



SILICON LABORATORIES®

AN205

## CP210x BAUD RATE SUPPORT

### Relevant Devices

This application note applies to the following devices:  
CP2101, CP2102, CP2103

### 1. Introduction

This document is intended for developers creating products based on the CP210x USB to UART Bridge Controller. It details the device's default baud rates and describes how to change this default behavior to support new baud rates. This document includes some example usage scenarios and advanced part customizability. Most products will work perfectly with the default device characteristics and do not need any customization defined in this document. Tweaking these options in a design that is already working can have adverse effects on communication reliability or throughput if used improperly.

### 2. Default Device Behavior

An application can request any baud rate. The CP210x device will translate this baud rate into one of 32 fixed UART baud rates. Table 1 lists all possible ranges for an application requested baud rate and shows the corresponding UART baud rate for that requested range.

Table 1. Default Baud Rate Configuration

Application-Requested Baud Rate Range		UART Baud Rate
High	Low	
—	2457601	Undefined
2457600	1474561	Undefined
1474560	1053258	Undefined
1053257	670255	921600
670254	567139	576000
567138	491521	500000
491520	273067	460800
273066	254235	256000
254234	237833	250000
237832	156869	230400
156868	129348	153600
129347	117029	128000
117028	77609	115200
77608	64112	76800
64111	58054	64000
58053	56281	57600
56280	51559	56000
51558	38602	51200
38601	28913	38400
28912	19251	28800
19250	16063	19200
16062	14429	16000
14428	9613	14400
9612	7208	9600
7207	4804	7200
4803	4001	4800
4000	2401	4000
2400	1801	2400
1800	1201	1800
1200	601	1200
600	301	600
300	57	300

## 3. Baud Rate Aliasing

*Baud rate aliasing* refers to configuring a specific baud rate range to target a baud rate that is different from its default baud rate. This feature is only available on CP2102/3 devices; refer to the device data sheet for support information. The application-requested baud rate ranges are static and can never be changed. On the other hand, the actual UART baud rate corresponding to a particular baud rate range is fully customizable. This customization is done using a Windows Dynamic Link Library (DLL) named *CP210xManufacturing.DLL*. Using the functions available in this API (*GetBaudRateConfig()* and *SetBaudRateConfig()*) the EEPROM settings can be changed using the USB connection. For more information on this API and corresponding functions, refer to “AN144: CP210x Device Customization Guide.” The CP210x Baud Rate Configuration utility uses this API and is an example program that demonstrates how to use this functionality in the *CP210xManufacturing.DLL*.

## 4. CP210x Baud Rate Configuration Utility

The main window of the CP210x Baud Rate Configuration Utility (Figure 1) has a pulldown list at the top which shows all of the connected CP210x devices; this is where the CP210x device to be programmed can be selected. If a CP210x device is plugged in after the program has been started, click the *Refresh* button to obtain the most recent list of connected CP210x devices. The large list box displays the current configuration. Below the current configuration are the *Get Configuration*, *Set Configuration*, *Restore to Default*, and *Export Configuration* buttons. The next sections will further explain how and when to use these buttons.

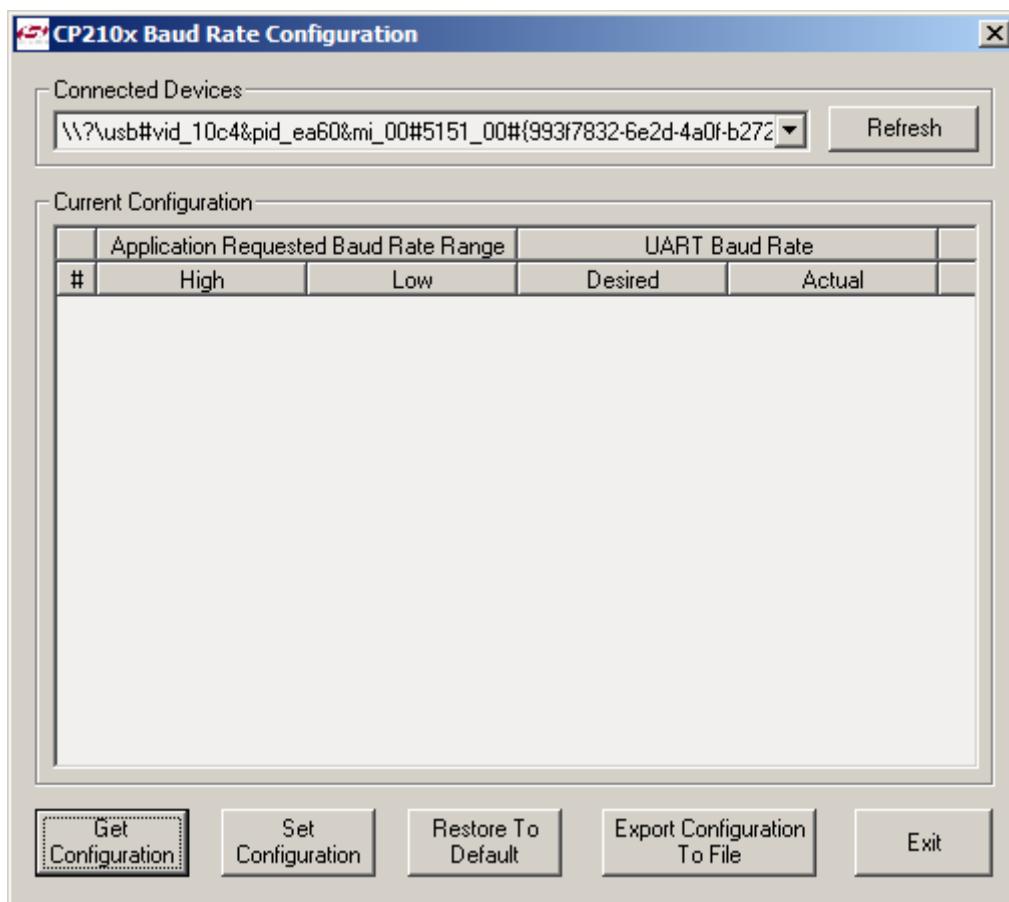
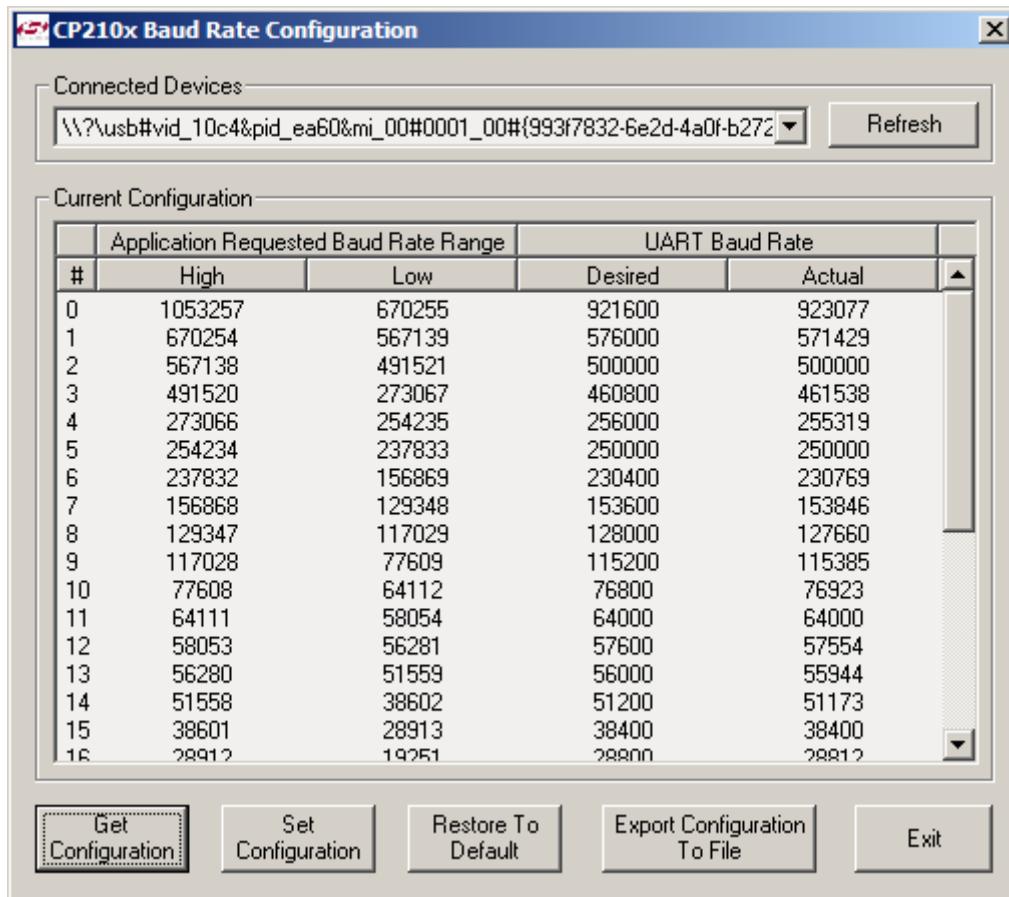


Figure 1. Main Window

## 5. Obtaining the Current Configuration of a Device

Click the *Refresh* button to obtain the most current list of connected CP210x devices. Clicking the *Get Configuration* button will obtain the current configuration of the device that is selected and display it in the *Current Configuration* list box (Figure 2).

**Note:** If a CP210x device is automatically detected on application start it will automatically get the device's configuration and display it. However, if a different CP210x device is selected, the configuration will not automatically display and the *Get Configuration* button must be pressed to display the newly selected device's current configuration in the window. This allows the configuration to remain static while switching between devices and allows multiple devices to be programmed without having to re-enter the desired settings when a new device is selected.

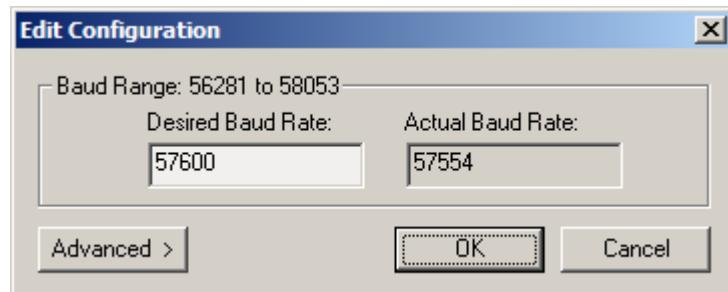


**Figure 2. Main Window After Get Configuration**

Each line displays a range of baud rates that an application might request, the desired baud rate to use in that range, and the actual baud rate that is used. There are a total of 29 entries (ranging from 57 to 1053257 bps) that can be customized. The leftmost column shows the entry number as a reference point.

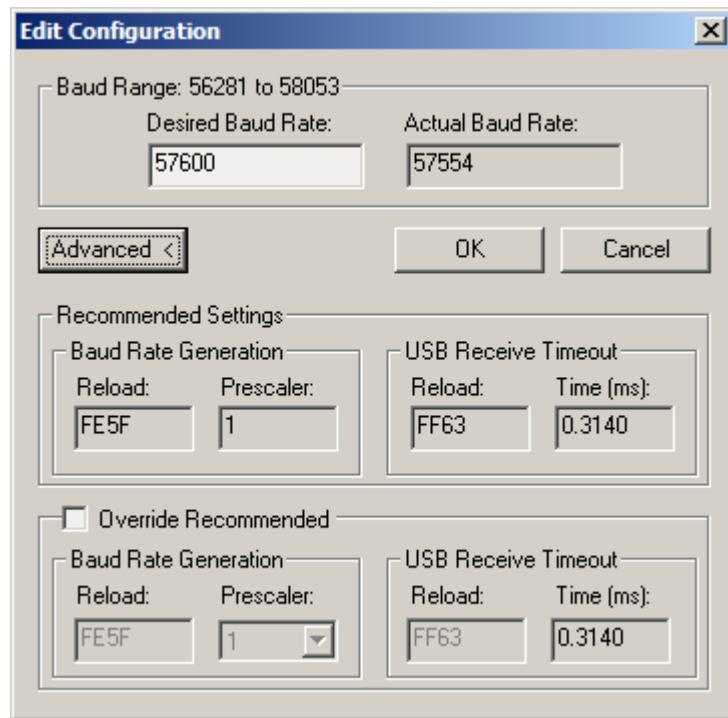
## 6. Customizing the Current Configuration of a Device

To change the current configuration, double click on the line that contains the baud rate range to be changed, and a window will open that contains the desired and actual baud rates for that range (Figure 3). Enter the new baud rate in the *Desired Baud Rate* field, and the *Actual Baud Rate* field will update to show the closest baud rate the CP210x hardware can achieve. Normally these two numbers will not be exactly the same, but as long as the actual baud rate is within  $\pm 3\%$  of the desired baud rate, the communication channel will work correctly.



**Figure 3. Edit Configuration Window (Simple)**

There is also an advanced mode where custom reload and prescaler values can be specified if needed. When the *Advanced* button is pressed, the window expands to show the recommended values used to produce the actual baud rate based on the desired baud rate (Figure 4). Below the default values is another group of boxes that can be used to override the recommended settings.



**Figure 4. Edit Configuration Window (Advanced)**

To override the recommended settings, click on the *Override Recommended Settings* check box. Then edit the *Reload* and *Prescaler* values using the following equation:

$$\text{Baud Rate} = (24,000,000/\text{Prescaler})/(65536 - \text{Reload})$$

Note: It is possible to set the baud rate to a value higher than the part can support properly. The CP2102/3 can work with 7 or 8 data bits up to 1,000,000 bps and 5 or 6 data bits up to 921,600 bps, for full-duplex data.

To change the USB receive timeout, change the *Reload* value under *USB Receive Timeout* using the equation:

$$\text{Timeout} = (65536 - \text{Reload})/(500,000)$$

See the section on USB data framing (section 9. "USB Timeouts") for more information on how this timeout can be used.

Once all of the customization has been complete, press the *Set Configuration* button to load the configuration into the CP210x device selected.

## 7. Restoring the Default Baud Rate Configuration

Clicking the *Restore To Default* button will restore the default settings shown in Table 1 to the device selected.

## 8. Exporting the Configuration to a File

To export all the custom settings in the EEPROM into a file, click the *Export Configuration to File* button. A common dialog will come up that allows a file to be specified for the output (Figure 5). This file is used by Silicon Laboratories to mass-produce parts with the same settings. Please contact a sales representative for availability and restrictions for this feature.

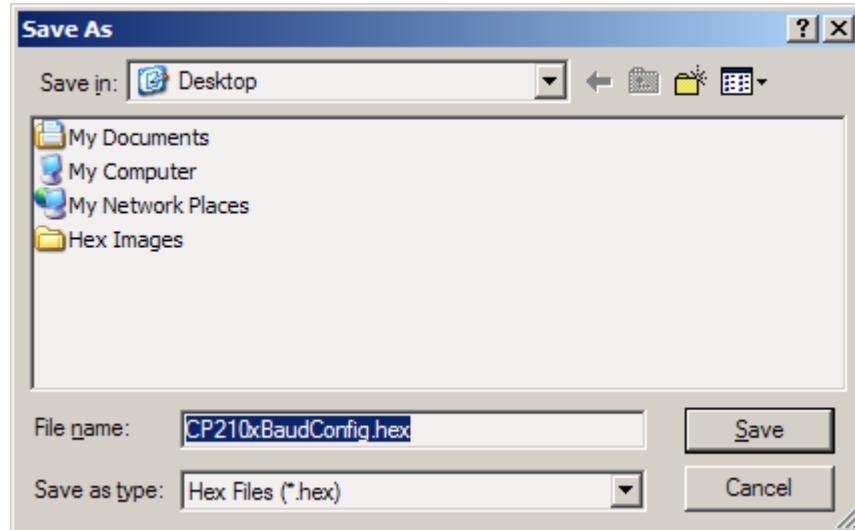


Figure 5. File Dialog

## 9. USB Timeouts

The CP210x doesn't finish sending received UART data until a certain amount of time has passed without receiving a UART character. This is referred to as the USB receive timeout and is individually configurable for each application requested baud rate range. The timeout is configured in the *Advanced* settings of the *Edit Configuration* dialog (Section 6). The default timeout length is 1 ms or (18/BaudRate), whichever is shorter.

## 10. Examples

The following are a few examples illustrating some of the functionality defined in this document.

1. **Problem**—The CP210x UART should support 115,380 baud.

**Answer**—No customization needed. The default part settings for 115,200 baud are as close to the desired baud rate as possible, and within  $\pm 3\%$ .

2. **Problem**—The CP210x UART should support 921,600 and 1,000,000 baud.

**Answer**—The application requested range for 921,600 and 1,000,000 is the same. 1,000,000 should be aliased to an unused baud rate, for example 64,000 baud. Using the configuration utility select the baud rate range of 64,111 to 58,054 on line number 11. Change the desired baud rate from 64,000 to 1,000,000. Then, your PC program can request 921,600 baud to use 921,600 baud, and 64,000 baud to use 1,000,000 baud.

3. **Problem**—The CP210x UART should operate at 300 baud regardless of application requested baud rate.

**Answer**—Using the configuration utility, set the desired baud rate for every application requested range to 300 baud. The CP210x UART will always operate at 300 baud.

## DOCUMENT CHANGE LIST

### Revision 0.1 to Revision 0.2

- Updated “AN144: CP210x Device Customization Guide” title.

### Revision 0.2 to Revision 0.3

- Added CP2103 to Relevant Devices on page 1.
- Updated note in "6. Customizing the Current Configuration of a Device" on page 4.

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