circle, and available versions which are unsupported by the selected core version are displayed with a circle backslash symbol (see Figure 3-7).

The MCC Core versions can be switched by right-clicking on an available core version and selecting "Switch core version" from the Context menu. Library versions can be loaded by right-clicking on a version of a component/module and selecting "Mark For Load." This action triggers the **Load Selected Library** button to appear at the top of the Versions Area. By clicking the button, all library versions which have been marked are loaded into MCC. Multiple selection is allowed; several components can be loaded at the same time. Only one version for each module/component is allowed to be loaded at a time.

If the component is already installed on the local machine, the absolute path to the corresponding `.jar` file is displayed next to the component name. If the component has not yet been installed, the "Available for download" message is displayed instead. Selecting an uninstalled component for load and then pressing the **Load Selected Libraries** button will download the corresponding `.jar` file from a Microchip server and will subsequently load it in MCC, provided that the selected version is compatible with the loaded core version.

Figure 3-7. Versions Area
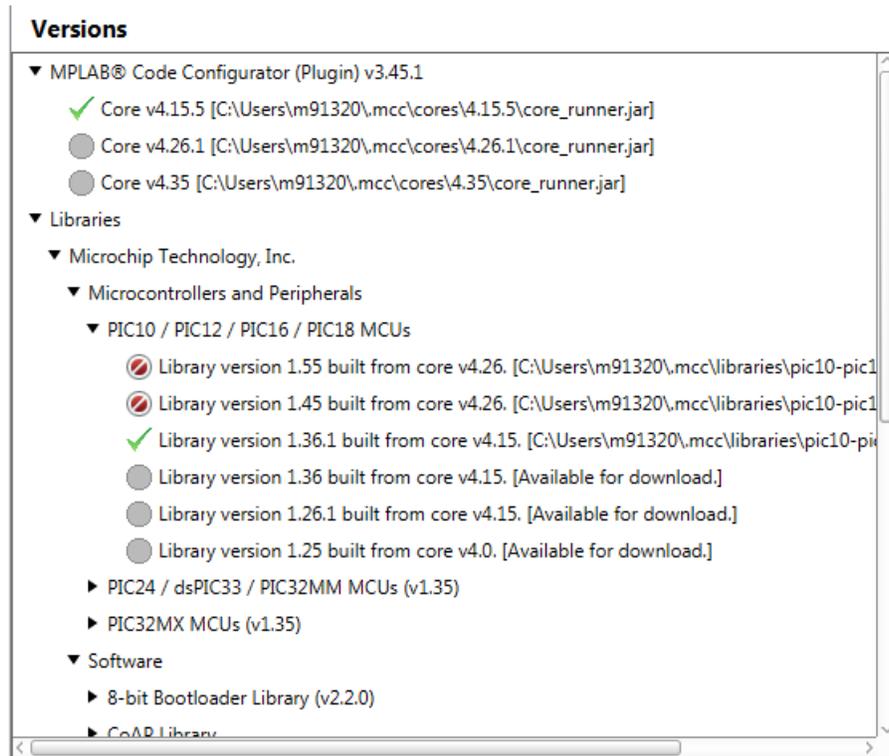
Besides the Versions Area, a core or a library can be loaded also via the MPLABX IDE menu in **Tools →
Options → Plugins → MPLAB Code Configurator** (see Section 3.8 "MCC Options").

Note: All MCC libraries are published via the Microchip website: www.microchip.com/mcc.

3.4   Package View Area

The following color combinations are associated with the pins in Graphical or Table View:

1. **Gray colored pin:** the pin is not usable in the selected configuration and there is no enabled
   module which has any functionality on that pin. There are also grayed out locks on a white
   background that indicate pins that are locked out by selected system functions.
2. **Blue colored pin:** pins that are available to be allocated to a module.
3. **Green colored pin (with a lock):** the pin has been allocated and selected for a module. The name
   displayed against the pin is either the name of the pin in the module's context or a custom name
   entered.
4. **Green colored pin (with chain link):** the pin is shared between multiple functions.
5. **Yellow colored pin:** a possible alternate pin for an already allocated pin function.
6. **Grayed out locks on a white background:** pins that are locked out by selected system functions.

The graphical Pin Manager can be zoomed in and out in order to adjust its visibility. This can be done by
scrolling the mouse wheel when the mouse is over the Package View. Zooming can also be achieved by
the "+" and "-" keys on the keyboard (useful if the mouse is not available).

By right-clicking on a specific pin all available pin functions are listed for selection. A snapshot of the package view configuration can be saved in PNG format by right-clicking on the package and selecting "Export Image."

Figure 3-8. Package View Area
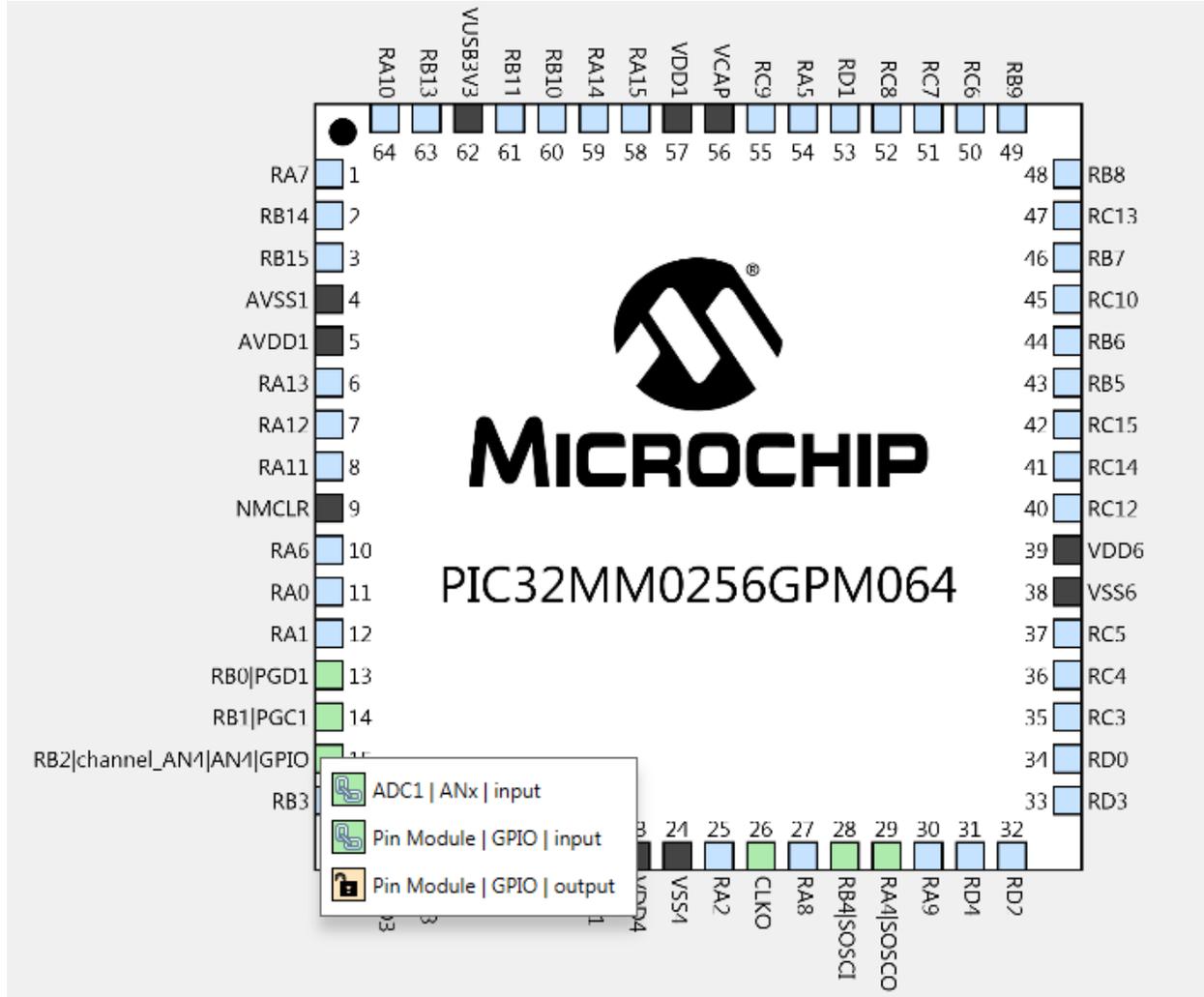
3.5   Table View Area

This area contains three inner tabs: Pin Manager Grid View, Output and Notifications.

3.5.1   The Pin Manager Grid View

In the Pin Manager Grid View, the device package can be selected from a drop-down list. The package selection is in the upper left side of the Pin Manager Table View. In the figure below, the drop-down list shows that the QFN64 package has been selected. The selected package will be displayed in the Package View. The pin numbers in the Table View will also show the pin numbers for the selected package.

Figure 3-9. The Grid View Area

The three leftmost columns in the Table View indicate the module's name, functionality name and the direction, respectively.

The Table View allows you to:

- Expand/collapse rows and ports (Figure 3-10)
- Hide and show ports and rows (Figure 3-11 and Figure 3-12)
- Show only the pins that are configured (Isolate) (Figure 3-13)

Figure 3-10. Collapsing Ports and Rows

Figure 3-11. Hiding Ports and Rows

Figure 3-12. Restoring Ports and Rows (Show All)
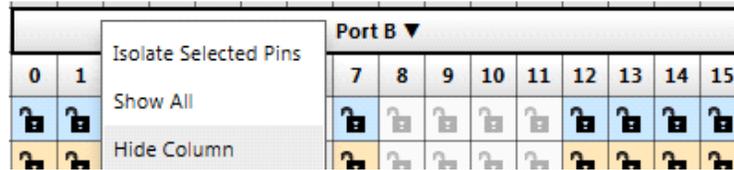
Figure 3-13. Isolating the Selected Pins
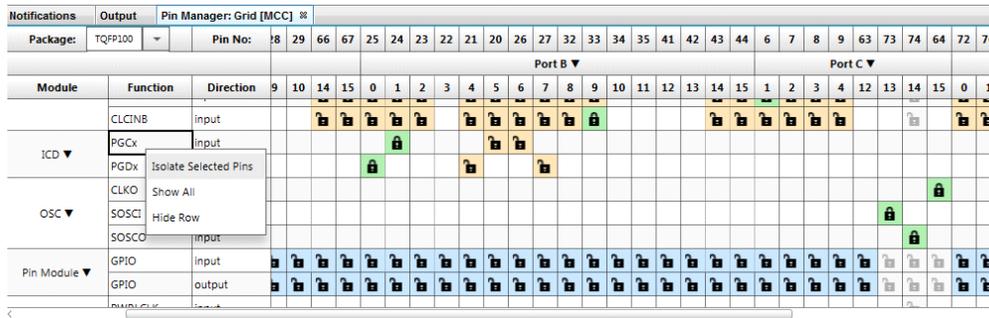
3.5.2 The MPLAB Code Configurator - Output Tab

This tab displays the MCC operation results. See figure below. The MPLAB X IDE Log is also displayed under the **Output** tab when you specifically open it from the **View -> IDE Log** menu.

Figure 3-14. The MPLAB Code Configurator - Output Tab

3.5.3 The Notifications Tab

During the configuration process, several messages may be displayed in the **Notifications** tab (Figure 3-15) to help identify issues or simply in order to make sure a specific setting is configured as intended. These are indexed in the **Notifications** tab by:

1. **Category:** identifies the notification as an alert or information that the module depends on another module.
2. **Module Name:** is the name of the module that generated the notification.
3. **Type:** indicates the severity of the notification.

There are four types of notifications:

- SEVERE: either the code generation or the compilation process will be faulty with the current configuration.
- WARNING: the code will be generated according to settings made and it may compile, but it might also fail to function as intended.
- HINT: this provides information to assist in the successful configuration of the module. The module and the MCC can still be used. Action might be required.
- INFO: information only, no action is required.

These can be filtered out using the Type combo box. If there are any WARNING or SEVERE type messages present in the **Notifications** tab when you click the **Generate** button, a message box displays, giving the option of reconfiguration in order to eliminate the possible errors in the current settings. This action can be skipped, assuming the notifications have been reviewed and taken into consideration.

Figure 3-15. The Notifications Tab

Category	Module Name	Type:	ALL ▼	Description
⚠	ADCC	HINT	Display SEVERE and above	Selected Tad (128.0 us) > maximumTad (6.0 us). Please higher the sampling frequency!
➡	CCP1	INFO	Display WARNING and above	The CCP1 module uses Timer 2
⚠	CCP1	WARNING	Display HINT and above	In order to use the PWM mode, please configure Timer 2 to use Fosc/4 as clock source.
⚠	DSM	HINT	Display INFO and above	Enable CLC1 module
			Display all levels	

Note: The notification type may change as you change the configuration of MCC. For example, WARNING might indicate that a module requires another module to be added to the project to operate correctly. After the module is added, the notification type would change to INFO.

3.6   The Composer Area

When a peripheral, library or other external component is selected from the Project Resources Area, its corresponding configuration GUI is displayed in the Composer Area. The Composer Area (Figure 3-16) is where peripherals and libraries are configured based on the application's requirements.

3.6.1   The Easy Setup Tab

Figure 3-16. The Easy Setup Tab of the PIC16F1947 EUSART Module
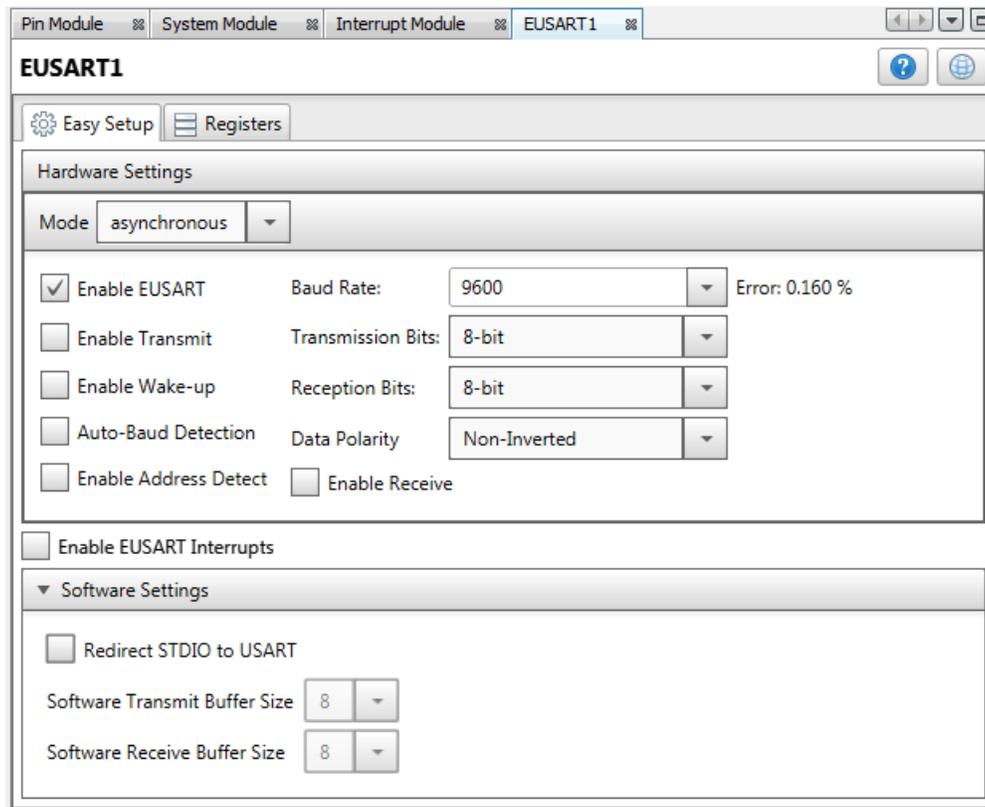
The EUSART **Easy Setup** tab in the Composer Area allows configuring various EUSART parameters related to transmission and reception operations.

3.6.2   The Registers Tab

In addition to the **Easy Setup** tab in the module's Composer, MCC also provides a **Registers** tab (Figure 3-17). The **Registers** tab provides direct access for you to configure the module's registers and settings, providing unrestricted access to the configuration of the module.

Any module configuration done using the **Easy Setup** tab will be reflected in the values displayed in the **Registers** tab. Likewise, changes performed in the **Registers** tab will be reflected in the values in the **Easy Setup** tab.

Figure 3-17. The Register View

3.6.3 The Pin Module Tab

For any pin which has been configured in the Pin Manager Table View, additional configuration of that pin can be done using the Pin Module View in the Composer Area. To display the Pin Module View, click on the **Pin Module** tab in the Project Resources Area. See Figure 3-18.

The following settings are available in this tab (depending on the selected pin): pin direction, custom name (editable text field which will be reflected in the generated code), initial value, analog/digital function, weak pull-ups, interrupt-on-change.

Figure 3-18. The Pin Module Tab

Pin Name ▲	Module	Function	Custom Name	Start High	Analog	Output	WPU	OD	IOC
RA0	ADC	AN0	channel_AN0	☐	☑	☐			
RA1	ADC	AN1	channel_AN1	☐	☑	☐			
RB2	Pin Module	GPIO	IO_RB2	☑		☐	☑		any ▾
RB4	Pin Module	GPIO	IO_RB4	☐		☑	☐		positive ▾
RC6	EUSART1	TX1		☐		☑			
RC7	EUSART1	RX1		☐		☐			

Pin Module System Module Interrupt Module EUSART1 ADC

Pin Module

Easy Setup | Registers
Selected Package : QFN64

3.7 MCC Options

Several aspects of the operation of the MCC can be managed by using the "Options" panel (see figure below), which can be invoked by clicking **Tools → Options → Plugins → MPLAB Code Configurator** in the menu bar of the MPLAB X IDE.

Figure 3-19. The MCC Option Panel

MPLAB® Code Configurator 3.x

File Handling   ☑ Remove unused files from the project
                 ☑ Delete unused files from the disk

Generated Line Endings   DOS (CRLF) ▾

Editor Behavior   ☑ Always ask before removing a module
                   ☐ Always ask before removing a pin

[Install Core]   [Remove Core]   [Open Core Folder]
[Install Library]   [Remove Library]   [Open Library Folder]
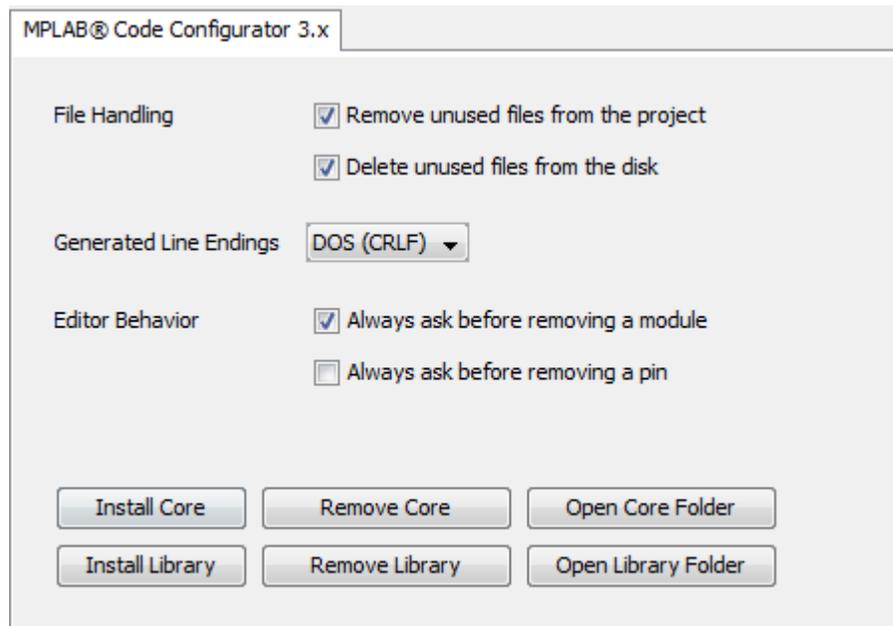
The MCC Options panel offers the following controls:

- File Handling
- Generated Line Endings
- Editor Behavior

3.7.1   MCC File Handling

1. **Remove unused files from the project:** enabling this option tells the MCC to remove `.c` and `.h` files for modules which were removed from the MCC configuration between the subsequent generation procedures. This option ensures that the files which are included in the project (and thus in the compilation) are only those which are strictly necessary. However, this will not delete the files from the disk.

2. **Delete unused files from the disk:** this option gets enabled only when selecting "Remove unused files from the project." This performs the additional task of deleting unused files from the disk. Once a file is deleted, it cannot be recovered.

3.7.2   MCC Line Endings

Specify the type of line endings to use in the files generated by MCC. The default is DOS (<CR><LF>). Unix line endings (<LF>) may be specified.

3.7.3   Editor Behavior

1. **Always ask before removing a module:** enabling this control enables the "Are you sure?" dialog box which appears while disabling or removing an enabled module.

2. **Always ask before removing a pin:** enabling this control enables the "Are you sure?" dialog box which appears while deallocating or removing a pin from a peripheral.

3.7.4   Installing a MPLAB Code Configurator Library

The MPLAB Code Configurator provides a peripheral or software library installation feature. You can use this feature to add MCC-compatible libraries. There are several libraries for various applications you can choose from on the http://www.microchip.com/mcc web page. An MCC Library file should have a `.jar` or a `.mc3lib` file extension. Once you have downloaded this file, open the MPLAB X IDE and in the above menu go to **Tools → Options → Plugins → MPLAB Code Configurator 3.x**, click on the **Install Library** button and select the `.jar` file via the **Open File** dialog box. The Versions window will now list your newly added library as installed.

If there are multiple versions of a library, the newly installed one will not be the loaded one. To load a particular version of a library, right-click on it and select "Mark for Load," which will then highlight your choice. If you have multiple libraries with multiple versions in each, you can highlight one from each before loading them. See Section 3.3. "Versions Area" for more details about switching library versions.

Removing a library is done using the **Remove Library** button. The File selection dialogue window will open your **Library** folder. Select the library you want to remove and click on the **Remove** button on the File selection dialogue. You can verify that the library is no longer present on your machine anymore by going to the Versions operating area - the library version you removed is not present on your machine anymore. It may be present as available for download.

If you attempt to remove a library you are currently using (green tick in the Versions area), MCC will not allow you to do so. In order to remove that library version, you need to switch to another version, go back to the Options window and press the **Remove Library** button again for the library version you want to delete.

3.7.5   Installing a MPLAB Code Configurator Core

The MPLAB Code Configurator provides a core switching feature. You can use this feature to work simultaneously on various projects with different core versions without uninstalling or reinstalling the plugin. In order to install a new core, you must first download the new core from the Microchip MCC web page (http://www.microchip.com/mcc). This file should have a `.mc3core` file extension. Once you have downloaded this file, open the MPLAB X IDE and in the above menu go to **Tools → Options → Plugins**

→ **MPLAB Code Configurator 3.x**, click on the **Install Core** button and select the `.mc3core` file via the **Open File** dialog box. The Versions window will now list your fresh core installation.

To switch to another core version, either double click on it, or right-click on it and select "Switch Core Version." The Versions window will now refresh the core selection with your choice. You can always check the core installations by opening the **Core** folder, from **Tools → Options → Plugins → MPLAB Code Configurator 3.x** path. Refer to Section 3.4. "Versions Area" for more details about core switching.

Removing a core version is done from the **Remove Core** button. The Folder selection dialogue window will open your "Core" folder. Select the core version you want to remove and click on the **Remove** button on the Folder selection dialogue. You can verify that the core version is no longer present on your machine anymore by going to the Versions operating area - the core version you removed is not present on your machine anymore. It may be present as available for download.

If you attempt to remove a core version you are currently using (green tick in the Versions area), MCC will not allow you to do so. In order to remove that core version, you need to switch to another core version, go back to the Options window and press the **Remove Core** button again for the core version you want to delete.

4.   Generating MCC Drivers

Now that you have installed MCC and learned about its main operating areas, it's time to set up MCC according to your needs and begin configuring your project. The following subsections cover basic MCC operation and the code generation process.

4.1   Setting Up MPLAB X IDE and Launching MCC

To generate drivers using the MCC in MPLAB X IDE, follow these steps:

1. Create a new MPLAB X IDE project or open an existing project (see figure below).
2. If multiple projects are open in MPLAB X IDE, set one as the main (active) project by selecting "Set as Main Project" in the MPLAB X IDE. For the active project, the MCC automatically includes the generated driver files.
3. Open the MCC plugin tool. In the menu bar of the MPLAB X IDE, go to **Tools → Embedded → MPLAB Code Configurator 3.x: Open/Close**. Or click on the MCC icon in the MPLAB X IDE toolbar.

Note: For MAC users, the "Embedded" selection will be under the Preferences menu. This launches the MCC GUI.

Figure 4-1. Opening the MCC in MPLAB X IDE
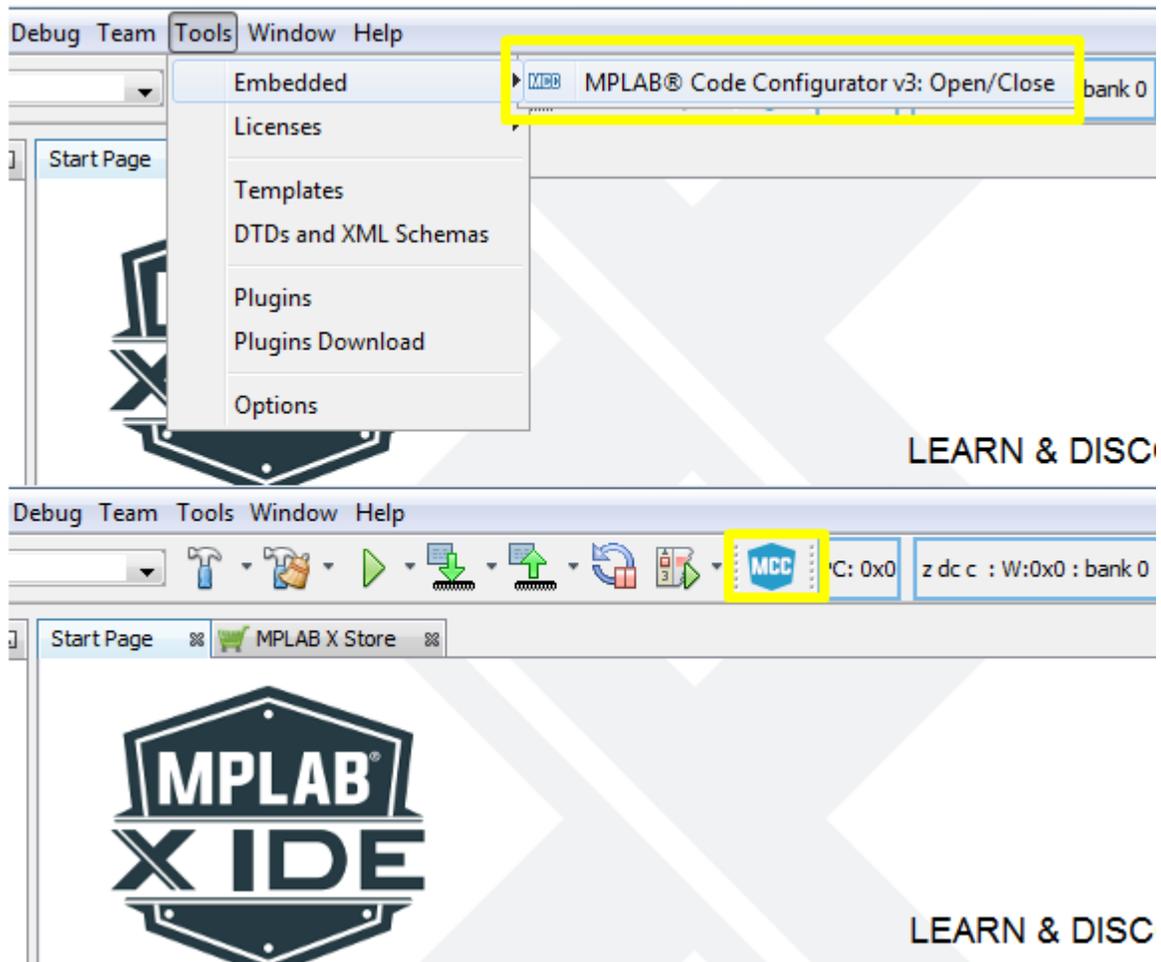
When opening MCC for the first time on an MPLAB X project, the configuration saving dialog will be displayed asking for a name and saving path for the MCC configuration file attached to the project. The MCC configuration is also saved to the disk when the **Generate** button is pressed, or if the MPLAB X IDE **Save** button is clicked. An existing MCC configuration file can be loaded by double-clicking on the desired `.mc3` file in the **Important Files** section of the MPLAB X IDE project.

4.2   Selecting and Configuring Modules

After opening the MCC, peripheral and library modules can be added to the project.

1. In the Project Resource Area, select the peripheral or library module which needs to be configured by clicking the module's name. After a peripheral or library module is selected for configuration, the configuration GUI for that peripheral is displayed in the Composer Area.
2. Configure the peripheral as required for your application in the Composer Area.
3. Configure the pins in the Pin Manager Area depending upon the application requirements.

4.3   Generating Code

When the MCC **Generate** button is pressed in the Project Resources window, the listed actions are performed by MCC. Details of the code generation are shown in the MCC **Output** tab. See Section 3.6.2 "The MPLAB Code Configurator - Output Tab."

1. The MCC configuration file is saved.
2. MCC generates code for the peripheral or library module if the module's configuration has changed since the last time MCC generated code for that module.

Note: You can force all modules to be generated by MCC by right-clicking in the Project Resources window and selecting "Force Update," before clicking on the **Generate** button.

If MCC attempts to regenerate a file on the disk that has been modified outside of MCC, the **Merge [MCC]** window is displayed. The **Merge [MCC]** window allows you to select whether to keep the modified file (default action), or to replace the modified content with the content generated by MCC.

The **Merge [MCC]** window is discussed in Section 4.3.2 "The Merge [MCC] Window."

4.3.1   Saving and Loading the MCC Configuration

Saving and loading the MCC configuration is integrated into the MPLAB X IDE Save and Load functions. The MCC configuration is saved whenever the **Generate** button is pressed. You can also save the MCC configuration by clicking on the MPLAB X IDE Save tool, or selecting **Save** from the File menu.

The MCC configuration file is included in the MPLAB X IDE project, under the **Important Files** folder. The configuration file uses the extension `.mc3`. Double-clicking on the MCC configuration file will cause that MCC configuration to be loaded.

4.3.2   The Merge [MCC] Window

If any of the files generated by the MCC has been edited outside of MCC and saved to the disk, then the **Merge [MCC]** window will appear in the Composer Area. The **Merge [MCC]** window allows you to decide whether to keep the edits, or to replace them with the MCC newly generated code.

Note: Your edits will never be overwritten by the MCC generated code, except by explicit action in the **Merge [MCC]** window.

When changes have been made both to a generated file and also in the corresponding MCC UI within the Composer Area, the **Merge [MCC]** window shown in Figure 4-2 will be displayed. The **Merge [MCC]** window allows you to resolve the conflicts between the newly generated file and the edits you have made to the file.

When the newly generated MCC content has been accepted, MCC makes the changes to the file. To the MPLAB X IDE, these changes are the same as if you typed in the new content. The normal MPLAB X IDE edit undo can be used in the MCC Merge operation.

Figure 4-2. Merge [MCC] Window - File List
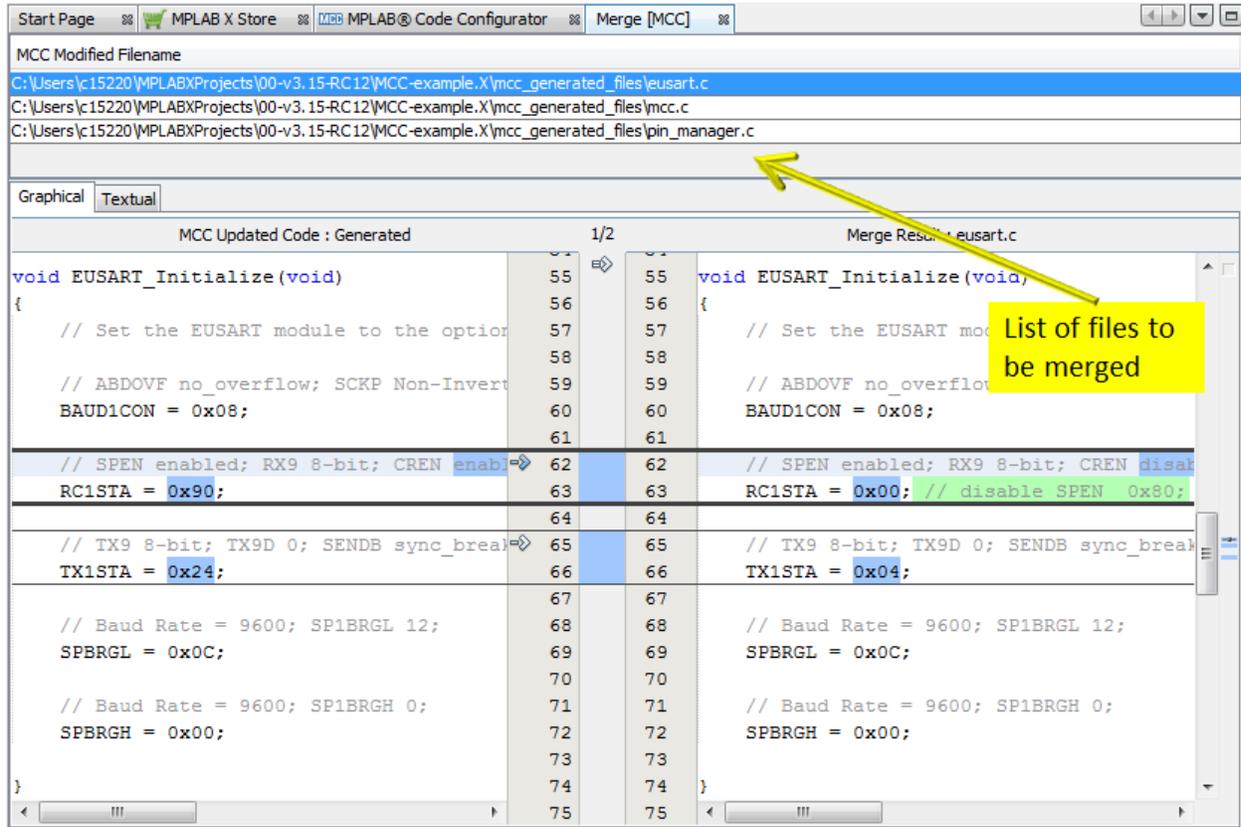
A list of all the files that need to be merged is shown at the top of the **Merge [MCC]** window. You must select each file in the list, in turn, to ensure that all of the newly generated code is incorporated into the project.

At the top of the **Merge [MCC]** window, in the center margin, there is an arrow, as shown in Figure 4-3. Clicking on the arrow will replace all of your edits in the current file with the MCC updated code that the MCC has just generated. The numbers above the arrow indicate the current difference and the total number of differences.

Figure 4-3. Merge [MCC] Window - Replacing All Edits with MCC Generated Code
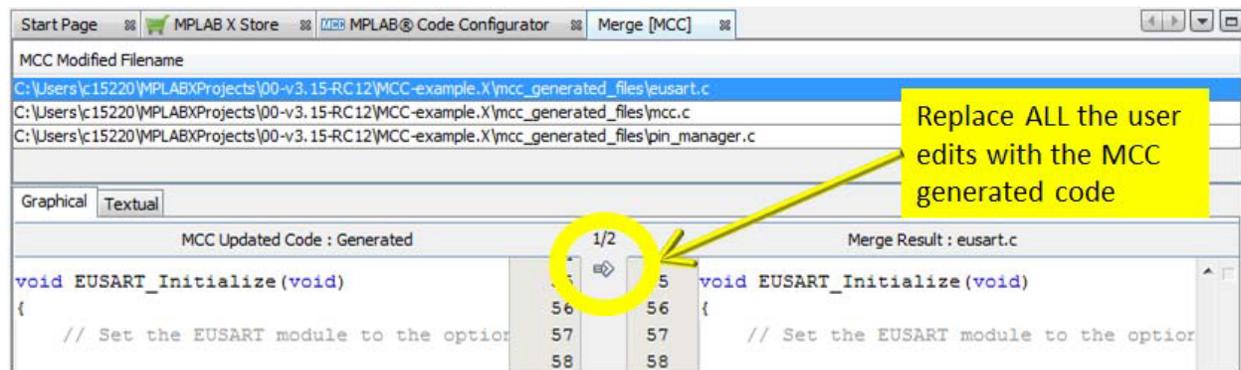
The individual lines of **MCC Updated Code** can be selected to replace the edited code. As shown in Figure 4-4, clicking on the arrows in the right margin of the left window will copy the **MCC Updated Code** to the generated driver file. Once the changes are accepted, the Merge mechanism will remove the highlighted file and highlight the next file on the list. To insure all updates are completed, a warning will be generated if the Merge mechanism is closed before all the changes are accepted.

Figure 4-4. Merge [MCC] Window - Replacing Single Changes with MCC Generated Code
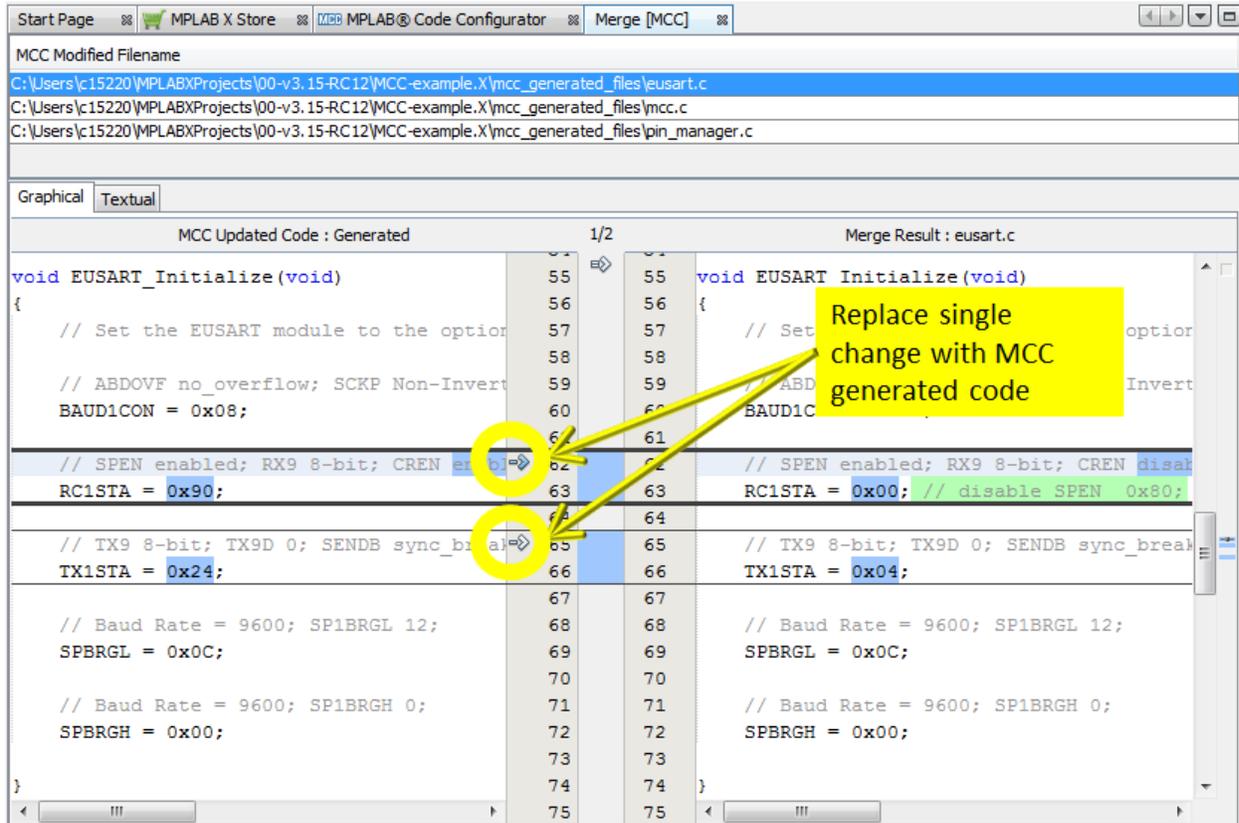
Note:

1.   Remember to merge the code for every file shown in the file list in the **Merge [MCC]** window.
2.   Be sure to save all the changed files from the Merge process.

5.   Generated Sources and Header Files

The generated drivers will be included in the active MPLAB X IDE project, as shown in the figure below.

Figure 5-1. Generated Source and Header Files
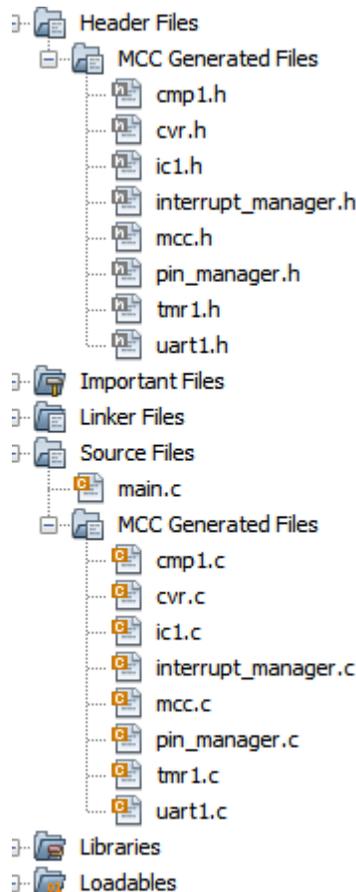
1. The `mcc.h` and `mcc.c` files include the definitions of Configuration bits and the '`OSCILLATOR_initializer`' function. These definitions are based on the settings which were made for the System module in the Composer. Also included is the '`SYSTEM_initializer`' function which can be called in the application program to call all the other default initializers (the ones marked in the GUI by sprocket symbol).

2. The `pin_manager.h` and `pin_manager.c` files include the Pin Manager initializer functions based on the configurations which were made in the Pin Manager GUI.

3. The `interrupt_manager.h` and `interrupt_manager.c` files are optional files which are generated only when peripheral interrupts are enabled and they include interrupt initializer functions.

4. The `.c` and `.h` are module specific files and include each module's peripheral\library configuration functions.

5. The `main.c` file is generated only when the MCC detects that there is no `main.c` file present in the project. If there is any previous `main.c` in the project regardless of its creator (you or the

MCC), it will not generate or overwrite the existing one. When using a `main.c` not generated by the MCC, the lines '`#include "mcc_generated_files/mcc.h";`' and '`SYSTEM_Initializer()`' need to be added to the `main.c` file. The `main.c` file generated by the MCC may include commented out code lines to enable interrupts. Remove the comments from the appropriate lines if the application requires interrupts to be enabled when it starts.

The functions provided in any of these MCC generated files can be called from the user application code, as required. The MPLAB X IDE provides auto-completion assistance of all of the MCC generated content. While editing source code in the project, start typing in a MCC API, or MCC variable name, and press **<CTRL+ Space>**. The MPLAB X IDE will show a list of options to complete the entry.

6.   MCC Device Migration

Using a MCC configuration created for one device, on a different device is called MCC device migration.

Note: MCC device migration is not supported in MCC.

It is possible that attempting to use a MCC configuration on a device other than the one for which it was created, might appear not to fail. It is entirely the user's responsibility to determine if the MCC code generated as the result of device migration is suitable for use in their application.

Unintended MCC device migration may occur if the selected device in the MPLAB X IDE project is changed after MCC has been configured for that project. Copying a MCC configuration file (`*.mc3`) to another MPLAB X IDE project may also cause MCC device migration or other unintended operation.

7.   Revision History

Revision A (January 2016)
Initial release of the document.

Revision B (May 2016)
Revise Figure 1-1; Revise Chapter 2; Revised Figure 2-5 Title; Add Figures 2-6 through 2-10; Revise Chapter 3.

Revision C (March 2018)
Added Chapter 2 Installation; updated text in Chapter 3 Operating Areas; removed previous Figures 1-1, 2-8, 2-13, 2-16, 2-17, 2-18 and 2-19; changed or replaced various figures; added Figures 3-3, 3-4, 3-6, added text in Chapter 3 in Project Resources Area and Versions Area; moved text to Package View Area; added subchapter 3.5.3. The Notification Tab; subchapter 3.6.3 The Pin Module Tab; subchapter 3.7.4 Installing a MPLAB Code Configurator Library; subchapter 3.7.5 Installing a MPLAB Code Configurator Core and different text corrections throughout the document.

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