Mixed-Signal Explorer CLI

Quick Reference Guide

Microchip Information

Trademarks

The "Microchip" name and logo, the "M" logo, and other names, logos, and brands are registered and unregistered trademarks of Microchip Technology Incorporated or its affiliates and/or subsidiaries in the United States and/or other countries ("Microchip Trademarks"). Information regarding Microchip Trademarks can be found at https://www.microchip.com/en-us/about/legalinformation/microchip-trademarks.

ISBN:

Legal Notice

This publication and the information herein may be used only with Microchip products, including to design, test, and integrate Microchip products with your application. Use of this information in any other manner violates these terms. Information regarding device applications is provided only for your convenience and may be superseded by updates. It is your responsibility to ensure that your application meets with your specifications. Contact your local Microchip sales office for additional support or, obtain additional support at www.microchip.com/en-us/support/design-help/client-support-services.

THIS INFORMATION IS PROVIDED BY MICROCHIP "AS IS". MICROCHIP MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND WHETHER EXPRESS OR IMPLIED, WRITTEN OR ORAL, STATUTORY OR OTHERWISE, RELATED TO THE INFORMATION INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY, AND FITNESS FOR A PARTICULAR PURPOSE, OR WARRANTIES RELATED TO ITS CONDITION, QUALITY, OR PERFORMANCE.

IN NO EVENT WILL MICROCHIP BE LIABLE FOR ANY INDIRECT, SPECIAL, PUNITIVE, INCIDENTAL, OR CONSEQUENTIAL LOSS, DAMAGE, COST, OR EXPENSE OF ANY KIND WHATSOEVER RELATED TO THE INFORMATION OR ITS USE, HOWEVER CAUSED, EVEN IF MICROCHIP HAS BEEN ADVISED OF THE POSSIBILITY OR THE DAMAGES ARE FORESEEABLE. TO THE FULLEST EXTENT ALLOWED BY LAW, MICROCHIP'S TOTAL LIABILITY ON ALL CLAIMS IN ANY WAY RELATED TO THE INFORMATION OR ITS USE WILL NOT EXCEED THE AMOUNT OF FEES, IF ANY, THAT YOU HAVE PAID DIRECTLY TO MICROCHIP FOR THE INFORMATION.

Use of Microchip devices in life support and/or safety applications is entirely at the buyer's risk, and the buyer agrees to defend, indemnify and hold harmless Microchip from any and all damages, claims, suits, or expenses resulting from such use. No licenses are conveyed, implicitly or otherwise, under any Microchip intellectual property rights unless otherwise stated.

Microchip Devices Code Protection Feature

Note the following details of the code protection feature on Microchip products:

- Microchip products meet the specifications contained in their particular Microchip Data Sheet.
- Microchip believes that its family of products is secure when used in the intended manner, within operating specifications, and under normal conditions.
- Microchip values and aggressively protects its intellectual property rights. Attempts to breach the code protection features of Microchip product is strictly prohibited and may violate the Digital Millennium Copyright Act.
- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of its code. Code protection does not mean that we are guaranteeing the product is "unbreakable". Code protection is constantly evolving. Microchip is committed to continuously improving the code protection features of our products.

Preface

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 (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 "DSXXXXXXXXA", where "XXXXXXXX" 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 chapter contains general information that is useful to know before using the Mixed-Signal Explorer CLI. Items discussed in this chapter include:

- Document Layout
- Conventions Used in this Guide
- Recommended Reading
- The Microchip Website
- Product Change Notification Service
- Customer Support
- Document Revision History
- Index

DOCUMENT LAYOUT

This document provides a quick reference to the command set supported by Mixed-Signal Explorer CLI. The manual layout is as follows:

- **Chapter 1. "Usage workflow"** – Includes instructions on how to use the Mixed-Signal Explorer CLI.
- **Chapter 2. "Command Line Interface"** – Includes detailed description for all commands supported by the Mixed-Signal Explorer CLI.
- **Chapter 3. "Usecases"** – Includes description of Mixed-Signal Explorer CLI basic usecases.

MIXED-SIGNAL EXPLORER CLI QUICK REFERENCE GUIDE

CONVENTIONS USED IN THIS GUIDE

This manual uses the following documentation conventions:

DOCUMENTATION CONVENTIONS

Description	Represents	Examples
Arial font:		
Italic characters	Referenced books	*MPLAB® 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`
	Sample command line	`adc> connect`
	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}`
Ellipses...	Replaces repeated text	`var_name [, var_name...]`

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

MIXED-SIGNAL EXPLORER CLI QUICK REFERENCE GUIDE

RECOMMENDED READING

This Quick Reference Guide provides a quick reference to the command set supported by Mixed-Signal Explorer CLI. Other useful documents are listed below. The following Microchip document is available and recommended as a supplemental reference resource:

- Mixed-Signal-Explorer-User-Guide.pdf
- Mixed-Signal-Explorer-Release-Notes.pdf
- Mixed-Signal-Explorer-CLI-User-Guide.pdf

THE MICROCHIP WEBSITE

Microchip provides online support via our website at microchip.com where files and information are easily available to customers. The website contains the following:

- **Product Support** – Data sheets and errata, application notes and sample programs, design resources, user's guides and hardware support documents, latest software releases and archived software
- **General Technical Support** – Frequently Asked Questions (FAQs), technical support requests, online discussion groups, Microchip consultant program member listing
- **Business of Microchip** – Product selector and ordering guides, latest Microchip press releases, listing of seminars and events, listings of Microchip sales offices, distributors and factory representatives

PRODUCT CHANGE NOTIFICATION SERVICE

Microchip's customer notification service helps keep customers current on Microchip products. Subscribers receive e-mail notifications whenever there are changes, updates, revisions or errata related to a specified product family or development tool of interest.

To register, access the Microchip website at microchip.com, select **Product Change Notification** and follow the registration instructions.

CUSTOMER SUPPORT

Users of Microchip products can receive assistance through several channels:

- Distributor or Representative
- Local Sales Office
- Field Application Engineer (FAE)
- Technical Support

Customers should contact their distributor, representative or field application engineer (FAE) for support. Local sales offices are also available to help customers. A listing of sales offices and locations is included in the back of this document, under **Worldwide Sales and Service**.

Technical support is available at: microchip.com/support.

DOCUMENT REVISION HISTORY

Revision B (February 2025)

- Update for Delta-Sigma support.

Revision A (November 2024)

- Initial Release of this document.

Table of Contents
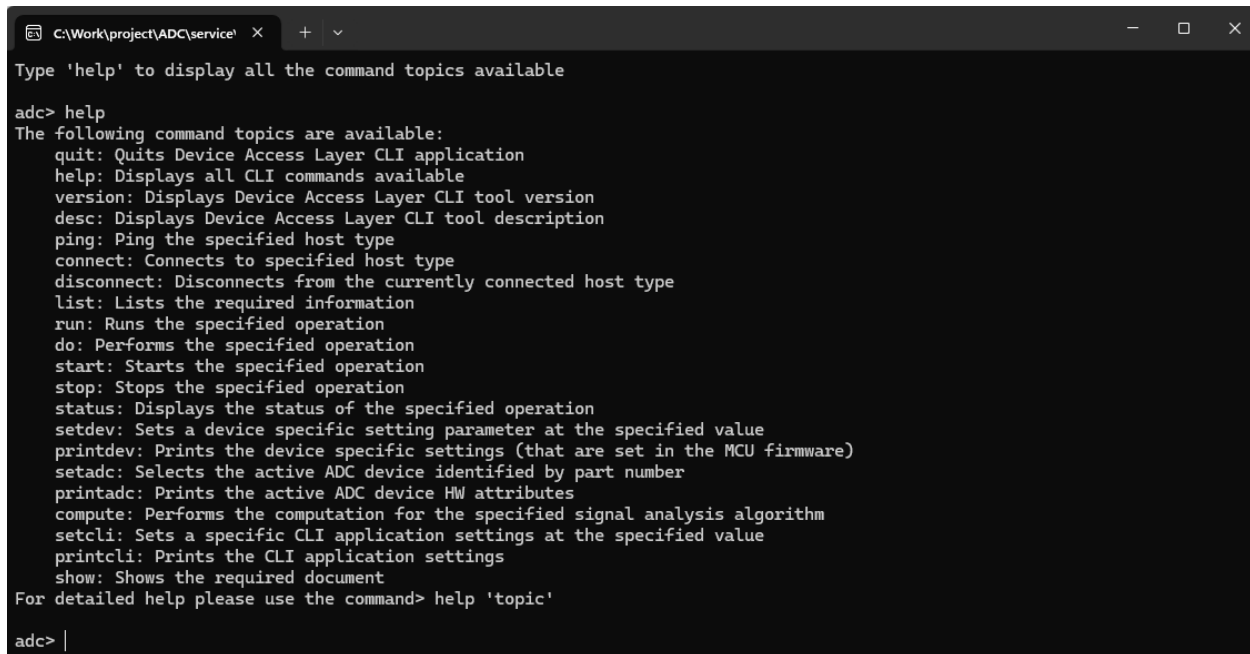
MIXED-SIGNAL EXPLORER CLI QUICK REFERENCE GUIDE

Chapter 1.   USAGE WORKFLOW

This chapter describes how the evaluation tool works and provides instructions for performing the basic operations.

The main purpose of this tool is to help users conduct a comprehensive evaluation of ADC devices focusing on their functionality, quality, precision and performance.

Mixed-Signal Explorer CLI application

Mixed-Signal Explorer CLI usage workflow:

- Type 'help' to display all available commands
    - For detailed help about a specific topic, use the command> help 'topic'

- Starting the system
    - Connect to USB Bridge Service
        - Use any of the provided connection options: Local host or Remote host
    - Connect to ADC target device
        - First list all devices that are physically attached to host
        - Then connect to desired ADC device by using its Device ID

- <Optional>: Set desired device configuration:
    - Display the current device configuration and modify it if needed
        - set the ADC sample rate (specified in ksps)
        - set the MCU operation mode: *MCU Simulated data*, *Firmware acquisition via SPI or Generic-SPI*

- <Optional>: Run the speed benchmark test:

© 2024-2025 Microchip Technology Inc. and its subsidiaries

- o Check the benchmark speed achieved. This test is useful to make sure that the device truly operates at the desired sample rate that was set at the previous step

- Perform single-shot acquisition:
    - o Perform single-shot acquisition over a specified number of samples
        - ▪ If it is not specified, then the number of samples to be acquired is set by default to 500ks
    - o Save acquired data in a specified file with the specified file format:
        - ▪ CSV format of the acquisition file: CSV text format, integer, 1 channel
        - ▪ Binary format of the acquisition file: Binary 16-bit raw data, LE, 1 channel
        - ▪ If no option is specified, then CSV format is used by default

- Run continuous acquisition:
    - o Start continuous acquisition mode for a predetermined time duration
        - ▪ If it is not specified, the continuous acquisition time duration is set by default to 5 seconds
    - o Save acquired data in a specified file with the specified file format:
        - ▪ CSV format of the acquisition file: CSV text format, integers, 1 channel
        - ▪ Binary format of the acquisition file: Binary 16-bit raw data, LE, 1 channel
        - ▪ If no option is specified, then CSV format is used by default
    - o Finally stop continuous acquisition manually or wait for the predetermined time duration to expire and continuous acquisition is automatically stopped

- Closing the system down:
    - o The following options are available:
        - ▪ Gracefully closing the system (by carefully checking all open connections and closing them manually)
        - ▪ Hard closing the system (by simply force closing the CLI and all open connections are automatically shut down)

Chapter 2.   COMMAND LINE INTERFACE

2.1   Starting CLI Application

Windows users:

Starting Mixed-Signal Explorer CLI application on **Windows 64-bit OS**:

- Use the Search Bar to type the following:
  - To start the CLI app: MSECLI
  - To start the GUI app: MSEGUI
  - To open the documentation folder: MSEDOCS

Linux users:

Starting Mixed-Signal Explorer CLI application on **Linux** OS:

- *Not supported by this release.*

2.2   CLI Commands Description

The following CLI commands are available:

- **help**
  - `help [<topic>]`
    - Displays all commands available.
      - `<topic>` - Displays detailed usage description for the requested command topic. This parameter is optional.

- **version**
  - `version`
    - Displays the current version of the Mixed-Signal Explorer CLI application and DAL module.

- **desc**
  - `desc`
    - Displays description of the Mixed-Signal Explorer CLI application and DAL module

- **quit**
  - `quit`
    - Exits the Mixed-Signal Explorer CLI application.

- **status**
  - `status`
    - Displays the current system status:
      - Connection to Host
      - Connection to Device
      - Continuous acquisition status

MIXED-SIGNAL EXPLORER CLI QUICK REFERENCE GUIDE

- **list**
    - *list <info>*
        - List information: this command is used to list desired information according to the first command parameter.
            - *<info>* - parameter 'info' is an alphanumeric symbol corresponding to the information type desired to be displayed: [devices, adc, settings, api, tests]

              >list devices

                Lists all devices attached to the host.

              >list adc

                Lists all supported ADC devices organized per families of ADC.

              >list settings

                Lists all CLI application specific settings.

              >list api

                Lists DAL module API.

              >list tests

                Lists all available tests.

- **ping**
    - *ping <target>*
        - Pings the specified target.
            - *<target>* - parameter 'target' is an alphanumeric symbol corresponding to the target type desired to ping: [host]

              >ping host <addr>

                Ping the Host of USB devices

                <addr> - parameter 'addr' identifies the Host IP address desired to ping.

- **connect**
    - *connect <target>*
        - Connects to specified target.
            - *<target>* - parameter 'target' is an alphanumeric symbol corresponding to the target type desired to connect: [host, device]

              >connect host <addr>

                Connects to Host of USB devices

                <addr> - parameter 'addr' identifies the Host IP address desired to connect.

              >connect device <devid>

                Connects to specified USB device

                <devid> - parameter 'devid' is the device id that identifies the USB device desired to connect.

- **disconnect**
    - *disconnect <target>*

- o Disconnects from the currently connected target.
    - ▪ *<target>* - parameter 'target' is an alphanumeric symbol corresponding to the target type desired to disconnect: [host, device]

      >disconnect host

      Disconnects from the currently connected Host

      >disconnect device

      Disconnects from the currently connected USB device

- **run**

  run <op>

  - o Runs the specified operation.
    - ▪ *<op>* - parameter 'op' identifies the desired operation to be run: [test]

      >run test <testname>

      Runs the specified test

      <testname> - parameter 'testname' identifies the desired test to be run.

- **do**

  do <op>

  - o Performs the specified operation.
    - ▪ *<op>* - parameter 'op' identifies the desired operation to be performed: [saq]

      >do saq <filename> [-csv] [-bin] [-s <size>]

      Performs single-shot acquisition operation

      <filename> - parameter 'filename' identifies the file name where to save the acquired data.

      -csv - specifies the CSV format of the acquisition file (CSV text format, integer, 1 channel)

      -bin - specifies the Binary format of the acquisition file (Binary 16-bit raw data, LE, 1 channel)

      -s <size> - parameter 'size' specifies the size of the acquisition. In can be entered as samples, kilo-samples or mega-samples.

- **start**

  start <op>

  - o Starts the specified operation.
    - ▪ *<op>* - parameter 'op' identifies the desired operation to be started: [caq]

      >start caq <filename> [-csv] [-bin] [-t <duration>]

      Starts the continuous acquisition operation

      <filename> - parameter 'filename' identifies the file name where to save the acquired data.

      -csv - specifies the CSV format of the acquisition file (CSV text format, integer, 1 channel)

-bin - specifies the Binary format of the acquisition file (Binary 16-bit raw data, LE, 1 channel)

-t <duration> - parameter 'duration' specifies the time duration (in seconds) of the acquisition process

- **stop**
    - *stop <op>*
        - o Stops the specified operation.
            - ▪ *<op>* - parameter 'op' identifies the desired operation to be stopped: [caq]
            >stop caq

                Stops continuous acquisition operation

- **printdev**
    - *printdev*
        - o Prints the device specific parameters:
            - ▪ Operation mode
            - ▪ Active mikroBUS slot
            - ▪ Sample rate

- **setdev**
    - *setdev <param>*
        - o Sets the specified device specific parameter.
            - ▪ *<param>* - parameter 'param' identifies the desired device specific parameter to be set: [slot, sr, opmode]
            >setdev slot <val>

                Sets the active mikroBUS slot

                <val> - parameter 'val' identifies the desired mikroBUS slot

            >setdev sr <val>

                Sets the ADC sample rate

                <val> - parameter 'val' identifies the desired sample rate value in ksps

            >setdev opmode <val> [-w <waveform>]

                Sets the MCU operation mode

                <val> - parameter 'val' identifies the desired operation mode:

                - ▪ *mcu-sim:* MCU simulation mode
                - ▪ *fw-spi:* Firmware acquisition via SPI
                - ▪ *gen-spi:* Generic-SPI acquisition

                -w <waveform> - optional parameter 'waveform' specifies the desired MCU simulated waveform

- **printadc**
    - *printadc*
        - o Prints the active ADC device name and HW attributes:

- Top sample rate
- Bit resolution
- Input mode
- Encoding scheme

- **setadc**
  - *setadc <partNo>*
  - ○ Selects the active ADC device identified by part number.
    - *<partNo>* - parameter 'partNo' identifies the desired ADC device to be used. The list of all supported ADC devices is displayed in case a wrong part number was entered.

- **compute**
  - *compute <alg>*
  - ○ Performs the computation for the specified signal processing algorithm.
    - *<alg>* - The parameter 'alg' identifies the desired signal processing algorithm to be performed: [fft, hist, inldnl]
    - *>compute fft <smpl> [-w <window>] [<filename>]*

      Performs the FFT analysis

      <smpl> - The parameter 'smpl' identifies the desired number of samples used to perform the FFT analysis. In can be entered into samples, kilo-samples or mega-samples.

      -w <window> - The optional parameter 'window' specifies the FFT window used for FFT calculation. The following window options are supported: rect, blackman, hamming, hann, kaiser.

      In case this option is not specified then the default window used is 'blackman'.

      <filename> - The parameter 'filename' identifies the file required to save the FFT results.

    - *>compute hist <smpl> [<filename>]*

      Computes the Histogram

      <smpl> - The parameter 'smpl' identifies the desired number of samples used to perform the Histogram analysis. In can be entered in samples, kilo-samples or mega-samples. Only a certain range of values is allowed.

      <filename> - The parameter 'filename' identifies the file required to save the Histogram.

    - *>compute inldnl <smpl> [<filename>]*

      Performs the INL/DNL analysis

      <smpl> - The parameter 'smpl' identifies the desired number of samples used to perform the INL/DNL analysis. In can be entered as samples, kilo-samples or mega-samples. Only a certain range of values is allowed.

      <filename> - The parameter 'filename' identifies the file required to save the INL/DNL results.

- **setcli**

> *`setcli <var> <val>`*
>
> o Sets a specific CLI application setting at the specified value.
>> ▪ *`<var>`* - The parameter 'var' is an alphanumeric symbol corresponding to the application settings variable.
>> The following application settings variables are supported: loglevel, wkdir
>> ▪ *`<val>`* - The parameter 'val' is an alphanumeric symbol corresponding to the desired value of the application settings.

- **printcli**

> *`printcli [<var>]`*
>
> o Prints the CLI application settings.
>> ▪ *`<var>`* - The parameter 'var' is an alphanumeric symbol corresponding to the application settings variable.
>> This parameter is optional. If it is not provided, then all application settings variables are displayed.

- **show**

> *`show <doc>`*
>
> o Shows the required document.
>> ▪ *`<doc>`* - The parameter 'doc' identifies the desired document to be shown.
>> The following documentation IDs are available:
>>> - ug: User Guide
>>> - qrg: Quick Reference Guide
>>> - docs: User documentation location
>>> - dcb: Data Capture Board online documentation

Chapter 3.   USECASES

3.1   Connection Modes

The connection mode refers only to the connection between CLI application and USB Bridge service. Once this connection is established, all operations provided by the CLI application work the same from user perspective (even if the connection is local or remote, this has no impact at user level).

Also, the target devices are accessible in the same manner via USB connections by USB Bridge service.

- **Local host connection mode:**
  In local host connection mode, the PIC32MZ Mixed Signal Data Capture Board (EV64F02A) and the ADC Evaluation Board are physically attached to the same machine running the CLI application, machine referred to as local host. The USB Bridge Service must also run on this local host to facilitate CLI application connection to USB connected devices.

- **Remote host connection mode:**
  In remote host connection mode, the PIC32MZ Mixed Signal Data Capture Board (EV64F02A) and the ADC Evaluation Board are physically attached to a remote host accessible over the local network. The USB Bridge Service must run on this remote host as well and be able to serve several client connections over TCP/IP at the same time.

3.2   Data Acquisition Modes

- **Single-shot acquisition mode:**
  In single-shot acquisition mode, only one single-shot of samples of specified length is acquired from target device at user request. The user has the option to acquire another set of samples as many times desires.

- **Continuous acquisition mode:**
  In continuous acquisition mode, the samples are continuously acquired from target device and saved in data acquisition file. The user has the option to start the continuous acquisition mode for a predetermined time duration, but also to manually stop continuous acquisition mode at any time or to wait until the predetermined time duration expires and continuous acquisition mode is automatically stopped.

INDEX

Alphabetical order	Meaning
ADC	Analog-to-digital converter
BE	Big Endian
CLI	Command Line Interface
CSV	Comma Separated Values
DAL	Device Access Layer
dB	Decibel
dBFS	Decibels relative to Full Scale
DNL	Differential Nonlinearity
FFT	Fast Fourier Transform
FW	Firmware
GUI	Graphical User Interface
HW	Hardware
INL	Integral Nonlinearity
INSTALLDIR	Installation Directory
IP	Internet Protocol
ksps	kilo-samples per second
LE	Little Endian
MCHP	Microchip
MCU	Microcontroller Unit
PC	Personal Computer
Rev	Revision
S/N	Serial Number
SPI	Serial Peripheral Interface
SW	Software
TCP	Transmission Control Protocol
USB	Universal Serial Bus