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# CE223820 – PSoC 6 MCU IPC Pipes

## Objective

This example demonstrates how to use the inter-processor communication (IPC) driver to implement a message pipe in PSoC® 6 MCU. The pipe is used to send messages between CPUs.

## Requirements

**Tool:** PSoC Creator™ 4.2, Peripheral Driver Library (PDL) 3.1.0

**Programming Language:** C (Arm® GCC 5.4.1 and Arm MDK 5.22)

**Associated Parts:** All PSoC 6 MCU parts with dual CPUs

**Related Hardware:** CY8CKIT-062-BLE PSoC 6 BLE Pioneer Kit and CY8CKIT-062-WiFi-BT PSoC 6 WiFi-BT Pioneer Kit

## Overview

In this example, the PSoC 6 MCU device works as a prompt calculator. The operands and operator are received as ASCII strings from a terminal emulator. The result is displayed back to the terminal. In firmware, the CM0+ CPU handles the UART communication with the terminal. The CM4 CPU parses the ASCII strings, converts operand strings to floating point numbers, and identifies the operator. It then executes the operation, if valid.

Messages containing ASCII strings are sent between the CPUs using the IPC pipe. A pipe has two endpoints, one on each CPU. Each endpoint contains a dedicated interrupt, which executes registered callbacks. The CM0+ CPU simply passes the ASCII string from the UART to the CM4 CPU, and from the CM4 to the UART.

## Hardware Setup

This example uses the kit's default configuration. Refer to the kit guide to ensure that the kit is configured correctly.

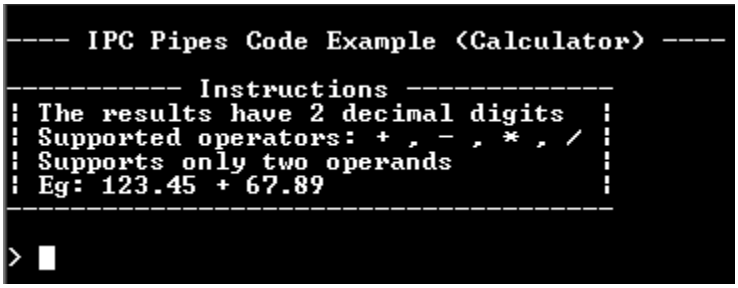
## Software Setup

If necessary, install a terminal emulator like Tera Term or PuTTY on your computer. The example uses the terminal window to send and display messages.

## Operation

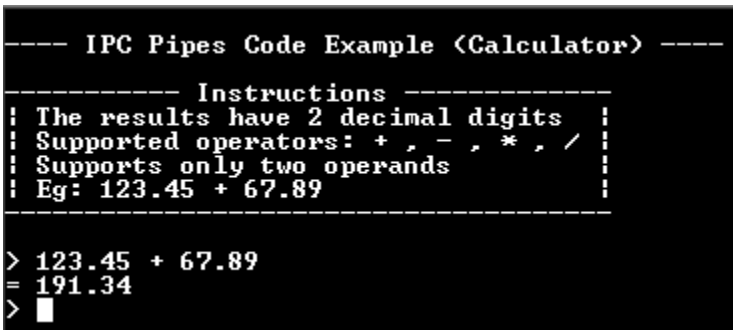
1. Plug the CY8CKIT-062 kit board into your computer's USB port.
2. Build the project and program it into the PSoC 6 MCU device. Choose **Debug** > **Program**. For more information on device programming, see PSoC Creator Help. Flash for both CPUs is programmed in a single program operation.
3. Open a serial port communication program such as Tera Term and select the corresponding COM port. Configure the terminal with 115200 baud rate, 8 data bits, 1 stop bits, and with parity and flow control set to none. Disable local echo.
4. The terminal should print the message shown in Figure 1. Press the reset button on the board in case it is not shown.

Figure 1. Initial Print Message in the Terminal



5. Type an expression using two operands and one operator. The calculator supports floating point numbers, and addition, subtraction, multiplication, and division operators.
6. Press Enter after typing the expression. The terminal should display the result, as shown in Figure 2.

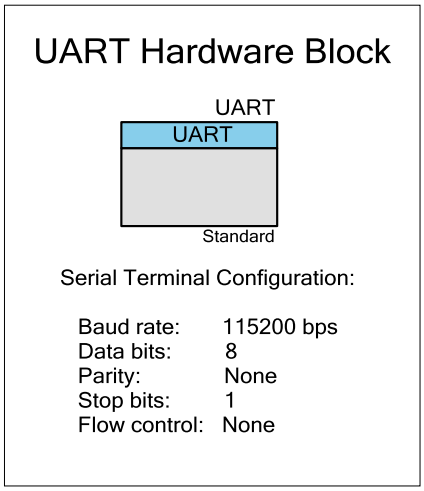
Figure 2. Result Printed in the Terminal




## Design and Implementation

The design shown in Figure 3 has a UART Component. The UART is configured in RX+TX mode to transmit/receive data at 115200 baud rate.

Figure 3. PSoC Creator Project Schematic



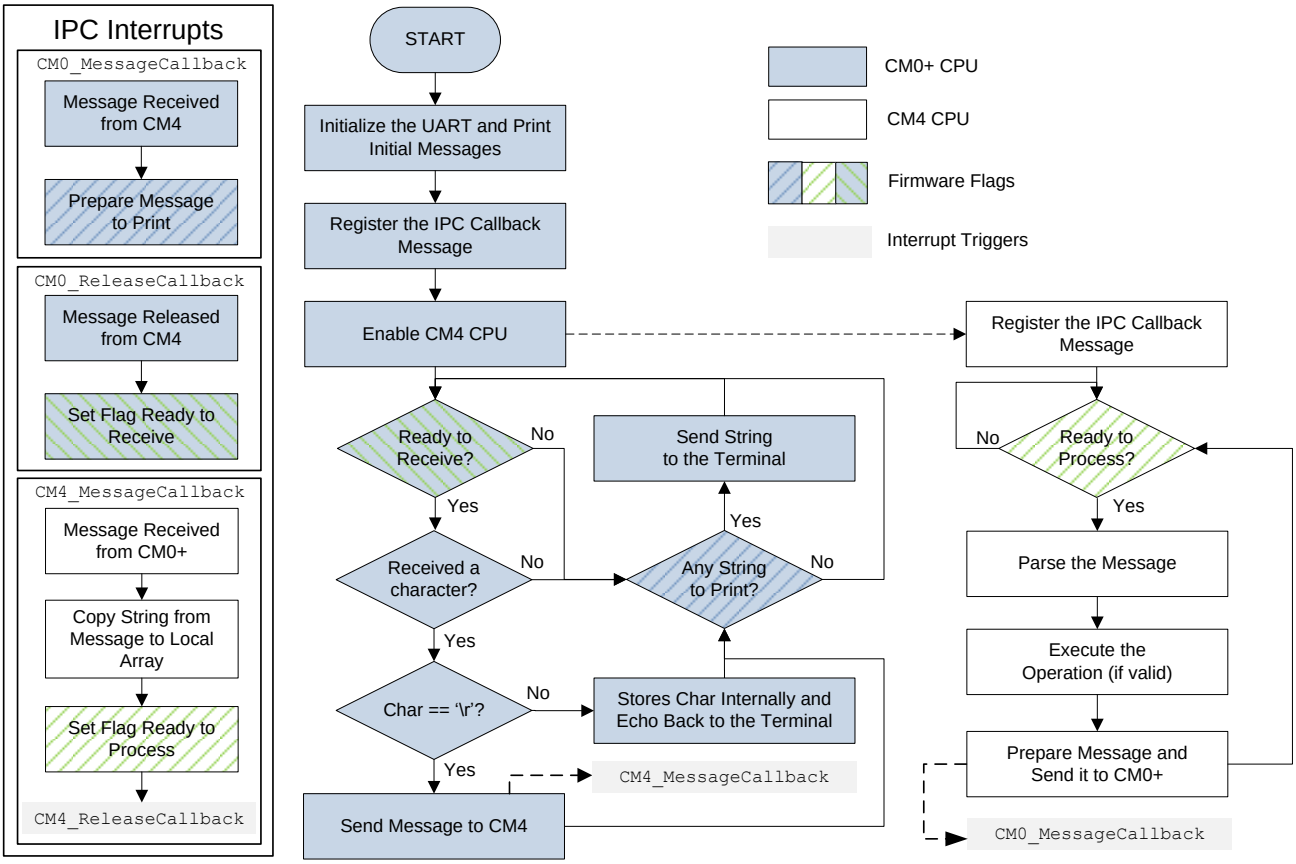

The CM0+ CPU initializes the UART and prints the initial messages to the terminal. It registers a callback to be executed when a message from the CM4 CPU is received. When registering this callback, an endpoint address and client ID are provided. The endpoint address designates which endpoint the callback is added to. The client ID determines the index in the callback array where the function pointer is saved. The CM4 CPU also registers its own callback to be executed when a message from the CM0+ CPU is received.

In the CM0+ CPU main loop, the firmware checks if any character was received. Once received, it echoes back to the terminal, so the user knows the exact characters transmitted. If the carriage return (Enter) character is received, CM0+ sends all the characters transmitted previously to CM4. When a message is received from CM4, CM0+ sends it to the terminal over UART.

When CM4 receives a message from CM0+, it parses it to extract the two operands and the operator. If the expression is valid, it calculates the result of the operation, converts it to a string, then sends it back to CM0+. If the expression is not valid, it sends an error message string to CM0+.

Figure 4 shows the firmware flowchart for the design.

Figure 4. Firmware Flowchart




Boxes filled with a diagonal pattern are related by firmware flags that are set in the IPC interrupt handlers. The main loop looks for the flag, acts if it is set, and then clear the flags.

## Components and Settings

Table 1 lists the PSoC Creator Components used in this example, how they are used in the design, and the non-default settings required so they function as intended.

Table 1. PSoC Creator Components

| Component | Instance Name | Purpose | Non-default Settings |
|---|---|---|---|
| UART | UART | Prints a message to a terminal window | All default |

For information on the hardware resources used by a Component, see the Component datasheet.

Because the example uses floating point numbers, the CM4 project is set up to include a floating point math library. To include the library in your own project, when using the GCC compiler, go to **Project** > **Build Settings** > **CM4 ARM GCC** > **Linker** > **Use newlib-nano Float Formatting**, and set to **True**.

# Reusing This Example

This example is designed for the CY8CKIT-062-WiFi-BT pioneer kit. To port the design to a different PSoC 6 MCU device and/or kit, change the target device using the Device Selector and update the pin assignments in the Design Wide Resources Pins settings as needed.

## Related Documents

| | |
|---|---|
| **Application Notes** | |
| AN210781 – Getting Started with PSoC 6 MCU with Bluetooth Low Energy (BLE) Connectivity | Describes PSoC 6 MCU with BLE Connectivity devices and how to build your first PSoC Creator project |
| AN215656 – PSoC 6 MCU: Dual-CPU System Design | Describes the dual-CPU architecture in PSoC 6 MCU, and shows how to build a simple dual-CPU design |
| AN219434 – Importing PSoC Creator Code into an IDE for a PSoC 6 MCU Project | Describes how to import the code generated by PSoC Creator into your preferred IDE |
| **Code Examples** | |
| Visit the Cypress Code Example site for a comprehensive collection of code examples using PSoC Creator IDE. | |
| **PSoC Creator Component Datasheets** | |
| UART | Provides asynchronous serial communications |
| **Device Documentation** | |
| PSoC 6 MCU Datasheets | PSoC 6 MCU Technical Reference Manuals |
| **Development Kit Documentation** | |
| CY8CKIT-062-BLE PSoC 6 BLE Pioneer Kit<br>CY8CKIT-062-WiFi-BT PSoC 6 WiFi-BT Pioneer Kit | |

## Document History

Document Title: CE223820 – PSoC 6 MCU IPC Pipes

Document Number: 002-23820

| Revision | ECN | Orig. of Change | Submission Date | Description of Change |
|---|---|---|---|---|
| ** | 6185420 | RLOS | 06/05/2018 | New code example |
| *A | 6438005 | RLOS | 01/10/2019 | Updated document and project to use PDL 3.1.0 |

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