Microchip Debugger (MDB) User's Guide

Notice to Customers

Important:
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 “DSXXXXXXXXN”, where “XXXXX” is the document number and “N” is the revision level of the document.

For the most up-to-date information on development tools, see the MPLAB® X IDE online help. Select the Help menu, and then Topics to open a list of available online help files.

Table of Contents

1. Preface

This chapter contains general information that will be useful to know before using the Microchip Debugger (MDB).

1.1 Conventions Used in This Guide

The following documentation conventions may appear in this document:

Table 1-1. Documentation Conventions

Description	Represents	Examples
Arial font:		
Italic characters	Referenced books	*MPLAB® X IDE User's Guide*
	Emphasized text	...is the *only* compiler...
Initial caps	A window	the Output window
	A dialog	the Settings dialog
	A menu selection	select Enable Programmer
Quotes	A field name in a window or dialog	"Save project before build"
Underlined, italic text with right angle bracket	A menu path	*File>Save*
Bold characters	A dialog button	Click **OK**
	A tab	Click the **Power** tab
N'Rnnnn	A number in verilog format, where N is the total number of digits, R is the radix and n is a digit.	4'b0010, 2'hF1
Text in angle brackets < >	A key on the keyboard	Press <Enter>, <F1>
Courier New font:		
Plain Courier New	Sample source code	`#define START`
	Filenames	`autoexec.bat`
	File paths	`c:\mcc18\h`
	Keywords	`_asm, _endasm, static`
	Command-line options	`-Opa+, -Opa-`
	Bit values	`0, 1`
	Constants	`0xFF, 'A'`
Italic Courier New	A variable argument	*`file.o`*, where *`file`* can be any valid filename
Square brackets [ ]	Optional arguments	`mcc18 [options] file [options]`
Curly brackets and pipe character: { | }	Choice of mutually exclusive arguments; an OR selection	`errorlevel {0|1}`

.....continued

Description	Represents	Examples
Ellipses...	Replaces repeated text	`var_name [, var_name...]`

	Represents code supplied by user	`void main (void)`
		`{ ...`
		`}`

1.2 Recommended Reading

This user's guide describes how to use the MDB. Other useful documents are listed below. The following Microchip documents are available and recommended as supplemental reference resources.

Microchip Command-line Debugger Webinar

This webinar gives an introduction to the command-line debugger and provides useful examples. The webinar is available on Microchip's web site:

www.microchip.com/webinars.microchip.com/WebinarDetails.aspx?dDocName=en565588

Multi-Tool Design Advisory (DS51764)

This small document presents guidelines and implementation considerations to ensure proper interfacing to the various development tools.

MPLAB X IDE WebHelp

This is an essential document to be used with any Microchip hardware tool.

This is an extensive help file for the MPLAB X IDE. It includes an overview of embedded systems, installation requirements, tutorials, details on creating new projects, setting build properties, debugging code, setting configuration bits, setting breakpoints, programming a device, etc. This help file is generally more up-to-date than the printable PDF of the user's guide (DS50002027) available as a free download at www.microchip.com/mplabx/.

Processor Extension Pak and Header Specification (DS50001292)

This booklet describes how to install and use headers. Headers are used to better debug selected devices, without the loss of pins or resources. See also the PEP and Header online Help file.

Transition Socket Specification (DS51194)

Consult this document for information on transition sockets available for use with headers.

Release Notes for MDB

For the latest information on using the MDB, go to the MPLAB X IDE Learn & Discover tab, click the Users Guide & Release Notes icon, and locate the Readme for MDB. The release notes (readme) contain updated information and known issues that may not be included in this user's guide.

MDB WebHelp

A comprehensive online help for the MDB is available on `onlinedocs.microchip.com`. This help file may be more up-to-date than the printed documentation.

2. Introduction

The Microchip Debugger (MDB) is a command-line debugger interface to Microchip's hardware and software development tools. As an alternative to using the Microchip MPLAB® X IDE (Integrated Development Environment) graphical interface, the MDB facilitates debugging devices through a Command Prompt interface and can program a production image for testing purposes.

The MDB is designed for engineers who prefer to use the Command Prompt. The command-line interface to the debugger is faster and allows more extensive testing to be performed. This is especially helpful when a task is repetitive, such as debugging an issue that is difficult to resolve, or when there is automation of a testing procedure.

The MDB can be used with a script or batch file. The MDB can be used with these tools:

- MPLAB ICD 3 In-Circuit Debugger
- MPLAB ICD 4 In-Circuit Debugger
- PICkit™ 3 In-Circuit Debugger/Programmer
- MPLAB PICkit™ 4 In-Circuit Debugger
- MPLAB Snap In-Circuit Debugger
- MPLAB REAL ICE™ In-Circuit Emulator
- MPLAB PM3 Device Programmer
- MPLAB SIM Software Simulator
- Licensed third party programmers and debuggers
- SK (Starter Kits PKOB)
- EDBG (embedded debugger)

2.1 Installation and Documentation

2.1.1 Install MPLAB X IDE

The MDB is automatically installed with the MPLAB X IDE. To download the latest version, go to the Microchip web site (www.microchip.com).

Generate a .cof or .elf file for debugging. (If simply programming a device, a hex file is sufficient.) The project can be built with MPLAB X IDE or using third-party compilers, as long as a .cof or .elf file is generated. The .cof/.elf file is a linked executable file that contains symbolic debugging information.

2.1.2 Find MDB Documentation

The MDB supporting documentation are automatically installed with the MPLAB X IDE. There are several ways to access MDB documentation: (1) through the MDB utility, (2) through the MPLAB X IDE, and (3) through the installation directory on your computer.

1. After invoking the MDB (see 2.2.2 Invoking the MDB), type help doc. This command displays the instructions on where to locate MDB documentation.
2. After launching MPLAB X IDE, click the Learn & Discover tab, then in the Getting Started area, the icon labeled Users Guide & Release Notes. A new window opens with a list of User's Guides, Release Notes and Support Documentation. Locate the links to the MDB User's Guide, MDB Help and Readme for MDB.
3. To find documentation on your computer, the MDB User's Guide (filename `MDBUserGuide.pdf`) can be found in the default location where the MPLAB X IDE was installed:
   `Program Files (x86)\Microchip\MPLABX\vx.xx\docs`

   The online help is located at `onlinedocs.microchip.com` where you can search for "Microchip Debugger."

   The Readme for MDB.htm contains the latest release notes.

2.2 Getting Started

Typically, you can use the defaults when invoking the MDB. More detailed information is available in 2.3 Debugging Methods.

2.2.1 Command Line Parameters

Before invoking the MDB, you may want to set certain command line options and arguments.

To view the options, type `mdb --help` in the Command Prompt. This only displays help information (refer to the table below) for the command line parameters (options and arguments) and then exits MDB. To find documentation about the MDB, such as online help, user's guide (PDF) or the Readme for MDB, type `help doc`. This command displays the instructions on where to locate MDB documentation.

To set any parameters, use the following format in the Command Prompt (put a space between the entries as shown):

```
mdb [options] [commandFile]
```

You can use these commands to pass a command file to the MDB.

Table 2-1. Command Line Parameters Help

Option	Meaning	Examples

`-h,--help`	Show the list of classes of commands	`mdb -h`
		or
		`mdb --help`

Argument	Meaning	Example
`commandFile`	Run the specified file with the MDB commands for scripting. Also see 2.4 Running a Command File Method	`mdb MyScriptingFile.txt`

2.2.2 Invoking the MDB

Use the Command Prompt to invoke MDB.

In Windows® 7, the Command Prompt must be opened in Administrator mode:

Start>All Programs>Accessories>Command Prompt, right click and select "Run as Administrator." This opens the Administrator: Command Prompt.

The path to the MDB may vary depending on where the MPLAB X IDE is installed and which operating system is installed. See the following table for the various operating systems and paths. The `vn.nn` in the path represents the version number, for example v3.00. These paths are long so you may want to add them to your path variable.

Table 2-2. Paths to the MDB by Operating System

Windows® 32-bit Operating System
`c:\Program Files\Microchip\MPLABX\vn.nn\mplab_platform\bin>mdb.bat`
Windows 64-bit Operating System
`c:\Program Files (x86)\Microchip\MPLABX\vn.nn\mplab_platform\bin>mdb.bat`
Linux® Operating System
`/opt/microchip/mplabx/vn.nn/mplab_platform/bin/mdb.sh`
macOS™ Operating System
`/Applications/microchip/mplabx/vn.nn/mplab_ide.app/Contents/Resources/mplab_platform/bin/mdb.sh`

Note: The `mdb.bat` and `mdb.sh` scripts do not need to be run from the directory where they were installed. If the directory where these scripts are installed is added to the system path, then `mdb.bat` and `msb.sh` may run from any directory.

2.3 Debugging Methods

You can run a test using either of the following methods:

- Entering Commands Method
- Running a Command File Method

Entering commands is the preferred method to run a test with MDB. It allows you to interact with the target application as it executes in simulation or on actual hardware. The result of each command is displayed one at a time, so that mistakes are more easily understood and corrected (see “Entering Commands Method”).

The Running a Command File method cannot be used after the MDB has been invoked. The command file is included as a parameter in the command line when invoking the MDB (see “Running a Command File Method”).

2.3.1 Entering Commands Method

Note: Although the MPLAB X IDE can run multiple tools simultaneously, the MDB will run only one tool at a time. However, you can have multiple instances of the MDB running. Refer to Section 1.6 “Using Multiple Instances of the MDB” for details.

Entering commands is a step-by-step method to run a test with MDB. Once the MDB is running, you can start entering commands. Note that while the MDB commands are not case-sensitive, the property options and file names are case-sensitive.

Type help for a list of classes of commands in MDB. Refer to Chapter 2. “MDB Reference”, Table 2-1 “MDB Classes of Commands.”

For other commands available, see Chapter 2. “MDB Reference,” Table 2-2 through Table 2-10.

The following sections describe these topics:

- Programming a Production Image for Testing Purposes
- Debugging a Device

2.3.2 Programming a Production Image for Testing Purposes

The MDB can be used to program a production image for testing purposes.

Note: ***The MDB should be used only for debugging purposes.*** For programming devices, use the IPECMD tool or the IPECMDBoost (for improved speed). Refer to the Release Notes for IPE Command Line Interface (Readme for IPECMD) located in the MPLABX install folder, for example, `\Microchip\MPLABX\vx.xx\docs`, where `vx.xx` represents the version of MPLAB X IDE.

Note: When programming a device, you must select a device first.

The file or hardware tool you need to use for MDB cannot be active or open simultaneously in the MPLAB X IDE, IPE, or a third party program. Make sure you close (or make inactive) the file or hardware tool before you attempt to use it with the MDB.

1. Select the device by entering the command:
   `Device [device name]`

   For example: `Device PIC18F66K22`
2. Use the set command to select any options you want to use (see Table 3-6 or Table 3-7).
3. Select the hardware tool. To verify the supported tools, type:
   `Help Hwtool`

   The MPLAB ICD 3/4, MPLAB REAL ICE, PICkit 3/4 and Simulator are for programming and debugging, while the MPLAB PM3 is for programming only. To select the hardware tool, type the command:

   `Hwtool [tool name]`

   For example: `Hwtool SIM`
4. If the project was already built, a cof or elf file was generated. To program the device with the cof, elf or hex file, enter the command:
   `Program "[location of the cof or elf or hex file]"`

For example:

```
Program "C:\MDBTestExample\Build\test\preprocess\files\dist\test_IO_Button.cof"
```

If you are using SIM (Simulator) as the hardware tool and the project needs an scl file, it can be set up by using the command:

```
Stim "[location of the scl file]"
```

For more information, use the command Help Stim. You can use Stimulus to set pin injection and/or register injection.

A "Program succeeded" message displays after programming is complete. A verify is automatically performed during a programming sequence.

2.3.3 Debugging a Device

Use the following commands to debug a device.

- **Reset** – refer to the device data sheet for Reset information. If a Reset is needed for debugging purposes: first, halt the target; then, enter the command:
  `Reset`
- **Set Breakpoint** – there are two ways to set a breakpoint for debugging:
  Set a breakpoint by source-line-number using the command:

  ```
  Break filename: linenumber
  ```

  For example: `Break main.c:53`

  Set a breakpoint at an absolute address using command:

  ```
  Break *address
  ```

  For example: `Break *0x108`
- **Set Watchpoint** – to set a watchpoint for debugging:
  Set a watchpoint by specifying an address and the type of watch using the command:

  ```
  Watch address breakontype
  ```

  For example: `Watch 0xa0007ff0 R`

  or

  ```
  Watch address breakontype[:value] [passcount]
  ```

  For example: `Watch 0xa0007ff0 R:0xf 1`
- **Delete Breakpoint** – to delete a breakpoint, use the command:
  `Delete [breakpoint number]`

  If no argument is specified in this command, it will delete all breakpoints.
- **Run Program** – the Run command can be used to run the program until it reaches a breakpoint.
- **Step Through** – to step through the program, use the Step command or Next command.
- **See Variable Value** – a Print [variable] command can be used to see the value of a variable or an SFR.
- **Exit** – use the Quit command to exit the MDB.

2.4 Running a Command File Method

Note: Although the MPLAB X IDE can run multiple tools simultaneously, the MDB will run only one tool at a time. However, you can have multiple instances of the MDB running. Refer to 2.5 Using Multiple Instances of the MDB for details

If programming and debugging needs to be done frequently or multiple times, run the test by running a command file. This is more efficient than entering the commands repeatedly. Put all the commands in a file and run the MDB using this command file in the Command Prompt, for example:

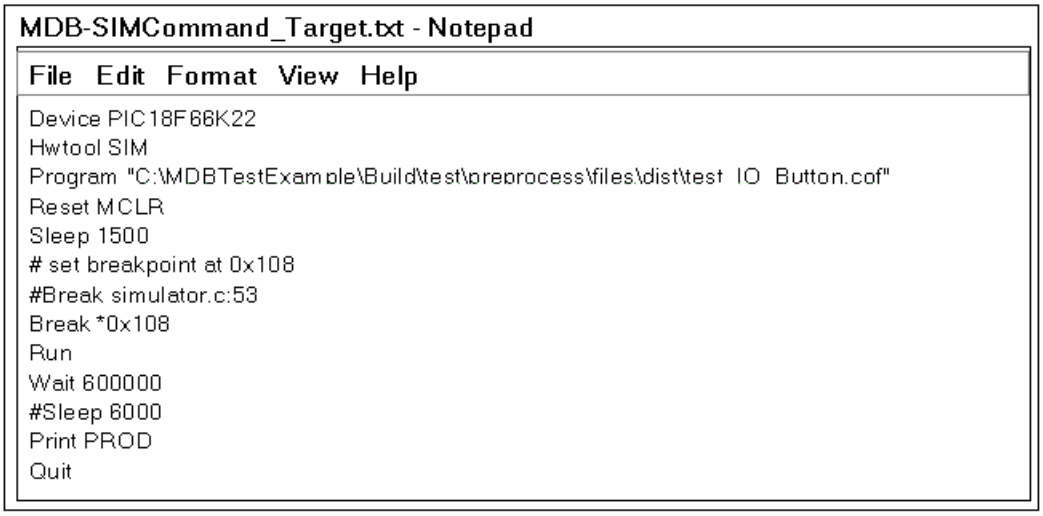
```
C:\Program Files\Microchip\MPLABX\vn.nn\mplab_ide\bin>mdb.bat <commandfile.txt>
```

The following is an example of a command file:

`C:\MDB-SIMCommand_Target.txt`

A line starting with # means that it is a comment. A Sleep command should be added to make sure the MDB has enough time to finish the previous command before it executes the next command. The MDB will run all the commands in the command file sequentially.

Figure 2-1. Example of Running a Command Line



Creating a Printable Log File

Redirecting output to a file is a general option that can be executed from the command prompt and is not specific to the MDB batch file. Redirecting output to a printable text file can be more useful for examining errors than looking at the Command Prompt window.

To create a printable file, open the MDB.bat file, and modify it by adding `>>%mplabx_dir%\bin\mdblog.txt` at the end of the batch file. This instructs the batch file to create the mdblog.txt file, which can be printed.

2.5 Using Multiple Instances of the MDB

Using multiple instances of the MDB is similar to using multiple instances of the MPLAB X IDE. Some set up is required before using hardware tools (PICkit 3, etc.) with an instance of the MDB. Refer to the MPLAB X IDE online help “Before You Begin,” and “Launch Multiple Instances of the IDE” for instructions on setting up the hardware tools and formatting the MCHPDEFPORT file. After any hardware tool setup is complete (to assign the appropriate driver for the tool), an instance of the MDB may be invoked from the bin directory of the installation.

3. MDB Reference

3.1 Help Commands

There are help commands available in MDB.

Type `help` followed by a class name for a list of commands in that class (see 3.2 Classes of Commands).

Type `help` followed by a command name for full documentation (see 3.3 List of commands Within Classes).

Type `help doc` to see how to access MDB documentation. There are three ways to access documentation for the MDB:

1. The MDB Help file provides the most **up-to-date** information and is located at: `onlinedocs.microchip.com` where you can search for “Microchip Debugger.”
2. The *Microchip Debugger (MDB) User’s Guide* is located in the default location where the MPLAB X IDE was installed: `Program Files>Microchip>MPLABX>vx.xx>docs>MDBUserGuide.pdf`, where `vx.xx` represents the MPLAB X IDE version.
3. The MDB User’s Guide (`.pdf`) can also be accessed by launching the MPLAB X IDE, clicking the Learn & Discover tab, then clicking on User’s Guide & Release Notes in the Getting Started area. A new window opens showing a list of User’s Guides, Release Notes and Support Documentation where you can find links to the MDB User’s Guide.

3.2 Classes of Commands

Type `help` for a list of classes of commands in MDB.

Table 3-1. MDB Classes of Commands

Class	Description
breakpoints	Making program stop at certain points
data	Examining/changing data
deviceandtool	Selecting debug tool and device
others	Miscellaneous commands
programming	Programming device and its relative functions
running	Running the program
stack	Examining stack

3.3 List of commands Within Classes

Note: MDB commands are not case-sensitive. However, when using the SET command, where tool option properties are passed as parameters, the parameter portion of the command line entered is case-sensitive.

For a list of all commands within a particular class, type `help` followed by the class name. The `help` command can also be abbreviated to `h`. See the following tables for information about each class of commands.

For documentation on a particular command, type `help [command or class of commands]` to display information about the command. For example, if you type:`help breakpoints` or `h Breakpoints` the MDB displays information about the break, watch, delete and halt commands.

The following sections provide information on commands.

3.3.1 Breakpoint Commands

To display information about the breakpoints commands available in MDB, type `help breakpoints`. The following table provides additional information for this class of commands

Table 3-2. Breakpoint Commands

Command	Description

Break	Sets a breakpoint at the specified source line number.
	Command format:
	`break filename:linenumber [passCount]`
	Example:
	`break newmain.c:142 4`

	Sets a breakpoint at an absolute address.
	Command format:
	`break *address [passCount]`
	• `address` – the address of the program memory to break on – use the command: `'print /a'` to get a symbol address.
	• `passCount` – the parameter is optional. Indicates the number of times the break 'on condition' is met before the program halts.
	Example:
	`break *0x9d0000cc 5`
	MDB assigns a breakpoint number and returns:`Breakpoint 0 at 0x9d0000cc: file newmain.c, line 16.`

	Sets a breakpoint at the beginning of the function.
	Command format:
	`break function_name [passCount]`
	Example:
	`break function_foo 5`

Delete	Deletes a breakpoint – if no argument is specified, this deletes all breakpoints.
	You can abbreviate this command as `d`.
	Command format:
	`delete [breakpoint number]`
	`d [breakpoint number]`
	The breakpoint number is generated by MDB for the `Break` and/or `Watch` commands.
	Examples:
	`delete` or `D`
	`delete 1` or `d 1`

Halt	Stops the debugger program.

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Command	Description

Watch	Sets a data breakpoint at the specified memory address, variable name, or an SFR (special function register).
	Command format:
	`Watch address breakonType[:value] [passCount]`
	• `address` – the name of a global variable, SFR, or data memory address to be watched. Use command `'print /a'` to get a variable address.
	• `breakonType:`
	`R` -- Read.
	`W` -- Write.
	`RW` -- Read or Write.
	• `value` – this parameter is optional. If it is specified, the program will break only when the value held in the data memory matches the specified value.
	• `passCount` – this parameter is optional. The number of times the breakon condition is met before the program breaks.
	Examples:
	`watch 0xa0007ff0 R:0xf 1`
	`watch 0xa0007ff0 R:10 1`
	`watch my_Variable W 4`
	MDB will assign and return the watchpoint number, for example: `Watchpoint 1`.

3.3.2 Data Commands

To display information about the data commands available in the MDB, type `help data`. The table below provides additional information for this class of commands.

Table 3-3. Data Commands

Command	Description

Print	Prints a variable with optional formatting.
	Command format:
	`print [/f] [/datasize:value] variable`
	• `f` - Optional format letter
	The format letters supported are:
	`x` - Print as integer in signed hexadecimal.
	`d` - Print as integer in signed decimal.
	`a` - Print the address of a symbol.
	• `datasize:value` – optional data size.
	Variable in assembly code might not have data size information. The user can specify the data size if the `.cof` or `.elf` file does not have the size information.
	The values supported are:
	`1` - The data size is 1 byte.
	`2` - The data size is 2 bytes.
	`4` - The data size is 4 byte.
	Use this command (not case sensitive) to display the pin information.
	Command format:
	`print pin pinName`
	Example:
	`print pin RA0`
	This command will print Pin, mode, Value, and Owner or Mapping.
	• For Pin, it displays the name of the signal that the user types to find the pin
	• For Mode, it displays the A/D state and I/O state
	• For Value, it displays HIGH/LOW for Digital mode or the HIGH/LOW nominal voltage for Analog mode
	• For Owner or Mapping, it displays the pin owner and all the signals in this pin
	• The owner of the pin is the signal with parentheses.

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Command	Description

Stim	Specifies a simulator SCL stimulus file to use.
	This loads the specified SCL stimulus file into the simulator, or if no path to the file is specified, it clears a loaded file.
	Note: If the path or filename has spaces in it, you must use the quotation marks, as shown below. If there are no spaces in the path of filename, the quotation marks are not needed.
	Command format:
	`Stim "[path to file]"`
	`Stim`

Write	Use this command to write to memory.
	Command format:
	`write [/t] addr word1 word2 ... wordn`
	• `t` - the type of memory. The type of memory is any of the following:
	`r` – File Registers (RAM) memory. This is the initial default.
	`p` – Program (flash) memory
	`e` – EE Data memory
	Each time you specify a memory type with `write`, that type becomes the default memory the next time you use `write`.
	• `addr` – the starting address where you want MDB to begin writing to memory
	• `word` – the following values will be written to successive words of memory
	Use this command to set a pin high or low when the simulator is used as a debug tool.
	Command format:
	`write pin pinName pinState`
	Example:
	`write pin RA0 high`
	Use this command to set a the voltage of a pin when the simulator is used as a debug tool.
	Command format:
	`write pin pinName pinVoltage`
	Example:
	`write pin RA0 3.3V`

.....continued

Command	Description
x	Examine memory. You can use the command `x` (for examine) to examine memory in any of several formats, independent of your program's data types. **Command format:** `x [/tnfu] [addr]` • `t` – the type of memory. **Note:** Each time you specify a memory type with `x`, that type becomes the default memory the next time you use `x`. The type of memory is any of the following: `r` – File Registers (RAM) memory. This is the initial default. `p` – Program (flash) memory. `m` – Memory-mapped control registers (PIC32 peripheral memory). `e` – EE Data memory. • `n` – the repeat count. Repeat count is a decimal integer; the default is `1`. It specifies how much memory (counting by units `u`) to display. `f` – the display format. The display format is one of the formats used by print (`x, d, o, f, s`), and in addition "`i`" (for machine instructions). The default is '`x`' (hexadecimal) initially. The default changes each time you use `x`. `u` – the unit size. Each time you specify a unit size with `x`, that size becomes the default unit the next time you use `x`. (For the '`s`' and '`i`' formats, the unit size is ignored and is normally not written.) The unit size is any of following: `b` – Bytes. `h` – Halfwords (two bytes). `w` – Words (four bytes). This is the initial default. • `addr` - the starting display address where you want MDB to begin displaying memory. The `addr` can be a literal or a symbol name. The default for `addr`, if not specified, is taken as the value just after the last address examined. However, several other commands also set the default address: `info breakpoints` (to the address of the last breakpoint listed); `info line` (to the starting address of a line); and `print` (if you use it to display a value from memory).

3.3.3 Device and Tool Commands

To display information about the device and tool commands available in MDB, type `help device`, `help hwtool` or `help deviceandtool`. The table below provides additional information about these commands.

Table 3-4. Device and Tool Commands

Command	Description
Device	Sets the name of the target device. **Command format:** `Device devicename` **Example:** `Device PIC32MX795F512L`

Hwtool	Sets the debug tool or list all the available hardware tools on the system. The device must be set with the `Device` command before a tool can be used/set.
	Command format:
	`Hwtool [toolType] [-p] [index]` Following are the supported tool names (not case-sensitive):
	• `ICD3` – MPLAB ICD 3 In-Circuit Debugger
	• `ICD4` – MPLAB ICD 4 In-Circuit Debugger
	• `RealICE` – MPLAB REAL ICE In-Circuit Emulator
	• `PICkit3` – PICkit 3 In-Circuit Debugger
	• `PICkit4` – MPLAB PICkit 4 In-Circuit Debugger
	• `SIM` – Simulator
	• `PM3` – MPLAB PM3 Programmer
	• `LicensedDebugger` – third party debugger
	• `LicensedProgrammer` – third party programmer
	• `SK` – Microchip Starter Kit (PICkit On Board – PKOB)
	• `SNAP` – MPLAB Snap In-Circuit Debugger
	• `EDBG` - Embedded Debugger
	To set the tool for programming only, a space must precede the `-p` option.
	Command format:
	`Hwtool [toolType] -p`
	Example:
	`Hwtool ICD3 -p`
	Use the index option to select the tool if there are more than one instance of a tool type. If you have two MPLAB ICD 3 units connected to the PC, use the `Hwtool` command to find the assigned index number of the tool.
	Example:
	`>Hwtool`
	`index Description`
	`0 MPLAB ICD 3 tm (MRK1000000000)`
	`1 MPLAB ICD 3 tm (MRK1000001111)`
	Example:
	`Hwtool ICD3 -p 1`
	Note: By default, when a hardware tool is selected, it is loaded as a debugger. This means that it always programs the device and adds the necessary debug requirements to enable the image to be debugged. To use a tool for programming only, use the `-p` option when setting the hardware tool.

Deviceandtool	Displays both the Device and Hwtool command information.

3.3.4 Others Commands

To display information about the others commands available in MDB, type `help others`. The following table provides additional information for these commands.

Table 3-5. Others Commands

Command	Description

Echo	Echo is a command typically used in command files and batch files to output status text to the screen or a file. The echo command will print text surrounded by `/* */`. Use `\n` in the text to print a new line.
	Command format:
	`echo text`
	Example:
	`echo Hello World`
	Result:
	`/*Hello World*/`
	This command prints text only. To print variables or other information, use commands such as `print`, `info`, `list`, etc.

Help	`help others` – Prints a list of commands.
Quit	`quit` - Exits the debugger.

Set	The tool property name and value are from the project properties that are selected when creating the project in MPLAB X IDE. **IMPORTANT:** *The Set command, including the tool property options, must be executed before the Hwtool command is issued, otherwise the changes to the tool properties will be ignored.*
	Command format:
	`Set tool-property-name value`
	Example:
	`Set programoptions.eraseb4program true`
	Refer to Table 3-6 for other tool properties options that can used with the `Set` command. Refer to Table 3-7 for simulator options that can be used with the `Set` command.

Sleep	Makes the current script processor sleep until specified milliseconds have elapsed.
	Command format:
	`Sleep milliseconds`
	Example:
	`Sleep 10`

Wait	The `Wait` command makes the current script processor wait until the debugger halts before processing the next command.
	Command format:
	`Wait`
	`Wait Milliseconds` makes the processor process the next command if the debugger does not halt and milliseconds have elapsed.
	Command format:
	`Wait [milliseconds]`

cd	This command changes the directory that you are currently working in to the directory you designate. **Command format:** `cd [directory]`

.....continued	
Command	**Description**

info	Prints a table of all breakpoints that have been set and not deleted.
	Optional argument `n` means “print information only” about the specified breakpoint.
	For each breakpoint the following columns are printed:
	• Breakpoint Numbers
	• Enabled or Disabled: Enabled breakpoints are marked with `'y'` . Disabled breakpoints are marked with `'n'`
	• Address - Where the breakpoint is in your program, as a memory address.
	• What - Where the breakpoint is in the source for your program: as a file and line number.
	Command format:
	`info breakpoints [n]`
	`info break [n]`

list	The list command prints (displays) the source code for the current PC location, or a different file, if specified. The `list` command displays lines from a source file. By default, 10 lines are displayed. `list` - displays 10 lines (5 above, 5 below) around the current line `list linenum` - displays 10 lines around a given line `list first,` - displays 10 lines from first line specified `list ,last` displays 10 lines up to last line specified `list first,last` - displays all lines from the first to the last line specified `list -` - displays 10 previous lines from the last output `list +` - displays 10 more lines from the last output `list function` - displays 10 lines around the given function `list file:linenum` - displays 10 lines around the given line in a given file `list file:function` - displays 10 lines around the given function in a given file `set system.listsize count` - changes the number of lines shown Using 0 or -1 means unlimited list size.
pwd	The `pwd` command displays the current working directory. **Command format:** `pwd`

3.3.4.1 Tool Property Options Used with the Set Command

The following table provides additional information for tool property options used with the Set command.

Important: The `set` command, including the tool property options, must be executed before the `Hwtool` command is issued, otherwise the changes to the tool properties will be ignored.

Notes:

1. MDB commands are not case-sensitive. However, when using the `set` command, where tool option properties are passed as parameters, the parameter portion of the command line entered is case-sensitive.
2. Tool property options that you want to use with the `set` command must be selected before using the `Hwtool` command.

Table 3-6. Tool Property Name Options Used by the Set Command

Tool Property Name	Value	Tool

`AutoSelectMemRanges`
Determines whether the debugger will automatically select the areas of memory and program memory ranges to program.
If set to `auto`, the debugger will automatically select the memory and ranges. `Manual` means the memories and ranges will be determined by the memories properties below.
Example:
`set AutoSelectMemRanges auto`
	`auto` or `manual`	MPLAB ICD3, MPLAB ICD4, MPLAB REAL ICE, PICkit 3, MPLAB PICkit 4, MPLAB PM3, MPLAB Snap, EDBG

`communication.interface`
Set the communication interface to *nnn* (*nnn* is the value).
Example:
`set communication.interface jtag`
	`jtag, swd, updi, dw, isp, pdi, tpi`	EDBG

`communication.speed`
Set the communication speed to *nnn* (*nnn* is the value).
Example:
`set communication.speed 0.100`
	a decimal value (in MHz), dependent on the device	EDBG

`debugoptions.useswbreakpoints`
`True` indicates that software breakpoints will be used for program address breakpoints, `false` indicates that hardware breakpoints will be used (does not apply to PICkit 3).
Example:
`set debugoptions.useswbreakpoints true`
	`true` or `false`	MPLAB ICD3, MPLAB ICD4, MPLAB REAL ICE, MPLAB PICkit 4, MPLAB Snap, EDBG

`memories.programmemory`
If `true`, the program memory will be programmed; if `false`, it will not.
Example:
`set memories.programmemory true`
	`true` or `false`	MPLAB ICD3,MPLAB ICD4, MPLAB REAL ICE, PICkit 3,MPLAB PICkit 4, MPLAB PM3, MPLAB Snap, EDBG

`memories.programmemory.start`
The value represents the starting program memory address that the debug tool will begin programming.
Example:
`set memories.programmemory.start 0x0000`
	a string representing a long value	MPLAB ICD3,MPLAB ICD4, MPLAB REAL ICE, PICkit 3,MPLAB PICkit 4, MPLAB PM3, MPLAB Snap, EDBG

.....continued

Tool Property Name	Value	Tool

`memories.programmemory.end`
The value represents the ending program memory address that the debug tool will end programming.
Example:
`set memories.programmemory.end 0xFFFF`
	a string representing a long value	MPLAB ICD3,MPLAB ICD4, MPLAB REAL ICE, PICkit 3,MPLAB PICkit 4, MPLAB PM3, MPLAB Snap, EDBG

`memories.eeprom`
If `true`, the EEPROM memory will be programmed; if `false`, it will not.
Example:
`set memories.eeprom true`
	`true` or `false`	MPLAB ICD3,MPLAB ICD4, MPLAB REAL ICE, PICkit 3,MPLAB PICkit 4, MPLAB PM3, MPLAB Snap, EDBG

`memories.id`
If `true`, the user ID memory will be programmed; if `false`, it will not.
Example:
`set memories.id true`
	`true` or `false`	MPLAB ICD3, MPLAB ICD4, MPLAB REAL ICE, PICkit 3, MPLAB PICkit 4, MPLAB PM3, MPLAB Snap, EDBG

`memories.bootflash`
If `true`, the boot flash (PIC32 only) memory will be programmed; if `false`, it will not.
Example:
`set memories.bootflash true`
	`true` or `false`	MPLAB ICD3, MPLAB ICD4, MPLAB REAL ICE, PICkit 3, MPLAB PICkit 4, MPLAB PM3, MPLAB Snap, EDBG

`memories.aux`
If `true`, the auxiliary program memory (dsPIC®/PIC24 EP parts only) will be programmed; if `false`, it will not.
Example:
`set memories.aux true`
	`true` or `false`	MPLAB ICD3, MPLAB ICD4, MPLAB REAL ICE, PICkit 3, MPLAB PICkit 4, MPLAB PM3, MPLAB Snap, EDBG

`programoptions.eraseb4program`
If `true`, the device will be erased before it is programmed; if `false` it will not.
Example:
`set programoptions.eraseb4program true`
	`true` or `false`	MPLAB ICD3, MPLAB ICD4, MPLAB REAL ICE, PICkit 3, MPLAB PICkit 4, MPLAB PM3, MPLAB Snap

`programoptions.ledbrightness`
Sets the brightness of the LEDs on the hardware tool. Setting `1` is darkest and `10` is the brightest. The default is `5`.
Example:
`set programoptions.ledbrightness 7`
	`1` to `10`	MPLAB ICD4, MPLAB PICkit 4

.....continued

Tool Property Name	Value	Tool

`programoptions.pgcconfig`
Sets the type of resistance to be applied to the PGC line. The default is `pull down`. The value of the resistance is set by the PGC resistor option.
Example:
`set programoptions.pgcconfig pullup`
	`none` or `pull up` or `pull down`	MPLAB ICD4, MPLAB PICkit 4

`programoptions.pgcresistor.value`
Sets the value of the resistance on the PGC line. Maximum value is 50 kohms. If PGC configuration is set to none, this value is ignored.
Example:
`set programoptions.pgcresistor.value 4.7`
	`0.1` to `50.0`	MPLAB ICD4, MPLAB PICkit 4

`programoptions.pgdconfig`
Sets the type of resistance to be applied to the PGD line. The default is `pull down`. The value of the resistance is set by the PGD resistor option.
Example:
`set programoptions.pgdconfig pullup`
	`none` or `pull up` or `pull down`	MPLAB ICD4, MPLAB PICkit 4

`programoptions.pgdresistor.value`
Sets the value of the resistance on the PGD line. Maximum value is 50 kohms. If PGD configuration is set to none, this value is ignored.
Example:
`set programoptions.pgdresistor.value 4.7`
	`0.1` to `50.0`	MPLAB ICD4, MPLAB PICkit 4

`programoptions.pgmentry.voltage`
Sets the method the hardware tool will use to put the target device in programming mode. For the low voltage method, Vpp will not exceed the Vdd supply voltage. Instead, a test pattern will be used on Vpp. For the high voltage method, a voltage in excess of 9 volts will be placed on Vpp.
Example:
`set programoptions.pgmentry.voltage low`
	`Low` or `High`	MPLAB ICD4, MPLAB PICkit 4, MPLAB Snap

`programoptions.pgmspeed`
Sets the speed that the hardware tool will use to program the target. If programming fails, try a slower speed. The default is `Med`.
Example:
`set programoptions.pgmspeed Min`
	`Min` or `Med` or `Max`	MPLAB ICD4, MPLAB PICkit 4
		MPLAB Snap

.....continued

Tool Property Name	Value	Tool

`poweroptions.powerenable`
If `true`, the debug tool will supply target power at the default voltage for the tool. If `false` it will not supply target power.
Note: This property does not apply to MPLAB REAL ICE.
To set a non-default voltage for the target power, first set the `poweroptions.powerenable` to `true`, then set the voltage value where `n.n` represents the desired voltage:
`set voltagevalue n.n`
Example:
`set poweroptions.powerenable true`
`set voltagevalue 3.3`
	`true` or `false`	MPLAB ICD3, MPLAB ICD4, PICkit 3, MPLAB PICkit 4, MPLAB PM3

`SecureSegment.SegmentProgramming SegmentProgrammingAll`
If true, it permits programming to “Program Over Secure and Protected FLASH.” This property must be set prior to using the program operation on the MDB. Use the -p option to set the tool as a programmer if it’s for a production final image and not just a debug image.
Example:
`set SecureSegment.SegmentProgramming SegmentProgrammingAll true`
	`true` or `false`	MPLAB ICD3, MPLAB ICD4, MPLAB REAL ICE, PICkit 3, MPLAB PICkit 4

`system.disableerrormsg`
This option has been deprecated as of v3.15 but will still function with existing projects. For new projects, use the `<Link>`
`system.disableoutput` and `<Link>system.yestoalldialog` options.
If `true`, the system will disable warnings and error messages and answer “yes” to all dialogs; if `false` the system will enable warning and error messages (this is the default).
Example:
`set system.disableerrormsg true`
	`true` or `false`	Not tool dependent

`system.disableoutput`
If `true`, the system will disable warnings and error message outputs but not disable dialogs; if `false` the system will enable warning and error message outputs and dialogs (this is the default).
Example:
`set system.disableoutput true`
	`true` or `false`	Not tool dependent

`system.yestoalldialog`
If `true`, the system will disable dialogs and answer “yes” to all of them; if `false` the sys-tem will enable dialogs (this is the default).
Example:
`set system.yestoalldialog true`
	`true` or `false`	Not tool dependent

3.3.4.2 Simulator Options Used with the Set Command

The following table provides additional information for simulator options used with the set command.

Important: The `set` command, including the tool property options, must be executed before the `Hwtool` command is issued, otherwise the changes to the tool properties will be ignored.

Note: For the following table, the break options allow you to set the conditions that will cause program execution to halt. In general, the program will either break on option, ignore the option, or report the option.

Table 3-7. Simulator Options Used with the Set Command

Simulator Options	Values	Device or Runtime Dependent

`breakoptions.coreerrors`
Sets the condition if core errors occur
Example:
`set breakoptions.coreerrors Break`
	`Break, Ignore, Report`	No

`breakoptions.corewarnings`
Sets the condition if core warnings occur
Example:
`set breakoptions.corewarnings Ignore`
	`Break, Ignore, Report`	No

`breakoptions.peripheralerrors`
Sets the condition if peripheral errors occur
Example:
`set breakoptions.peripheralerrors Report`
	`Break, Ignore, Report`	No

`breakoptions.peripheralwarnings`
Sets the condition if peripheral warnings occur
Example:
`set breakoptions.peripheralwarnings Break`
	`Break, Ignore, Report`	No

`breakoptions.stimulusmessages.notes`
Sets the condition if stimulus notes occur
Example:
`set breakoptions.stimulusmessages.notes Ignore`
	`Break, Ignore, Report`	No

`breakoptions.stimulusmessags.errors`
Sets the condition if stimulus errors occur
Example:
`set breakoptions.stimulusmessages.errors Report`
	`Break, Ignore, Report`	No

`breakoptions.stimulusmessags.warnings`
Sets the condition if stimulus warnings occur
Example:
`set breakoptions.stimulusmessages.warnings Ignore`
	`Break, Ignore, Report`	No

.....continued

Simulator Options	Values	Device or Runtime Dependent

`breakoptions.wdtwarnings`
Sets the condition if watchdog timer warnings occur
Example:
`set breakoptions.wdtwarnings Ignore`
	`Break, Ignore, Report`	No

`codecoverage.enabled`
Enables or disables code coverage
Example:
`set codecoverage.enabled Disable`
	`Disable,`
	`Enabled_Reset_on_POR`
	`Enabled_Reset_on_Run`
		No

`codecoverage.enableoutputtofile`
Enables write to file
Example:
`set codecoverage.enableoutputtofile true`
	`true, false`	No

`codecoverage.outputtofile`
Absolute path to output file
Example:
`set codecoverage.outputtofile "c:\path\to\file.txt"`
	`String path`	No

`oscillator.auxfrequency`
Auxiliary PLL Frequency, used by PWM and ADC
Example:
`set oscillator.auxfrequency 4400`
	`Numeric`	Yes

`oscillator.auxfrequencyunit`
Auxiliary PLL Frequency Units
Example:
`set oscillator.auxfrequencyunit None`
	`Mega, Kilo, None`	Yes

`oscillator.frequency`
Instruction Execution Frequency
Example:
`set oscillator.frequency 4700`
	`Numeric`	No

`oscillator.frequencyunit`
Instruction Frequency Units
Example:
`set oscillator.frequencyunit Kilo`
	`Mega, Kilo, None`	No

`oscillator.rcfrequency`
RC Oscillator Frequency
Example:
`set oscillator.rcfrequency 4500`
	`Numeric`	No

.....continued

Simulator Options	Values	Device or Runtime Dependent

`oscillator.rcfrequencyunit`
RC Oscillator Frequency Units
Example:
`set oscillator.rcfrequencyunit None`
	`Mega, Kilo, None`	No

`periphADC1.altscl`
Use MPLAB 8 style ADC
Example:
`set periphADC1.altscl true`
	`true, false`	Yes

`periphADC1.minTacq`
Specifies minimum acquisition time (Tacq) in seconds
Example:
`set periphADC1.minTacq 10`
	`Numeric`	Yes

`periphADC1.tacqunits`
Units for minimum acquisition time (Tacq)
Example:
`set periphADC1.tacqunits nanoseconds`
	`milliseconds, microseconds, nanoseconds`	Yes

`periphADC2.altscl`
Use MPLAB 8 style ADC
Example:
`set periphADC2.altscl true`
	`true, false`	Yes

`periphADC2.minTacq`
Specifies minimum acquisition time (Tacq) in seconds
Example:
`set periphADC2.minTacq 20`
	`Numeric`	Yes

`periphADC2.tacqunits`
Units for minimum acquisition time (Tacq)
Example:
`set periphADC2.tacqunits milliseconds`
	`milliseconds, microseconds, nanoseconds`	Yes

`uartNio.output`
Specifies location of UART output
`N` represents the UART number 1 through 6
Example:
`set uart1io.output file`
	`file, window`	Yes

.....continued		
Simulator Options	**Values**	**Device or Runtime Dependent**

`uartNio.uartioenabled`
If `true`, the system will enable the UART I/O; if `false` the system will disable it
`N` represents the UART number 1 through 6
Example:
`set uart1io.uartioenabled false`
	`true, false`	Yes

Passes in a string containing the root (absolute path) of the file system to the file used for UART output `N` represents the UART number 1 through 6 **Example:** `set uart1io.outputfile "c:\path\to\outputfile.txt"`	`Absolute path to file`	Yes

3.3.5 Programming Commands

To display information about the programming commands available in the MDB, type `help [programming option]`. The following table provides additional information for these commands.

Important: The `set` command, including the tool property options, must be executed before the `Hwtool` command is issued, otherwise the changes to the tool properties will be ignored.

Table 3-8. Programming Commands

Command	Description
Program	Programs device memory with the image specified by the file. **Note:** If the path or filename has spaces in it, you must use the quotation marks. If there are no spaces in the path of filename, the quotation marks are not needed, as shown below. **Command format:** `Program executableImageFile`
Upload	Uploads the executable image to MDB memory. The source of the instructions to be loaded is the contents of the memory of an attached PIC® device through the programmer or debugger. **Command format:** `Upload`

.....continued	
Command	**Description**
Dump	Writes the device memory to a hex file. **Command format:** `Dump [-m] filename` The `m` is an optional argument that specifies which memories to write to the hex file. It can be any combination of the following: • `p` - Program Memory (Flash) • `e` - EE Data • `c` - Configuration Bits • `u` - User ID memory • `b` - Boot Memory • `f` - Flash Data The `filename` is the full path and name to the hex file.

3.3.6 Running Commands

To display information about the running commands available in the MDB, type help running. The following table provides additional information for these commands.

Command	Description
Continue	Resumes program being debugged, after breakpoint. **Command format:** `Continue`
Halt	Stops the debugged program. **Command format:** `Halt`
Next	Step program, proceeding through subroutine calls. Like the “step” command as long as subroutine calls do not happen; when they do, the call is treated as one instruction. **Command format:** `Next`
Run	Start the debugged program. **Command format:** `Run`
Step	Step program until it reaches a different source line. The step command only enters a function if there is a line number information for the function. **Command format:** `Step`
Stepi	Execute one machine instruction, then stop and return to the debugger. The optional argument count is a repeat count. **Command format:** `Stepi [count]`

3.3.7 Stack Commands

To display information about the stack commands available in MDB, type help backtrace. The following table provides additional information for these commands.

Table 3-9. Stack Commands

Command	Description
Backtrace	Print a backtrace of the entire stack, one line per frame for all frames in the stack. **Command format:** `Backtrace [full] [<n, -n>]` • `full` – prints the values of local variables • `n` – prints the innermost n frames • `-n` – prints the outermost n frames

4. Revision History

4.1 Revision A (November 2012)

Initial release of this document.

4.2 Revision B (April 2013)

- added note in Invoking the MDB section
- added Tool Property Name Options for the Set command
- added Simulator Options for the Set command
- added `-p` option
- added note on running multiple tools
- removed example of using commands to debug a project
- added section on creating a printable log file

4.3 Revision C (March 2014

- relocated Revision History from Preface to it's own appendix.
- added a Document Layout section to the Preface.
- added new section "Using Multiple Instances of the MDB".
- moved reference tables to "MDB Reference".
- added notes about case-sensitivity for commands in "MDB Reference".
- added tool column to table "Tool-Property-Name Options Used with the Set Command"
- added new table: "Simulator Options Used With the Set Command".

4.4 Revision D (February 2017)

- added more documents to the Recommended Reading section in Preface.
- revised the title to "How to Use Microchip Debugger", revised the description of the MDB and added a note to the revised Programming a Production Image for Testing Purposes section.
- revised section "Getting Started" to add information on Command Line Parameters.
- added information in the Help Commands section.
- revised multiple tables in the MDB Reference chapter.

4.5 Revision E (October 2018)

- added information for the MPLAB PICkit 4 and MPLAB Snap In-Circuit Debuggers in "Introduction" .
- renamed, reorganized and added information in "Installation and Documentation" and "Getting Started".
- updated paths in table "Paths to the MDB by Operating System"
- updated tools in table "Device and tool Commands" and table "Tool-Property-Name Options Used with the Set Command"

4.6 Revision F (February 2019)

- added SK (Starter Kits PKOB) and EDBG (embedded debugger) to list of MDB supported tools in "Introduction".
- added two EDBG options to a table "Tool-Property-Name Options Used with the Set Command".

- added EDBG tool to applicable options in table “Tool-Property-Name Options Used with the Set Command”.

4.7 Revision G (June 2020)

- Entire document has been reformatted and renumbered.
- Updated references to online help to WebHelp.
- Updated paths to documentation locations.

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PART NO.	[X](1)	-	X	/XX	XXX
Device	Tape and Reel Option		Temperature Range	Package	Pattern

Device:	PIC16F18313, PIC16LF18313, PIC16F18323, PIC16LF18323	
Tape and Reel Option:	Blank	= Standard packaging (tube or tray)
	T	= Tape and Reel(1)
Temperature Range:	I	= -40°C to +85°C (Industrial)
	E	= -40°C to +125°C (Extended)
Package:(2)	JQ	= UQFN
	P	= PDIP
	ST	= TSSOP
	SL	= SOIC-14
	SN	= SOIC-8
	RF	= UDFN
Pattern:	QTP, SQTP, Code or Special Requirements (blank otherwise)	

Examples:

- PIC16LF18313- I/P Industrial temperature, PDIP package
- PIC16F18313- E/SS Extended temperature, SSOP package

Notes:

1. Tape and Reel identifier only appears in the catalog part number description. This identifier is used for ordering purposes and is not printed on the device package. Check with your Microchip Sales Office for package availability with the Tape and Reel option.
2. Small form-factor packaging options may be available. Please check www.microchip.com/packaging for small-form factor package availability, or contact your local Sales Office.

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