



Mixed-Signal Explorer CLI

User's Guide

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Preface

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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 describes how to use the Mixed-Signal Explorer CLI. The manual layout is as follows:

- **Chapter 1. “Software Overview”** – Includes overall description of the Mixed-Signal Explorer CLI capabilities.
- **Chapter 2. “Usage workflow”** – Includes instructions on how to use the Mixed-Signal Explorer CLI.
- **Chapter 3. “Key features”** – Includes description of all features supported by the Mixed-Signal Explorer CLI.
- **Chapter 4. “Command Line Interface”** – Includes detailed description for all commands supported by the Mixed-Signal Explorer CLI.
- **Chapter 5. “Usecases”** – Includes description of Mixed-Signal Explorer CLI basic usecases.

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CONVENTIONS USED IN THIS GUIDE

This manual uses the following documentation conventions:

DOCUMENTATION CONVENTIONS

Description	Represents	Examples
Arial font:		
Italic characters	Referenced books	<i>MPLAB® IDE User's Guide</i>
	Emphasized text	...is the <i>only</i> 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	<u><i>File > Save</i></u>
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'

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Italic Courier New	A variable argument	<i>file.o</i> , where <i>file</i> can be any valid filename
Square brackets []	Optional arguments	mcc18 [options] <i>file</i> [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) { ... }

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RECOMMENDED READING

This user's guide describes how to use the 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-Quick-Reference-Guide.pdf (for quick reference to CLI commands)

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- **General Technical Support** – Frequently Asked Questions (FAQs), technical support requests, online discussion groups, Microchip consultant program member listing
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- Local Sales Office
- Field Application Engineer (FAE)
- Technical Support

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Technical support is available at: [microchip.com/support](https://www.microchip.com/support).

DOCUMENT REVISION HISTORY

Revision B (February 2025)

- Update for Delta-Sigma support.

Revision A (November 2024)

- Initial Release of this document.

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Chapter 1. SOFTWARE OVERVIEW

Mixed-Signal Explorer CLI is an intuitive, user-friendly software tool for evaluating mixed-signal ADC devices. It is specifically designed to support all types of ADC devices evaluation procedures and is a part of Mixed-Signal Explorer software package.

This evaluation tool is designed for controlling and monitoring ADC devices (by enabling configuration of the device settings and acquisition of ADC samples). It also supports signal processing (by allowing the execution of signal processing algorithms on the acquired samples, such as FFT, Histogram and INL/DNL).

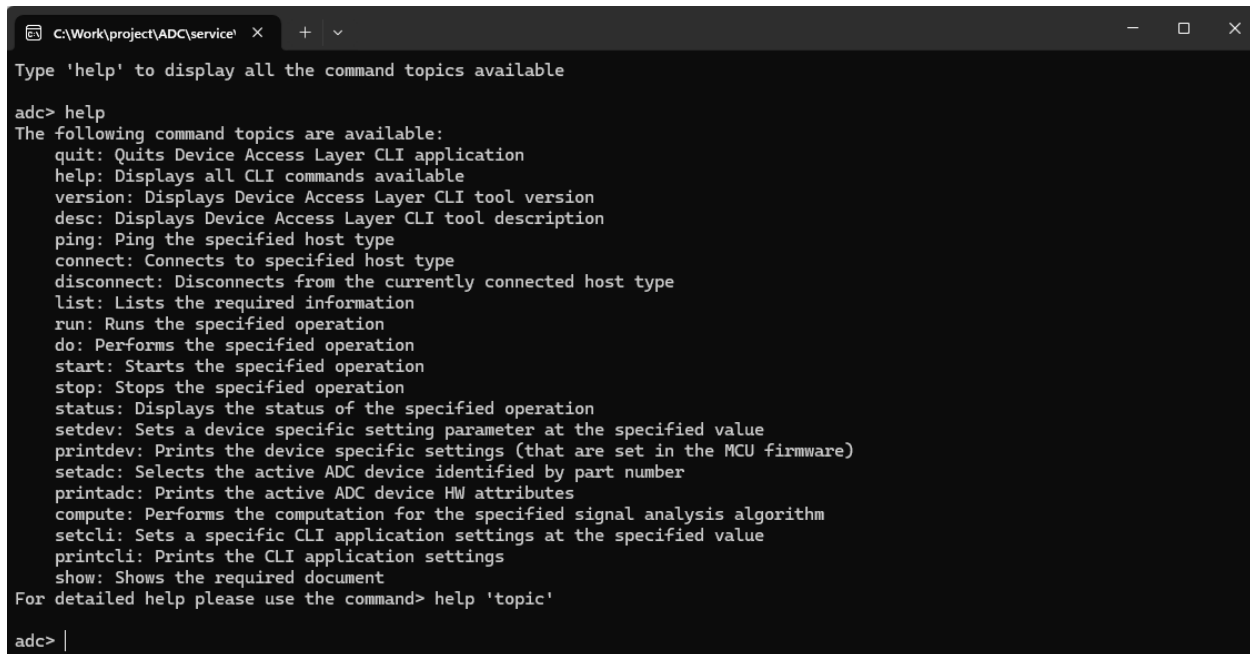
The main purpose of this tool is to provide a quick start for beginners and streamline tasks for experienced users, enhancing productivity by offering an intuitive high-level view of the ADC system while hiding the complexities of hardware implementation.

For detailed information on how to install the package, including the Mixed-Signal Explorer CLI, and about the boards supported by this package refer to the following document: "Mixed-Signal Explorer User Guide.pdf"

Chapter 2. 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.



```
C:\Work\project\ADC\service' x + v
Type 'help' to display all the command topics available

adc> help
The following command topics are available:
quit: Quits Device Access Layer CLI application
help: Displays all CLI commands available
version: Displays Device Access Layer CLI tool version
desc: Displays Device Access Layer CLI tool description
ping: Ping the specified host type
connect: Connects to specified host type
disconnect: Disconnects from the currently connected host type
list: Lists the required information
run: Runs the specified operation
do: Performs the specified operation
start: Starts the specified operation
stop: Stops the specified operation
status: Displays the status of the specified operation
setdev: Sets a device specific setting parameter at the specified value
printdev: Prints the device specific settings (that are set in the MCU firmware)
setadc: Selects the active ADC device identified by part number
printadc: Prints the active ADC device HW attributes
compute: Performs the computation for the specified signal analysis algorithm
setcli: Sets a specific CLI application settings at the specified value
printcli: Prints the CLI application settings
show: Shows the required document
For detailed help please use the command> help 'topic'

adc> |
```

Mixed-Signal Explorer CLI

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 target device
 - First list all devices that are physically attached to host
 - Then connect to desired 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 kbps)
 - set the MCU operation mode: *MCU Simulated data, Firmware acquisition via SPI or Generic-SPI*
- <Optional>: Run the speed benchmark test:

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- 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:
 - 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 for high-speed modes and 1000 samples for low-speed modes
 - 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:
 - 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
 - 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
 - Finally stop continuous acquisition manually or wait for the predetermined time duration to expire and continuous acquisition is automatically stopped
- Closing the system down:
 - 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)

3.1 Local/Remote Host Connection/Disconnection

Mixed-Signal Explorer CLI enables the connection or disconnection to/from a local or remote host. The host refers to the machine which the ADC devices are attached to. The USB Bridge Service must run on the host to provide connectivity to all ADC devices attached to the host.

In local host connection mode, the PIC32MZ Mixed Signal Data Capture Board (EV64F02A) with the ADC Evaluation Board are physically attached to the same machine where CLI application is running, referred to as local host.

In remote host connection mode, the PIC32MZ Mixed Signal Data Capture Board (EV64F02A) with the ADC Evaluation board is physically attached to a remote host accessible over the local network.

A confirmation message is displayed at the CLI if the connection/disconnection succeeded or an error message in case of failure.

Usage examples:

- Successful connection to local host:

```
adc> connect host local
Connecting to host: local, please wait...
Successfully connected to Host: 127.0.0.1 (localhost)
```

- Successful disconnection from local host:

```
adc> disconnect host
Disconnecting from host: 127.0.0.1...
Successfully disconnected from Host: 127.0.0.1 (localhost)
```

- Connection to remote host failed:

```
adc> connect host 10.10.10.10
Connecting to host: 10.10.10.10, please wait...
Connection to Host 10.10.10.10 failed with error: 4: Host address
is not available or USB Bridge service is not running
```

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3.2 List of the Available Devices Attached to Host

Mixed-Signal Explorer CLI allows listing all devices connected to the host.

This command is useful for viewing the available devices and obtaining their connection details.

The following information is displayed on each available device:

- Device ID
- Bridge used to connect to device
- Serial Number
- Firmware version
- Device type

Usage examples:

- List all available devices attached to the host:

```
adc> list devices
Number of devices attached to Host: 1
| Devices attached to Host: -----|
| ID   | Bridge                               | S/N                               | Fw version| Target  |
| 1    | PIC32MZ Generic USB Bridge         | CAB3B221F108B79FF | 24.07.001 | MCP331x1 |
|-----|
```

3.3 List all Supported ADC Devices

Mixed-Signal Explorer CLI allows listing all supported ADC devices organized by supported families.

This command is useful for viewing the supported ADC devices.

Usage examples:

- List all supported ADC devices:

```
adc> list adc
ADC supported by families:
MCP331x1 family:
MCP33111-05
MCP33111-10
MCP33121-05
MCP33121-10
MCP33131-05
MCP33131-10
MCP33141-05
MCP33141-10
MCP33151-05
MCP33151-10
MCP356xR family:
MCP3561R
MCP3562R
MCP3564R
```

3.4 Device Connection/Disconnection

Mixed-Signal Explorer CLI provides the ability to connect/disconnect to/from an ADC device.

Usage examples:

- Successful connection to ADC device:

```
adc> connect device 1
Checking devices attached to host...
Connecting to Device ID: 1, please wait...
Successfully connected to Device ID: 1
```

- Successful disconnection from ADC device:

```
adc> disconnect device
Successfully disconnected from Device: 1
```

3.5 Display the Current System Status

Mixed-Signal Explorer CLI offers the capability to display the overall status of the system at any given moment.

This command is useful for checking the connection status to both the host and the device, as well as the status of long-running operations (e.g., continuous acquisition).

Usage examples:

- Display system status:

```
adc> status
System status:
Connected to Host: 127.0.0.1 (localhost)
Connected to Device ID: 1 | Device is online
Continuous acquisition is not running.
```

3.6 Single-shot Acquisition Mode

Mixed-Signal Explorer CLI offers the capability to perform single-shot acquisition. The acquired samples are saved in a file which must be specified by the user as the first argument of this command. The sample acquisition file can be in CSV or binary format at user selection. The user must also specify the size of the acquired samples in the command arguments, with a default size being applied if this argument is omitted.

The system must be connected to a device to perform this operation. The command automatically starts the acquisition of the required number of samples and details about this operation status are displayed at console. The samples are acquired and saved in the specified file, and confirmation is displayed on the console at the end, indicating the file where the samples have been saved.

This is a blocking operation, which means no other command can be executed in CLI until this operation is completed.

Usage examples:

- Perform single-shot acquisition of 1Ms saved in CSV format:

```
adc> do saq test_01.csv -s 1Ms
Acquiring the requested number of 1Ms samples, please wait...
Singleshot acquisition samples saved in file: test_01.csv
```

3.7 Continuous Acquisition Mode

Mixed-Signal Explorer CLI offers the capability to perform continuous acquisition. The acquired samples are saved in a file which must be specified by the user as the first argument of this command. The sample acquisition file can be in CSV or binary format at user selection. The user must also specify the time duration for continuous acquisition in the command arguments, with a default duration applied if this argument is omitted.

The system must be connected to a device to perform this operation. The command automatically starts the continuous acquisition process and details about this operation status are displayed at console. The samples are acquired and saved in the specified file.

While continuous acquisition is running, a tilde symbol appears immediately after the standard command prompt symbol (e.g.: `adc>~`) indicating that an operation is running in the background (in this case the continuous acquisition) and only a limited set of commands (e.g., `stop`, `status`) are available.

The continuous acquisition can be manually stopped at any time using the `stop` command. If it is not manually stopped by the user from CLI, the continuous acquisition is automatically stopped when the time duration expires.

At the end, a confirmation message is displayed on the console, indicating that the continuous acquisition process has been stopped and specifying where the acquired samples have been saved.

Usage examples:

- Perform continuous acquisition and save acquired samples in CSV format:

```
adc> start caq test_01.csv -t 30
Continuous acquisition set to run for 30 seconds...
Continuous acquisition successfully started for device id: 1
```

- Continuous acquisition automatically stopped when time duration has expired:

```
adc>~
Time duration of 30 seconds for continuous acquisition expired...
Continuous acquisition will be automatically stopped now.
Continuous acquisition successfully stopped for device id: 1
Continuous acquisition samples saved in file: test_01.csv
```

- Manually stopping continuous acquisition operation:

```
adc>~ stop caq
Continuous acquisition successfully stopped for device id: 1
Continuous acquisition samples saved in file: test_01.csv
```

- Request status during continuous acquisition operation is running:

```
adc>~ status
System status:
Connected to Host: 127.0.0.1 (localhost)
Connected to Device ID: 1 | Device is online
Continuous acquisition is running on device id: 1 (for 4 seconds)
```

3.8 Export Acquired Samples in External File

Mixed-Signal Explorer CLI provides the option to export the acquired data samples in an external file specified by user at CLI command. The following file formats are supported and can be selected by the user: CSV and Binary.

Data acquisition file export feature is available for both acquisition modes: single-shot acquisition and continuous acquisition.

3.9 Spectral Analysis (FFT)

Mixed-Signal Explorer CLI provides the ability to perform spectral analysis in the form of FFT (Fast Fourier Transform). The user must specify the number of samples used to perform the FFT analysis which can be entered as samples, kilo-samples or mega-samples, along with an optional file name to store the FFT results.

The desired FFT window can be selected from the following available options:

- Rectangular
- Blackman
- Hamming
- Hann
- Kaiser

The system automatically acquires the specified number of samples and then computes the FFT and displays the resulting metrics. If the optional filename was specified at CLI in the command arguments, then the FFT results are stored in this file.

At the end, a confirmation message appears on the console suggesting that the FFT calculation was successfully performed.

Usage examples:

- Perform FFT calculation and save the results in CSV format:

```
adc> compute fft 8192 results.csv
  Acquiring the requested number of 8192 samples and performing FFT
  computation, please wait...
  FFT Metrics:
    Signal to Noise and Distortion Ratio: 17.04 (dB)
    Signal to Noise Ratio: 24.03 (dB)
    Spurious Free Dynamic Range: 17.85 (dB)
    Total Harmonic Distortion: -18.06 (dB)
    Power of Fundamental frequency: -3.73 (dBFS)
    Fundamental Frequency: 4.00 (kHz)
    Offset above the average: 274.18 (LSB)
    Noise Floor: -63.88 (dBFS / bin)
    Effective Number of Bits: 2.54
  FFT computation successfully performed over 8192 samples
```

3.10 Linearity Analysis (Histogram, INL/DNL)

Mixed-Signal Explorer CLI offers the capability to perform linearity analysis in the form of Histogram and INL/DNL (Integral/Differential Non-Linearity). The user must specify the number of samples used to perform the FFT analysis which can be entered in samples, kilo-samples or mega-samples, along with an optional file name to store the results.

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The system automatically acquires the specified number of samples and then computes Histogram or INL/DNL and displays the resulting metrics. If the optional filename was specified at CLI in the command arguments, then the Histogram or INL/DNL results are stored in this file.

At the end, a confirmation message is displayed at the console suggesting that the Histogram or INL/DNL calculation was successfully performed.

Usage examples:

- Perform Histogram calculation and save results in CSV format:

```
adc> compute hist 128k hres.csv
Acquiring the requested number of 128k samples and performing Histogram
calculation, please wait...
Histogram saved in file: hres.csv
Histogram calculation successfully performed over 128k samples
```

- Perform INL/DNL calculation and save results in CSV format:

```
adc> compute inldnl 128k idnlres.csv
Acquiring the requested number of 128k samples and performing INL/DNL
calculation, please wait...
INL/DNL saved in file: idnlres.csv
INL/DNL Metrics:
Maximum INL: 2008.50
Maximum DNL: 137.22
Offset: 0.00 (LSB)
Data Range: 21999.00 (Codes)
Minimum code: -32742.00
Maximum code: 32732.00
INL/DNL calculation successfully performed over 128k samples
```

3.11 Export Signal Analysis Results in External File

Mixed-Signal Explorer CLI provides the option to export the signal analysis results in an external file of CSV format specified by user at CLI command.

The results export feature is available for all supported signal analysis algorithms: FFT, Histogram, INL/DNL.

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3.12 Set/Print Device Configuration

Mixed-Signal Explorer CLI offers the capability to change the current device configuration according to the user's preferences and displays the updated configuration on the console.

Device configurations are device specific settings that affect the ADC functionality in terms of speed, performance, input signal, etc.

The following device configuration settings are available:

- ADC sample rate
- MCU operation mode

The system must be connected to a device to perform this operation. The command sets or retrieves the desired configuration setting directly into/from the ADC device and then displays the details about this operation.

Usage examples:

- Printing the current device configuration:

```
adc> printdev
Device configuration:
Sample rate: 1000 ksp/s
Operation mode: MCU simulated data
```

- Changing the current sample rate:

```
adc> setdev sr 1000
Sample rate successfully set to: 1000 ksp/s
```

- Changing the current operation mode:

```
adc> setdev opmode mcu-sim
Operation mode successfully set to: MCU simulated data
```

3.13 Set/Print Active ADC

Mixed-Signal Explorer CLI offers the capability to change the current ADC part number according to user desire but also display it at console as well.

ADC HW attributes are device specific settings that affect the ADC device functionality in terms of speed, performance, input signal, etc.

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The following ADC HW attributes are available:

- Top sample rate
- Bit resolution
- Input mode

The command selects or prints the desired ADC part number:

Usage examples:

- Printing the active ADC part number:

```
adc> printadc
Active ADC device: MCP33131D-10
Top sample rate: 1000 ksps
Bit resolution: 16 bit
Input mode: Differential
```

- Changing the active ADC part number:

```
adc> setadc MCP33151-05
Active ADC part number successfully set to: MCP33151-05
```

3.14 Set/Print CLI Application Specific Settings

Mixed-Signal Explorer CLI offers the capability to change the current CLI application settings according to the user's preferences and displays it on console.

CLI application settings are tool specific settings that affect the CLI Tool functionality in terms of logging, data storage location, etc.

The following CLI application settings are available:

- Log level
- Working directory

Usage examples:

- Printing the current CLI settings:

```
adc> printcli
Application settings:
loglevel: err
wkdir:
C:\Users\<user>\AppData\Local\Microchip\Mixed_Signal_Explorer\Data
```

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- Changing the current log level:

```
adc> setcli loglevel warn
Application settings 'loglevel' set to: 'warn'
```

- Changing the current working directory:

```
adc> setcli wkdir
C:\Users\<user>\AppData\Local\Microchip\Mixed_Signal_Explorer\Data
Application settings 'wkdir' set to:
'C:\Users\<user>\AppData\Local\Microchip\Mixed_Signal_Explorer\Data'
```

3.15 List/Run Device Specific Tests

Mixed-Signal Explorer CLI offers the capability to list the device specific tests available and to run according to the user's preferences.

These tests are used to evaluate device-specific features, such as: speed, performance, etc.

The following tests are available:

- Speed benchmark test: used to evaluate the connectivity speed performance. This test is affected by the ADC sample rate configured and therefore it is useful to check the current ADC sample rate.

Usage examples:

- Listing the available tests:

```
adc> list tests
The following tests are available:
  benchmark: Benchmark test to evaluate the connectivity speed
performance
To run a test use the following command: 'run test <testname>'
```

- Running the speed benchmark test:

```
adc> run test benchmark
Running 'benchmark' test on Device ID 1 ...

Benchmark test results:
  10485760 Bytes / 5.0709 sec
  2.0678 MBps = 16.5426 Mbps
  1033.9145 ksps = 1.0339 Msps

Test 'benchmark' Passed.
```

3.16 Show User Documentation

Mixed-Signal Explorer CLI offers the capability to open user documentation directly from the CLI application.

The following documents are available to be viewed with this feature:

- User Guide document
- Quick Reference Guide document
- Board online documentation

Usage examples:

- Showing the available documentation:

```
adc> show ug
adc> show qrg
adc> show dcb
adc> show docs
    The following user documentation is available in local path:
      ADC CLI User Guide
      ADC CLI Quick Reference Guide
```

3.17 Events Logging

Mixed-Signal Explorer CLI offers the capability to log events (like runtime data and exceptions) for debugging and analysis purposes. Log events are printed on CLI console.

Events are logged on different logging levels:

- **None:** No events are logged
- **Error:** Major errors occurred during runtime which led to catastrophic failures, such as failing to find required resources
- **Warning:** Minor errors occurred during runtime which allow application to continue running
- **Information:** Information mainly intended for tracing and monitoring
- **Debug:** Debug information used for debug purposes

Setting the desired logging level to a lower level includes logging for all upper-level event types.

For example, setting the desired logging level to 'Debug' logs everything while setting it to 'None' logs nothing.

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Events logging example:

```
adc> setcli loglevel info
  Application settings 'loglevel' set to: 'info'
adc> connect host local
  Connecting to host: local, please wait...
13:31:17:197 INFO: Successfully connected to MCHP USB Bridge control port.
13:31:17:198 INFO: -----

13:31:17:198 INFO:
13:31:17:198 INFO: Sending 'lst' command: lst

13:31:17:199 INFO: Command 'lst' sent
13:31:17:287 INFO: Response: []

13:31:17:287 INFO: Closing the control socket
13:31:17:288 INFO: MCHP USB Bridge control port successfully closed.
13:31:17:288 INFO: -----
13:31:17:288 INFO:
13:31:17:289 INFO: Successfully connected to MCHP USB Bridge control port.
13:31:17:289 INFO: -----

13:31:17:290 INFO:
13:31:17:291 INFO: Sending 'lst' command: lst

13:31:17:291 INFO: Command 'lst' sent
13:31:17:383 INFO: Response: []

13:31:17:383 INFO: Closing the control socket
13:31:17:384 INFO: MCHP USB Bridge control port successfully closed.
13:31:17:385 INFO: -----
13:31:17:385 INFO:
  Successfully connected to Host: 127.0.0.1 (localhost)
adc>
```

Chapter 4. COMMAND LINE INTERFACE

This chapter describes the details of using the CLI (Command Line Interface) application.

4.1 CLI Mode

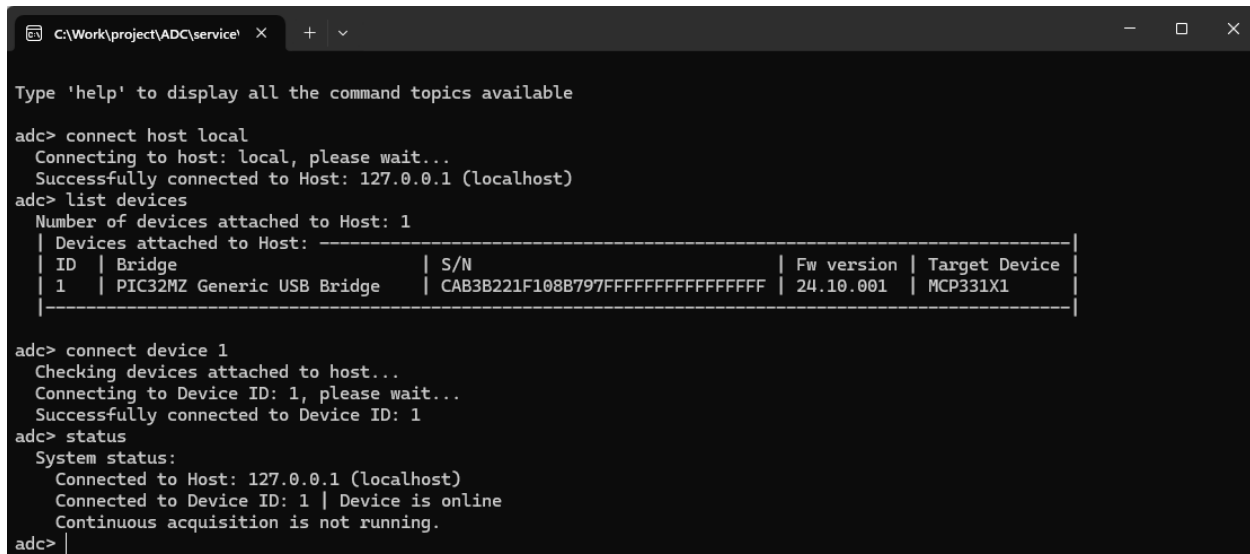
CLI (Command Line Interface) mode allows users to use a command line-oriented interface as a means of interacting with ADC devices.

CLI is the lowest level of the UI methods and provides users with full access to all system configuration settings.

CLI mode is intended to be used by experts that understand the system and usage flow.

4.2 CLI Design

Mixed-Signal Explorer CLI (Command Line Interface) is available on Windows 64-bit OS.



```
C:\Work\project\ADC\service\ x + -
Type 'help' to display all the command topics available
adc> connect host local
Connecting to host: local, please wait...
Successfully connected to Host: 127.0.0.1 (localhost)
adc> list devices
Number of devices attached to Host: 1
| Devices attached to Host: -----|
| ID | Bridge | S/N | Fw version | Target Device |
| 1 | PIC32MZ Generic USB Bridge | CAB3B221F108B797FFFFFFFFFFFFFFFF | 24.10.001 | MCP331X1 |
|-----|
adc> connect device 1
Checking devices attached to host...
Connecting to Device ID: 1, please wait...
Successfully connected to Device ID: 1
adc> status
System status:
Connected to Host: 127.0.0.1 (localhost)
Connected to Device ID: 1 | Device is online
Continuous acquisition is not running.
adc> |
```

Mixed-Signal Explorer CLI application

CLI is a command line-oriented shell type interface with the following usage flow:

- The user receives a prompt
- The user inputs a one-line command followed by ENTER
- The system executes the command and responds back with a text response on one or more lines
- The process repeats until “quit” command when the application exits

Command prompt:

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Command prompt is specific for every supported device, and it is displayed by the framework at the beginning of the usage flow (as it can be seen in the figures above).

Typically, the command prompt is defined as Device name followed by the character '>'.

Command prompt in the case of ADC device is: `adc>`

Command indentation:

Command indentation is very useful to understand the structure of command response. The framework uses automatic command indentation to format the command response in an organized and meaningful way (as can be seen in the figures above).

4.3 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: MSEDPCS

Linux users:

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

- *Not supported by this release.*

4.4 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.

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- **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
- **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.

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- `<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>`

- 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>`

- 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>`

- 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)

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

- **start**

start <op>

- 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>

- Stops the specified operation.

- **<op>** - parameter 'op' identifies the desired operation to be stopped: [caq]
>stop caq

Stops continuous acquisition operation

- **printdev**

printdev

- Prints the device specific parameters:

- Operation mode
- Active mikroBUS slot
- Sample rate

- **setdev**

setdev <param>

- 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 ksp/s

```
>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
```

- 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 <smp1> [-w <window>] [<filename>]
```

Performs the FFT analysis

**<smp1>** - The parameter 'smp1' 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 <smp1> [<filename>]
```

Computes the Histogram

**<smp1>** - The parameter 'smp1' 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.

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**<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>
```

- 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>]
```

- 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>
```

- 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

### 5.1 Host 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.

### 5.2 Samples 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            |