Polarization controller instructions for MCP2210

User guide

Document No.: -

Revision: 1.2

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2 Revision History

Rev.	Date	Author(s)	Comment
1.0	20.12.2024	R.B.	Initial version
1.1	08.01.2025	R.P.	Review
1.2	08.01.2025	R.B.	Added a figure of the setup

3 Table of Contents

4 Scope of the Document

Document describes user defined run parameters settings in Python and through command line to control MCP2210 breakout module via USB.

C library is also supported but has not been tested. Refer to MCP2210 documentation for details.

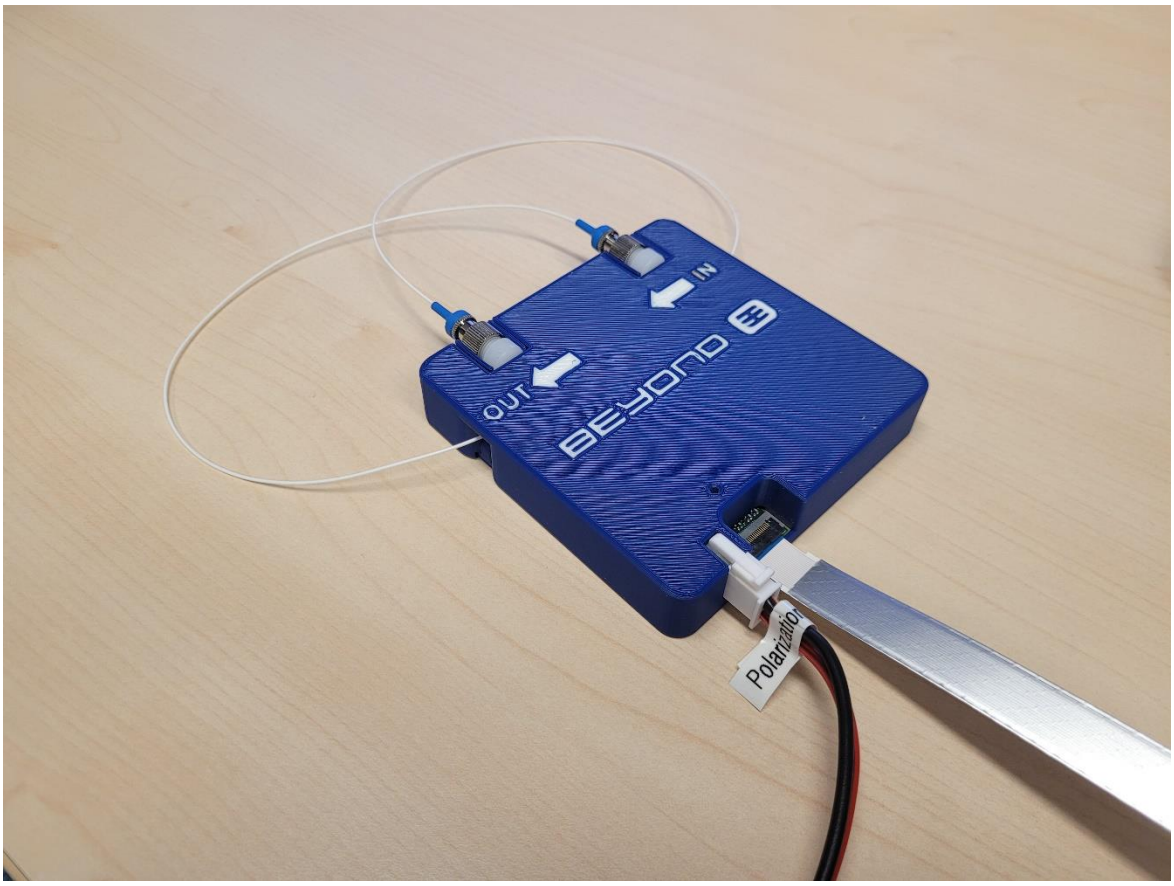
Run PC_control_application (PC_control_application.py) with following files in the same folder:

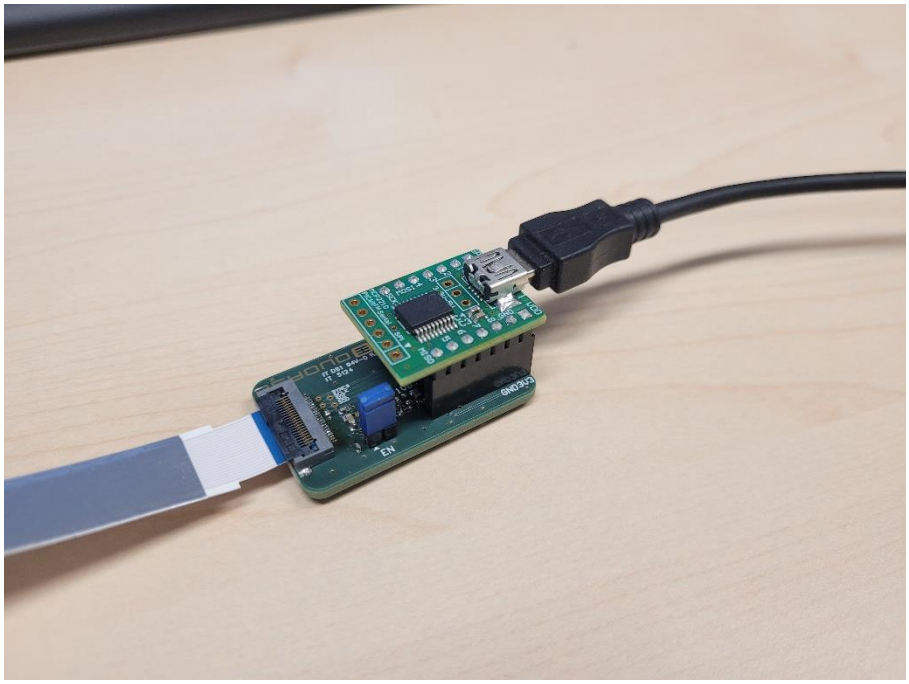
- functions.py
- MCP2210CLI.exe
- MCP2210DLL-UM.dll

5 Connecting MCP2210 to polarization controller

Use 12V supply with 1.5A supply current (max startup current of 1.5A). Operating current at steady state is ~200mA.

Only use provided power supply cable.





6 Use of application

6.1 Python script

This is the code that needs to be run in order to set desired DAC settings on the polarization controller driver PCB (BYSP296), which in turn set polarization controller (PC) channel voltage and consequently polarization angle.

We can achieve voltage range of 0V to 130V on polarization controller channels by setting »PC_channel_1/2/3/4« variables to desired voltage (number in volts [V]).

Temperature can be set by setting »temperature« variable (number in degrees [°C]) from 10°C to 75°C. Note that cooling is not supported (set temperature should be 15°C above max ambient temperature to have stabilization within 1°C accuracy).

```
##USER defined run parameters
PC_channel_1 = 60 #from 0 to 130V
PC_channel_2 = 60
PC_channel_3 = 60
PC_channel_4 = 60
temperature = 50 #from 10 to 75degC (cooling is not supported)

#END USER INPUT

import os
from funs import *      # functions file

print("configure DAC6, DAC3-DAC0")
os.system("mcp2210cli -spitxfer=28,4f -bd=100000, -cs=gp4 -md=1")  # configure
DAC6, DAC3-DAC0

voltage("DAC0", PC_channel_1)
voltage("DAC1", PC_channel_2)
voltage("DAC2", PC_channel_3)
voltage("DAC3", PC_channel_4)

temp_set(temperature)
```

6.2 Run command from terminal

For direct control in terminal execute command as shown below.
In the figure below is an example of running the code above where setting the temperature to 50°C translates to thermistor voltage around 1.34V.

```
Ukazni poziv
        >TxData: 28,4F
        >RxData: 44,3A
mcp2210cli -spitxfer=81,37 -bd=100000, -cs=gp4 -md=1

SPI transfer 2 bytes using as chip select pins: GP4
        >TxData: 81,37
        >RxData: 44,3A
mcp2210cli -spitxfer=91,37 -bd=100000, -cs=gp4 -md=1

SPI transfer 2 bytes using as chip select pins: GP4
        >TxData: 91,37
        >RxData: 44,3A
mcp2210cli -spitxfer=a1,37 -bd=100000, -cs=gp4 -md=1

SPI transfer 2 bytes using as chip select pins: GP4
        >TxData: A1,37
        >RxData: 44,3A
mcp2210cli -spitxfer=b1,37 -bd=100000, -cs=gp4 -md=1

SPI transfer 2 bytes using as chip select pins: GP4
        >TxData: B1,37
        >RxData: 44,3A
Thermistor voltage: ~1.34V
mcp2210cli -spitxfer=E3,d3 -bd=100000, -cs=gp4 -md=1

SPI transfer 2 bytes using as chip select pins: GP4
        >TxData: E3,D3
        >RxData: 44,3A

C:\Program Files (x86)\Microchip\MCP2210CLI>
```

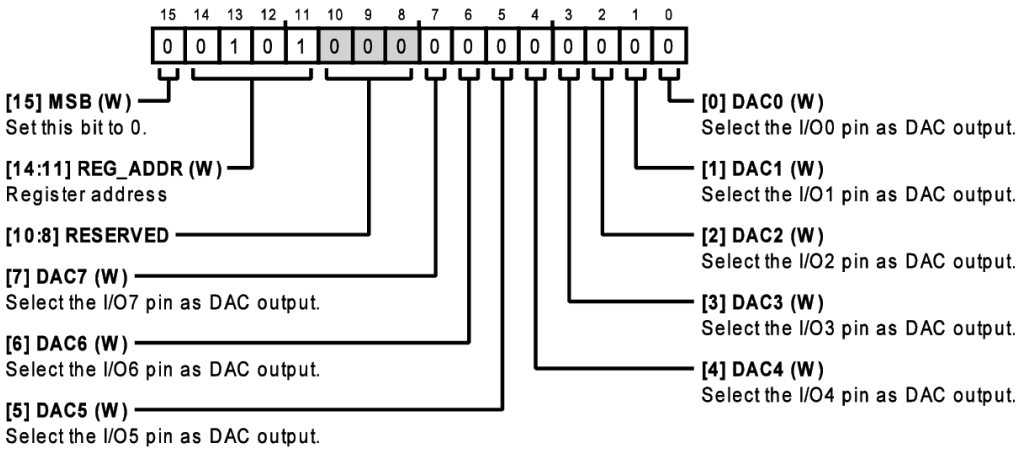
System is initialized with command:

```
mcp2210cli -spitxfer=28,4f -bd=100000, -cs=gp4 -md=1
```

where “28” is a fixed register value address and reserved bits and “4f” represents selected I/Ox output as DAC. “-bd” sets the baud rate, “-cs” sets which GPIO output of MCP2210 will work as a chip select and “-md” set the SPI mode. For more information on command line switches type

```
mcp2210cli -help
```

With bits “4f” DAC0, DAC1, DAC2, DAC3 and DAC6 are selected as DAC outputs as shown in the figure below.



To set desired CHx channel to desired voltage of Polarization controller send command

```
mcp2210cli -spitxfer={dac_num}{dac_code1},{dac_code2} -bd=100000, -cs=gp4 -md=1
```

where 4 bit wide dac_num’s first bit must be set to ‘1’ and the other 3 represent which DAC to send the data to as shown in the figure below.

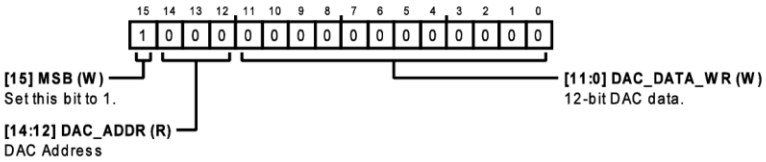


Table 29. Bit Descriptions for DAC_WR

Bits	Bit Name	Description	Default Value
15	MSB	Set this bit to 1.	0x1
[14:12]	DAC_ADDR	DAC Address. 000: DAC0. 001: DAC1. 010: DAC2. 011: DAC3. 100: DAC4. 101: DAC5. 110: DAC6. 111: DAC7.	0x0
[11:0]	DAC_DATA_WR	12-bit DAC data.	0x0

12-bit DAC data are represented with 4-bit Dac_code1 and 8-bit Dac_code2 eg. if we want to set the one CHx high voltage output to 60V (say CH1, which is connected to DAC1) we calculate the DAC code by the following equation

$$dac = V_{CH_1} * \frac{4095}{5.088V * 25.877} = 1866.14$$

Where V_{CH_1} is a desired output voltage, 4095 maximum code for 12-bit DAC, analog supply is 5.088V and OpAmp gain is set to 25.877. Value of $dac = 1866.14$ is rounded to 1866 and converted to hexadecimal value 0x74a.

Values to set CH1 to 60V are displayed below:

- Dac_num = '9'
- Dac_code1 = '7'
- Dac_code2 = "4a"

Example of a command ("`mcp2210cli -spitxfer={dac_num}{dac_code1},{dac_code2} -bd=100000, -cs=gp4 -md=1`") to send to ADC/DAC chip:

- `mcp2210cli -spitxfer=97,4a -bd=100000, -cs=gp4 -md=1`