# XDAC-120MUB-R4G8

# SPECIFICATION SHEET & MANUAL 2023

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Version: 6.9 Date 1 December 2023

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#### Before Applying DC Power Supply

Verify that the DC power supply is in good condition and safe to use. It is imperative to use ONE DC power supply as a source power for this product and the input voltage is no more than  $\pm$  18 V, or it can impair this product. Make all connections to the unit before applying power.

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#### Do Not Alter the Instrument

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#### **Caution**

This symbol indicates the hazard of any operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data.

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# 1. Introduction

Nicslab XDAC-120MUB-R4G8 system is a versatile multichannel source measurement system. The XDAC-120MUB-R4G8 supports multiple voltage/current sourcing and voltage/current measurement. The system is suitable for sourcing and measuring low-power applications from simple electronic circuits to complex photonic integrated circuits.

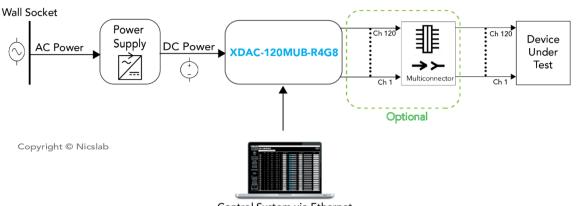
The XDAC-120MUB-R4G8 provides independent 120 channels controlled by Graphical User Interface (GUI) and Standard Commands for Programmable Instruments (SCPI) through an Ethernet port. The system has two modes: Constant Current (CC) ranging from 5 to 500 mA (source and sink) per channel and Constant Voltage (CV) ranging from bipolar  $\pm$  2.5 Volt,  $\pm$  5 Volt,  $\pm$  10 Volt, and  $\pm$ 16 Volt per channel (please check your feature selection).

The features for XDAC-120MUB-R4G8 in detail are:

- 16-bits voltage control, see the resolution at Table 5.
- 16-bits current control, see the resolution at Table 6.
- Enable voltage range configuration through software (technology that enables the user to select the output range with software without losing control of the high-resolution feature).
- Flexible output configuration with 16-bit resolution: ±2.5 V, ±5 V, ±10 V, ±16 V (*Premium Upgrade*).
- Flexible current output configuration with 16-bit resolution 5 500 mA.
- Measurement time for single channel: 5.492 ms.
- Intuitive GUI.
- The maximum power output per channel is 10 watts.
- Real time voltage reading (16-bits resolution = 1.25 mV).
- Real time current reading (16-bits resolution =  $5 \mu$ A).
- Save function to create a database.
- Upload function to generate the registrable voltage and current pattern.
- Sequence function for continuous voltage and current.
- Short circuits protection.
- SCPI command support (Python, C#, Matlab, and LabVIEW).
- SCPI Library (Premium Upgrade).
- Windows, Mac, and Linux support.
- Ethernet port.

The XDAC-120MUB-R4G8 needs to be connected with DC Power then you can plug into the Device-Under-Test (DUT) or multi-connector first. The voltage/current can be controlled through GUI or SCPI command via Ethernet or USB (Ethernet to USB port converter).

#### The system diagram is as follows:



Control System via Ethernet

Figure 1. XDAC-120MUB-R4G8 System Diagram

The package should include the following items:

| No | Item   | Qty (pc) | Checklist |
|----|--|----------|-----------|
| 1  | XDAC-120MUB-R4G8 Box   | 1        |           |
| 2  | DC power line cord (Red, Green,<br>Black)  | 9        |           |
| 3  | Multi-connector optional   | 1        |           |
| 4  | Ribbon rainbow cable optional  | 6        |           |
| 5  | Ethernet cable   | 1        |           |
| 6  | USB 2.0 Ethernet Network<br>Adaptor  | 1        |           |
| 7  | USB flash disk   | 1        |           |
| 8  | Inside USB flash disk:<br>a. GUI Installer<br>b. Specification & Manual<br>c. Test Report<br>d. Serial key (Upgrade)<br>e. XDAC key<br>f. Software Library (Premium)<br>g. Comma-separated values<br>(CSV) template (upload, demo<br>sequence) | 1        |           |

Table 1. Checklist Items

# 2. Hardware

#### **Specification Conditions**

The operating and measurement conditions are under the following conditions:

| ltems                | Conditions  |
|----------------------|---|
| Room Temperature     | 0 ~ 40 °C   |
| Humidity             | 5 ~ 80 % (No Condensing)  |
| Power Supply Input   | DC Supply Max +18 V (potential at red<br>& green DC in).<br>DC Supply Min -18 V (potential at <b>black</b><br>& green DC in).<br>Effective voltage output range ±16 V.<br>Power up minimum 72 watt (+18 V, 2 A<br>and -18 V, 2 A power supply setting).<br>Required headroom 1.4 – 2 V. |
| Waterproof/Dustproof | To be operated under room condition   |
| Calibration period   | 2 years   |

#### Table 2. Specification Conditions

#### Note:

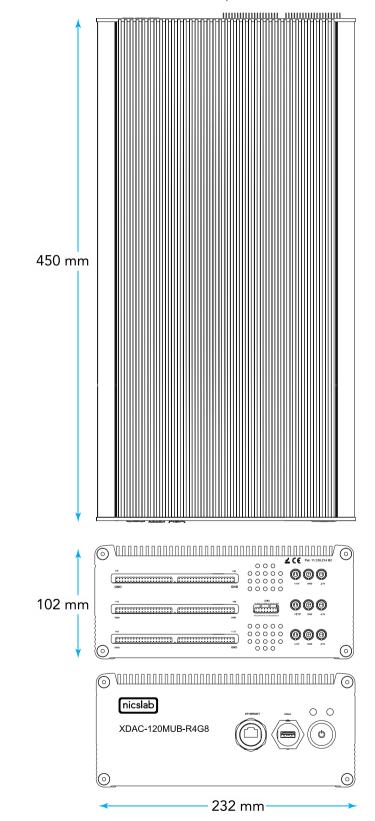
- To minimize the possibility of overheating the device, it is recommended that the supply voltage value should be the maximum output to be generated + 3 volts. For example, if you have a DUT that needs to be driven by 100mA current with a voltage of 10V, then the recommended power supply setting is 10 + 3 Volts which is 13 Volts.
- Maximum current output for 120 channels simultaneously is 150mA.
- Maximum channel control for 500mA output is 6 channels simultaneously each board, which is 6 channels from channel 1 – 40, 6 channels from channel 41 – 80, and 6 channels from channel 81 – 120.

#### Hardware Requirement

The requirements for the PC/Laptop to be used for this product installation are:

- Resolution Min. 1024 x 768 pixel
- Hard disk Min. 500 MB of available free space (32-bit and 64-bit operating system)
- USB Port USB 2.0
- RAM Min. 2 GB
- CPU 2.4 GHz or faster
- Ethernet port or internet connection via a router.

## **Box Descriptions**



The box size is 232 (W) x 450 (L) x 102 (H) mm, as the pictures below:

Figure 2. Product Dimension

The details of the front and back panels of the box are described below:

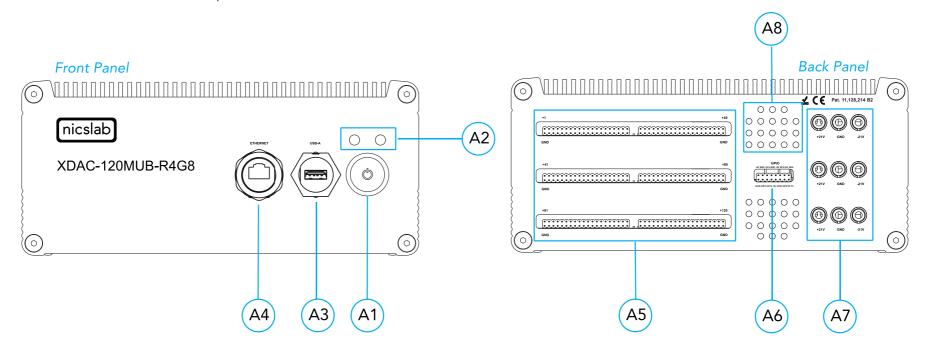


Figure 3. Front and Back Panel

#### Note:

| A1 | Power Switch                        | Turns the instrument on or off.<br>Caution<br>Before turning OFF please close the GUI or type<br>shutdown (SCPI command) to minimize the risk of<br>corrupting the system file (such as data loss).                              |
|----|-------------------------------------|--|
| A2 | Indicator Light                     | Blue -> Power Indicator.<br>Green -> Serial Transfer Data Active.  |
| A3 | USB-A                               | USB port type A.   |
| A4 | Ethernet port                       | Use an ethernet cable to connect. An ethernet to<br>USB port converter is also possible to be used if<br>the computer doesn't have the ethernet port.  |
| A5 | Pin Output (40<br>channels per row) | To connect to Device Under Test (DUT) using cable or multi-connector.  |
|    |                                     | Row 1: Channel 1 to 40   |
|    |                                     | Row 2: Channel 41 to 80  |
|    |                                     | Row 3: Channel 81 to 120   |
| A6 | GPIO                                | You may use it for external control and monitoring directly to the microprocessor.   |
| A7 | Input DC Max ±18V                   | Caution  |
|    |                                     | Please follow the safety notice on your DC power supply. <b>USE ONLY ONE DC POWER SUPPLY</b> and the input is no more than $\pm 18V$ . The XDAC will not power up if the current from the power supply is too low (minimum 2 A). |
|    |                                     | Green cable inserts to 0 V   |
|    |                                     | <b>Black</b> cable inserts to negative terminal (-18 V)  |
|    |                                     | Red cable inserts to positive terminal (+18 V)   |
| A8 | Airflow                             | For air circulation inside the box.  |

# XDAC-120MUB-R4G8 Specifications

#### The performance specifications of Digital Analog Converter (DAC) voltage are listed in Table 3 below:

| No   | Parameter                          | Min   | Тур     | Max   | Unit             | Test conditions/comments  |
|------|------------------------------------|-------|---------|-------|------------------|---|
| 1    | Resolution                         | 16    |         |       | Bits             |   |
| 2    | Integral nonlinearity (INL)        | -1    | ± 0.5   | 1     | LSB              | All ranges, except ±2.5 V   |
| 3    | Differential Nonlinearity<br>(DNL) | -1    | ± 0.5   | 1     | LSB              | Specified 16-bit monotonic  |
| 4    | Total unadjusted error             | -0.1  | ± 0.01  | 0.1   | %FSR             | All ranges except ±2.5 V  |
| 5    | Unipolar offset error              | -0.03 | ± 0.015 | 0.03  | %FSR             | All unipolar ranges   |
| 6    | Unipolar zero-code error           | 0     | 0.04    | 0.1   | %FSR             | All unipolar ranges   |
| 7    | Bipolar zero-code error            | 0     | 0.04    | 0.1   | %FSR             | All bipolar ranges  |
| 8    | Full-scale error                   | -0.2  | ± 0.075 | ± 0.2 | %FSR             | All ranges  |
| 9    | Gain error                         | -0.1  | ± 0.02  | 0.1   | %FSR             | All ranges except ±2.5 V  |
| 10   | Unipolar offset error drift        |       | ±2      |       | ppm of<br>FSR/°C | All unipolar ranges   |
| 11   | Bipolar offset error drift         |       | ±2      |       | ppm of<br>FSR/°C | All bipolar ranges  |
| 12   | Gain error drift                   |       | ±2      |       | ppm of<br>FSR/°C | All ranges  |
| 13   | Output voltage drift over time     |       | 5       |       | Ppm of<br>FSR    | $T_A = 40 \text{ °C}$ , Full-scale code, 1900<br>hours  |
| DYN, | AMIC PERFORMANCE                   |       |         |       |                  |   |
| 14   | Output Voltage Settling<br>Time    |       | 12      |       | μs               | 1/4 to 3/4 and 3/4 to 1/4 scale setting time<br>to $\pm$ 1 LSB, $\pm$ 10 V range, R <sub>L</sub> = 5 k $\Omega$ , C<br>= 200 pF |
| 15   | Slew Rate                          |       | 4       |       | V/µs             | All ranges except 0 to 5 V  |
| 16   | Power-on glitch magnitude          |       | 0.3     |       | V                | Power-down to active DAC output,<br>±20 V range, Midscale code, $R_L = 5$<br>$k\Omega$ , $C_L = 200 \text{ pF}$                 |
| 17   | Output noise                       |       | 15      |       | µV р-р           | 0.1 Hz to 10 Hz, Midscale code, 0 to V range  |
| 18   | Output noise density               |       | 78      |       | nV/\Hz           | 1 kHz, Midscale code, 0 to 5 V range  |
| 19   | AC PSRR                            |       | 1       |       | LSB/V            | Midscale code, frequency = 60 Hz,<br>amplitude 200 mVpp superimposed<br>on $V_{DD}$ , $V_{CC}$ , or $V_{SS}$                    |
| 20   | DC PSRR                            |       | 1       |       | LSB/V            |   |
| 21   | Code change glitch impulse         |       | 4       |       | nV-s             | 1 LSB change around the major carrier, 0 to 5 V range   |
| 22   | Channel to Channel AC<br>crosstalk |       | 4       |       | nV-s             | 0 to 5 V range. Measured channel at midscale. Full-scale swing on all othe channels.  |
| 23   | Channel to Channel DC<br>crosstalk |       | 0.25    |       | LSB              | 0 to 5 V range. Measured channel at midscale. All other channels at full-scale.   |
| 23   | Digital feedthrough                |       | 1       |       | nV-s             | 0 to 5 V range, Midscale code, F <sub>SCLK</sub> =<br>1 MHz   |

Table 3. DAC Voltage Performance Specification

#### The performance specifications of the current buffer circuit are listed in Table 4 below:

#### Table 4. Current Limit and Buffer Performance Specification

| No  | Parameter                     | Min   | Тур  | Max  | Unit              | Test conditions/comments   |
|-----|-------------------------------|-------|------|------|-------------------|--|
| POW | ER OP AMP CHARACTERISTICS     |       |      |      |                   |  |
|     |                               |       | 200  | 600  | μV                |  |
| 1   | Input offset voltage          |       |      | 1000 | μV                | 0 °C < TA < 70 °C  |
|     |                               |       |      | 1300 | μV                | -40 °C < TA < 85 °C  |
| 2   | Input offset voltage drift    | -10   | -4   | 10   | µV/∘C             |  |
| 3   | Input offset current          | -100  |      | 100  | nA                | $V_{CM} = 0 V$   |
| 4   | Input bias current            | -600  | -160 |      | nA                | $V_{CM} = 0 V$   |
| 5   | Input noise voltage           |       | 3    |      | μV <sub>P-P</sub> |  |
| 6   | Input noise voltage density   |       | 15   |      | μV/\Hz            |  |
| 7   | Input noise current density   |       | 3    |      | pA/\Hz            |  |
| _   |                               |       | 500  |      |                   | Common mode  |
| 8   | Input resistance              |       | 100  |      |                   | Differential mode  |
| 9   | Input capacitance             |       | 6    |      | pF                | Pin 8 and Pin 9 to Ground  |
|     |                               | -14.5 |      | 13.6 | V                 | Typical  |
| 10  | Input voltage range           | -12.0 |      | 12.0 | V                 | Guaranteed by CMRR test  |
| 11  | Common mode rejection ratio   | 92    | 105  |      | dB                | -12 V < V <sub>CM</sub> < 12 V   |
|     | Power supply rejection ratio  | 90    | 100  |      | dB                | $V_{EE} = V_{-} = -5 V, V_{CC} = V_{+} = 3$<br>V to 30 V   |
| 40  |                               | 110   | 130  |      | dB                | $V_{EE} = V_{-} = -5 V$ , $V_{CC} = 30 V$ ,<br>$V_{+} = 2.5 V$ to $30 V$   |
| 12  |                               | 90    | 100  |      | dB                | $V_{EE} = V_{-} = -3 V, V_{CC} = V_{+} = 5 V$  |
|     |                               | 110   | 130  |      | dB                | $V_{EE} = -30 V_{-} = -2.5 V \text{ to } -30 V_{-}$<br>$V_{CC} = V_{+} = 5 V$  |
| 13  | Large-signal voltage gain     | 75    |      |      | V/mV              | $R_L = 1 k\Omega$ , -12.5 V < V <sub>OUT</sub> < 12.5  |
|     |                               | 40    |      |      | V/mV              | R <sub>L</sub> = 100 Ω, -12.5 V < V <sub>OUT</sub> < 12.5 V  |
|     |                               | 5     |      |      | V/mV              | $\label{eq:RL} \begin{split} R_L &= 10 \; \Omega,  -5 \; V < V_{\text{OUT}} < 5 \; V, \\ V+ &= -V- = 8 \; V \end{split}$           |
| 14  | Output sat voltage low        |       | 1.9  | 2.5  | V                 |  |
| 15  | Output sat voltage high       |       | 1.7  | 2.3  | V                 | $\label{eq:Voh} \begin{split} V_{0H} &= V + - V_{OUT} \\ R_L &= 100,  V_{CC} = V + = 15  V, \\ V_{EE} &= V - = -15  V \end{split}$ |
| 1/  | Output about size it.         | 500   | 800  | 1200 | mA                | Output Low, $R_{SENSE} = 0 \Omega$   |
| 16  | Output short-circuits current | -1000 | -800 | -500 | mA                | Output High, $R_{SENSE} = 0 \Omega$  |
| 17  | Slew rate                     | 0.7   | 1.6  |      | V/µs              |  |
| 18  | Full power bandwidth          | 11    |      |      | kHz               | V <sub>OUT</sub> = 10 V <sub>PEAK</sub>  |
| 19  | Gain bandwidth product        | _     | 3.6  |      | MHz               | f = 10 kHz   |

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| 20   | Settling time                                |      | 8     |      | μV  | 0.01 %, $V_{OUT} = 0$ V to 10 V,<br>AV = -1, $R_L = 1$ k $\Omega$  |
|------|--|------|-------|------|-----|--|
| CURF | RENT SENSE CHARACTERISTICS                   |      |       |      |     |  |
| 21   | Minimum current sense voltage                | 0.1  |       | 10   | mV  | $VC_{SRC} = VC_{SNK} = 0 V$  |
| 22   | Current sense voltage 4% of the full scale   | 15   | 20    | 25   | mV  | $VC_{\text{SRC}} = VC_{\text{SNK}} = 0.5 \text{ V}$  |
| 23   | Current sense voltage 10% of the full scale  | 45   | 50    | 55   | mV  | $VC_{\text{SRC}} = VC_{\text{SNK}} = 0.5 \text{ V}$  |
| 24   | Current sense voltage 100% of the full scale | 480  | 500   | 520  | mV  | $VC_{SRC} = VC_{SNK} = 5 V$  |
| 25   | Current limit control input bias current     | -1   | -0.2  | 0.1  | μΑ  | $VC_{SRC}$ , $VC_{SNK}$ Pins   |
| 26   | SENSE- input current                         | -500 |       | 500  | nA  | $0 V < (VC_{SRC}, VC_{SNK}) < 5 V$   |
| 27   | FILTER input current                         | -500 |       | 500  | nA  | $0 V < (VC_{SRC}, VC_{SNK}) < 5 V$   |
|      |  | -500 |       | 500  | nA  | $VC_{SRC} = VC_{SNK} = 0 V$  |
| 28   | CENCE Lingut ourrest                         | 200  | 250   | 300  | nA  | $VC_{SRC} = 5 V$ , $VC_{SNK} = 5 V$  |
| 20   | SENSE+ input current                         | -300 | -250  | -200 | nA  | $VC_{SRC} = 0 V$ , $VC_{SNK} = 5 V$  |
|      |  | -25  |       | 25   | nA  | $VC_{SRC} = VC_{SNK} = 5 V$  |
| 29   | Current sense change with<br>output voltage  |      | ±0.1  |      | %   | $\label{eq:VC_SRC} \begin{array}{l} VC_{\text{SRC}} = VC_{\text{SNK}} = 5 \ \text{V}, \ \text{-}12.5 \ \text{V} \\ < V_{\text{OUT}} < 12.5 \ \text{V} \end{array}$ |
|      | Current sense change with supply voltage     |      | ±0.05 |      | %   | $\label{eq:VC_SRC} \begin{array}{l} VC_{\text{SRC}} = VC_{\text{SNK}} = 5 \text{ V, } 6 \text{ V} < \\ (V_{\text{CC}}, \text{ V+}) < 18 \text{ V} \end{array}$     |
| 30   |  |      | ±0.01 |      | %   | 2.5 V < V+ < 18 V, VCC = 18<br>V   |
|      |  |      | ±0.05 |      | %   | $-18 \text{ V} < (\text{V}_{\text{EE}}, \text{ V}-) < -2.5 \text{ V}$  |
|      |  |      | ±0.01 |      | %   | $-18 V < V_{-} < -2.5 V, V_{EE} = -18 V$   |
| 31   | Current sense bandwidth                      |      | 2     |      | MHz |  |
| 32   | Resistance FILTER to SENSE-                  | 750  | 1000  | 1250 | Ω   |  |
| OGI  | C I/O CHARACTERISTICS                        |      |       |      |     |  |
| 33   | Logic output leakage                         |      |       | 1    | μA  | V = 15 V   |
| 34   | Logic low output level                       |      | 0.2   | 0.4  | V   | I = 5 mA   |
| 35   | Logic output current limit                   |      | 25    |      | mA  |  |
| 36   | Enable logic threshold                       | 0.8  | 1.9   | 2.5  | V   |  |
| 37   | Enable pin bias current                      | -1   |       | 1    | μA  |  |
| 38   | Total supply current                         |      | 7     | 13   | mA  | V <sub>CC</sub> , V+ and V-, V <sub>EE</sub> connected   |
| 39   | V <sub>cc</sub> supply current               |      | 3     | 7    | mA  | $V_{\text{CC}},$ V+ and V-, $V_{\text{EE}}$ separate   |
| 40   | Supply current disabled                      |      | 0.6   | 1.5  | mA  | V <sub>CC</sub> , V+ and V-, V <sub>EE</sub><br>connected, V <sub>ENABLE</sub>   |
| 41   | Turn-On delay                                |      | 10    |      | μs  |  |
| 42   | Turn-Off delay                               |      | 10    |      | μs  |  |

The voltage control resolution is listed in Table 5 below. The resolution is 16-bits and have different value for each range. The default range is  $\pm 20$  V ( $\pm 16$  V) and can be adjusted in GUI premium version.

| No | Range         | Resolution |
|----|---------------|------------|
| 1  | ±20 V (±16 V) | 0.6 mV     |
| 2  | ±10 V         | 0.3 mV     |
| 3  | ±5 V          | 150 μV     |
| 4  | ±2.5 V        | 76 μV      |

Table 5. Voltage Control Resolution

The current control resolution is listed in Table 6 below. The resolution is 16-bits and have a fixed range of 0 - 500 mA. The controllable range is 5 - 500 mA.

|  | Table 6 | . Current | Control | Resolution |
|--|---------|-----------|---------|------------|
|--|---------|-----------|---------|------------|

| No | Range      | Resolution |
|----|------------|------------|
| 1  | 0 – 500 mA | 7.6 µA     |

#### Hardware Installation

This section describes how to install XDAC-120MUB-R4G8 and how to connect your Device Under Test (DUT) to the output terminals.

The steps are as follows:

- 1. Precondition step: connect to the DC power supply (max ±18 V). Make certain that the DC power supply is always 'ON'.
- 2. Connect an Ethernet cable to your workstation (PC/Laptop) via Ethernet Port or USB 2.0 Ethernet Network Adaptor.
- 3. Install the software/GUI (see the Software Installation section) from the flash disk or Dropbox link.
- 4. Turn ON the switch.
- 5. Wait until there is Blue light (the system is ready to use).
- 6. You may now open the GUI.
- 7. Connect XDAC output to your Device Under Test (DUT).

# 3. Software and Graphical User Interface (GUI)

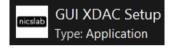
#### Software Requirement

The GUI software is suitable for the following operating systems:

- Windows<sup>®</sup> 7 (32-bit, 64-bit).
- Windows<sup>®</sup> 10 (32-bit, 64-bit).
- Windows<sup>®</sup> 11 (64-bit).
- macOS Big Sur.
- Linux Ubuntu

#### Software Installation

The first step is to install the XDAC\_setup.exe file into your computer, then double-click to launch the GUI. The icon is as below:



At the end step of the installation, check a 'Create a desktop shortcut'.

| Setup - GUI_XDAC version 2.6.14.40  | _              |           | ×     |
|---|----------------|-----------|-------|
| Select Additional Tasks<br>Which additional tasks should be performed?          |                |           | (lon) |
| Select the additional tasks you would like Setup to perform while installing GU | L_XDAC, then c | ick Next. |       |
| Additional shortcuts:   |                |           |       |
| Create a desktop shortcut   |                |           |       |
|   |                |           |       |
|   |                |           |       |
|   |                |           |       |
|   |                |           |       |
|   |                |           |       |
|   |                |           |       |
|   |                |           |       |
|   |                |           |       |
|   | Next           | )         | ancel |

Double-click the executable GUI icon (as shown below) on your desktop to launch the GUI.



#### Graphical User Interface (GUI)

Start the XDAC by pressing the ON button, then you can control it by GUI. the display details are on the next page.

First, set up the connection to your instruments by entering the IP address. Please scan the XDAC IP address to know the XDAC IP. The XDAC IP address should appear if you scan it in the local network using an IP scanner such as Angry IP Scanner or NMAP.

#### Series XDAC-120MUB-R4G8

| B29                   | B28        | B27              | B26 | B2               | 5       | B24              | ţ        |   | B23          |             | B22              |      | B21    | (                | B20 | B19     |     |
|-----------------------|------------|------------------|-----|------------------|---------|------------------|----------|---|--------------|-------------|------------------|------|--------|------------------|-----|---------|-----|
| XDAC-120MUB-R4G8      |            | _                |     |                  |         |                  |          |   |              |             |                  |      |        |                  |     | - 0 ×   | 7   |
| nicslab               | XD/AC-     |                  |     | 58<br>61-80      | 01 400  | 101 100          | -        |   |              |             |                  |      |        |                  |     | UPGRADE | B18 |
|                       |            | 21-40<br>Chanrel |     | Voltage          | Current | 101-120          |          |   | Votage Setti | ngs         |                  |      |        | Current Settings |     | Notes   |     |
| (B1)                  | Off        | 1                |     | 00.000           | V       | 000.00           | mA       |   | 00.000       |             |                  |      | 000.00 |                  |     |         |     |
| B2 Status : Connected | Off        | 2                |     | 00.000           | V       | 000.00           | mA       | • | 00.000       |             |                  |      | 000.00 |                  |     |         |     |
|                       | Off        | 3                |     | 00.000           | V       | 000.00           | mA       | • | 00.000       | •           |                  |      | 000.00 |                  |     |         |     |
| Value Increment       | Off        | 4                |     | 00.000           | V       | 000.00           | mA       | • | 00.000       |             |                  |      | 000.00 |                  |     |         |     |
| B3 0.001 O            | Off        | 5                |     | 00.000           |         | 000.00           | mA       |   | 00.000       |             |                  |      | 000.00 |                  |     |         |     |
|                       | Off        | 6                |     | 00.000           |         | 000.00           | mA       |   | 00.000       |             |                  |      | 000.00 |                  |     |         |     |
| B4 SAVE UPLOAD        | Off<br>Off | 7<br>8           |     | 00.000<br>00.000 |         | 000.00<br>000.00 | mA<br>mA |   | 00.000       |             |                  |      | 000.00 |                  |     |         |     |
|                       | Off        | 9                |     | 00.000           |         | 000.00           | mA       |   | 00.000       |             |                  |      | 000.00 |                  |     |         |     |
| B5 Auto Mode          | Off        | 10               |     | 00.000           |         | 000.00           | mA       |   | 00.000       |             |                  |      | 000.00 |                  |     |         |     |
|                       | Off        | 11               |     | 00.000           |         | 000.00           | mA       |   | 00.000       |             |                  |      | 000.00 |                  |     |         |     |
|                       | Off        | 12               |     | 00.000           | V       | 000.00           | mA       | - | 00.000       |             |                  |      | 000.00 |                  |     |         |     |
|                       | Off        | 13               |     | 00.000           | V       | 000.00           | mA       | • | 00.000       |             |                  |      | 000.00 |                  |     |         |     |
| B8 RUN                | Off        | 14               |     | 00.000           | V       | 000.00           | mA       | • | 00.000       | •           |                  |      | 000.00 |                  |     |         |     |
| (B9) Sequence :       | Off        | 15               |     | 00.000           | V       | 000.00           | mA       | • | 00.000       | •           |                  |      | 000.00 |                  |     |         |     |
|                       | Off        | 16               |     | 00.000           | V       | 000.00           | mA       |   | 00.000       | •           |                  |      | 000.00 |                  |     |         |     |
| Recording each        | Off        | 17               |     | 00.000           | V       | 000.00           | mA       | - | 00.000       |             |                  |      | 000.00 |                  |     |         |     |
|                       | Off        | 18               |     | 00.000           | V       | 000.00           | mA       |   | 00.000       | •           |                  |      | 000.00 |                  |     |         |     |
| B10 I Second -        | Off        | 19               |     | 00.000           | V       | 000.00           | mA       | - | 00.000       | •           |                  |      | 000.00 |                  |     |         |     |
| RECORD                | Off        | 20               |     | 00.000           | V       | 000.00           | mA       |   | 00.000       | •           |                  |      | 000.00 |                  |     |         |     |
|                       |            |                  |     |                  |         |                  |          |   | Set f        | or all chan | nels in this tab |      |        |                  |     |         |     |
| B11 SETTINGS          | Off        |                  |     |                  | Voltage |                  | 18       |   |              |             |                  | Curr | ent 50 | 00               |     |         |     |
|                       | B12        |                  | B13 |                  |         | B                | 14       |   |              | B15         |                  |      | B      | 16               | B1  | 3       |     |

Figure 4. GUI

#### Note:

| Callout | Description   |
|---------|---|
| B1      | ON/OFF Switch   |
| B2      | Status of connection  |
| B3      | Increment Settings  |
| B4      | Save File Button - Premium Feature  |
| B5      | Upload File Button - Premium Feature  |
| B6      | Auto Feature Sequence: Upload Table Button   CV Mode - Premium Feature  |
| B7      | Auto Feature Sequence: Upload Table Button   CC Mode - Premium Feature  |
| B8      | Auto Feature: Run Button CV and/or CC Mode - Premium Feature  |
| B9      | Name of the Sequence - Premium Feature  |
| B10     | 1. Record Data Button - Premium Feature   |
| B11     | <ul> <li>Setting for:</li> <li>2. Set Limit voltage and current values - Premium Feature</li> <li>3. V Range (16-bit precision for every range of voltages: ±2.5 V, ±5 V, ±10 V, ±16 V) - Premium Feature</li> <li>Set the Reading speed of Voltage and Current (Fast, Medium, Slow) - Premium Feature</li> </ul> |
| B12     | ON/OFF Button for the current Tab   |
| B13     | Enable/Disable (Lock) Channel Controller for all channels in the current tab  |
| B14     | Text area to set the voltage for all channels in the current tab  |
| B15     | Slider to set the voltage for all channels in the current tab   |
| B16     | Text area to set the current for all channels in the current tab  |
| B17     | Slider to set current for all channels in the current tab   |
| B18     | Upgrade Button  |
| B19     | Notes - Premium Feature   |
| B20     | Current Settings Slider   |
| B21     | Current Value Based on Increment Setting  |
| B22     | Voltage Settings Slider   |
| B23     | Voltage Value Based on Increment Setting  |
| B24     | Current Value   |
| B25     | Voltage Value   |
| B26     | Enable/Disable (Lock) Channel Controller  |
| B27     | Number of channels  |
| B28     | ON/OFF Button per Channel   |
| B29     | Tab Channel   |

#### Initializing the GUI

This section shows how to initialize the GUI:

- 1. Launch the program by double-clicking the "XDAC\_setup\_exe" icon.
- 2. Enter XDAC's IP address and XDAC key as given. If the connection is successful, then the GUI will open and there is the Green indicator light.

| Connect                       | $\times$ |
|-------------------------------|----------|
| Input IP Address and XDAC Key |          |
| IP Address                    |          |
| XDAC KEY                      |          |
| Connect                       |          |

3. Press the 'ON/OFF' button (B1) to start the GUI.



4. Turn ON (B28) on each channel to the input voltage and current values.



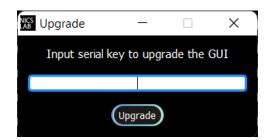
#### Premium Upgrade

This section shows how to upgrade the GUI to enable advanced features.

1. Press the upgrade button (B18) at the top right corner of the window



2. After the upgrade window opened, input the Premium Upgrade Key.



3. If your Premium Upgrade Key is valid, you will get a message that indicates a successful upgrade.



4. You can use several features that were previously locked

| XDAC-120MUB-R4G8   |        |          |           |            |     |         |    |       |                          |              |         |           |                  | - 0 × |
|--------------------|--------|----------|-----------|------------|-----|---------|----|-------|--------------------------|--------------|---------|-----------|------------------|-------|
| nicslab            | XDAC-1 | 20MU     |           | 61-80 81-1 | 100 | 101-120 |    |       |                          |              |         |           |                  |       |
|                    | SW Ch  | iannel L | ock Volta | ige Curre  | int |         |    | Volts | age Settings             |              |         |           | Current Settings | Notes |
|                    | Off    |          |           | 00.000     |     | 000.00  | mA | •     | 00.000                   |              |         |           | 000.00           |       |
| Status : Connected | Off    |          |           | 00.000     |     | 000.00  | mA | •     | 00.000                   |              |         |           | 000.00           |       |
|                    | Off    |          |           | 00.000     |     | 000.00  | mA |       | 00.000                   |              |         |           | 000.00           |       |
| Value Increment    | Off    |          |           | 00.000     |     | 000.00  | mA |       | 00.000                   |              |         |           | 000.00           |       |
| 0.001              | Off    |          |           | 00.000     |     | 000.00  | mA |       | 00.000                   |              |         |           | 000.00           |       |
|                    | Off    |          |           | 00.000     |     | 000.00  | mA |       | 00.000                   |              |         |           | 000.00           |       |
|                    | Off    |          |           | 00.000     |     | 000.00  | mA | -     | 00.000                   |              |         |           | 000.00           |       |
|                    | Off    |          |           | 00.000     |     | 000.00  | mA | -     | 00.000                   |              |         |           | 000.00           |       |
|                    | Off    |          |           | 00.000     |     | 000.00  | mA |       | 00.000                   |              |         |           | 000.00           |       |
|                    | Off    | 10       |           | 00.000     |     | 000.00  | mA | -     | 00.000                   |              |         |           | 000.00           |       |
|                    | Off    | 11       |           | 00.000     |     | 000.00  | mA | -     | 00.000                   |              |         |           | 000.00           |       |
|                    | Off    |          |           | 00.000     |     | 000.00  | mA |       | 00.000                   |              |         |           | 000.00           |       |
|                    | Off    |          |           | 00.000     |     | 000.00  | mA | -     | 00.000                   |              |         |           | 000.00           |       |
|                    | Off    | 14       |           | 00.000     |     | 000.00  | mA |       | 00.000                   |              |         |           | 000.00           |       |
|                    | Off    | 15       |           | 00.000     |     | 000.00  | mA |       | 00.000                   |              |         |           | 000.00           |       |
|                    | Off    | 16       |           | 00.000     |     | 000.00  | mA | -     | 00.000                   |              |         |           | 000.00           |       |
|                    | Off    |          |           | 00.000     |     | 000.00  | mA | -     | 00.000                   |              |         |           | 000.00           |       |
|                    | Off    | 18       |           | 00.000     |     | 000.00  | mA |       | 00.000                   |              |         |           | 000.00           |       |
|                    | Off    | 19       |           | 00.000     |     | 000.00  | mA |       | 00.000                   |              |         |           | 000.00           |       |
|                    | Off    | 20       |           | 00.000     | V   | 000.00  | mA |       | 00.000<br>Cot for all ck |              | big tab |           | 000.00           |       |
|                    |        |          | _         |            |     |         |    |       | Set for all ch           | iannels in t |         |           |                  |       |
|                    | Off    |          |           | Volta      | age | 18      |    |       |                          |              | Cu      | rrent 500 |                  |       |

| nicslab            | XDAC-      |          | 61-80            | 81-10    | 0 101-120 |          |   |                                  |     |          |                  | - 0   |
|--------------------|------------|----------|------------------|----------|-----------|----------|---|----------------------------------|-----|----------|------------------|-------|
|                    |            |          | Voltage          | Current  |           | _        |   | Voltage Settings                 |     |          | Current Settings | Notes |
|                    | Off        |          | 00.000           |          | 000.00    | mA       |   | 00.000                           | -   | 000.00   |                  |       |
| Status : Connected | Off        |          | 00.000           |          | 000.00    | mA       |   | 00.000                           | -   | 000.00   |                  |       |
|                    | Off        |          | 00.000           |          | 000.00    | mA       |   | 00.000                           |     | 000.00   |                  |       |
| Value Increment    | Off        |          | 00.000           |          | 000.00    | mA       | • | 00.000                           | -   | 000.00   |                  |       |
| 0.001              | Off        |          | 00.000           |          | 000.00    | mA       | • | 00.000                           | -   | 000.00   |                  |       |
|                    | Off        |          | 00.000           |          | 000.00    | mA       |   | 00.000                           |     | 000.00   |                  |       |
| SAVE UPLOAD        | Off        |          | 00.000           |          | 000.00    | mA       |   | 00.000                           |     | 000.00   |                  |       |
|                    | Off        |          | 00.000           |          | 000.00    | mA       |   | 00.000                           |     | 000.00   |                  |       |
| Auto Mode          | Off        |          | 00.000           |          | 000.00    | mA       |   | 00.000                           |     | 000.00   |                  |       |
| $\frown$           | Off        | 10       | 00.000           |          | 000.00    | mA       | • | 00.000                           |     | 000.00   |                  |       |
| CV SEQUENCE        | Off        |          | 00.000           |          | 000.00    | mA       |   | 00.000                           |     | 000.00   |                  |       |
| CC SEQUENCE        | Off        |          | 00.000           |          | 000.00    | mA       | • | 00.000                           | -   | 000.00   |                  |       |
|                    | Off        |          | 00.000           |          | 000.00    | mA       |   | 00.000                           |     | 000.00   |                  |       |
| RUN                | Off        | 14       | 00.000           |          | 000.00    | mA       |   | 00.000                           |     | 000.00   |                  |       |
| quence :           | Off        |          | 00.000           |          | 000.00    | mA       |   | 00.000                           |     | 000.00   |                  |       |
|                    | Off<br>Off | 16<br>17 | 00.000<br>00.000 |          | 000.00    | mA       |   | 00.000                           |     | 000.00   |                  |       |
| Recording each     | (Off)      | 17       | 00.000           | v<br>v   | 000.00    | mA<br>mA |   | 00.000                           |     | 000.00   |                  |       |
| Second ·           | Off        | 19       | 00.000           | v        | 000.00    | mA       |   | 00.000                           |     | 000.00   |                  |       |
|                    | (off)      | 20       | 00.000           | v        | 000.00    | mA       |   | 00.000                           |     | 000.00   |                  |       |
| RECORD             |            | 20       | 00.000           | <u> </u> | 000.00    | 119A     |   | Set for all channels in this tab |     | 000.00   |                  |       |
| SETTINGS           | Off        |          |                  | Voltag   | je 🛛      | 18       | T |                                  | Cur | rent 500 |                  |       |

The next few sections are the advanced features that are enabled after upgrading the GUI.

#### Constant Current Mode (CC Mode)

This section shows how to do CC mode according to your purpose:

To do CC mode, you need to move the voltage slider (B22) or adjust the voltage value (B23) to a certain value before setting the current value on (B21) or slider (B20). As an example, channels 1 to 5 in the below picture were given 120  $\Omega$  load.

Important note: When you manually input the values, always press 'Enter'.

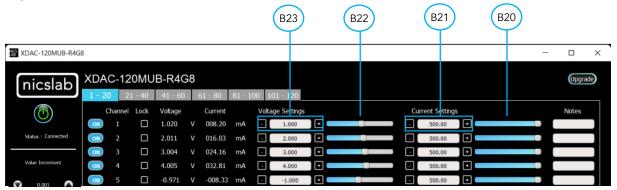
|                                     | B2                     | 23 B22 B2 | 21 B20       |
|-------------------------------------|------------------------|-----------|--------------|
| XDAC-120MUB-R4G8                    |                        |           | X            |
| nicslab XDAC-120MI                  |                        |           | Upgrade      |
| 1 - 20 21 - 40<br>(()) Channel Lock |                        |           | ttings Notes |
| Status : Connected                  |                        |           |              |
| ON 2 □                              |                        |           |              |
| Value Increment 01 4                |                        |           |              |
| 0.001 🔿 💽 5 🗆                       | 5.939 V 050.21 mA - 18 |           |              |

#### Constant Voltage Mode (CV Mode)

This section shows how to do CV mode according to your aim:

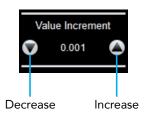
To do CV mode, you need to move the current slider (B20) or adjust the current value (B21) to a certain value. Then adjust the voltage value on (B23) or slider (B22). You may also adjust the current settings or current slider to the maximum value (500 mA).

Important note: When you manually input the values, always press 'Enter'.



#### Value Increment Setting

In this setting, the value of the voltage and current can be incrementally changed from a minimum of 0.001 to 1. Adjust the arrow to increase and decrease the value increment (B3).



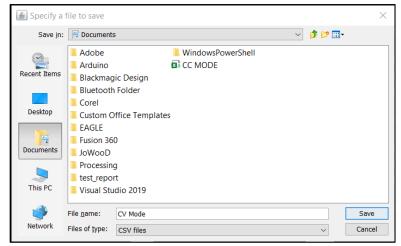
#### Save and Upload

The CSV file (.csv) resulting from the Save function can be uploaded again through the Upload button (B5). You may also create your own CSV file of voltage and current and upload it later.

1. To save the configuration, click the 'Save' button (B4).



2. Select a directory and write the file name.



- 3. The file will be saved as a .csv file.
- 4. Check the .csv file that you have saved.

|    |              | Insert P              | age Layout | Formulas     | Data | Review  | View | Help |
|----|--------------|-----------------------|------------|--------------|------|---------|------|------|
| 1  | 🚬 👗 🛛 🖸      | alibri                | - 11       | * A A        | = ;  | = = *   | - ab | G    |
| Pa | iste j       |                       | Les L      |              |      |         |      |      |
|    | - 🔸 📕        | s <i>I</i> <u>U</u> ∙ |            | <u>` A</u> - | -    | •       | •    | 9    |
| ci | ipboard 🙃    |                       | Font       |              | 5    | Algnmen | t    | ~    |
|    | -            |                       | √ .fx      |              |      |         |      |      |
| A1 | · · ·        | • 🗠                   | √ Jx       | voltage      |      |         |      |      |
|    | A            | В                     | С          | D            | E    | F       | G    |      |
|    | voltage      |                       | note       |              |      |         |      |      |
| 2  | 1            |                       |            |              |      |         |      |      |
| 3  | 2            | 150                   |            |              |      |         |      |      |
| 4  | 3            |                       |            |              |      |         |      |      |
| 5  | 4            |                       |            |              |      |         |      |      |
| 6  | 5            |                       |            |              |      |         |      |      |
| 7  | 6            |                       |            |              |      |         |      |      |
| 8  | 7            |                       |            |              |      |         |      |      |
| 9  | 8            |                       |            |              |      |         |      |      |
|    | 1.1          | 150                   |            |              |      |         |      |      |
|    | 2.2          | 150                   |            |              |      |         |      |      |
|    | 3.3          | 150                   |            |              |      |         |      |      |
|    | 4.4          | 150                   |            |              |      |         |      |      |
|    | 5.5          | 150                   |            |              |      |         |      |      |
|    | 6.6          | 150                   |            |              |      |         |      |      |
|    | 7.7          | 150                   |            |              |      |         |      |      |
|    | 8.8          | 150                   |            |              |      |         |      |      |
|    | 1.23<br>2.34 | 150<br>150            |            |              |      |         |      |      |
|    | 2.34 CV      | Mode                  |            |              |      |         |      |      |

The voltage, current, and notes are recorded. If the file doesn't appear to have saved data from all channel, consider trying to open the file with another program, like Notepad, for further inspection.

5. To upload the configuration, click the 'Upload' button (B5).



6. Choose and open the intended file.

| 📔 🛃 📮 🛛 Documents |                                    |                         |            |                  |   |
|-------------------|------------------------------------|-------------------------|------------|------------------|---|
| File Home Share   | View                               |                         |            |                  | ^ (   |
| 🗡 📲 📕 🔛           | Cut<br>Copy path<br>Paste shortcut | Move Copy<br>to to      | New item * | Edit             | Select all<br>Select none<br>Invert selection |
|                   |                                    |                         |            |                  |   |
| – → 🕶 ↑ 🖹 > Thi   | s PC → Docur                       | nents                   |            |                  |   |
|                   | ^                                  | Name                    | Status     | Date modified    | Type Si                                       |
| 📌 Quick access    |                                    | 📮 Corel                 |            | 21/11/2021 19:05 |   |
| desktop           | *                                  | Custom Office Templates |            | 28/09/2021 13:58 |   |
| Downloads         | *                                  | EAGLE                   |            |                  |   |
| Pictures          | *                                  | Fusion 360              |            |                  |   |
| Documents         |                                    | 📕 JoWooD                |            |                  |   |
| Manual AIST       |                                    | Processing              |            |                  |   |
|                   |                                    | test_report             |            |                  |   |
| test_report       |                                    | Visual Studio 2019      |            |                  |   |
| XPOW120AX         |                                    | WindowsPowerShell       |            |                  |   |
| 🝀 Nicslab Dropbox |                                    | CC MODE                 |            | 04/02/2022 14:27 | Microsoft Excel Co                            |
|                   |                                    | CV Mode                 |            | 04/02/2022 14:32 | Microsoft Excel Co                            |
| 🌷 This PC         |                                    |                         |            |                  | >   |

7. It will upload the configuration like the previous configuration.

| 🕼 XDAC-120MUB-R4G  | 8     |         |        |         |    |         |        |                |     |    |                 |   | - |       | ×   |
|--------------------|-------|---------|--------|---------|----|---------|--------|----------------|-----|----|-----------------|---|---|-------|-----|
| nicslab            | XDA   | C-12    | 0MU    | B-R40   | G8 |         |        |                |     |    |                 |   |   | Upgra | ide |
|                    | 1 - 2 | 0 2     | 1 - 40 | 41 - 60 |    | 61 - 80 | 81 - 1 | 100 101 - 120  |     |    |                 |   |   |       |     |
|                    |       | Channel | Lock   | Voltage |    | Current |        | Voltage Settin | gs  | Cu | urrent Settings |   |   | Notes |     |
|                    | ON    | 1       |        | 1.020   | V  | 008.20  | mA     | - 1.000        | •   |    | 500.00          | • |   |       |     |
| Status : Connected | ON    | 2       |        | 2.011   | V  | 016.03  | mA     | - 2.000        | •   |    | 500.00          | • |   |       |     |
|                    | ON    | 3       |        | 3.004   | V  | 024.16  | mA     | - 3.000        | ) 🛨 |    | 500.00          | • |   |       |     |
| Value Increment    | ON    | 4       |        | 4.005   | V  | 032.81  | mA     | - 4.000        | •   |    | 500.00          | • |   |       |     |
|                    | ON    | 5       |        | -0.971  | v  | -008.33 | mA     | -1.000         | •   |    | 500.00          | • |   |       |     |

Note: When you upload CV mode, the current setting slider values automatically show 2184.50 bits to open the current flow from the supply. You may adjust this to match your requirements.

#### Sequence Automation

Sequence is the setting that automates the determined values of current (mA) or voltage (V) given the certain Delay Time (in milliseconds).

 The template of the Sequence is given, then you need to input your intended values of CC Sequence (from 5 to 500 mA), CV Sequence (± 16 V), and Delay Time (in milliseconds). Set the delay time to more than 2 seconds to have more accurate values. To have a faster response (switching time) you can set it via the SCPI command.

|    | Α          | В     | С     | D     | E     | F     | G     | Н     | 1     | J        |
|----|------------|-------|-------|-------|-------|-------|-------|-------|-------|----------|
| 1  |            | Seq 1 | Seq 2 | Seq 3 | Seq 4 | Seq 5 | Seq 6 | Seq 7 | Seq 8 | Note     |
| 2  | Delay Time | 6000  | 5478  | 4912  | 3409  | 4213  | 5902  | 6012  |       |          |
| 3  | Channel 1  | 5     | 50    | 0     | 100   | 150   | 150   | 0     | 300   | Fan1     |
| 4  | Channel 2  | 10    | 50    | 0     | 100   | 160   | 150   | 0     | 300   | Fan2     |
| 5  | Channel 3  | 15    | 50    | 0     | 100   | 170   | 150   | 0     | 300   | Motor1   |
| 6  | Channel 4  | 20    | 50    | 0     | 100   | 180   | 150   | 0     | 300   | Motor2   |
| 7  | Channel 5  | 25    | 50    | 0     | 100   | 190   | 150   | 0     | 300   | Sensor1  |
| 8  | Channel 6  | 30    | 50    | 0     | 100   | 200   | 150   | 0     | 300   | Sensor2  |
| 9  | Channel 7  | 35    | 50    | 0     | 100   | 210   | 150   | 0     | 300   | Sensor3  |
| 10 | Channel 8  | 40    | 50    | 0     | 100   | 220   | 150   | 0     | 300   | Not Used |

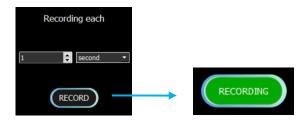
Note:

- A. Template given for CC and CV sequences.
- B. Input your intended values according to the modes (CC: 5 500 mA, CV: ±16 V).
- Choose the sequence mode that you will use, either CV Sequence (B6) or CC sequence (B7). When you click, for example, if you want to use a CC sequence, you need to open the corresponding CSV sequence file.
- After uploading, choose sequence mode by clicking Run' (B8). It will run either CC, CV, or CC & CV Sequence depends on the .csv file that you uploaded before.

**Important note**: when 'Run CCCV' use the <u>same delay time</u> on the template .csv of CC and CV sequence.

#### Record

'Record' (B10) keeps data on voltage and current values. You can choose how often the data is stored in a unit of time. The default value is the data will be stored each one second. The record starts by the time you click the Record button and finish when you click again the same button.



Click the same button to stop Recording. After that, put the file in any directory

| Save Files  |                         |        |                  | ×          |
|---|-------------------------|--------|------------------|------------|
| $\leftarrow$ $\rightarrow$ $\checkmark$ $\uparrow$      | This PC > Documents >   | ~ C    | Search Documents | م          |
| Organize ▼ New folder                                   |                         |        |                  | ≣ • ?      |
| 🗸 📮 This PC   | Name                    | Status | Date modified    | Туре       |
| > 📒 Desktop   | 🚞 Adobe                 |        | 21/09/2021 8:33  | File folde |
| > Documents   | 🚞 Arduino               |        | 18/03/2022 14:17 | File folde |
| > 🛓 Downloads   | Blackmagic Design       |        | 08/10/2021 16:19 | File folde |
| > 🔀 Pictures  | Bluetooth Folder        |        | 15/09/2022 16:42 | File folde |
| > 🚺 Videos  | Corel                   |        | 21/11/2021 19:05 | File folde |
| <ul> <li>Windows-SSD (C:)</li> <li>Data (D:)</li> </ul> | Custom Office Templates |        | 28/09/2021 13:58 | File folde |
| File name: Record12                                     | 0c                      |        |                  | ~          |
| Save as type: CSV Files                                 | (*.CSV)                 |        |                  | ~          |
| ∧ Hide Folders  |                         |        | Save             | Cancel     |

This is the output of the recorded file

|             | • <b>5</b> × ⊘ × ∓    |              |                          |           |               |       |          |                                |        |                              |                           |   |           | slab 4 N          | •  |                 |          |
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|             |                       | Page Layo    |                          | ulas Dat  | a Review      |       | Add-ins  | Help Ç                         |        | what you war                 |                           |   |           |                   |  |                 |          |
| Get<br>Data | From Text/CSV         | je           | nt Sources<br>ng Connect | Ref       | resh          |       |          | 2↓ <mark>X A</mark><br>X↓ Sort | Filter | Clear<br>Reapply<br>Advanced | Text to<br>Columns<br>Dat | III ⊂<br>III ⊂<br>IIII ⊂<br>III ⊂<br>IIII ⊂<br>III | Analysis  | Forecast<br>Sheet | <ul> <li>Group</li> <li>Ungro</li> <li>Subto</li> <li>Outling</li> </ul> | oup ∽ "∃<br>tal | s .      |
| 1           | • I ×                 | J.<br>-      | r Time                   | Stamp     |               |       |          |                                |        |                              |                           |   |           |                   |  |                 |          |
| 4           | A B                   | C            | D                        | E         | F             | G     | H        | 1                              | J      | K                            | L                         | M   | N         | 0                 | P  | Q               | R        |
| Т           | ime Stamp Voltage[1   | ] Current[1] | Notes                    | Voltage[2 | 2] Current[2] | Notes | Voltage[ | 3] Current[3                   | Notes  | Voltage[4                    | ] Current[4               | ] Notes   | Voltage[5 | 5] Current[5      | Notes  | Voltage[        | 6] Curre |
|             | 20:29:19 1.111 V      | 9.1 mA       | Fan1                     | 1.053 V   | 9.17 mA       | Fan2  | 1.125 V  | 9.12 mA                        | Motor1 | 1.107 V                      | 9.12 mA                   | Motor2  | 1.099 V   | 9.07 mA           | Sensor1  | 1.112 V         | 9.05     |
|             | 20:29:20 1.111 V      | 9.07 mA      | Fan1                     | 1.053 V   | 9.17 mA       | Fan2  | 1.125 V  | 9.12 mA                        | Motor1 | 1.107 V                      | 9.12 mA                   | Motor2  | 1.099 V   | 9.07 mA           | Sensor1  | 1.112 V         | 9.05     |
|             | 20:29:21 1.111 V      | 9.1 mA       | Fan1                     | 1.053 V   | 9.17 mA       | Fan2  | 1.125 V  | 9.12 mA                        | Motor1 | 1.107 V                      | 9.12 mA                   | Motor2  | 1.1 V     | 9.07 mA           | Sensor1  | 1.112 V         | 9.05     |
|             | 20:29:22 1.111 V      | 9.1 mA       | Fan1                     | 1.053 V   | 9.17 mA       | Fan2  | 1.125 V  | 9.12 mA                        | Motor1 | 1.107 V                      | 9.12 mA                   | Motor2  | 1.099 V   | 9.07 mA           | Sensor1  | 1.112 V         | 9.05     |
|             | 20:29:23 1.111 V      | 9.1 mA       | Fan1                     | 1.053 V   | 9.17 mA       | Fan2  | 1.125 V  | 9.12 mA                        | Motor1 | 1.107 V                      | 9.12 mA                   | Motor2  | 1.1 V     | 9.07 mA           | Sensor1  | 1.112 V         | 9.05     |
|             | 20:29:24 1.111 V      | 9.1 mA       | Fan1                     | 1.053 V   | 9.17 mA       | Fan2  | 1.125 V  | 9.12 mA                        | Motor1 | 1.107 V                      | 9.12 mA                   | Motor2  | 1.1 V     | 9.07 mA           | Sensor1  | 1.112 V         | 9.05     |
|             | 20:29:25 8.716 V      | 71.8 mA      | Fan1                     | 1.054 V   | 9.17 mA       | Fan2  | 1.125 V  | 9.12 mA                        | Motor1 | 1.107 V                      | 9.12 mA                   | Motor2  | 1.1 V     | 9.07 mA           | Sensor1  | 1.112 V         | 9.05     |
|             | 20:29:26 8.716 V      | 71.8 mA      | Fan1                     | 1.054 V   | 9.17 mA       | Fan2  | 1.125 V  | 9.12 mA                        | Motor1 | 1.107 V                      | 9.12 mA                   | Motor2  | 1.1 V     | 9.07 mA           | Sensor1  | 1.112 V         | 9.05     |
| 1           | 20:29:27 8.716 V      | 71.8 mA      | Fan1                     | 1.054 V   | 9.17 mA       | Fan2  | 1.125 V  | 9.12 mA                        | Motor1 | 1.107 V                      | 9.12 mA                   | Motor2  | 1.1 V     | 9.07 mA           | Sensor1  | 1.112 V         | 9.05     |
|             | 20:29:28 8.716 V      | 71.8 mA      | Fan1                     | 8.699 V   | 76.37 mA      | Fan2  | 1.125 V  | 9.12 mA                        | Motor1 | 1.109 V                      | 9.15 mA                   | Motor2  | 1.1 V     | 9.07 mA           | Sensor1  | 1.112 V         | 9.05     |
|             | 20:29:29 8.717 V      | 71.8 mA      | Fan1                     | 8.699 V   | 76.35 mA      | Fan2  | 1.125 V  | 9.12 mA                        | Motor1 | 1.109 V                      | 9.15 mA                   | Motor2  | 1.1 V     | 9.07 mA           | Sensor1  | 1.112 V         | 9.05     |
|             | 20:29:30 8.717 V      | 71.8 mA      | Fan1                     | 8.699 V   | 76.35 mA      | Fan2  | 1.125 V  | 9.12 mA                        | Motor1 | 1.109 V                      | 9.15 mA                   | Motor2  | 1.1 V     | 9.07 mA           | Sensor1  | 1.112 V         | 9.05     |
|             | 20:29:31 8.717 V      | 71.8 mA      | Fan1                     | 8.699 V   | 76.35 mA      | Fan2  | 1.156 V  | 9.35 mA                        | Motor1 | 1.109 V                      | 9.12 mA                   | Motor2  | 1.1 V     | 9.07 mA           | Sensor1  | 1.112 V         | 9.05     |
|             | 20:29:32 8.717 V      | 71.8 mA      | Fan1                     | 8.699 V   | 76.35 mA      | Fan2  | 1.372 V  | 11.15 mA                       | Motor1 | 1.109 V                      | 9.15 mA                   | Motor2  | 1.1 V     | 9.07 mA           | Sensor1  | 1.112 V         | 9.05     |
|             | 20:29:33 8.717 V      | 71.8 mA      | Fan1                     | 8.699 V   | 76.35 mA      | Fan2  | 1.372 V  | 11.15 mA                       | Motor1 | 1.475 V                      | 12.2 mA                   | Motor2  | 1.1 V     | 9.07 mA           | Sensor1  | 1.114 V         | 9.05     |
| 1           | 20:29:34 8.716 V      | 71.8 mA      | Fan1                     | 8.699 V   | 76.35 mA      | Fan2  | 1.372 V  | 11.15 mA                       | Motor1 | 1.474 V                      | 12.2 mA                   | Motor2  | 1.1 V     | 9.07 mA           | Sensor1  | 1.112 V         | 9.05     |
|             | 20:29:35 8.717 V      | 71.8 mA      | Fan1                     | 8.699 V   | 76.35 mA      | Fan2  | 1.372 V  | 11.15 mA                       | Motor1 | 1.475 V                      | 12.2 mA                   | Motor2  | 2.148 V   | 17.75 mA          | Sensor1  | 1.114 V         | 9.05     |
| 1           | 20:29:36 8.716 V      | 71.77 mA     | Fan1                     | 8.699 V   | 76.35 mA      | Fan2  | 1.372 V  | 11.15 mA                       | Motor1 | 1.475 V                      | 12.2 mA                   | Motor2  | 2.441 V   | 20.22 mA          | Sensor1  | 1.72 V          | 13.8     |
| 1           | 20:29:37 8.716 V      | 71.77 mA     | Fan1                     | 8.699 V   | 76.35 mA      | Fan2  | 1.372 V  | 11.15 mA                       | Motor1 | 1.475 V                      | 12.2 mA                   | Motor2  | 2.441 V   | 20.22 mA          | Sensor1  | 3.7 V           | 30.2     |
| 1           | 20:29:38 8.716 V      | 71.77 mA     |                          | 8.699 V   | 76.35 mA      | Fan2  | 1.372 V  | 11.15 mA                       | Motor1 | 1.475 V                      | 12.2 mA                   | Motor2  | 2.441 V   | 20.22 mA          | Sensor1  | 3.7 V           | 30.2     |
|             | Record120             | (+)          |                          |           |               |       |          |                                |        | 1                            |                           |   |           |                   |  |                 | Þ        |
| adv         | ( Accessibility: Unav | ilable       |                          |           |               |       |          |                                |        |                              | <b>Dia</b>                | play Settings   | Ħ         | e m               |  |                 | + 100    |

#### Settings

Click the 'Settings' button (B11).



The 'Settings' feature consists of:

• Set the maximum limit for both current and/or voltage values



Important note: When you input the values, always press 'Enter'.

Set the range for voltage values where you can choose the voltage range to limit the voltage values (B22, B23, and B25), the range of voltages are ±2.5 V, ±5 V, ±10 V, and ±16 V. Each range has 16-bit precision. The set range setting is also restricting the set limit setting, so the limit cannot exceed the range.

| Set Volt         | age Rar               | nde            |                | nicslab            | 1-20 | 21-40        | 41-60 61-8           | 0 81-100 | 101-120 |                  |            |   |                  |      |
|------------------|-----------------------|----------------|----------------|--------------------|------|--------------|----------------------|----------|---------|------------------|------------|---|------------------|------|
|                  |                       | .90            |                |                    | SW   | Channel Loci | k Voltage            | Current  |         | Voltage Settings |            | G | Eurrent Settings | Note |
|                  |                       |                |                |                    | ON   |              | 00.000 V             |          |         | 25               |            |   |                  |      |
|                  |                       |                |                | Status : Connected | ON   |              |                      |          |         | 5                |            |   |                  |      |
| ings             |                       |                | - 0            |                    |      |              | 00.000 V             |          |         | 5                |            |   |                  |      |
| Set Limit Set Ra | nge Set Reading Speed | Terminal       |                | Value Increment    | ON   |              | 00.000 V             |          |         | 5                |            |   |                  |      |
|                  | Sectored Speed        | ICTION &       |                | <b></b> 💿 🚥 🔿      |      | 5 🛛          | 00.000 V             | 00.00 mi |         | 5                |            |   |                  |      |
| foltage          |                       |                |                |                    | - 01 |              | 00.000 V             | 00.00 mi |         | 5                |            |   |                  |      |
| 1-20 21-40       | 41-60 61-80           | 81-100 101-120 |                | SAVE UPLOAD        |      | 7 🛛          | 00.000 V             |          |         | 25               |            |   |                  |      |
|                  |                       |                |                |                    |      |              | 00.000 V             |          |         | · •              |            |   |                  |      |
| : 📧 🗉 💷 V        | 6 24 💽 🖬 🖬 V          | 11 28 5 💽 19 V | 16 28. 5 💷 📧 V | Auto Mode          |      | 9 🖸          | 00.000 V             | 00.00 mi |         | 5                |            |   |                  |      |
|                  | • 🖬 🖬 🖬 •             |                |                |                    |      | 10           | 00.000 V             | 00.00 mi |         |                  | - <b>1</b> |   |                  |      |
|                  |                       |                |                | CV SEQUENCE        |      | 11 O<br>12 O | 00.000 V<br>00.000 V |          |         | 5                |            |   |                  |      |
| 2 II 💽 💌 🖬 V     | 7 🔝 🗈 🕫 🖬 V           | 12 💷 💽 🗯 🖬 V   | 17 23 🐿 🔽 🕫 V  |                    |      | 12 U         | 00.000 V             | 00.00 mi |         | 25               |            |   |                  |      |
|                  |                       |                |                | CC SEQUENCE        |      | 13 U<br>14 O | 00.000 V             | 00.00 mi |         |                  | _          |   |                  |      |
| 3 AA 🛯 💌 W V     | 8 AA 💶 🖬 🖬 V          | 13 💷 🗉 🖼 V     | 18 AA 💽 🔍 🕨 V  | RUN                |      | 15 0         | 00.000 V             | 00.00 m  |         |                  |            |   |                  | _    |
| , c              |                       |                |                |                    |      | 16 0         | 00.000 V             | 00.00 mi |         | 5 0              |            |   |                  |      |
|                  |                       |                |                | Sequence :         |      | 17 0         | 00.000 V             | 00.00 mi |         | 5                |            |   |                  |      |
| 4 💷 🔳 📧 V        | 9 IA 🗈 🔜 🖬 V          | 14 == 💽 📼 🖬 V  | 19 💶 🛋 🖬 🖬 V   |                    | - 0  | 18 0         | 00.000 V             | 00.00 m  |         | 5                |            |   |                  |      |
|                  |                       |                |                | Recording each     |      | 19 0         | 00.000 V             | 00.00 mi |         | 25               |            |   |                  |      |
|                  |                       |                |                | 1 tecond           |      | 20 0         | 00.000 V             | 00.00 mi |         | 5 0              |            |   |                  |      |
| 5 245 🗉 💌 W V    | 10 2.5 5 19 📧 V       | 15 28 🖪 🔚 🖬 ¥  | 20 25 💽 🔟 🕫 V  | RECORD             |      |              |                      |          |         |                  |            |   |                  |      |

Set the reading speed to adjust different speeds for reading voltage and current. The speed is • based on averaging the number of sample output values. There are three options which are Fast, Medium, and Slow. Faster options can make conversion time smaller but the results noisier.



Terminal to read the input from software to hardware and the corresponding hardware response. • This feature is useful to find problems with the hardware or software.

| Settings              |                             |                   | -        | × |
|-----------------------|-----------------------------|-------------------|----------|---|
| Set Limit             | Set Range                   | Set Reading Speed | Terminal |   |
| This is Terminal      |                             |                   |          |   |
| GUI Command and Hardw | are Response will appear he | re                |          |   |
|                       |                             |                   |          |   |
|                       |                             |                   |          |   |
|                       |                             |                   |          |   |
|                       |                             |                   |          |   |
|                       |                             |                   |          |   |
|                       |                             |                   |          |   |
|                       |                             |                   |          |   |
|                       |                             |                   |          |   |
|                       |                             |                   |          |   |
|                       |                             |                   |          |   |
|                       |                             |                   |          |   |
|                       |                             |                   |          |   |
|                       |                             |                   |          |   |

Terminal

Speed

# 4. Operating XDAC through SCPI command

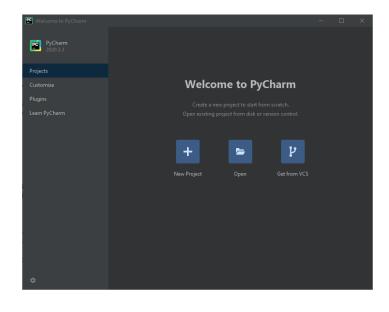
This section set guidelines to help you develop a program for any language that suits you best. As an example, we give the Python example.

#### Python Installation (Example)

Please follow the steps below for dynamic programming using the SCPI command through Python via TCP/IP.

The following Python versions and packages need to be installed:

- 1. Python 2.7 or Python 3.X (download and install the latest version from <u>www.python.org</u>). \*Tested with Python 3.9.
- 2. PyCharm 2017.3.4 or the latest version (download and install the latest version from <a href="https://www.jetbrains.com/pycharm/">https://www.jetbrains.com/pycharm/</a>)



# Run Python Code (Example)

To run the Python code please follow the steps below:

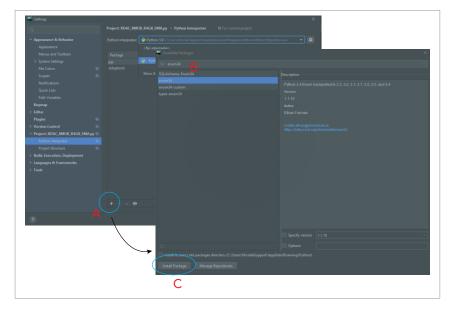
1. Open PyCharm software and open file example (e.g XDAC-8MUB-R4G8-SMA.py)

| Velcome to PyCharm                    |                       |                 | – 🗆 ×            |
|---------------------------------------|-----------------------|-----------------|------------------|
| PyCharm<br>2020.3.3                   | Q. Search projects    | New Project Ope | n Get from VCS × |
| Projects                              | ♠⊒ ⊪,   ⊪, ×   S,   @ |                 | Hide path        |
| Customize<br>Plugins<br>Learn PyCharm | Dati                  |                 | MUB_R4G8_SMA.py  |
|                                       | > tari<br>Dega        |                 | OK Cancel        |
| \$                                    |                       |                 |                  |

2. Configure the Python interpreter (see figure below) by clicking Configure Python Interpreter link on the drop-down menu, or in File >> Settings >> Project Interpreter.

| Eile Edit View Navigate XDAC_8MUB_R468_SMA.py  | <u>C</u> ode <u>R</u> efactor R <u>u</u> n <u>T</u> ools VCS <u>W</u> indow   | Help XDAC_8MUB        | _R4G8_SMA.py - XDAC_8MUB_R4G8_SMA.py  |      | – □ ×   |
|--|---|-----------------------|---|------|---|
|  | Settings  |                       |   |      |   |
| 몇  |   | Project: XDAC_8M      | UB_R4G8_SMA.py > Python Interpreter   |      | Configure Python interpreter 💠                  |
| III Extend Libraries<br>Scratches and Consoles | <ul> <li>Appearance &amp; Behavior</li> <li>Appearance</li> <li>Appearance</li> <li>Appearance</li> <li>Appearance</li> <li>Appearance</li> <li>Stations</li> <li>Stations</li> <li>Quick Lists</li> <li>Path Variables</li> <li>Keymap</li> <li>Editor</li> <li>Version Control</li> <li>Version Control</li> <li>Version Control</li> <li>Project: XDAC_BMUB_R4G8_SMA_pry</li> <li>Poject Structure</li> <li>Build, Execution, Deployment</li> <li>&gt; Languages &amp; Frameworks</li> <li>&gt; Tools</li> </ul> |                       | Python 39 C/UVerrYHICItbS/upportAppOstalLocal/Programs/lython     No interpreter?     Python 39 C/UVerrYHICItbS/upportAppOstalLocal/Programs/lython     Show AlL. |      | Indexing  |
|  |   |                       |   |      | -   |
| * Favorites                                    |   |                       |   |      |   |
|  | Terminal Python Console<br>rred as the project interpreter // Configure a Pythe   | on interpreter (momer | its ago)  | 7:19 | 1 Event Log<br>CRLF UTF-8 4 spaces Python 3.9 🍗 |

- 3. Install additional packages, for example enum34, by:
  - A. Clicking '+' button
  - B. Search and choose enum34
  - C. Install all the packages.



4. The packages for the Python Interpreter are listed in the green rectangle.

|                                 | Project: XDAC_8MUB_R40  | 58_SMA.py > Python Interpreter 🧧             |  |
|---------------------------------|-------------------------|--|--|
| Appearance & Behavior           | Python Interpreter: 🍦 P | ython 3.9 C:\Users\NicslabSupport\AppData\Lo |  |
| Кеутар                          |                         |  |  |
|                                 |                         |  |  |
| Plugins                         |                         |  |  |
|                                 |                         |  |  |
| Project: XDAC_8MUB_R4G8_SM      | A.py 👜 pip              |  |  |
| Python Interpreter              |                         |  |  |
| Project Structure               | setuptools              |  |  |
| Build, Execution, Deployment    |                         |  |  |
|                                 |                         |  |  |
| Languages & Frameworks<br>Tools |                         |  |  |
|                                 |                         |  |  |
|                                 |                         |  |  |
|                                 |                         |  |  |

- 5. Select Python Configuration and choose the file name.
- 6. Run the file by clicking the green arrow button on the top right corner to test the XDAC (Please refer to the code and SCPI commands references).

#### Python Function (Example)

1. Input IP Address

XDAC IP = "169.254.xx.xx"

2. Unlock and Lock XDAC

```
print(unlock("XDACkey"))
lock()
note: You must unlock your XDAC first before you can use
```

#### 3. <u>Set XDAC voltage range for all channels and measurement mode</u>

setXDAC(voltRange, voltReadingMode, currentReadingMode )
voltRange (int list): List for all channels range
voltReadingMode (string): "FAST" or "MEDIUM" or "SLOW"
currentReadingMode (string): "FAST" or "MEDIUM" or "SLOW"
Example:

AllRValues = [5, 5, 6, 7,5, 5, 7,4] setXDAC(AllRValues, "FAST", "SLOW")

#### 4. Set Voltage for single channel

setChannelVoltage(channel, voltageVal)
channel (int): channel number
voltageVal (float): -16 - +16 V
Example:
SetChannelVoltage(1, 15)
#Set voltage to 15 V In channel 1

#### 5. <u>Set Current for single channel</u>

setChannelCurrent(channel, currentVal)
channel (int): channel number
currentVal (float): 5 - 500 mA

Example:

```
SetChannelCurrent(1, 200)
#Set current to 200 mA in channel 1
```

#### 6. <u>Set Voltage Range for single channel</u>

```
setChannelVoltangeRange(channel, range)
channel (int): channel number
range (int): 4 - 7
Description:
4: -2.5 - 2.5 V
5: -5 - 5 V
6: -10 - 10 V
7: -16 - 16 V
```

#### 7. <u>Set for all channels</u>

setVoltageAllChannels(AllVValues)
AllVValues (float array): voltage values in an array (V)
setCurrentAllChannels(AllCValues)
AllCValues (float array): current values in an array (mA)
setRangeAllChannels(AllRValues)
AllRValues (float array): range values in an array
Example:
AllCValues = [100, 150, 100, 50, 200, 10, 10]
AllVValues = [20.1, 2.5, 13.0, 4, 5, 10.5, 9.5, 22]
AllRValues = [5, 5, 6, 7,5, 5, 7,4]
setRangeAllChannels(AllRValues)
setVoltageAllChannels(AllVValues)

setCurrentAllChannels(AllCValues)

#### 8. <u>Set OFF for single channel</u>

setOff(channel)
channel (int): channel number

#### 9. <u>Set averaging method and count for measurement</u>

setReadingModeVoltage(mode, count)
setReadingModeCurrent(mode, count)
count (int): number of measurements to be averaged
mode (string): "MOVING" or "REPEAT"
Example:
mode: "MOVING", count: 5
#n : read #n from sensor
[#1, #2, #3, #4, #5 ] ⇒ averaged ⇒ reading #1
[#2, #3, #4, #5, #6 ] ⇒ averaged ⇒ reading #2
mode: "REPEAT", count: 5
#n : read #n from sensor
[#1, #2, #3, #4, #5 ] ⇒ averaged ⇒ reading #1
[#6, #7, #8, #9, #10 ] ⇒ averaged ⇒ reading #2

# 10. <u>Read voltage or current for single channels</u> readSingleChannelVoltage (channel) readSingleChannelCurrent (channel) channel (int): channel number Return value of voltage or current in one channel

# 11. <u>Read measurement values for all channels</u> readAllChannelVoltage() Return list of voltage from all channels readAllChannelCurrent() Return list of current from all channels

- 12. Set one channel to run automatically and record it sweepOne(channel, seqValueV, seqValueC, duration) channel (int): channel number seqValueV: voltage values in an array (V) seqValueC: current values in an array (mA) duration (int): duration in seconds
- 13. <u>Shutdown</u>

shutdown()

#### **SCPI** Commands

The XDAC can be controlled using Standard Commands for Programmable Instruments (SCPI). To initialize the SCPI commands, you need to import ZMQ library. Then you must use Req-Rep mode in port "5555". After that you can type your commands and send it to the XDAC. You can see the example below:



Description: Unlock XDAC by XDAC Key

Format:

GETINFO:KEY

Example 1: Unlock XDAC with XDAC Key: nicslab.

GETINFO:nicslab

Description: Lock XDAC

Format:

LOCK

Series XDAC-120MUB-R4G8

#### Description: Set output voltage for single channel

Format: SETV:CHANNEL:VOLT Example 1: Set the output of channel 1 to 16 V. SETV:1:16 Example 2: Set the output of channel 3 to -12.5 V. SETV:3:-12.5

Description: Set output current for single channel

Format:

SETV:CHANNEL:CURRENT

Example 1: Set the output of channel 1 to 500 mA.

SETC:1:500

Example 2: Set the output of channel 3 to 50 mA.

SETC:3:50

#### Description: Set output voltage range for single channel

#### Format:

SETR:CHANNEL:RANGE

Range (int): 4 - 7

4 = -2.5 - 2.5 V

5 = -5 - 5 V

6 = -10 - 10 V

7 = -16 – 16 V

Example 1: Set the voltage range of channel 1 from -16 to 16 V.

SETR:1:7

Description: Read voltage of a single channel Format: MEASV:CHANNEL Example 1: Get the voltage output of channel 1 MEASV:1

Description: Read current of single channel Format: MEASC:CHANNEL Example 1: Get the current output of channel 1 MEASC:1

#### Description: set averaging mode and count of voltage measurement

Format:

MEASV:MODE:COUNT

Example 1: Set voltage measurement averaging to repeat mode and count 100.

MEASV:REPEAT:100

Example 2: Set voltage measurement averaging to moving mode and count 5. MEASV:MOVING:5

#### Description: set averaging mode and count of current measurement

Format:

MEASC:MODE:COUNT

Example 1: Set current measurement averaging to repeat mode and count 100.

MEASC:REPEAT:100

Example 2: Set current measurement averaging to moving mode and count 5.

MEASC:MOVING:5

Description: Set zero voltage for a single channel

Format:

ZERO:CHANNEL

example: Set zero of channel 1

ZERO:1

Description: Shutdown System

Format:

EXIT

# 5. System Shutdown

This section describes how to shut down the XDAC-120MUB-R4G8.

In the case of using GUI, the steps are as follows:

- 1. Set OFF all the channels in the GUI.
- 2. Press the ON/OFF Button in GUI (B1, Figure 4). It will change the color of the button from green to grey.
- 3. Close the GUI application (it will soft shut down the program inside the XDAC-120MUB-R4G8).
- 4. Press the power switch (A1, Figure 3).
- 5. Turn off or disconnect the DC Power Supply.

In the case of using SCPI Command, the steps are as follows:

- 1. Use setOff(channel) function to set off the channel used before.
- 2. Use lock() and shutdown() functions to soft shut down the program inside the XDAC-120MUB-R4G8.
- 3. Press the power switch (A1, Figure 3).
- 4. Turn off or disconnect the DC Power Supply.

NOTE: Once the soft shutdown occurred, the Blue led will be turned off, and XDAC-120MUB-R4G8 cannot directly be used again, since the system is not ready (refers to The voltage control resolution is listed in Table 5 below. The resolution is 16-bits and have different value for each range. The default range is ±20 V (±16 V) and can be adjusted in GUI premium version.

| No | Range         | Resolution |
|----|---------------|------------|
| 1  | ±20 V (±16 V) | 0.6 mV     |
| 2  | ±10 V         | 0.3 mV     |
| 3  | ±5 V          | 150 μV     |
| 4  | ±2.5 V        | 76 µV      |

| Table 5. Vo | oltage Co | ntrol Resolutio | n |
|-------------|-----------|-----------------|---|
|-------------|-----------|-----------------|---|

The current control resolution is listed in Table 6 below. The resolution is 16-bits and have a fixed range of 0 – 500 mA. The controllable range is 5 – 500 mA.

Table 6. Current Control Resolution

| No | Range | Resolution |
|----|-------|------------|

| 1 | 0 – 500 mA | 7.6 µA |
|---|------------|--------|
|   |            | •      |

Hardware Installation clause 7). To use XDAC-120MUB-R4G8 after a soft shutdown occurred, restart the power from DC Power Supply (using button A8 or unplug and plug the DC Power Supply).

# 6. Troubleshooting

Please use the following guidelines to identify a particular problem. If the solution does not rectify the problem, contact us at <u>support@nicslab.com</u>.

| Problem   | Cause                                | Solution  |
|---|--------------------------------------|---|
| Failed to connect at GUI  | The DC power supply is OFF           | Turn ON the DC power supply and switch ON the power   |
| Failed to connect at GUI  | The switching power is<br>OFF        | Switch ON the power   |
| Failed to connect at GUI  | No Green light (no<br>data transfer) | Restart the GUI   |
| The Green light offs when<br>software is active or software<br>freeze | Initialization failed                | Restart the software, or unplug -<br>plug the USB/Ethernet<br>connector, or Press the Reset<br>Button |
| No channel output detected at the device under test                   | Connection failed                    | Check the metal pad checkpoint to the intended channel  |
| Unable to upload the file   | File format problem                  | Make sure the file format is .csv   |
| No value after uploading the file                                     | File problem                         | Check the file content, and<br>make sure there is no blank<br>space on each row.                      |
| Unable to use the Auto Mode<br>feature                                | File format problem                  | Check file format. It should be a<br>CSV file.<br>Check content format                                |

#### Table 7. Troubleshooting

# 7. Warranty

Nicslab warrants the hardware and software designed by Nicslab to work accordingly, fulfilling the highest standard of a quality product. Nicslab is not liable for consequential or incidental damages for errors in subject to misuse, neglect, accident, modification, use in critical operation, or has been soldered or altered in any way outside stated by us or unauthorized maintenance.

Nicslab retains to change the material and technical data of this manual at any time without notice, in future editions.

Please do not hesitate to contact us at support@nicslab.com if you would like to have more information on the warranty or return and refund policy.

# 8. Compliance

This product complies with the requirements of the European Union's *Conformite Europenne* (CE) and Restriction of Hazardous Substances in Electrical and Electronic Equipment (RoHS) Directive 2015/863 (RoHS3). The certificates can be accessed <u>here</u>.

## 9. Contact

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Book Meeting <u>here</u>.