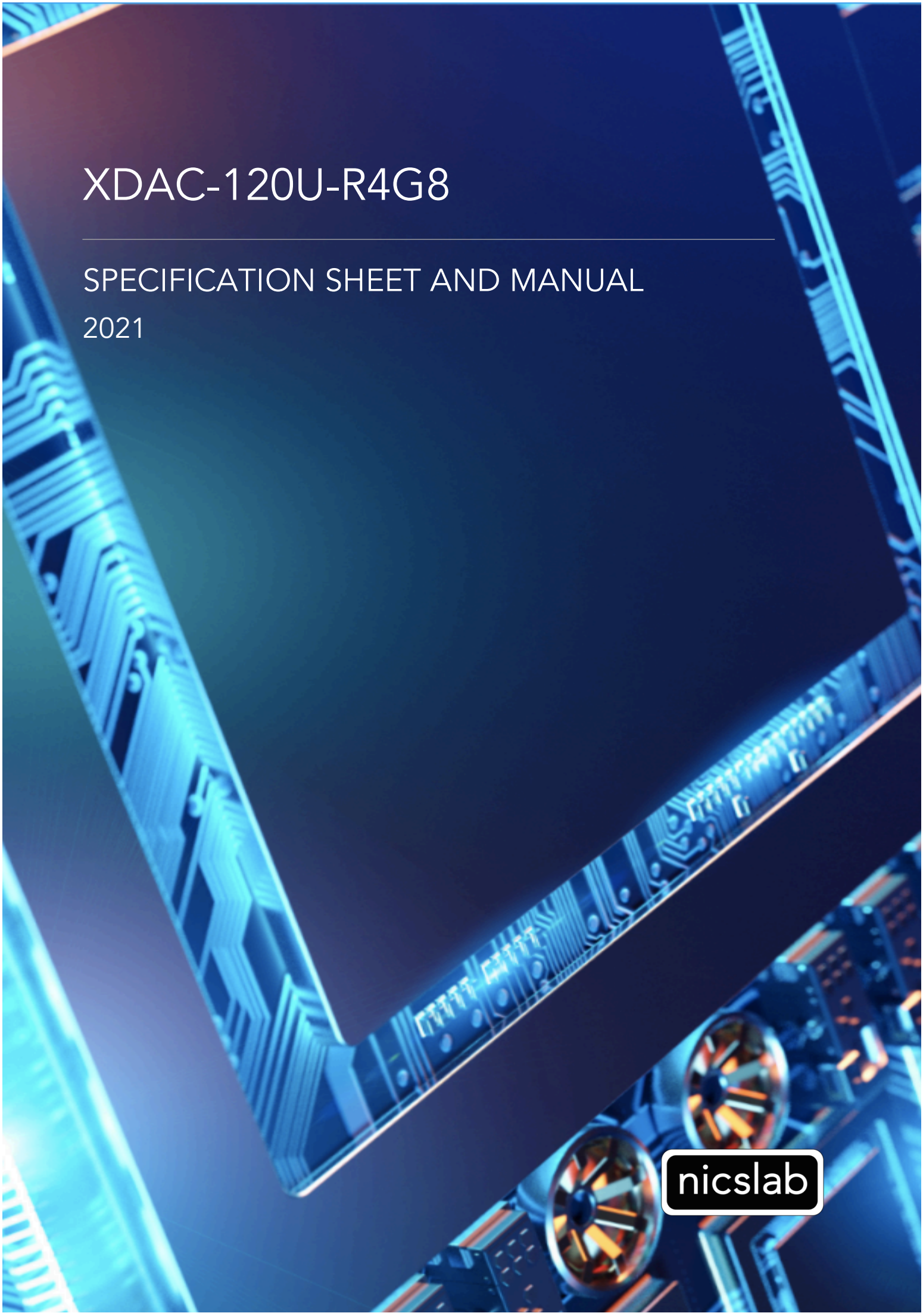
XDAC-120U-R4G8

SPECIFICATION SHEET AND MANUAL

2021



Version: 3.0
Date: 28 September 2021

Important Notice and Disclaimer:

This product is designated for skilled user. You are entirely responsible for (1) choosing the appropriate Nicslab products for your operation, (2) designing, validating and testing your operation, (3) ensuring your operation meets applicable standards, and any other safety, security or other requirements.

Safety Note

Do not operate this product in any manner not specified by Nicslab. Failure to comply with these precautions or with specific warnings or instructions elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Nicslab assumes no responsibility for any damage caused by mishandling that is beyond normal usage defined in this manual of this product.

Before Applying DC Power Supply

Verify that DC power supply is 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 38 V or it can impair this product. Make all connections to the unit before applying power.

Do Not Discard the Instrument Cover

Only authorized personnel from Nicslab should remove the instrument cover.

Do Not Alter the Instrument

Do not put any unauthorized parts or modify the instrument without Nicslab approval and warranty.

Caution

This symbol indicates 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-120U-R4G8 system is a versatile multichannel source measurement system. The XDAC-120U-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-120U-R4G8 provides independent 120 channels controlled by GUI and SCPI through Ethernet port. The system has two modes: Constant Current (CC) ranging from 0 to 300 mA per channel and Constant Voltage (CV) ranging from unipolar 0-36 Volt.

The features for XDAC-120U-R4G8 in details are:

- 16-bits voltage control.
- 16-bits current control.
- Enable voltage range configuration through software (technology that enables the user to select the output range with software without lose control of the high-resolution feature).
- Intuitive GUI.
- Multi-connectors according to your application
- Maximum power output per channel 10 Watt.
- Real time voltage and current reading.
- Save function to create 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# and LabVIEW).
- SCPI Library *(Premium Upgrade)*.
- Windows, Mac, and Linux support.
- USB port with USB line termination, filtering and ESD protection.
- Bi-directional EMI filtering prevents noise from entering/leaving the system.
- Compliance with IEC61000-4-2 ESD Protection for USB Port.
- Ethernet Port.

The XDAC-120U-R4G8 is connected with DC Power then you can plug into the Device-Under-Test (DUT). The voltage/current can be controlled through GUI or SCPI command via Ethernet port.

The system diagram is as follow:

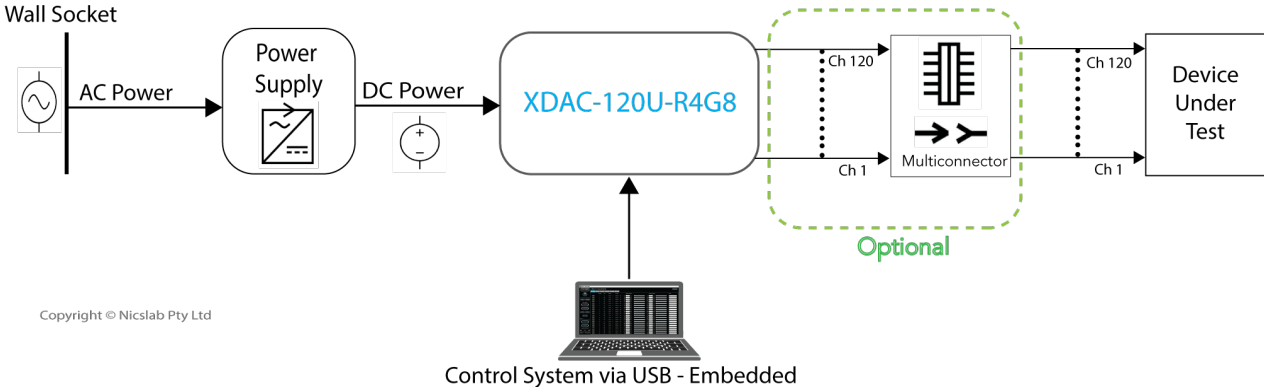

Figure 1. XDAC-120U-R4G8 System Diagram

The package should include the following items:

No	Item	Qty (pc)	Checklist
1	XDAC-120U-R4G8 Box	1	
2	DC cable (Red, Green, Black)	3	
3	Multi-connector 6	1	
4	Ribbon rainbow cable	6	
5	Ethernet cable	1	
6	USB flash disk	1	
7	Inside USB flash disk: a. GUI b. Specification & Manual c. Test Report d. Serial key (Upgrade) e. Software Library (Premium) f. Template Excel (upload, demo sequence)	@1	

Table 1. Checklist Items

2. Hardware

Specification Conditions

The operating and measurement conditions are under the following conditions:

Items	Conditions
Room Temperature	0 ~ + 40°C
Humidity	5 ~ 80% (No Condensing)
Power Supply Input	DC Supply Max 38V (potential at red & black DC in). Required headroom 1.4 – 2 V.
Waterproof/Dustproof	To be operated under room condition
Calibration period	2 years

Table 2. Specification Conditions

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)
- RAM Min. 2 GB
- CPU 2.4 GHz or faster
- Ethernet port or internet connection via router

Box Descriptions

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

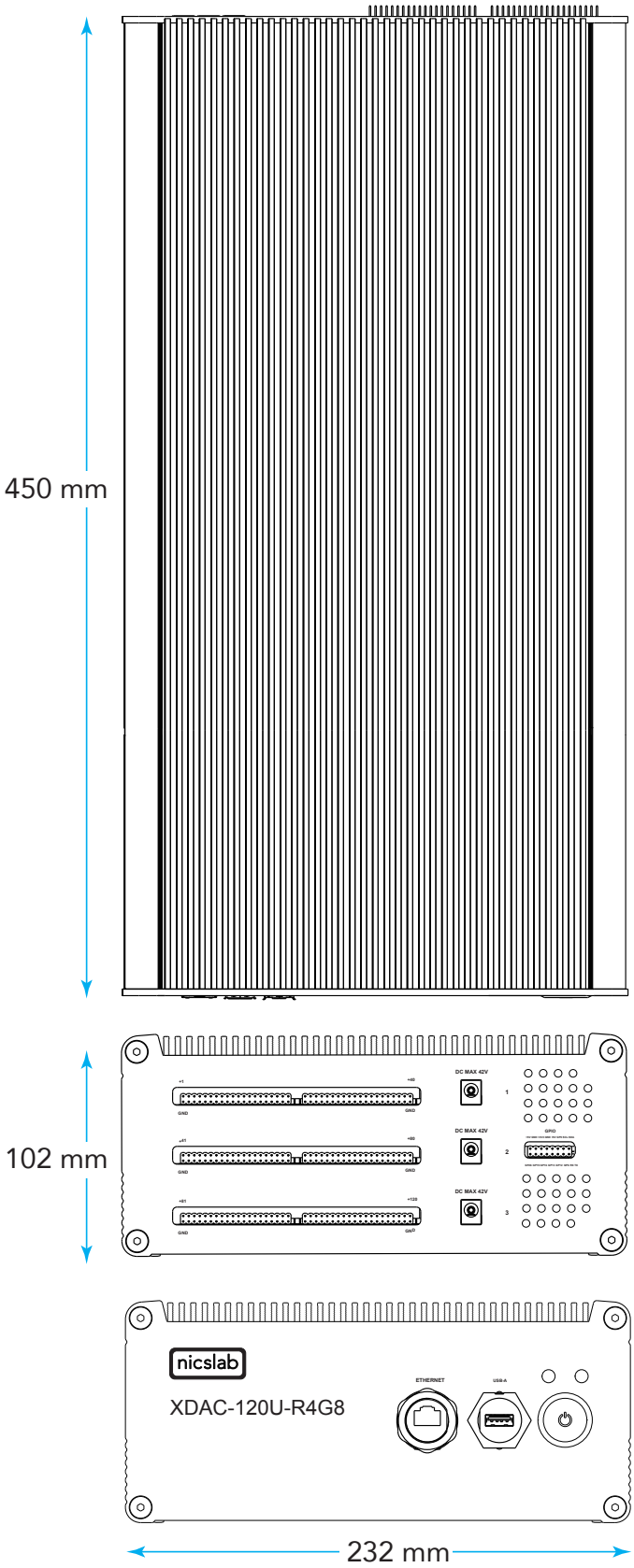

Figure 2. Product Dimension

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

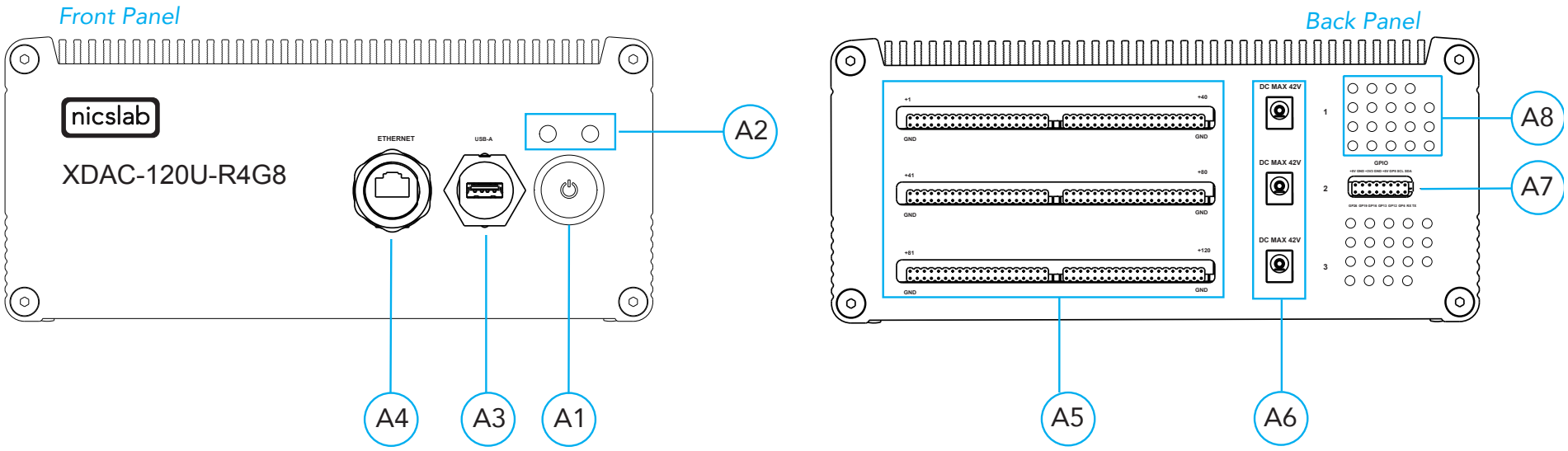

Figure 3. Front and Back Panel

Note:

A1	Power Switch	Turns the instrument on or off.
A2	Indicator Light	Green -> Power Indicator. Blue -> Serial Transfer Data Active.
A3	USB-A	USB port type A.
A4	Ethernet	Use ethernet cable to connect.
A5	Pin Output (40 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	Input DC Max 38V	Caution Please follow the safety notice on your DC power supply. Use only ONE DC power supply and the input is no more than 38 V.
A7	GPIO	You may use for external control and monitoring direct to microprocessor.
A8	Airflow	For air circulation inside the box.

XDAC-120U-R4G8 Specifications

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

No	Parameter	Min	Typ	Max	Unit	Test conditions/comments
1	Resolution	16			Bits	
2	Integral nonlinearity (INL)	-1	± 0.5	1	LSB	All ranges, except 0 to 40 & ±2.5V
3	Differential Nonlinearity (DNL)	-1	± 0.5	1	LSB	Specified 16-bit monotonic
4	Total unadjusted error	-0.1	± 0.01	0.1	%FSR	All ranges except ±2.5V
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	Full-scale error	-0.2	± 0.075	± 0.2	%FSR	All ranges
8	Gain error	-0.1	± 0.02	0.1	%FSR	All ranges except ±2.5V
9	Unipolar offset error drift		±2		ppm of FSR/°C	All unipolar ranges
10	Gain error drift		±2		ppm of FSR/°C	All ranges
11	Output voltage drift over time		5		Ppm of FSR	T_A = 40°C, Full-scale code, 1900 hours
DYNAMIC PERFORMANCE						
12	Output Voltage Settling Time		12		µs	¼ to ¾ and ¾ to ¼ scale setting time to ± 1 LSB, ±10V range, R_L = 5kΩ, C_L = 200pF
13	Slew Rate		4		V/µs	All range except 0 to 5V
14	Power-on glitch magnitude		0.3		V	Power-down to active DAC output, ±20V range, Midscale code, R_L = 5kΩ, C_L = 200pF
15	Output noise		15		µV p-p	0.1Hz to 10Hz, Midscale code, 0 to 5V range
16	Output noise density		78		nV/√Hz	1 kHz, Midscale code, 0 to 5V range
17	AC PSRR		1		LSB/V	Midscale code, frequency = 60Hz, amplitude 200 mVpp superimposed on V_{DD}, V_{CC} or V_{SS}
18	DC PSRR		1		LSB/V	Midscale code, V_{DD} = 5V, V_{CC} = 20V ±5%, V_{SS} = 20V
19	Code change glitch impulse		4		nV-s	1 LSB change around major carrier, 0 to 5V range
20	Channel to Channel AC crosstalk		4		nV-s	0 to 5V range. Measured channel at midscale. Full-scale swing on all other channels.
21	Channel to Channel DC crosstalk		0.25		LSB	0 to 5V range. Measured channel at midscale. All other channels at full-scale.
22	Digital feedthrough		1		nV-s	0 to 5V range, Midscale code, F_{SCLK} = 1MHz

Table 3. DAC Voltage Performance Specification

The performance specifications of Digital Analog Converter (DAC) current are listed in the table 4 below:

No	Parameter	Min	Typ	Max	Unit	Test conditions/comments
1	Resolution	16			Bits	
2	Monotonicity	16			Bits	
3	Differential Nonlinearity		± 0.2	± 1	LSB	
4	Integral Nonlinearity		± 12	± 64	LSB	
5	Offset Error Current		± 0.1	± 0.4	%FSR	
6	V= Temperature Coefficient		± 10		ppm/℃	
7	Gain Error		± 0.3	± 0.9	%FSR	300 mA Range
8	Gain Temperature Coefficient		30		%FSR	FSADJ = VCC
9	Total Unadjusted Error		± 0.4	± 1.4	%FSR	300 mA Range
10	Power Supply Rejection Ratio		± 2.2		LSB	100 mA; IOUT = 50 mA
11	DC Crosstalk		±14		LSB	Due to 200 mW Change in Dissipated Power
12	DC Performance					
13	VDROPOUT		1.15	1.751	V	300 mA Range
14	Hi-Z Output Leakage Current		0.1	1	μA	
AC CHARACTERISTIC						
16	tSET		4.7		μs	Settling time, Full-Scale 200 mA range
17	Glitch Impulse		180		pA.s	At Mid-Scale Transition, 200 mA Range
18	DAC-to-DAC Crosstalk		150		pA.s	100 mA to 200 mA Step, Rload = 15Ω
19	Inoise					Output Current Noise Density Internal Reference, Iout = 150 mA, Rload= 4Ω, Cload = 10μF
20			12			f = 1kHz
21			5		nA/√Hz	f = 10kHz
22			0.5	n	nA/√Hz	f = 100kHz
23			0.05		nA/√Hz	f = 1MHz

Table 4. DAC Current Performance Specifications

Hardware Installation

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

The steps are as follow:

1. Precondition step: connect to the DC power supply (max 38 V). Make certain that DC power supply is always 'ON'.
2. Connect an Ethernet cable to your router/ethernet workstation (PC/Laptop) via ethernet port.
3. Connect XDAC output to the multi-connector (optional, see the manual M6) and your Device Under Test (DUT).
4. After you install the software/GUI (see the Software Installation section), then the XDAC is ready to use by switching the ON/OFF button at the front panel.

3. Software and Graphical User Interface (GUI)

Software Requirement

The GUI software is suitable with the following operating systems:

- Windows® 7 (32-bit, 62-bit).
- Windows® 10 (32-bit, 62-bit).
- macOS Big Sur.

Starting the Software

First step is to copy the GUI file into your hard disk then double click 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 IP address. Please scan the XDAC IP address to know the XDAC IP. The XDAC IP address should appear if you scan it in local network using IP scanner such as Angry IP scanner or NMAP.

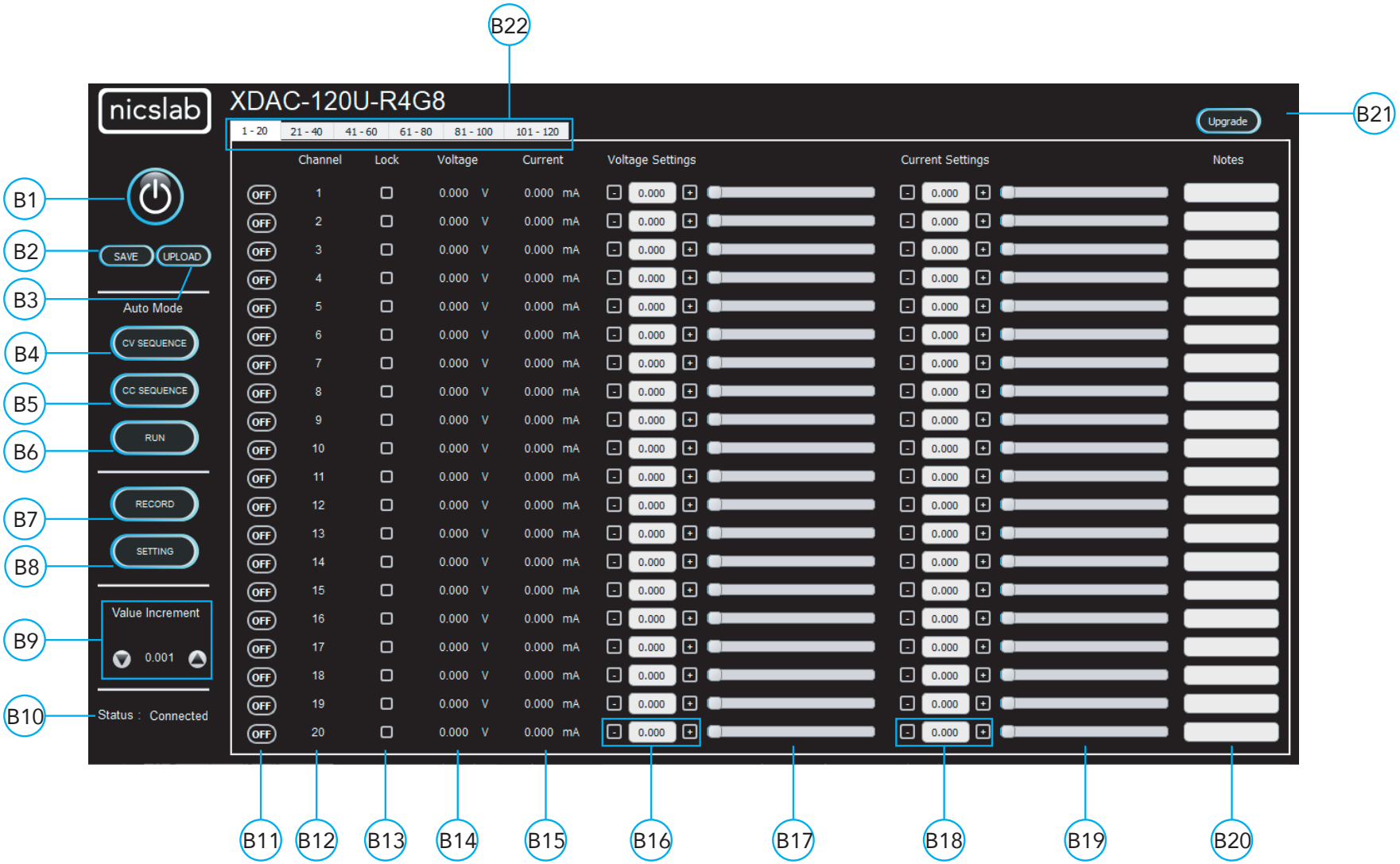

Figure 4. GUI

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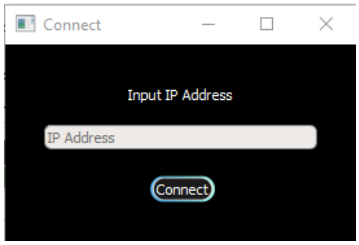
Note:

Callout	Description
B1	ON/OFF Switch
B2	Save File Button
B3	Upload File Button
B4	Auto Feature: Upload Table Button I CV Mode
B5	Auto Feature: Upload Table Button I CC Mode
B6	Auto Feature: Run Button
B7	Record Data Button
B8	Setting for: 1. Set Limit voltage and current values 2. V Range (16-bit precision for every range of voltages: 5, 10, 20, 40V)
B9	Increment Settings
B10	Status connection
B11	ON/OFF Button per Channel
B12	Number of channels
B13	Enable/Disable (Lock) Channel Controller
B14	Voltage Value
B15	Current Value
B16	Voltage Value Based on Increment Setting
B17	Voltage Settings Slider
B18	Current Value Based on Increment Setting
B19	Current Settings Slider
B20	Notes
B21	Upgrade Button
B22	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 IP address as given. If the connection is successful, then the GUI will open.

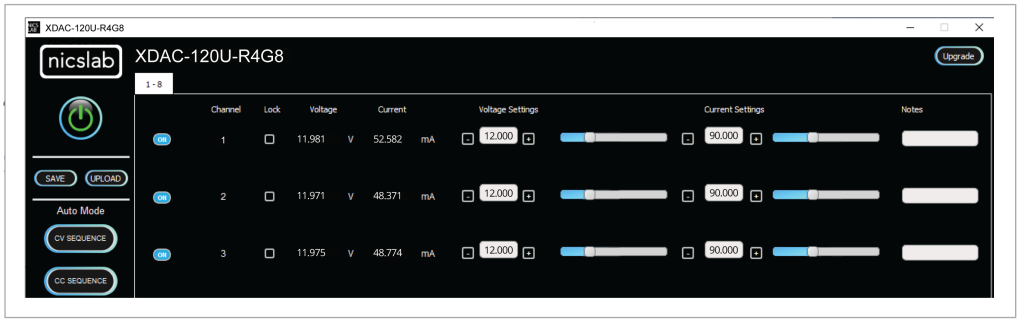


3. Press the 'ON/OFF' button (B1) to start the GUI.

4. Turn ON (B13) on each channel to input voltage and current values.

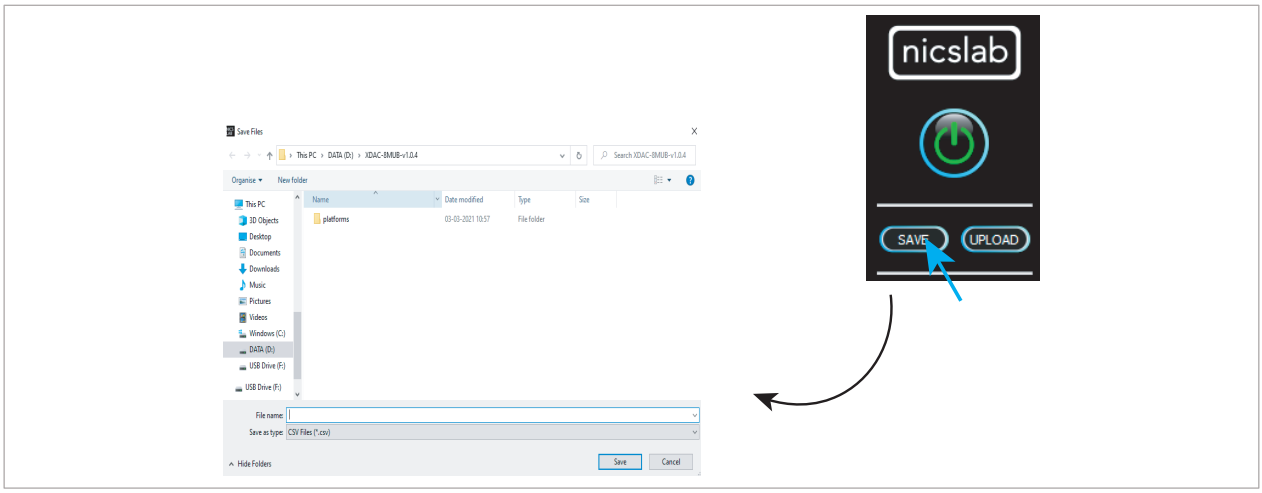
Constant Current (CC) Mode

To do CC mode, you have to adjust the voltage value (B18) or move the slider (B19), then set the current value (B20 or B21). As an example.



Save and Upload

You can save all the data in GUI by clicking the 'Save' button and the save file location will open.



You can upload the saved .csv file or your voltage and current setting values (.csv file template provided) by clicking the 'Upload' button.

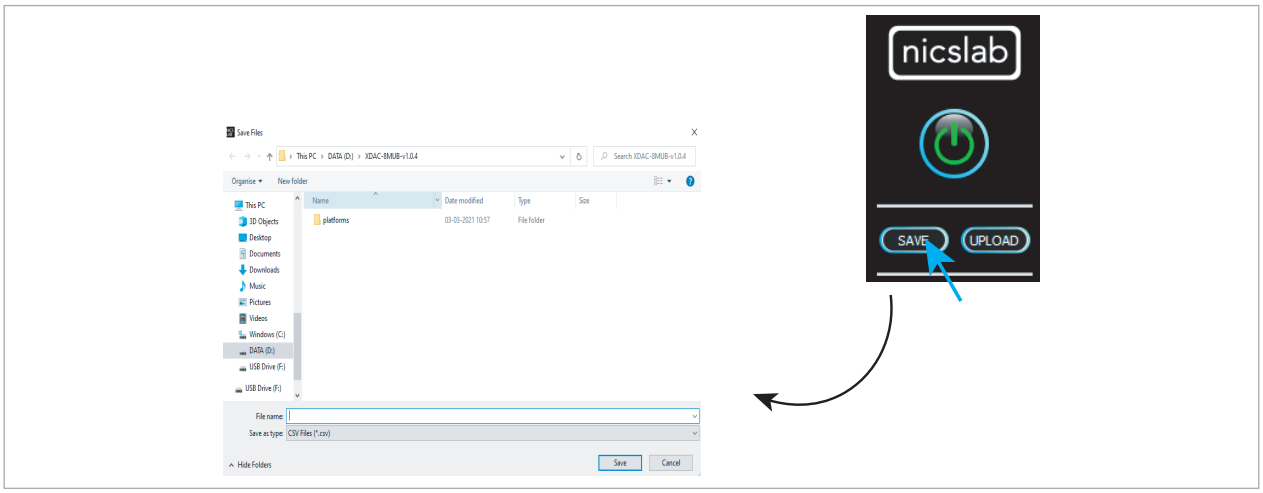
Constant Voltage (CV) Mode

To do CV mode, adjust the values on value settings (B18) or move the voltage slider (B19). You may also adjust the current settings or current slider to maximum value (300 mA).

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

Save and Upload

You can save all the data in GUI by clicking the 'Save' button and the save file location will open.

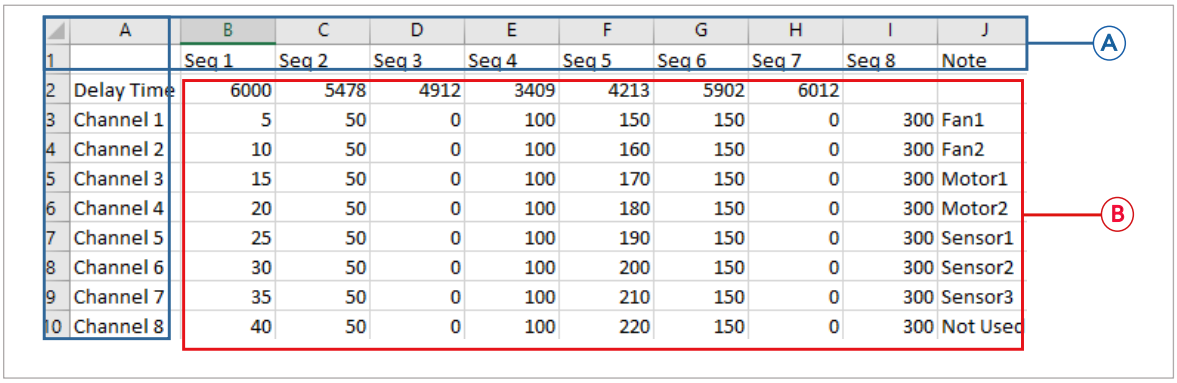


You can upload the saved .csv file or your voltage and current setting values (.csv file template provided) by clicking the 'Upload' button.

Auto Mode - Sequence

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

1. The template of Sequence is given, then you need to input your intended values of CC Sequence (300 mA), CV Sequence (40 V) and Delay Time (in millisecond). Set the delay time more than 2 seconds to have more accurate values. To have faster response (switching time) you can set via SCPI command.



	A	B	C	D	E	F	G	H	I	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: 300 mA, CV: 40 V).

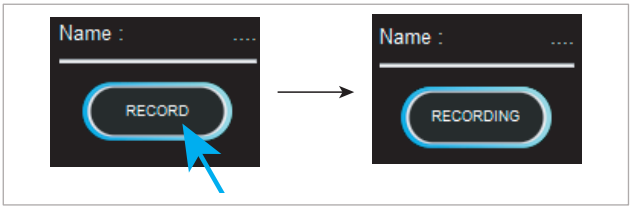
2. Upload the .csv file of sequence by pressing CC Sequence (for CC Mode) and CV Sequence (for CV Mode).

3. After uploading, choose sequence mode by clicking either 'Run CV' (B6 - Mode for CV sequence), 'Run CC' (B6 - Mode for CC sequence), or 'Run CCCV' (B7 – Mode for both CC and CV sequences).

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

Record

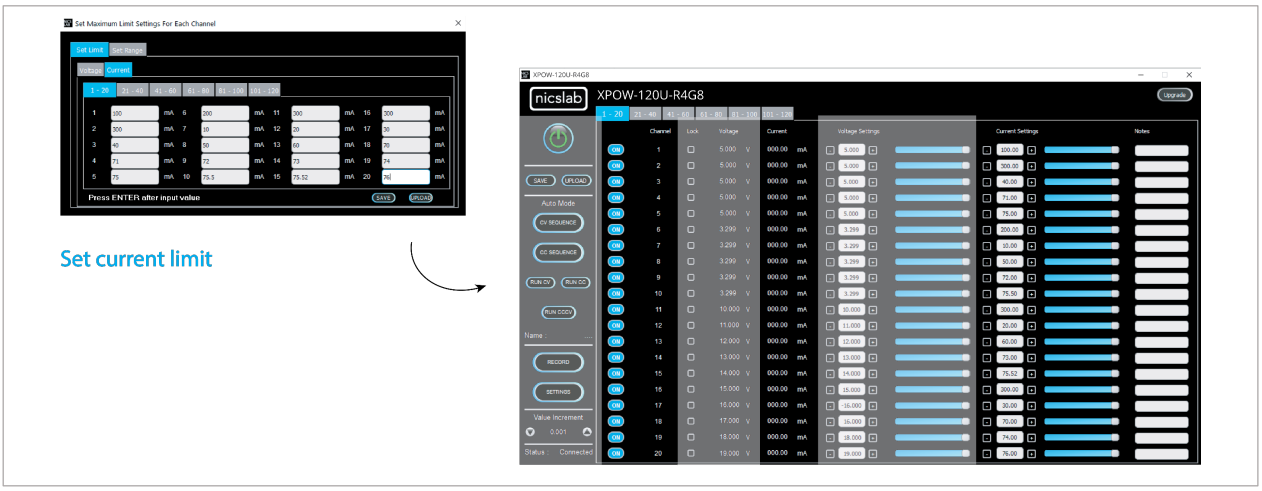
'Record' (B9) keeps data of voltage and current values. The record starts by the time you click the Record button and finish until you click again the same button. The Excel file (.csv) will be created automatically in the same folder as XDAC's GUI file.



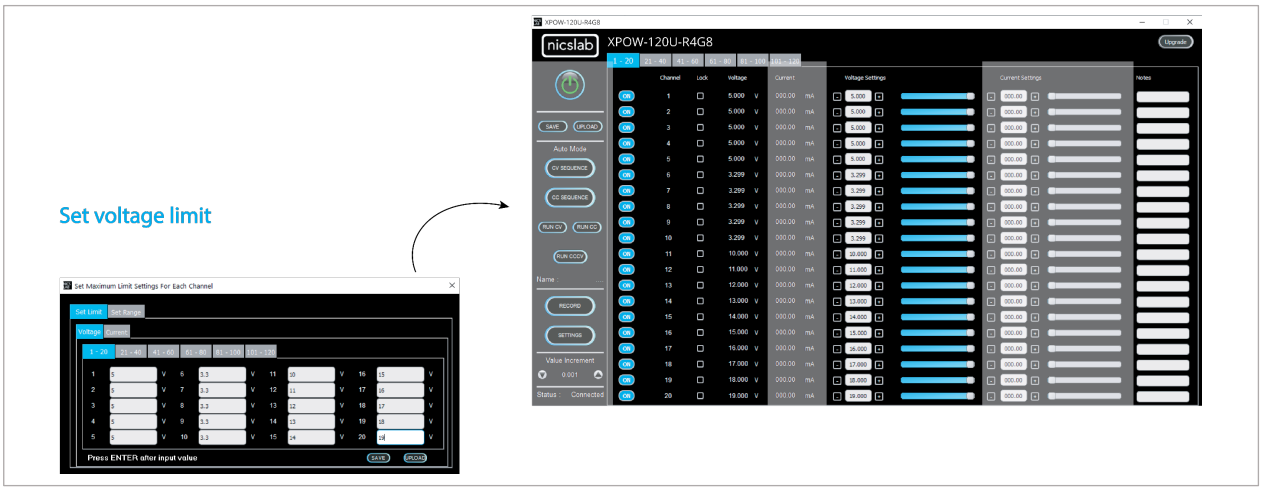
Settings

The 'Settings' feature consists of:

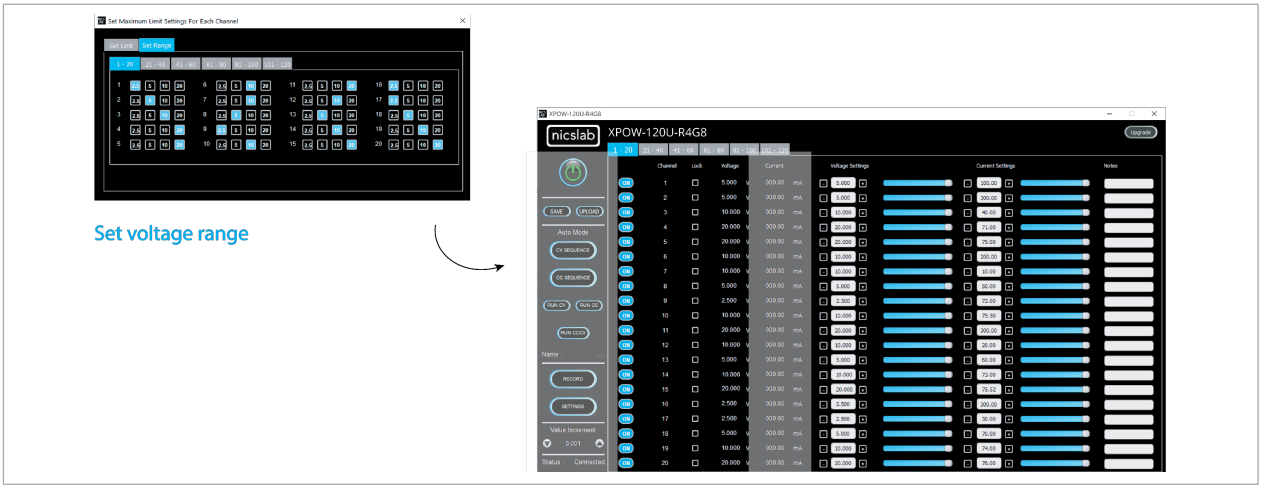
- set maximum limit for both current and/or voltage values
- set range for voltage values where you can choose the voltage range to limit the voltage values (B16, B18, and B19), the range of voltages are 5 V, 10 V, 20 V, and 40 V. Each range has 16-bit precision.



Set current limit



Set voltage limit



Set voltage range

The XDAC can be controlled using Standard Commands for Programmable Instruments (SCPI) with 115200 baud rates.

Description: Set output voltage for single channel

Format:

CH: [n]: VOLT:[BIT VALUES]

Example 1: Set output of channel to maximum or 65535 (16-bit max).

CH:1:VOLT:65535 (set output of channel 1 to max 40 V)

Example 2: Set output of channel 3 to half max or 32767

CH:3:VOLT:32767 (set output of channel 3 to 20 V)

Description: Set output current for single channel

Format:

CH: [n]: CUR:[BIT VALUES]

Example 1: Set output current of channel 1 to 65535 (16-bit max).

CH:1:CUR:65535 (set output of channel 1 to max 300 mA)

Example 1: Set output of channel 3 to half max or 32767.

CH:3:CUR:32767 (set output of channel 3 to 150mA)

Display real-time data for single channel

Format:

CH:[n]:VAL?

Description: Display voltage and current real-time value of channel n.

Example:

CH:1:VAL?

Result:

CH:1:VAL? >> Channel 1 = 6.101 V, 100.211 mA

Set output voltage for group of channels

Format:

CH:[m-n]:VOLT:[0-Vmax]

Description: Set output voltage of channel m to channel n to [0-65535].

Note: 1 <= m < n <= Channel Max

Example:

CH:1-10:VOLT:32767 (set outputs of channel 1 to channel 10 to 20 Volt)

Set output current for group of channels

Format:

CH:[m-n]:CUR:[0-Amax]

Description: Set output of channel m to channel n to [0-65535].

Note: 1 <= m < n <= Channel Max

Example:

CH:1-10:CUR:32767 (set outputs of channel 1 to channel 10 to 150 mA)

Set pin GPIO

Input

Format:

GPIO:[PIN NAME]

Description: Read GPIO pin

Example:

GPIO:PD4

Result :

GPIO:PD4

Output - High

Format:

GPIO:[PIN NAME]:HIGH

Description: Set GPIO pin to high (5V)

Example:

GPIO:PF5:HIGH

Result : GPIO:PF5:HIGH

Output - Low

Format:

GPIO:[PIN NAME]:LOW

Description: Set GPIO pin to low (0V)

Example:

GPIO:PF5:LOW

Result :

GPIO:PF5:LOW

Retrieve device information

Format:

*IDN?

Description: Get information of the device.

Example:

*IDN?

Result :

*IDN? >> XDAC-120U-R4G8, Nicslab.

Set range

Format:

CH: [n]: SVR:[0-3]

Note:

0 -> 5 V

1 -> 10 V

2 -> 20 V

3 -> 40 V

Default: 3

Example 1: Set range of channel to maximum.

CH:1:SVR:3 (set output of channel 1 to max 40 V.

5. Warranty

Nicslab warrants the hardware and software designed by Nicslab to work accordingly fulfilling the highest standard of quality product. Nicslab is not liable for consequential or incidental damages or for errors in subject to misuse, neglect, accident, modification, 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 warranty or return and refund policy.

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