

SPI interfacing on EV-COG-AD3029 platform using Mbed OS

- **Features:**

- [ADuCM3029](#) has three SPI ports SPI0, SPI1 and SPI2
- It supports different clock phase and polarity mode
- It supports 3-pin SPI and master or slave mode
- Multiple chip select (CS) lines
- Maximum data rate supported is 13 Mbps

- **Overview:**

- Create object for class [SPI](#) specifying MOSI, MISO and SCLK pin parameters with CS pin as optional parameter
 - MOSI pin: 'P1_07', MISO pin: 'P1_08' and SCLK pin: 'P1_06' (for SPI1)
- SPI SCLK frequency can be specified by [frequency](#)(int hz) function where 'hz' parameter is frequency in hertz (default = 10000000)
- SPI mode can be set by [format](#)(int bits, int mode) function:
 - bits: Number of bits per frame
 - mode: As per clock polarity and phase
- To read and write data, virtual int [write](#)(int value) function is used:
 - value: is data to be sent to SPI slave
 - This function returns data received by slave

- **Example Code:**

- For programming AD3029 board using Mbed OS [click here](#)
- **Example 1:** Read acceleration data from [ADXL362](#) accelerometer onboard AD3029
 - Program reads accelerometer data from ADXL362, converts it in the form of gravitational constant 'g' and prints on serial terminal
 - Initialize SPI at 1 MHz(8-bit and mode 0) and UART at 9600 bps
 - To write at memory location on slave device, first byte sent must be write command i.e. 0x0A, then second byte is address of memory location and third byte is data to be stored at that memory location on slave device
 - To read memory location from slave device, first byte sent must be read command i.e. 0x0B, then second byte is address of memory location and third byte can be any dummy byte (e.g. 0xFF)

- The return value of third write() function is actual data which is stored at that memory location on slave device
 - In this way accelerometer is configured in measurement mode by setting 0x02 value in POWER CONTROL REGISTER(address: 0x2D)
 - Then data of all three axes is stored and then converted in the form of 'g' (gravitational constant)
- **Example 2:** Read acceleration data from external [ADXL345](#) accelerometer

- Program reads accelerometer data from external ADXL345, converts it in the form of gravitational constant 'g' and prints on serial terminal
- ADXL345 is connected to AD3029 board using [EV-GEAR-EXPANDER1Z](#) board and connections are as follows:

ADXL362	<==>	AD3029
MISO	<==>	P1_08
MOSI	<==>	P1_07
SCLK	<==>	P1_06
CS	<==>	P1_10

- Initialize SPI at 1 MHz(8-bit and mode 3) and UART at 9600 bps
- To write at memory location on slave device, first byte sent must be address of memory location, bitwise or with 0x40 if multi-byte operation is used, second byte should be data to be stored at that memory location on slave device
- To read memory location from slave device, first byte sent must be address of memory location, bitwise or with 0x80 for reading operation and again bitwise or with 0x40 if multi-byte operation is used and second byte can be any dummy byte (e.g. 0xFF)
- The return value of second write() function is actual data which is stored at that memory location on slave device
- In this way accelerometer is configured in measurement mode by setting 0x08 value in POWER CONTROL REGISTER(address: 0x2D)
- Multi-byte operation is used for reading all six data registers sequentially
- Then data of all three axes is stored and then converted in the form of 'g' (gravitational constant)

● **Note:**

- CS pin can be used as GPIO pin for flexibility and to meet timing specifications

- If 8-bit data is sent using write() function then it returns 8-bit data received from slave device at the same time, i.e. 8 cycles are required to send 8-bit data then in the same 8 cycles data is sampled on MISO line and is assigned to return value of write() function, Hence adjustments should be made according to timing diagram

- **References:**

- <https://os.mbed.com/platforms/EV-COG-AD3029LZ/>
- <https://www.analog.com/media/en/dsp-documentation/processor-manuals/ADuCM302x-mixed-signal-control-processor-hardware-reference.pdf>
- <https://www.analog.com/media/en/technical-documentation/data-sheets/ADXL362.pdf>
- <https://www.analog.com/media/en/technical-documentation/data-sheets/ADXL345.pdf>
- <https://os.mbed.com/docs/mbed-os/v5.13/apis/index.html>