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Technical description and manual for

ND18

18 Channel USB/EEPROM bias controller

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V2

Prepared for:	**Prepared by:**
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1. Abbreviations

EEPROM	Electrically Erasable Programmable Read-Only Memory
SIPM	Silicon Photomultiplier
USB	Common PC interface (Universal Serial Bus)
LED	Light Emitting Diode
DAC	Digital-to-Analog Converter
PC	Personal Computer
RMS	Root Mean Square
AC	Alternating Current
TTL	Transistor-Transistor Logic
GND	Ground (electrical)
FTDI	USB interface chip manufacturer

2. Introduction

The ND18 device does the following :

1. Provides 18 fully independent channels of bias (positive polairty).
2. Provides bias to Hamamatsu SiPms in bias range 67 to 71V (or wider depending on the software constants set).
3. Bias voltage can be programmed both in volatile DACs and EEPROM (nonvolatile, default-on values)
4. Provides current up to 1.2mA per channel (actual current limit is around 2..2.5mA)
5. Bias step resolution <10mV (1024 steps of DAC range)
6. Bias ripple < 0.1mV RMS (100Hz...100kHz)
7. Provide USB-based (Python GUI script) and individual potmeter based adjustment
8. The boards can be used independently (with bias setting preserved in EEPROM)
9. Bias voltages can be stored and retrived from text-format files
10. 72..80V external voltage has to be provided, current > 50mA.
11. USB power is not required if running from EEPROM/potmeter settings
12. Potmeters allow approximatelly +-1V bias adjustment range, they have to be set to 70V with 70V set in GUI to provide proper DAC opeartions (recalibrated to 70V point).
13. Python script may run under Linux or Windows, USB interface is based on UM245R FTDI device (bit-bang mode), uses libusbK (v3.0.5.16) driver.
14. The bias boards allow current monitoring of each bias channel by mesauring voltage across 100 ohm resistor (R1 on the bias board schematics), two terminals in the top left corner of the boards.

3. Connection diagramms

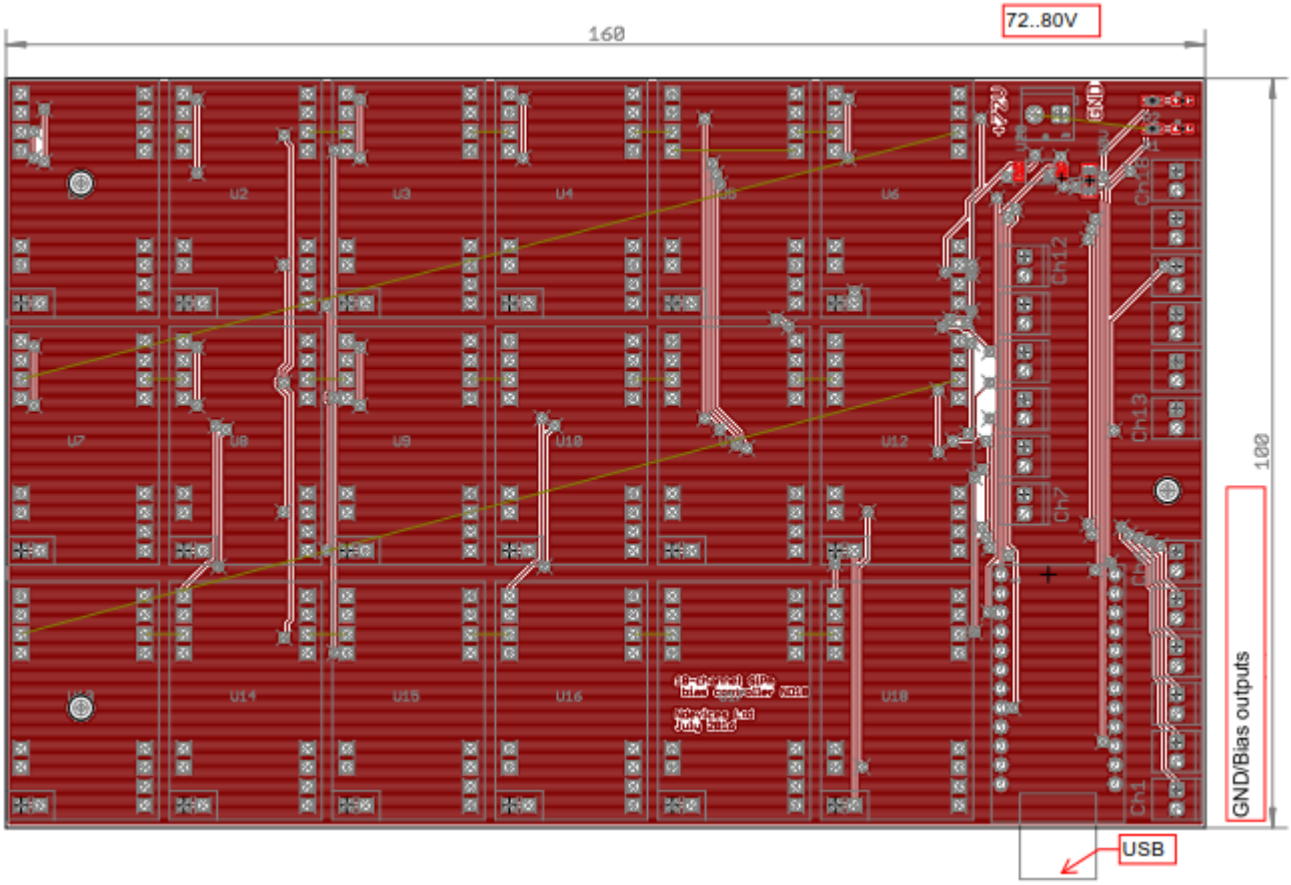

Illustration 1: Motheboard with 18 channels (hosting 18 pulggable bias boards and UM245R USB interface)

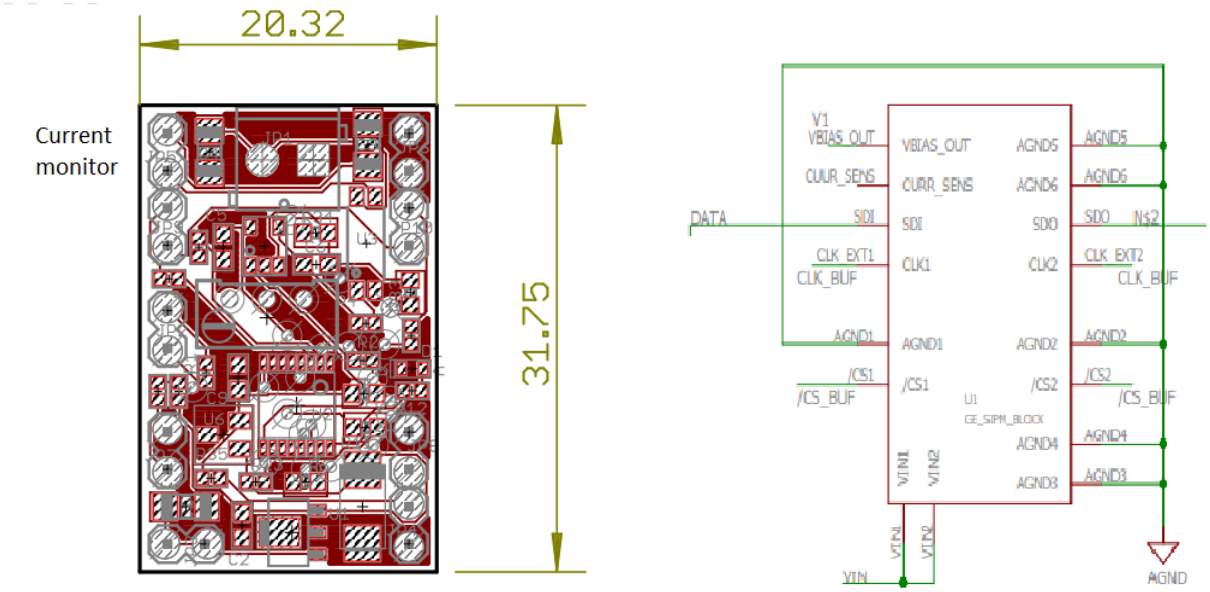

Illustration 2: Layout of the bias board

The 72..80V voltage has to be provided to the top right corner of the motheboard, polairty is positive in respect to GND.

The output bias channels are interleaved with GND.

If the bias board (small pluggable board) to be used individually, the connections have to be provided according to the schematics and layout.

4. Software installation

1. Use Zadig according to http://embedded-funk.net/running-libftdi-under-windows/

Instructions also availabe in file:

Running libFTDI Under Windows _ Embedded Funk.pdf

Instructions also available at :

https://sourceforge.net/projects/libwdi/files/zadig/zadig_v2.0.1.160.7z/download

To put it short:

1.start Zadig.exe

2. Connect the USB (no need for 72V power at this stage)

3. In "Options" menu on the top, run "List all devices"

4. From the list select UM245R

5. From alternative driver list select libusbK (v3.0.5.16)

6. Click 'replace driver'

!! - Note - standard FTDI driver will not work. Accedintal upgrade may install it thus disabling the system!!

Then,

Install Python 2.7 (free enviroment).

Install pylibftdi via pip or other way:

$ pip install pylibftdi

To get pip, one can use python file from http://stackoverflow.com/questions/4750806/how-do-i-install-pip-on-windows

Copy two .dll files attached (commonly avialble libftdi1.dll and libusb-1.0.dll) to same folder as .py files.

Run the MainNd18.py

For test, one may run list_devices.py from below. It should list UM245R when USB is connected (72V power does not matter).

5. List of deliveries

ND18 mother board with 18 bias boards plugged

UM245R USB interface (plugged into the motheboard)

USB cable

One spare bias board

PDF files of schematics and PCBs

6. Running the system

When connected, if the program does not see the USB device, it generates error message.

Then, when running, it shows red box if not seeing the device; yellow - if loopback not working (not all boards or 72V not present). Otherwise, green OK box is shown.

"Send to RAM" - saves to volatile DAC registers sets the actual voltages.

"Send to EEPROM" - volatile DAC registers plus EEPROM.

Once EEPROM programmed, the boards may run without USB.

Current limit set around 2..2.5 mA per channel.

Potmeter can be used to adjust voltage in range of approx +-1V; for proper use of the DACs control all GUI voltage boxes should be set to 70V, the actual channel outputs then brought to that value via potmeters.

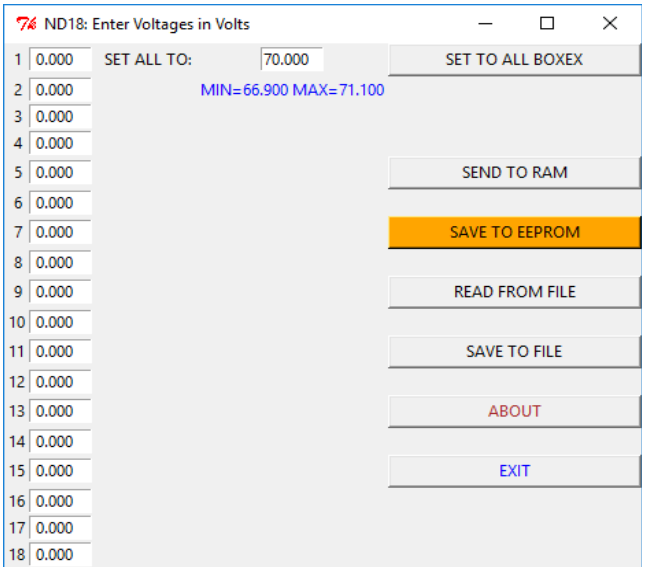

Illustration 3: The main software window