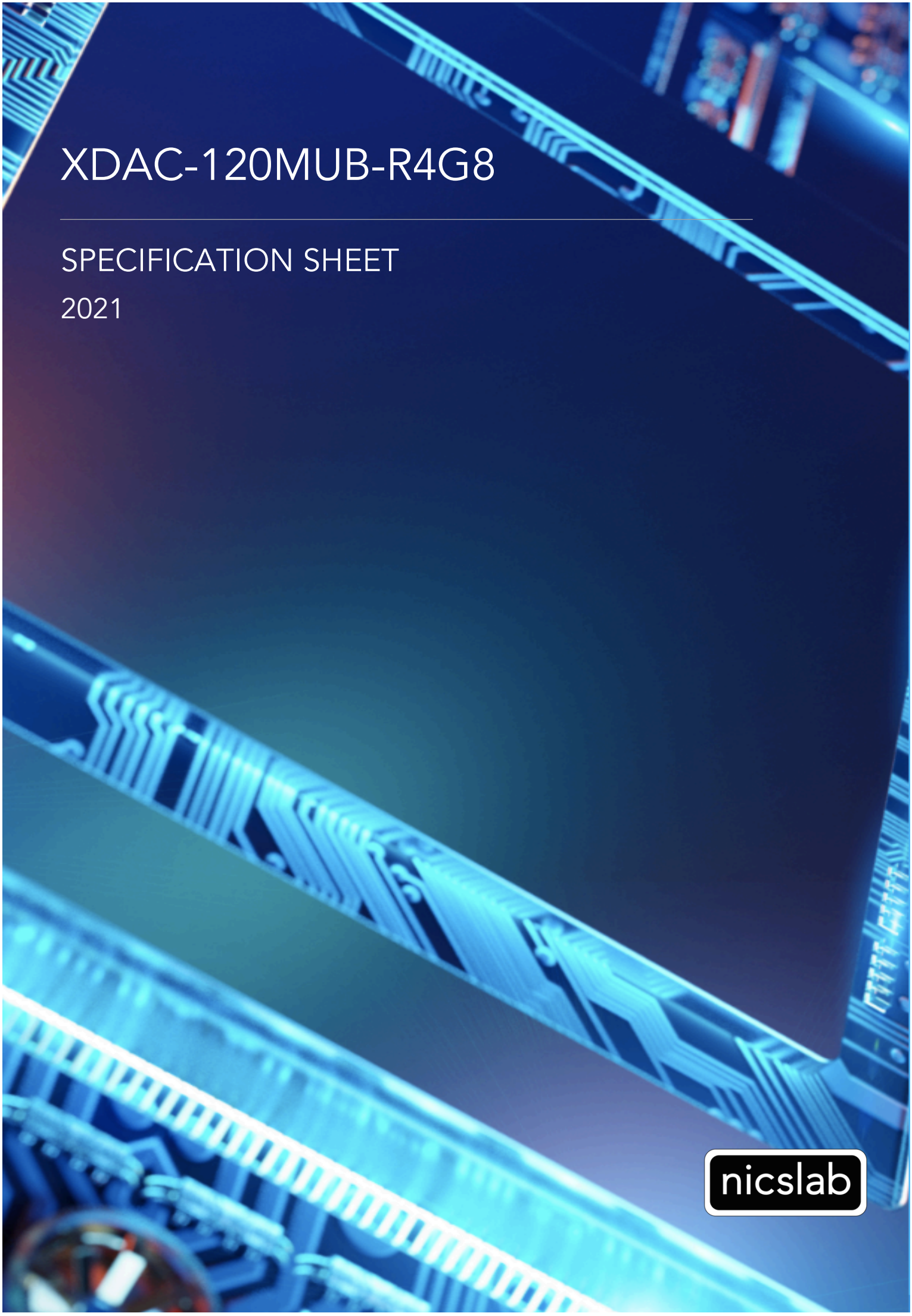

XDAC-120MUB-R4G8

SPECIFICATION SHEET

2021

nicslab

Version: 2.0
Date: 14 January 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. The input voltage is no more than 42 Volt 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-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 GUI and SCPI through Ethernet port. The system has two modes: Constant Current (CC) ranging from ±500 mA per channel and Constant Voltage (CV) ranging from unipolar 0-40 Volt or bipolar ±20 Volt per channel (effective at 0 – 38 Volt and ±19 Volt).

The features for XDAC-120MUB-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).
- Flexible output configuration with 16-bit resolution: ±2.5V, ±5V, ±10V, ±20V, 0 to 5V, 0 to 10V, 0 to 20V or 0 to 40V *(Premium Upgrade)*
- Intuitive GUI.
- 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.
- Ethernet port.

The XDAC-120MUB-R4G8 is 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.

The system diagram is as follow:

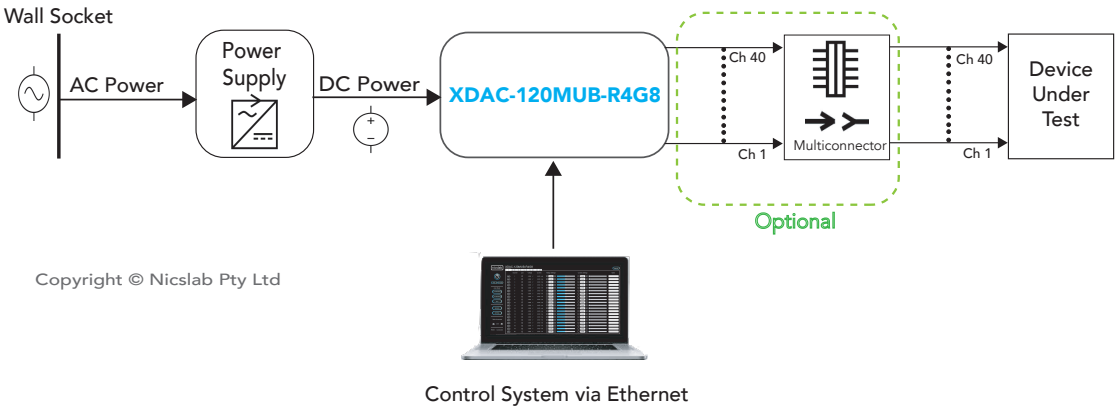

Figure 1. XDAC-120MUB-R4G8 System Diagram

The package should include the following items:

No	Item	Qty (pc)	Checklist
1	XDAC-120MUB-R4G8 Box	1	
2	DC cable (Red, Green, Black)	3	
3	Ethernet cable	1	
4	Multi-connector package	1	
5	USB flash disk	1	
6	Inside USB flash disk: a. GUI b. Specification & Manual c. Test Report d. Serial key (Upgrade) e. XDAC key f. Software Library (Premium) g. 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 42V (potential at red & black DC in). Required headroom 1.4 – 2 V. For example, if you need 12 Volt output per channel then the DC input is minimum 14 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:

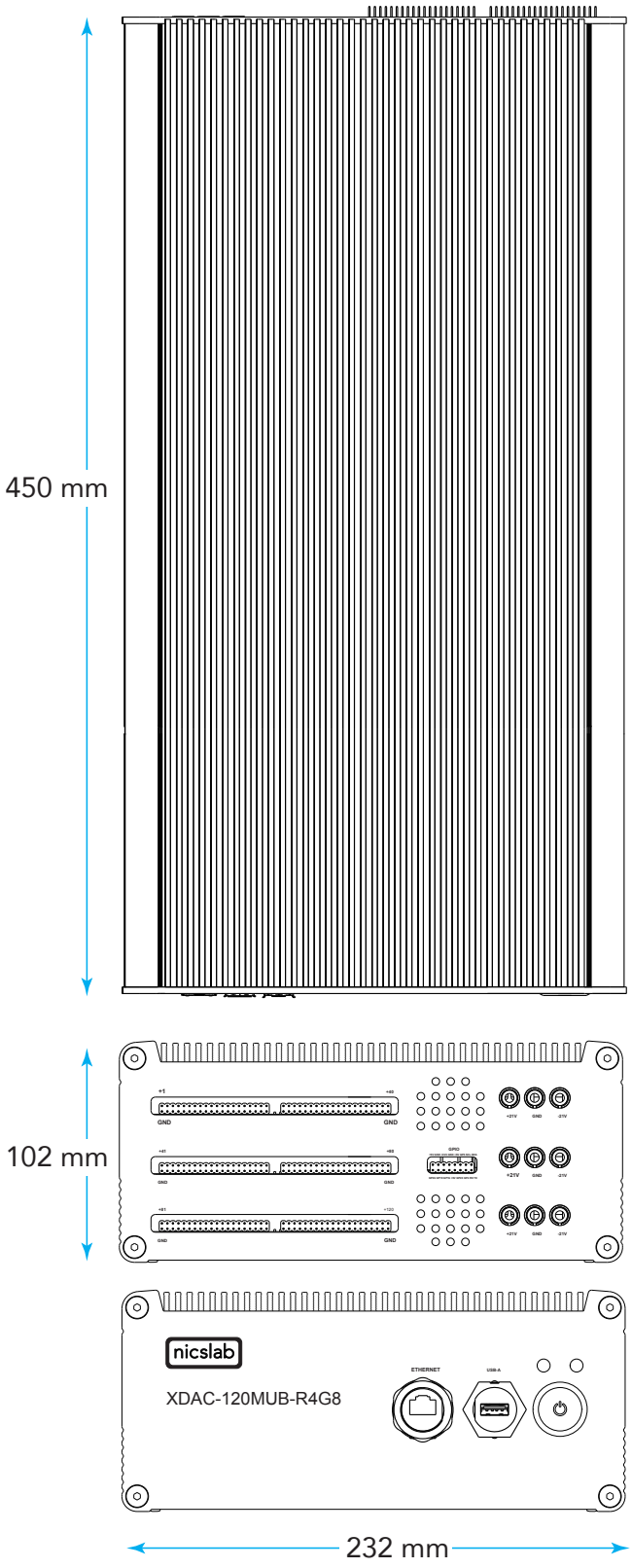

Figure 2. Product Dimension

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

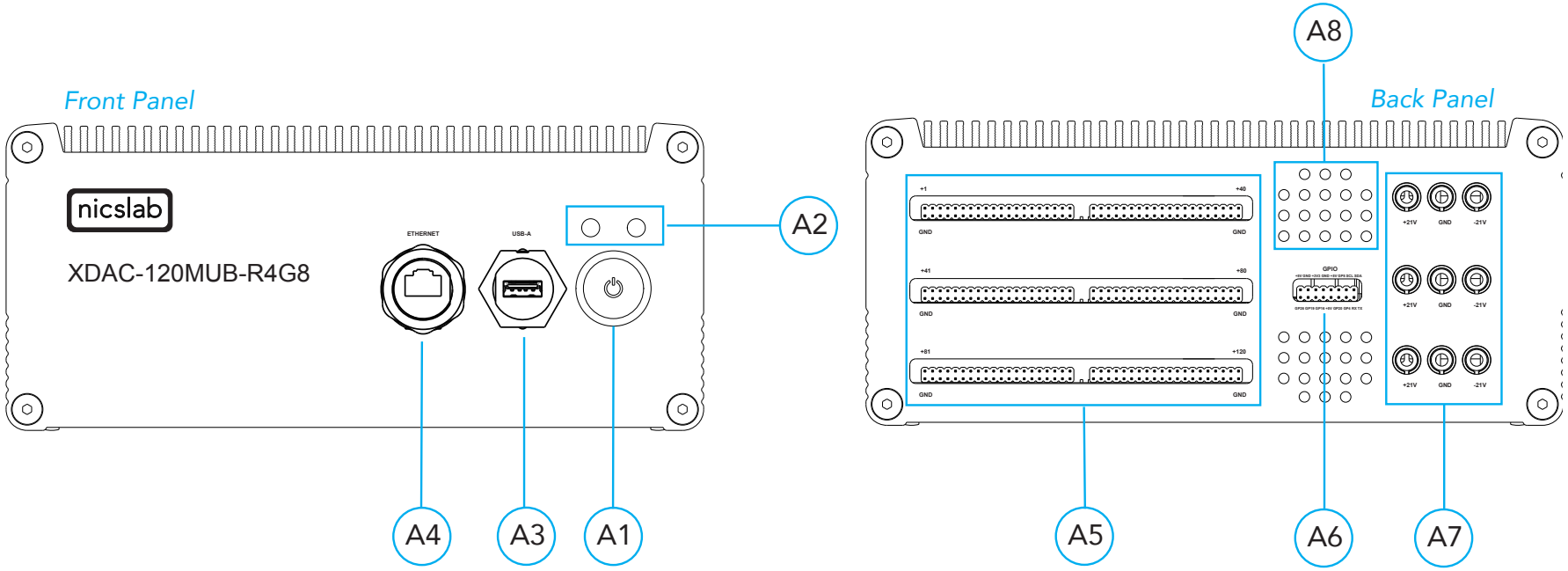

Figure 3. Front and Back Panel

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	GPIO	You may use for external control and monitoring direct to microprocessor.
A7	Input DC Max 42V	Caution Please follow the safety notice on your DC power supply. The DC input is no more than 42 V. Green cable inserts to +21 V Black cable inserts to GND Red cable inserts to -21V
A8	Airflow	For air circulation inside the box.

XDAC-120MUB-R4G8 Specifications

The performance specifications of Digital Analog Converter (DAC) voltage and current control 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	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 ±2.5V
10	Unipolar offset error drift		±2		ppm of FSR/°C	All unipolar ranges
11	Bipolar offset error drift		±2		ppm of FSR/°C	All bipolar ranges
12	Gain error drift		±2		ppm of FSR/°C	All ranges
13	Output voltage drift over time		5		Ppm of FSR	T_A = 40°C, Full-scale code, 1900 hours
DYNAMIC PERFORMANCE						
14	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
15	Slew Rate		4		V/µs	All range except 0 to 5V
16	Power-on glitch magnitude		0.3		V	Power-down to active DAC output, ±20V range, Midscale code, R_L = 5kΩ, C_L = 200pF
17	Output noise		15		µV p-p	0.1Hz to 10Hz, Midscale code, 0 to 5V range
18	Output noise density		78		nV/√Hz	1 kHz, Midscale code, 0 to 5V range
19	AC PSRR		1		LSB/V	Midscale code, frequency = 60Hz, amplitude 200 mVpp superimposed on V_{DD}, V_{CC} or V_{SS}
20	DC PSRR		1		LSB/V	Midscale code, V_{DD} = 5V, V_{CC} = 20V ±5%, V_{SS} = 20V
21	Code change glitch impulse		4		nV-s	1 LSB change around major carrier, 0 to 5V range
22	Channel to Channel AC crosstalk		4		nV-s	0 to 5V range. Measured channel at midscale. Full-scale swing on all other channels.
23	Channel to Channel DC crosstalk		0.25		LSB	0 to 5V range. Measured channel at midscale. All other channels at full-scale.
23	Digital feedthrough		1		nV-s	0 to 5V range, Midscale code, F_{SCLK} = 1MHz

Table 3. DAC Voltage Performance Specification

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

No	Parameter	Min	Typ	Max	Unit	Test conditions/comments
POWER OP AMP CHARACTERISTICS						
1	Input offset voltage		200	600	μV	
				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_{P-P}	
6	Input noise voltage density		15		μV/√Hz	
7	Input noise current density		3		pA/√Hz	
8	Input resistance		500			Common mode
			100			Differential mode
9	Input capacitance		6		pF	Pin 8 and Pin 9 to Ground
10	Input voltage range	-14.5		13.6	V	Typical
		-12.0		12.0	V	Guaranteed by CMRR test
11	Common mode rejection ratio	92	105		dB	-12V < V_{CM} < 12V
12	Power supply rejection ratio	90	100		dB	V_{EE} = V- = -5V, V_{CC} = V+ = 3 V to 30 V
		110	130		dB	V_{EE} = V- = -5V, V_{CC} = 30V, V+ = 2.5 V to 30 V
		90	100		dB	V_{EE} = V- = -3V, V_{CC} = V+ = 5 V
		110	130		dB	V_{EE} = -30 V- = -2.5V to -30V, V_{CC} = V+ = 5V
13	Large-signal voltage gain	75			V/mV	R_L = 1K, -12.5V < V_{OUT} < 12.5
		40			V/mV	R_L = 100Ω, -12.5V < V_{OUT} < 12.5V
		5			V/mV	R_L = 10Ω, -5V < V_{OUT} < 5V, V+ = -V- = 8V
14	Output sat voltage low		1.9	2.5	V	V_{0L} = V_{OUT} – V- R_L = 100, V_{CC} = V+ = 15V, V_{EE} = V- = -15V
15	Output sat voltage high		1.7	2.3	V	V_{0H} = V+ – V_{OUT} R_L = 100, V_{CC} = V+ = 15V, V_{EE} = V- = -15V
16	Output short-circuits current	500	800	1200	mA	Output Low, R_{SENSE} = 0Ω
		-1000	-800	-500	mA	Output High, R_{SENSE} = 0Ω
17	Slew rate	0.7	1.6		V/μs	
18	Full power bandwidth	11			kHz	V_{OUT} = 10V_{PEAK} (Note 5)
19	Gain bandwidth product		3.6		MHz	f = 10 kHz
20	Settling time		8		μV	0.01%, V_{OUT} = 0V to 10V, AV = -1, R_L = 1K

CURRENT SENSE CHARACTERISTICS						
21	Minimum current sense voltage	0.1		10	mV	VC_{SRC} = VC_{SNK} = 0V
22	Current sense voltage 4% of full scale	15	20	25	mV	VC_{SRC} = VC_{SNK} = 0.5V
23	Current sense voltage 10% full scale	45	50	55	mV	VC_{SRC} = VC_{SNK} = 0.5V
24	Current sense voltage 100% of full scale	480	500	520	mV	VC_{SRC} = VC_{SNK} = 5V
25	Current limit control input bias current	-1	-0.2	0.1	µA	VC_{SRC}, VC_{SNK} Pins
26	SENSE- input current	-500		500	nA	0V < (VC_{SRC}, VC_{SNK}) < 5V
27	FILTER input current	-500		500	nA	0V < (VC_{SRC}, VC_{SNK}) < 5V
28	SENSE+ input current	-500		500	nA	VC_{SRC} = VC_{SNK} = 0V
		200	250	300	nA	VC_{SRC} = 5V, VC_{SNK} = 5V
		-300	-250	-200	nA	VC_{SRC} = 0V, VC_{SNK} = 5V
		-25		25	nA	VC_{SRC} = VC_{SNK} = 5V
29	Current sense change with output voltage		±0.1		%	VC_{SRC} = VC_{SNK} = 5V, -12.5V < V_{OUT} < 12.5V
30	Current sense change with supply voltage		±0.05		%	VC_{SRC} = VC_{SNK} = 5V, 6V < (V_{CC}, V+) < 18V
			±0.01		%	2.5V < V+ < 18V, VCC = 18V
			±0.05		%	-18V < (V_{EE}, V-) < -2.5V
			±0.01		%	-18V < V- < -2.5V, V_{EE} = -18V
31	Current sense bandwidth		2		MHz	
32	Resistance FILTER to SENSE-	750	1000	1250	Ω	
LOGIC I/O CHARACTERISTICS						
33	Logic output leakage			1	µA	V = 15V
34	Logic low output level		0.2	0.4	V	I = 5mA
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_{CC}, V+ and V-, V_{EE} connected
39	V_{CC} supply current		3	7	mA	V_{CC}, V+ and V-, V_{EE} separate
40	Supply current disabled		0.6	1.5	mA	V_{CC}, V+ and V-, V_{EE} connected, V_{ENABLE}
41	Turn-On delay		10		µs	
42	Turn-Off delay		10		µs	

Table 4. Current Limit and Buffer Performance Specification

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 follow:

1. Precondition step: connect to the DC power supply (max 42 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 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, 64-bit).
- Windows® 10 (32-bit, 64-bit).
- macOS Catalina.

Software Installation

First step is to copy the GUI file into your hard disk then double click to launch the GUI. The icon is as below:

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 via using IP scanner such as Angry IP scanner or NMAP.

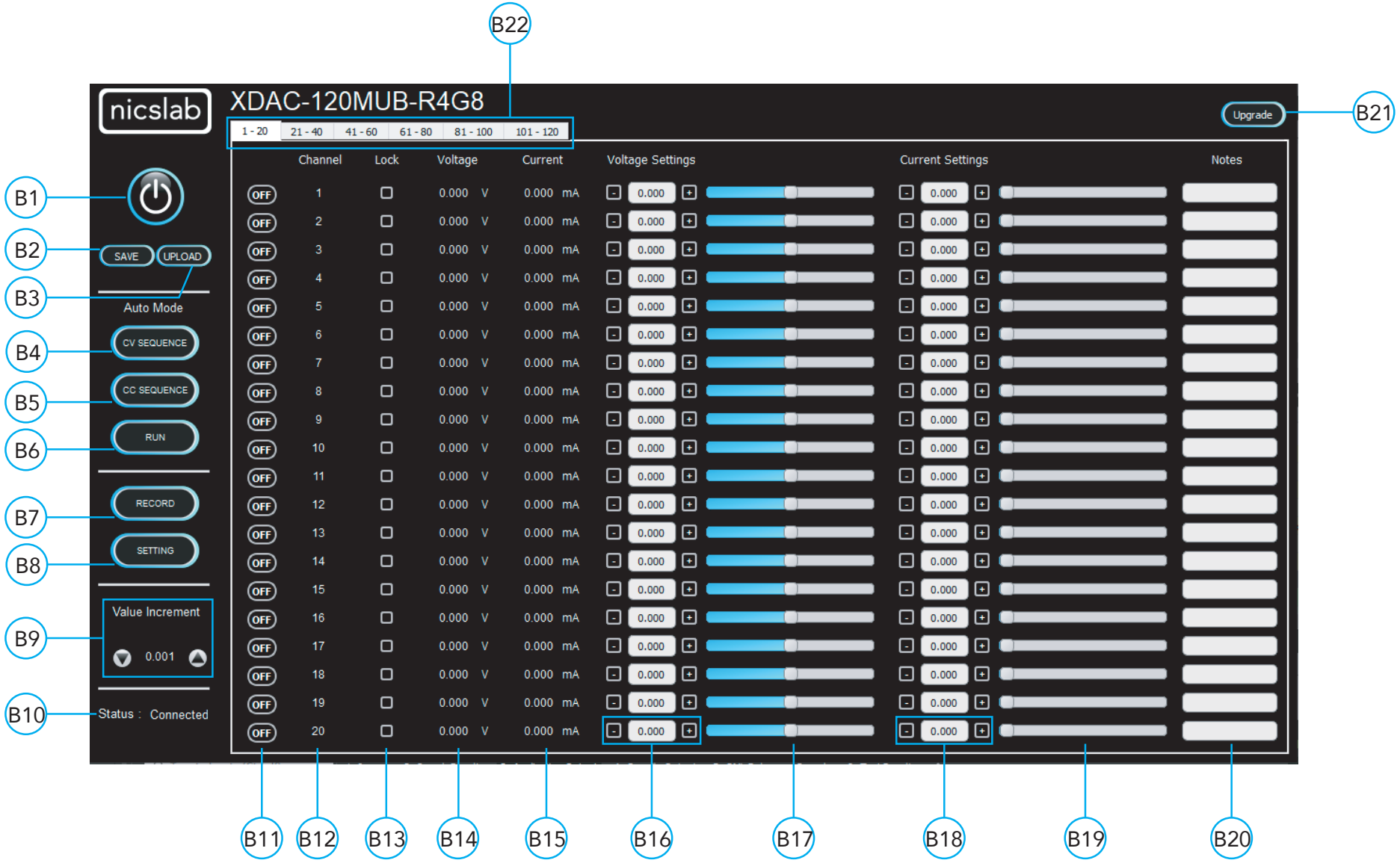

Figure 4. GUI

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

4. Operating XDAC through SCPI command

This section set guidelines to help you develop program for any language suits you best.

SCPI Commands

The XDAC can be controlled using Standard Commands for Programmable Instruments (SCPI).

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-120MUB-R4G8, Nicslab Pty Ltd.

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, 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 warranty or return and refund policy.

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