Low Noise / High Resolution DAC II

Physics Basel SP 1060

LabVIEW Drivers Description | Revision 1.1

For Software Release 3.4.9

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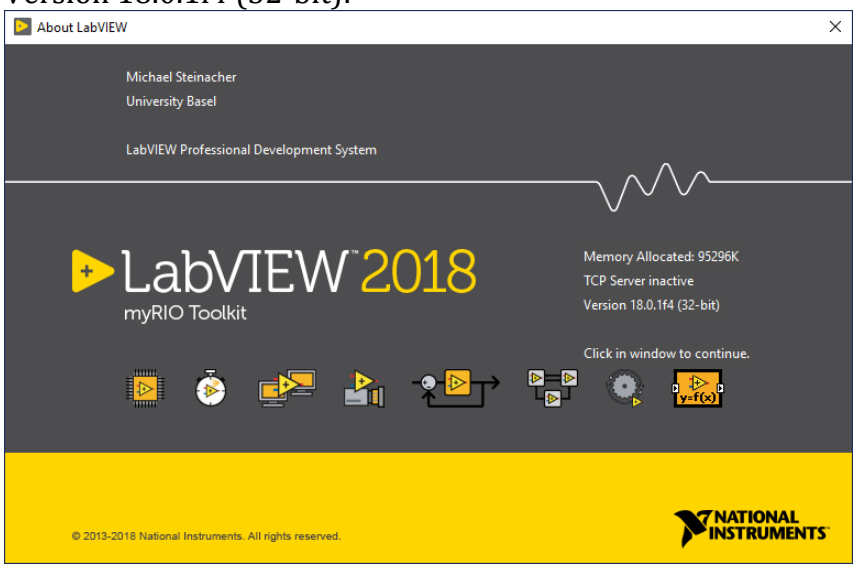
1 General

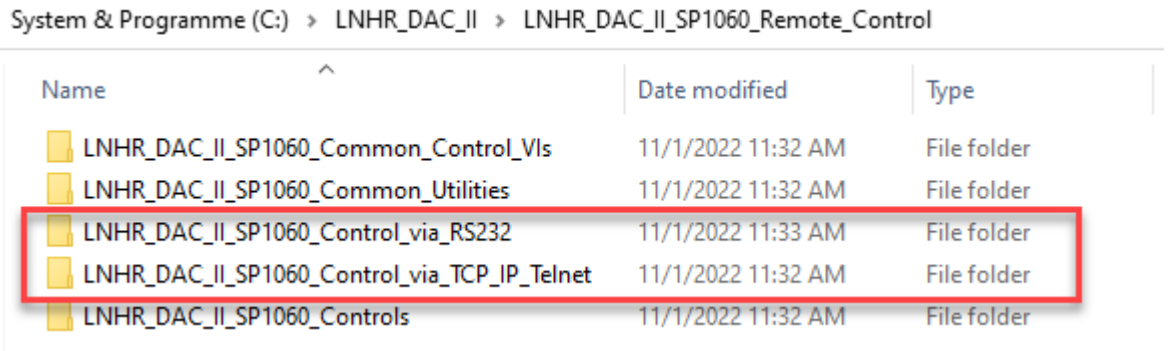
These LabVIEW drivers allows the remote control of the LNHR DAC II either via TCP/IP-Telnet or via RS-232 serial port. They are designed to work with the LNHR DAC II with a software release 3.4.9 (or higher). Several sample programs are also included and they allow the user to quickly create their own LabVIEW application for remote controlling the device. The drivers and sample programs are written with the 32-bit LabVIEW 2018 Version 18.0.1f4 (32-bit):



The LabVIEW drivers and sample programs are stored in the sub-directory "LNHR_DAC_II_SP1060_Remote_Control" on the USB memory-stick which was delivered with the LNHR DAC II. One should copy the full content of the memory-stick to the root of the PC-drive C: under the directory "LNHR_DAC_II"; doing so, the path to the drivers is: C:\LNHR_DAC_II\LNHR_DAC_II_SP1060_Remote_Control\

2 Selecting the Communication Port

Two separate LabVIEW projects, one for communication via TCP/IP-Telnet and one for the serial communication via RS-232 are available under the directory "LNHR_DAC_II_SP1060_Remote_Control":

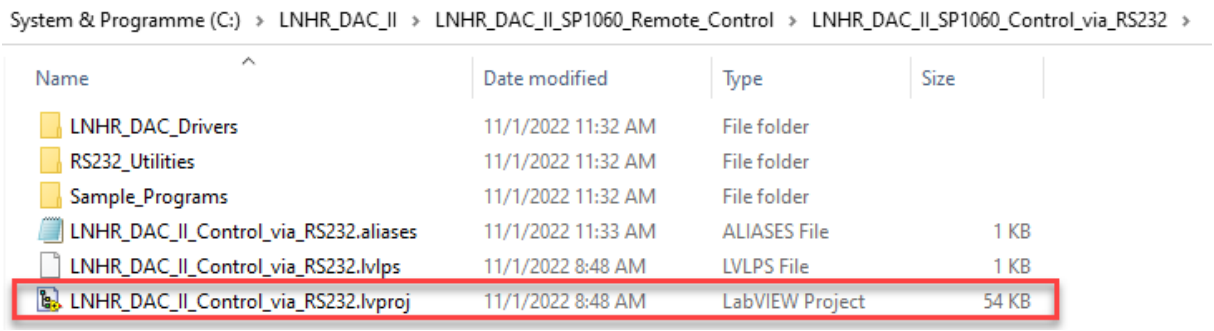


It is recommended to use the TCP/IP-Telnet communication to the LNHR DAC II as it is much faster and less prone to interference.
Nevertheless, it is possible to use the RS-232 for the communication to the LNHR DAC II.

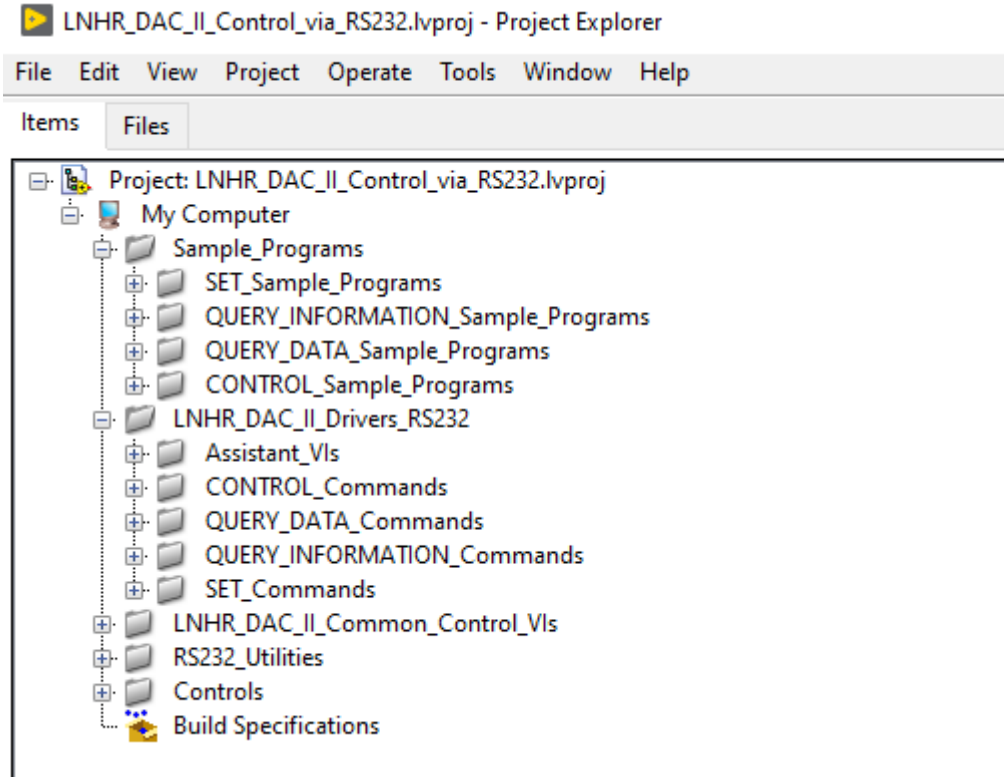
Note: At the highest RS-232 communication speed of 115.2 kbit/s the cable length shouldn't exceed three meters – otherwise, erroneous communication may occur.
Use the included 3-meter RS-232 null-modem cable between your computer and the LNHR DAC II.

2.1 Serial Communication via RS-232

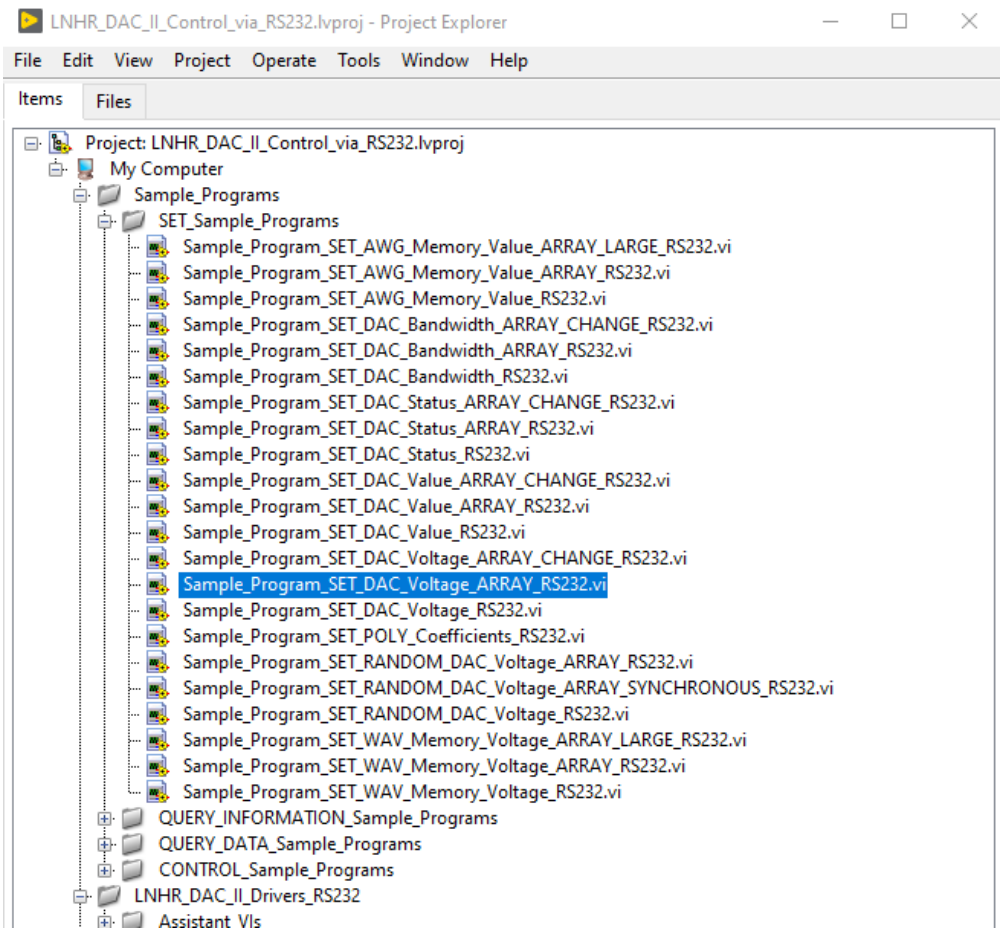
If you plan to communicate via RS-232 serial port, navigate to the folder "LNHR_DAC_II_SP1060_Control_via_RS23" and open the LabVIEW project "LNHR_DAC_II_Control_via_RS232.lvproj":



The structure of the RS-232 LabVIEW project is the following:

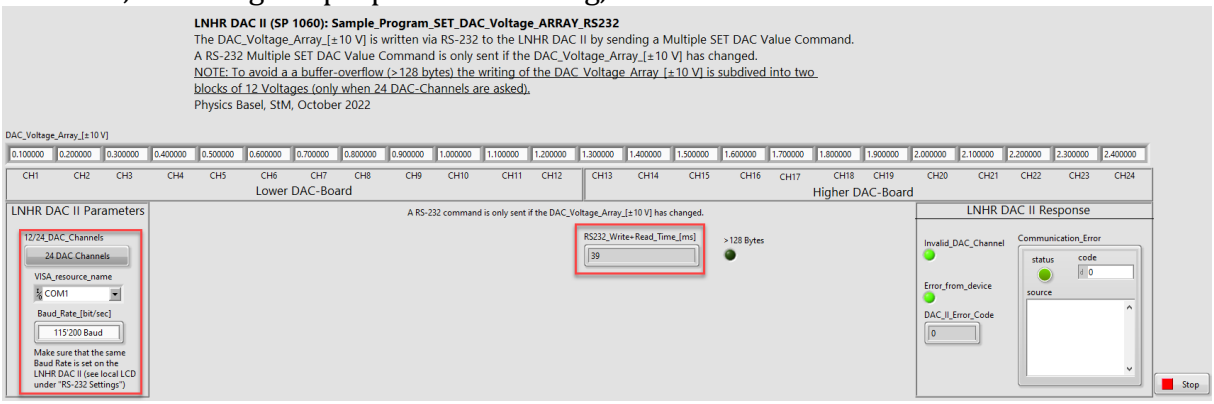


The folder "Sample Programs" is structured in SET, QUERY_INFORMATION, QUERY_DATA and CONTROL sample programs. After unfolding the "SET_Sample_Programs" one can open the desired SET sample program (e.g. the "Sample_Program_SET_DAC_Voltage_ARRAY_RS232.vi"):



Before you start this sample program select the number of DAC-channels (12 or 24), the communication port in "VISA_resource_name" (e.g. COM1) and choose the same "Baud_Rate_[bit/sec]" as set on the LNHR DAC II (see local LCD under "RS-232 Settings"). Connect the serial port (e.g. COM1) of your computer to the serial port connector on the back-panel of the LNHR DAC II by using a null-modem serial cable (include in the delivery). For details see the chapter "Communication via Serial-Port (RS-232)" in the documentation "LNHR_DAC_II_Programmers_Manual".

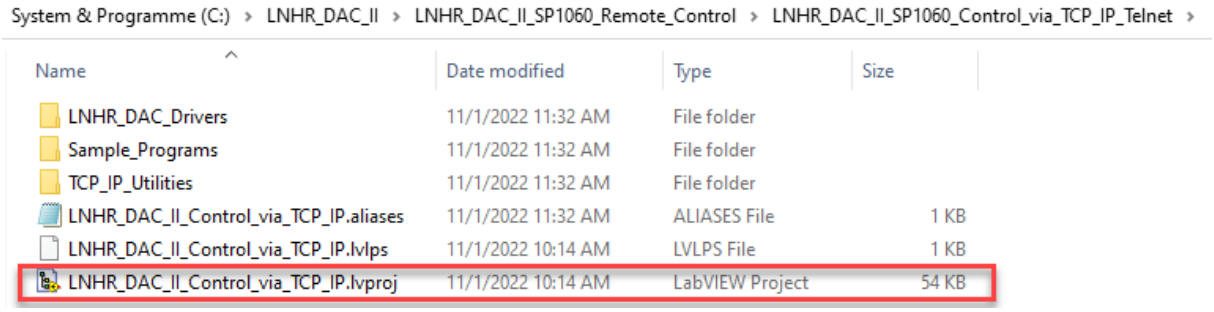
After pressing START this program writes the "DAC_Voltage_Array_[±10 V]" (when changed) to the device and its response (error-code) is evaluated; a correct handshaking is implemented. At a Baud rate of 115'200 bit/sec the data transfer for the 24 DAC-channels, including the proper handshaking, takes around 40 msec:



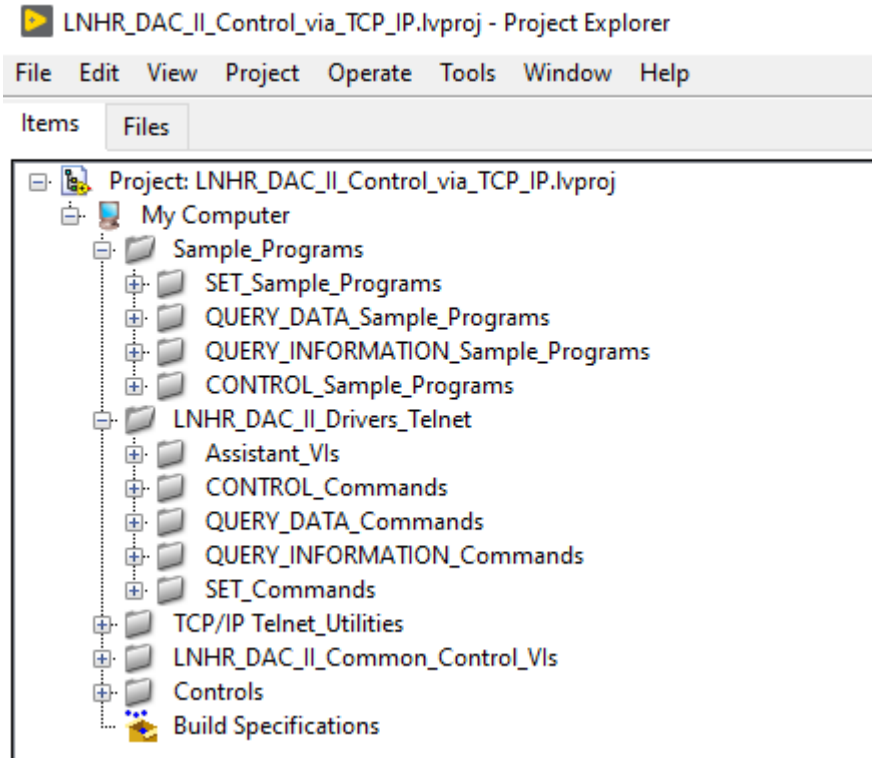
Press "Stop" to terminate this sample program.

2.2 Ethernet Communication via TCP/IP-Telnet

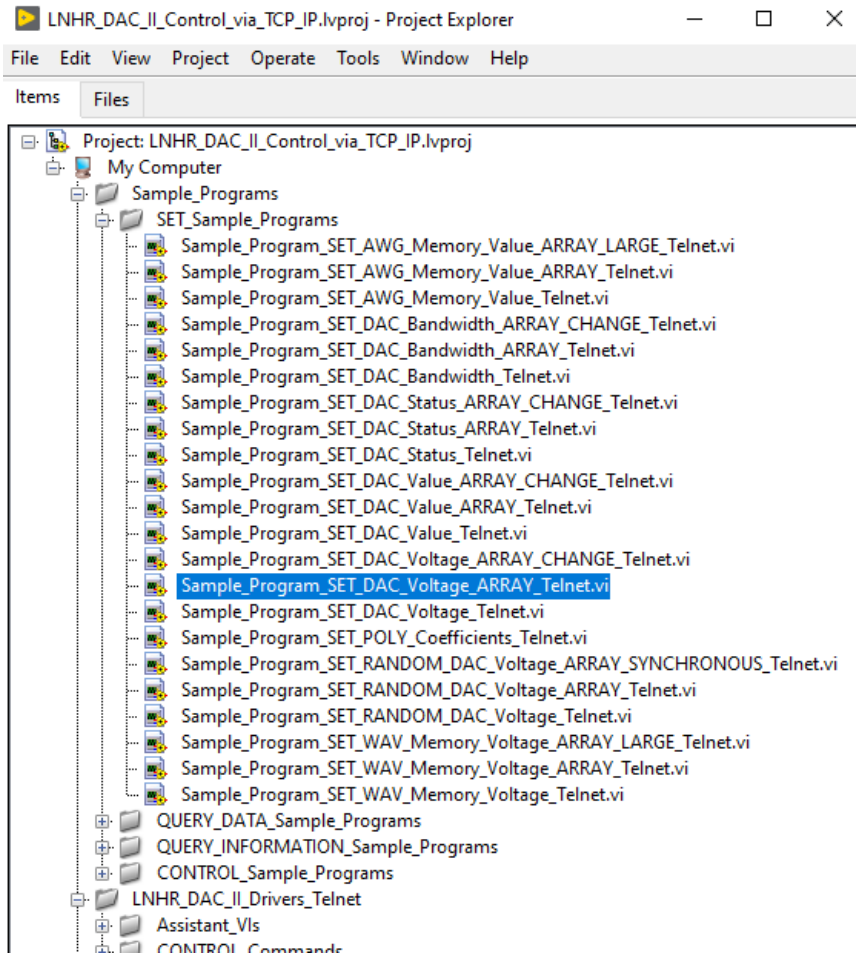
If you plan to communicate via Ethernet TCP/IP-Telnet, navigate to the folder "LNHR_DAC_II_SP1060_Control_via_TCP_IP_Telnet" and open the LabVIEW project "LNHR_DAC_II_Control_via_TCP_IP.lvproj":



The structure of the TCP/IP-Telnet LabVIEW project is the following (the same as for RS-232):

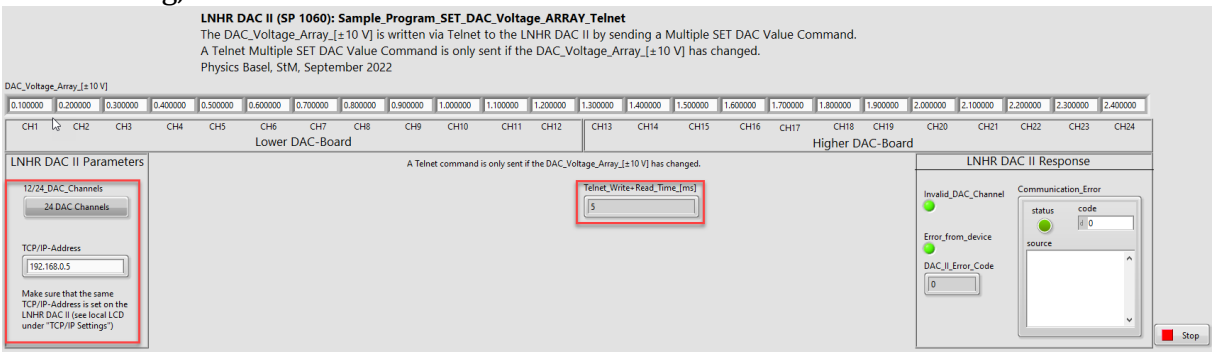


The folder "Sample_Programs" is structured in SET, QUERY_INFORMATION, QUERY_DATA and CONTROL sample programs. After unfolding the "SET_Sample_Programs" one can open the desired SET sample program (e.g. the "Sample_Program_SET_DAC_Voltage_ARRAY_Telnet.vi"):



Before you start this sample program select the number of DAC-channels (12 or 24) and choose the same "TCP/IP-Address" as set on the LNHR DAC II (see local LCD under "TCP/IP Settings"). Connect the LAN Ethernet port (configured as private network) of your computer to the LAN Ethernet port on the back-panel of the LNHR DAC II by using a LAN cable (minimum Cat 5e). For details see the chapter "Communication via TCP/IP-Telnet Port" in the documentation "LNHR_DAC_II_Programmers_Manual".

After pressing START this program writes the "DAC_Voltage_Array_[±10 V]" (when changed) to the device and its response (error-code) is evaluated; a correct handshaking is implemented. The data transfer for the 24 DAC-channels, including the proper handshaking, takes around 5 msec:



Press "Stop" to terminate this sample program.

3 Converting DAC-Voltage to DAC-Value

A DAC-Value is a 24-bit number in the decimal range from 0 to 16'777'215 (2^{24}-1); this corresponds to a hexadecimal range from 0x000000 to 0xFFFFFF.

The DAC-Voltage has a fixed range from -10 V to +10 V with a step-size of 1.192093 µV (20 V / 16'777'215).

For a given DAC output voltage (Vout [-10 V ...+10 V]) the 24-bit decimal DAC-Value (DACval [0…16'777'215]=[0x000000…0xFFFFFF]) is given by (rounded to the next integer value):

$$DACval\_dec = (Vout + 10) \cdot 838'860.74$$

To get a DAC-Value (HEX), which is needed for remote programming the DAC output voltage, the decimal number has to be converted to a hexadecimal number. All higher program languages have already included such a conversion-function.

For a given decimal DAC-Value (DACval_dec [0...16'777'215]=[0x000000…0xFFFFFF]) the DAC output voltage (Vout [-10 V...+10 V]) can be determined by:

$$Vout = (DACval\_dec / 838'860.74) - 10$$

The table below shows the DAC-Voltage [±10 V] in 1 V steps and the calculated DAC-Value (decimal) and the corresponding DAC-Value (HEX):

DAC-Voltage	DAC-Value (decimal)	DAC-Value (HEX)
+10 V	16'777'215	0xFFFFFF
+9 V	15'938'354	0xF33332
+8 V	15'099'493	0xE66665
+7 V	14'260'633	0xD99999
+6 V	13'421'772	0xCCCCCC
+5 V	12'582'911	0xBFFFFF
+4 V	11'744'050	0xB33332
+3 V	10'905'190	0xA66666
+2 V	10'066'329	0x999999
+1 V	9'227'468	0x8CCCCC
0 V	8'388'607	0x7FFFFF
-1 V	7'549'747	0x733333
-2 V	6'710'886	0x666666
-3 V	5'872'025	0x599999
-4 V	5'033'164	0x4CCCCC
-5 V	4'194'304	0x400000
-6 V	3'355'443	0x333333
-7 V	2'516'582	0x266666
-8 V	1'677'721	0x199999
-9 V	838'861	0x0CCCCD
-10 V	0	0x000000

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