

USERS MANUAL V2.1

NS-IG4E

4 channel
0/4-20mA current generator

SINCE 1998

NANOSPACE

*Kereskedelmi, Oktatási
és Informatikai Bt.*

Contents

CONTENTS	2
1. GENERAL INFORMATION.....	4
1.1. INTRODUCTION	4
1.2. THE PURPOSE OF THE EQUIPMENT	4
2. START UP	4
2.1. CONTENTS OF THE PACKAGE.....	4
2.2. TECHNICAL ENVIRONMENT	5
2.3. CLEANING.....	5
2.4. THE CONTROLS AND CONNECTORS OF THE UNIT.....	6
2.4.1. <i>Controls on the front panel.....</i>	6
2.4.2. <i>Controls on the rear panel</i>	7
2.5. GETTING STARTED	8
3. SETTING UP AND HANDLING OF THE INSTRUMENT	9
3.1. BASIC SETTINGS	9
3.1.1. <i>Voltage limits of the outputs</i>	9
3.1.2. <i>Setting the current value.....</i>	10
3.1.2.1. Using the data entry wheel	10
3.1.2.2. Numeric keyboard	10
3.1.2.3. Direct value keys	10
3.1.2.4. Using USR-1, USR-2, PRESET keys.....	11
3.1.3. <i>Direct value entry.....</i>	11
3.1.3.1. Setting the range	11
3.1.3.2. Maximal value	12
3.1.3.3. Name and units for the channels.....	12
3.1.3.4. Calibrating output/resistor	12
3.2. HANDLING PROGRAM PLACES	13
3.2.1. <i>Saving configurations.....</i>	13
3.2.2. <i>Loading configurations.....</i>	13
3.2.3. <i>Set a channel to its default settings</i>	14
3.2.4. <i>Copy channel's data</i>	14
3.3. FUNCTION GENERATOR	14
3.3.1. <i>Basic waveforms and their sub-types</i>	15
3.3.2. <i>Minimum and maximum values</i>	17
3.3.3. <i>Setting the period time of the function.....</i>	17
3.3.4. <i>Inter-channel synchronization and starting, stopping the generator</i>	17
3.4. BEEP CONTROL	17
4. SERIAL COMMUNICATION RS232	18
4.1. CONNECTOR PINOUT AND COMMUNICATION PARAMETERS	18
4.2. COMMUNICATION PROTOKOLL	18
4.2.1. <i>Parameters of communication.....</i>	18
4.2.2. <i>Commands accepted by the unit and structure of the answers.....</i>	18
4.3. SOFTWARE UPDATE.....	21
5. TEST MODE	23

5.1. KEYBOARD TEST	23
5.2. DISPLAY & LED TEST	23
5.3. TEST OF RS232 LINE.....	23
5.4. EEPROM INITIALIZATION.....	23
5.5. UNIT'S IDENTIFICATION (SERIAL NUMBER).....	23
6. TECHNICAL DATA AND SCHEMATIC	24

1. General information

1.1. Introduction

Thank you purchasing one of our company's magnificent equipment the NS-IG4 4 channel 0/4-20mA current generator. Our development goal is to design and manufacture high level products, so we hope this tool will serve you for long time.

To reach the maximal life-time period of the unit please read this manual carefully to minimize the possible errors and problems, and to enjoy the benefits of the equipment without failures for as long as possible.

Our company seeks to produce and distribute the products in maximal quality. However to reach this goal it is indispensable to adhere to the description of this manual as our company cannot undertake a guarantee for the damages caused by ignoring information detailed here.

Important!

The NANOSPACE Bt. does not undertake a guarantee for the damages caused by incorrect handling, mechanical damages and elemental blows, fluctuations of the electrical line and the failures or malfunctions of the connected equipments. Furthermore we do not take responsibility of the consequences of any damage, missed benefit caused by the failures or inoperability of the equipment. The guarantee is lost immediately by opening the unit, or any attempt to repair by the user or any not accredited third party person!

1.2. The purpose of the equipment

The NS-IG4 is especially dedicated for the test of equipments with inputs based on the industrial standard of 0/4-20mA. As an active current source, it can substitute the different sensors and signal sources on four, galvanically isolated channels. The tool is suitable to use in the development phase of new equipments as well as the testing of existing ones. The unit is also usable in cases when the generation of a given current is necessary between 0 and 20mA. An example is testing semiconductors and taking their characteristics. With the built-in voltage limiter one can set the maximal - no load - output voltage too.

2. Start up

If the equipment is not handed over personally but is delivered in a package, as first step please check it for damages. In case of any damage please advice immediately the dealer who supplied the unit. We accept complaints only if the box is not opened.

If you have any problems, questions or you need any technical support, first please ask your dealer. If you still have any unresolved question, please ask our company. To reach us you can find address at the end of this manual or on the www.nanospace.hu web page.

2.1. Contents of the package

In the package or in case of personal handover you must get the following items:

1 pc. of NS-IG4 current generator

1 pc. of power cord

1 pc. CD * with this manual and in some cases further softwares. **
1 pc. Warranty card
1 pc. printed manual

* The content of the CD may vary. For new firmware please visit the page www.nanospace.hu on the WEB, where you can download it for free.

** The software requirements are: WINDOWS'98, WINDOWS XP or higher version, RS232 port, 1Mbyte free space on hard-drive. To read the manual files, you will need Adobe Reader.

2.2. Technical environment

Prior to startig up please check if the parameters of your local power line are the same as the items indicated on the rear panel of the unit. (ex. 230VAC/50Hz). In case of difference, please use an appropriate converter.

Please avoid powering the instrument from any power line with high loads or electrically noisy environment, such as motors, fluorescent lamps, thyrisor controlled equipements etc. If this is unavoidable, please use an EMI filter.

The ambiantal working temperature of the unit must be between 5°C and 40°C. The optimal temperature is 20°C (the system calibration is made on this temperature) Always wait until the unit reaches the room temperature especially if it was in wery cold place (during transport or storage) as the condensed vapor can damage the electronics when powering up.

Be carefull not to expose the unit to water, rain, direct sunshine, ultraviolet radiation or direct heat source (heating, high power light source). Don't use it in a dusty, smoked environment as these can deposit inside the instrument causing malfunctions or deteriorating the parameters and make the functioning unstable.

Covering the ventilation slots may overheat the equipement and this can produce malfunctions or even damage. In case of building in a closed space please take care of appropriate cooling.

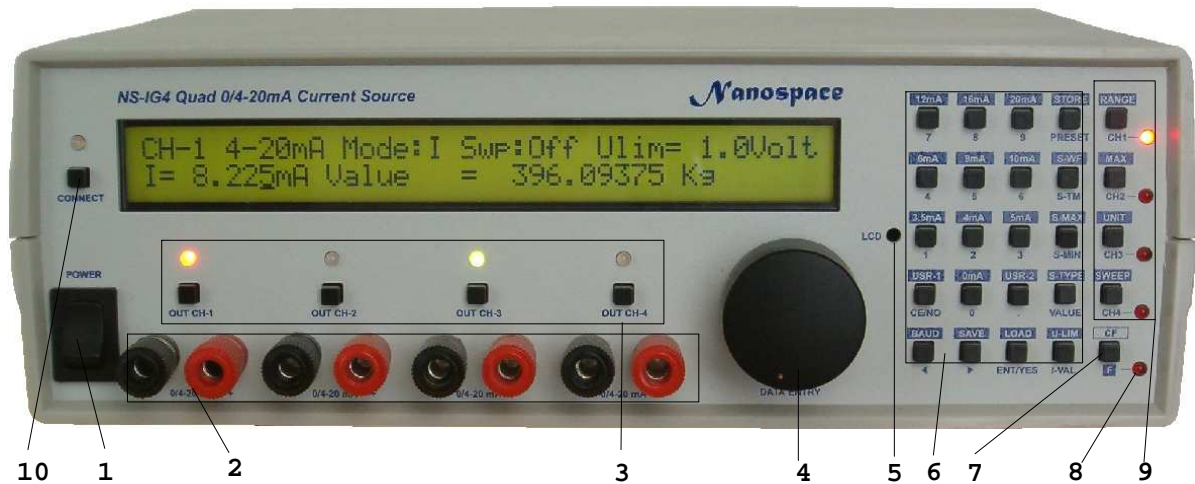
2.3. Cleaning

To protect the painting and the labeled area aginst damages take care of the followings:

1. Before cleaning always unplug the unit from the power line!
2. Don't use solvents and other chemicals as they can solve the painting or damage the display window.
3. Liquid materials dropping inside the instrument can damage the electronic parts, making short circuits and even fire!
4. Don't use sharp tools to remove contaminations as they can scratch the case or the display window.
5. To clean the unit we strongly recommend the use of a wet or slightly watery (soapy) rag. Always dry the unit after cleaning it, then - depending on the external temperature – wait a few hours before use it.
6. In the case that any liquid drops inside the instrument, power it off immediately and depending on the material used it must be cleaned and dried perfectly. **This procedure must be done by personel proficient in service and reair of electronic instruments! To turn on the unit again it must be perfectly dried!**

2.4. The controls and connectors of the unit

2.4.1. Controls on the front panel



1. POWER

This is the main switch of the unit. After turning on, the LCD (Liquid Crystal Display) immediately will show a sort welcome text and the version of the software with the creation date.

2. OUTPUTS

These are the banana pods outputs of the four channels. The RED are the positive (+) and the BLACK are the negative (-) connection points

3. Channel switches and state indicators

These push-buttons switch on and off the given output, and their associating state indicator LED-s give information about the states of the channels. When the LED is off then the output is off too, while when lit and it have green color, the channel is on. Red or orange color indicates switched or limited overvoltage condition (see chapter 3.1.1)

4. Value setting wheel

The control helps to set the selected parameter's value and to set step by step the current value. (see: settings)

5. LCD contrast

To display the system's messages and the channel's partameters, there is a 2x40 character Liquid Crystal Display (LCD). As it has a backlight panel, the unit is well readable in a dark environment. On the front panel there is a hole indicated by (5). To adjust the contrast of the display you need a maximum 3 mm Phillips screwdriver.

6, 7, 9 Keyboards

These are the double-function push-buttons for the setting of parameters and functions. There are three well separated groups. Group (6) is the general numeric and function buttons, button (7) is to select the upper and lower functions and the group (9) in the basic situation is to

select channel to edit and with the upper function to set other parameters. The associated LED indicates the selected channel to edit.

8. LED indicating the lower and upper function of the button.

If the LED is not lit, the function is always determined by the text under the key, while if lit, the button function is indicated by the text above the key.

10. Connection to PC (Personal Computer): button and LED

Pressing this key makes it possible to toggle the communication with a PC on and off. If the LED is lit the unit is in ON-LINE mode. In case of traffic, the LED's orange color indicates that the unit has a message received from the PC.

2.4.2. Controls on the rear panel



1. Power connector

This connector is the main power input of the unit. Use a standardized instrumentation power cord with ground connector. As the unit is double-insulated and the channels are separated galvanically, the ground is only connected to the rear case-panel holding the instrument's transformer making an electrical shield for it.

2. Fuse

To protect the unit from any line ripple, there is a standard glass-type fuse with 160mAT/230V (delayed). To change it, please use a screwdriver to turn off the moving part of the fuse-holder and replace the fuse. Always use fuse with the value indicated under the fuse holder!

3. RS23 port

It is the standardized RS232 DSUB-9 female connector, for the serial communication with personal computers or with other controller systems. Please check the section "Computer Link" for further information.

4. Connection for the calibration resistor

These pods serve to connect a current-meter serially with the output. See section 3.1.3.4 for more information.

2.5. Getting started

Connect the instrument with the supplied power cord into a 230VAC power line, then switch on the unit with the POWER (1) switch on the front panel. During the first approximately 5 seconds the display will show the following text:

```
NS-IG4 4-CH. 0/4-20 mA CURRENT GENERATOR
NANOSPACE Bt. V03.00.077 12-apr-2010
```

The lower line shows the version number of the software and the date of the creation. Then it will show the basic display mode with the most important information belonging to the first channel, Ex.:

```
CH1 0-20mA Mode:I Swp:Off Ulim= 1.0Volt
I= 0.000mA Value = 0.000000 mA
```

The LED near to the RANGE/CH-1 button will be illuminated, signaling that the selected Channel is the first channel.

The LED's above the channel's ON/OFF buttons are lit when the given channel is ON

3. Setting up and handling of the instrument

3.1. Basic Settings

The instrument is not only a current source in the general sense but an instrument versatilely usable for many purposes. To use these functions there are a lot of parameters to set. The values of the currents to generate are not only programmable by their own values but there is possibility to assign real physical values to the channels. This feature makes it avoidable for the user the difficulty of conversions “value-current-value” and makes it possible to give a better overview of the instrument especially when using multiple channels at the same time.

With the use of the internal function generator there is the possibility to generate currents varying by the time, even with periods of days. If that weren't enough, the PC link makes it possible to do automated measurements too.

The possibility of programation and save/recall of the settings are to support the fast and error-free adjustments.

3.1.1. Voltage limits of the outputs

One of the most important features of the channels are the output voltage limiting. As known, an ideal current source – if there is no current on its outputs – theoretically can supply infinit voltage on the output. In this instrument this value can be approximately 30VDC. As this voltage is able to destroy devices in some measurements (Ex. testing LED's and brightness) or in case of accidentally reversed connection, the unit has a built-in voltage protection circuit that can limit the maximum output voltage value on a given level.

The user must setup the voltage limiting value as the first step. What happens when the desired current value needs a bigger output voltage than the value set? In this case after switching on the channel, the associated LED's color (key group 3) will be red or orange instead of green. This signals the overvoltage situation (ex. if you set 10mA on a 2Kohm resistor, the voltage across the resistor is 20V. If the limit is set for example to 18V, the limit system will be active).

There are two operation modes: switching and limiting mode. The difference between the two modes is that in switch mode - if the limit is reached once -, the output will be disabled and it remains disabled until the CE/NO key is pressed, if the overvoltage condition ceases. In limiting mode the output will be active and the output current falls to the level, where the output voltage is equal to the level of limit set.

To set the limit value and the limit mode:

1. Select the channel to edit with one of the CH1-CH4 buttons.
2. Press the "F" then the U-LIM buttons.
3. The display will show a similar text:

```
CH1  0-20mA  Mode:I  Swp:Off  Ulim= 1.0V-L
```

4. With the Data Entry knob (4) select the limit value between 1.0V and 25V by steps of 0.5V then press ENT/YES. If the limit is set >25.V the limiting system will be disabled.

5. By pressing the CE/NO button the program will return to the basic display mode without any modification
6. To select the working mode press the < or > keys to select the desired mode. The letter L or R will show 'limiting' or 'switching' mode. After selecting the working mode press ENT/YES to accept choice.

Warning! If the limit value is too low (1-2 Volts) sometimes happens that the limiting system activates even for zero current. This happens when the outputs are connected galvanically or there is any noise on the output. It is not a failure, simply press the CE/NO key to disable the error!

3.1.2. Setting the current value

There are multiple methods to set the value of the current: the use of the data entry wheel, Using the numeric keypad, or the use of keys dedicated to fixed values. Furthermore there are three more possibilities to recall user-predefined values.

Warning! To enter directly the value of the current, the letter after the 'Mode' must be an 'I' (current mode) In case if this letter is V (value mode) please press IVAL key to set the I-mode. To readout the current value, please use the field on the left side of the second line of the display! (On the next figure it is shown in italic, on the display there is no italic letter)

CH1 0-20mA Mode:I Swp:Off Ulim= 1.0V-L R
I= 0.0000mA Value = 0.000000 mA

3.1.2.1. Using the data entry wheel

After selecting the channel to modify (CH1-CH4) rotating the wheel (4) selects the current value. The increment/decrement step of the setting is depending on the position of the cursor. To select the decades to edit, use the < and > keys. If the cursor is under the 10E-3 position, the step is 312.5nA

If the channel is on (and the LED above the key is green) the output will follow the changes immediately.

3.1.2.2. Numeric keyboard

To enter values with the numeric keyboard:

1. Press the wanted value directly with key numbers and the dot key as on a calculator
2. Press the ENT/YES key to record the value
3. To correct the value (one step back) press the CE/NO key shortly.
4. To cancel editing and to restore the previous value, press the CE/NO button for 2 seconds, and you will be back in the basic display mode.

The current value is adjustable between 0 and 20.4795 mA.

3.1.2.3. Direct value keys

Some often-used current values are directly recallable with the numeric keys. To do this

1. Press the "F" key
2. Then press one of the fixed value keys. These are: 0, 3.5, 4, 5, 6, 8, 10, 12, 16 and 20mA

On the output you can measure immediately the selected current value, if the output is on and there is no overvoltage condition!

3.1.2.4. Using USR-1, USR-2, PRESET keys

If you need to use any other special current value not presented in the fixed current list, you can set them in three special memories. These are the PRESET, USR-1 and USR-2 memories. To set the value:

1. Set up the desired current value with one of the methods mentioned previously: wheel, or numeric keys
2. Press "F" then the STORE/PRESET key
3. Press the key for the selected memory:
 - a. PRESET or
 - b. "F" then USR-1 or
 - c. "F" then USR-2 key
4. After this the instrument will store the value.
5. To exit from this flow use the CE/NO button

To recall the value from the memory please press

1. The PRESET key or
2. After pressing "F" press USR-1 or USR-2 key

The display will show the selected value immediately. Recalling the value from the memory will not change it. In the second case, pressing "F" again, will abort this procedure.

3.1.3. Direct value entry

In case of industrial processes, the use of direct current values is very rare but more often the use of direct physical values. Therefore the instrument has a system to enter and display direct values. For example, if we want to simulate a water flow-meter which is measuring in the domain of 0-5000m³/h and the output is in the range of 4-20mA, with setting the following parameters it is possible to enter the current indirectly with the physical value and we can display the current value directly from the physical value.

3.1.3.1. Setting the range

As the first step we must tell the system which current (0 or 4mA) is assigned to the 0 physical value. This can be done with the use of RANGE function:

Press "F", then the RANGE/CH1 keys. The display will show the change:

1. In the upper line it is possible to see 0-20mA or 4-20mA
2. On the left side of the lower line the display will show the current value assigned to the given value shown on the right side of the lower line

3.1.3.2. Maximal value

This informs the system of the physical value assigned to the 20mA output current.

To activate this press "F" then the MAX/CH2 keys. On the display the following (or similar) text can be seen:

Assign value to 20ma current: 20.000000

Now with the numeric keys please enter the new value assigned to the maximum value. To correct data use the CE/NO and to accept it the ENT/YES keys. The change can be realized immediately.

Conversion between the physical values and the currents are the following formulas:

0-20mA	4-20mA
Value= $I/20*MAX$	Value= $(I-4)/16*MAX$
Current= $Value/MAX*20mA$	Current= $Value/MAX*16+4$

3.1.3.3. Name and units for the channels

To ease the identification of a channel, it is possible to assign the name of the physical parameter to the selected one. For example temperature, weight, etc. It is also possible and useful to assign the unit of the parameter. To do these:

1. Press "F" then the VAL-N/CH1 (value name) or the UNIT/CH3 (unit name) keys
2. Using the wheel select the desired letter. If you do not rotate the wheel during more than 2 seconds, the current position will hold the last selected letter and the cursor steps to the next position (except from the last position). To move the cursor between the positions, use one of the < > buttons. Pressing the CE/NO key shortly clears all the text filling it with space characters. Holding this key approx. 2 seconds, it exits from the editing mode without modifying the last value.
3. To save the new value's or unit's name press the ENT/YES key. There are 8 characters for the name of the parameter, and 7 characters for the units.

3.1.3.4. Calibrating output/resistor

The instrument has an external connection (R-CALIB) which allows the user to measure the selected channel's current by an external device or to connect a serial resistor to measure voltage across it.

To select the channel to be outputted for measurement purposes, press the "F" then the RS232/(R-CALIB) key and now is possible to select it with the wheel. There are many possibilities to choose from.

R-TEST MODE: CHANNEL-1

To disable this function, select the OFF option. To select a fixed channel, select Channel 1-4. If you want to select the channel under editing, select the Auto-select standalone or cascade. In this case pressing CH1-CH4 the test output will be connected serially with the normal output of the selected channel.

If two NS-IG4 generators are connected via RS232 with a special cable, and cascade mode is choosed, the two instruments can control each other. This way it is possible to control 8 or more channels with the same tesing point without any modification of the connections. When switching over from one channel to another channel, all channels will be separated from the test lines, and the new channel will be selected only after a short time. This avoids the system to make short-circuit between channels in the moment of switching. Please note, that to use this feature, the voltage limiting settings must be in limiting mode! To understand more about this function, please check the circuit diagram in chapter 5! In the basic display mode the last letter (R) of the first line indicates if the channel is connected serially to the output pods or not.

```
CH1 0-20mA Mode:I Swp:Off Ulim= 1.0V-L R
I= 0.0000mA Value = 0.0000000 mA
```

3.2. Handling program places

3.2.1. Saving configurations

After seting up all channels, it's usefull to save this configuration in one of the 17 program memory places. To do this:

1. Press "F" then SAVE/> keys.
2. With the aid of the wheel select the memory place between 1 and 17
3. Press the ENT/YES button. The cursor will jump to the field of the program's name
4. Using the same method as editing the name of the channel or units, give a name to the program to be saved as your requirement. If the name has the text '<Empty>', theoretically that is an empty memory place, but be sure to not save without modifying the name when saving. After editing and pressing the ENT/YES key, the unit will display:

```
programming position xx Please wait .....
```

Please wait until the process terminates and the system returns to the normal basic display mode.

```
Warning! One memory place holds all the data for the four channels, the communication parameters and the ON/OFF states too!
```

3.2.2. Loading configurations

To recall the saved configurations use the similar method as for saving:

1. Press "F" then LOAD/ENT-YES keys
2. Select the program position based on its name or its number with the data entry wheel
3. Press the ENT/YES button

The stored configuration will be loaded and the instrument will setup based on this information.

Warning! Restoring the configuration will overwrite all channel's data, communication parameters and state of channels!

3.2.3. Set a channel to its default settings

To set a channel to the default state:

1. Select the channel to initialize with one of the CH1-CH4 keys
2. Press "F" then OUT CH2 (INIT) key
3. The display will show a warning:

This will initialize current channels's parameter area! Are you sure? YES or NO

4. To set the channel into default state, press the ENT/YES key or the CE/NO key to exit from this function without modification.

There is more information in the appendix about the default states of the channels.

3.2.4. Copy channel's data

To set two channels with similar data, there is a possibility to copy the data of one channel to another selected. To do this:

1. Select the source channel with its selector key CH1-CH4
2. Press "F" then OUT CH3 (COPY) keys
3. With one of the CH1-CH4 keys select the destination channel to copy the source information. To exit without modification press the CE/NO key.
4. After the selection, the system will ask for confirmation of this operation. To confirm copying press ENT/YES or press CE/NO key to abort operation. In this case you can continue from the 2. point.

It is possible to repeat this operation with any channel, thus you can setup all channel with the same information.

Warning! After the copy procedure – due to some earlier settings - the internal function generator can reference mutually from one channel to another. In this case the synchronization between channels can be 'frozen'. To avoid this please check all generators and set the synchronization sources again after the copy procedure. See chapter 3.3.4!

3.3. Function generator

One source of the versatility of the instrument is the internal function generator. The originally planned sweep generator nowadays grew up to be a complete function generator, which can work alone on any channel but may work together in a synchronized mode too. This feature makes it possible to create slow changes using complex functions. Furthermore this system allows the user to modulate the output current by randomized values too.

For the setup of the function generator there is an individual page to display all parameters for the selected channel.

These are

- The function group (S-WF)
- Sub type of the function or other special parameter such as phase, decay time etc. (S-TYPE)
- Minimal (S-MIN) and maximal (S-MAX) value of the range in which the output current will change
- Period time of the function (S-TM)
- Source channel for the synchronized starting
- On/off state of the random generator

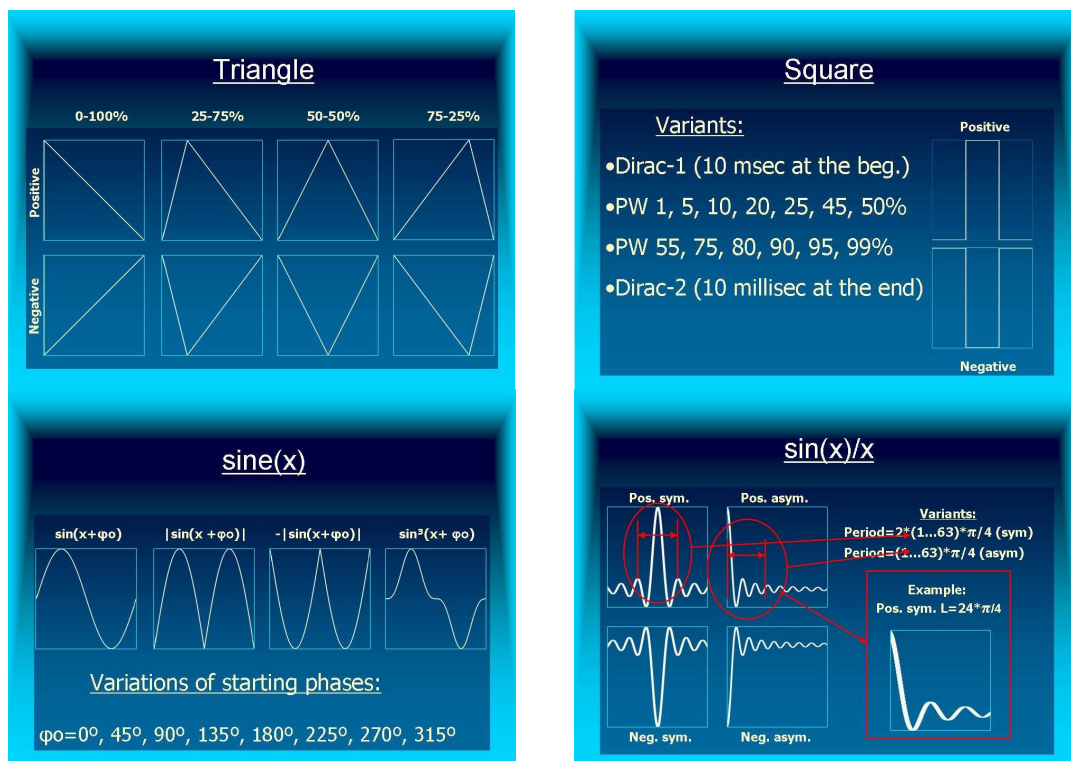
To edit the parameters of the generator:

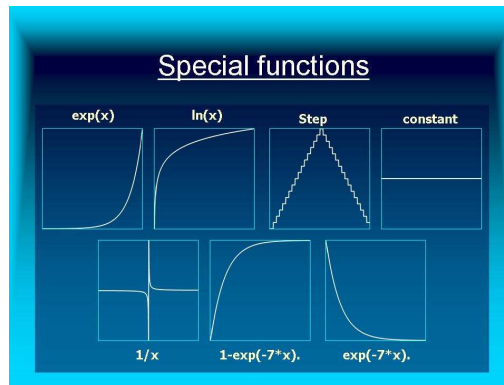
- After selecting the channel which we want to modify, press the key of the parameter. These may be S-WF, S-TYPE, S-MAX, S-MIN, S-TM. Do not forget to press “F” first if the parameter name is above the key! (Ex. S-WF is upper function for the key)
- With the key CE/NO we can step back to the basic display mode without modification of any data.
- Pressing ENT/YES button we can step back too, but the last modification will be stored.
- Pressing one of the channel selection key (CH1-CH4) while in the generator’s page, the input modifications are stored in the abandoned channel’s memory and the new channel is selected.

3.3.1. Basic waveforms and their sub-types

1. Press "F" then S-WF/S-TM keys to select the generator’s parameter page
2. Select the desired group of function with the wheel
3. To exit press the ENT/YES or to exit without modification the CE/NO key

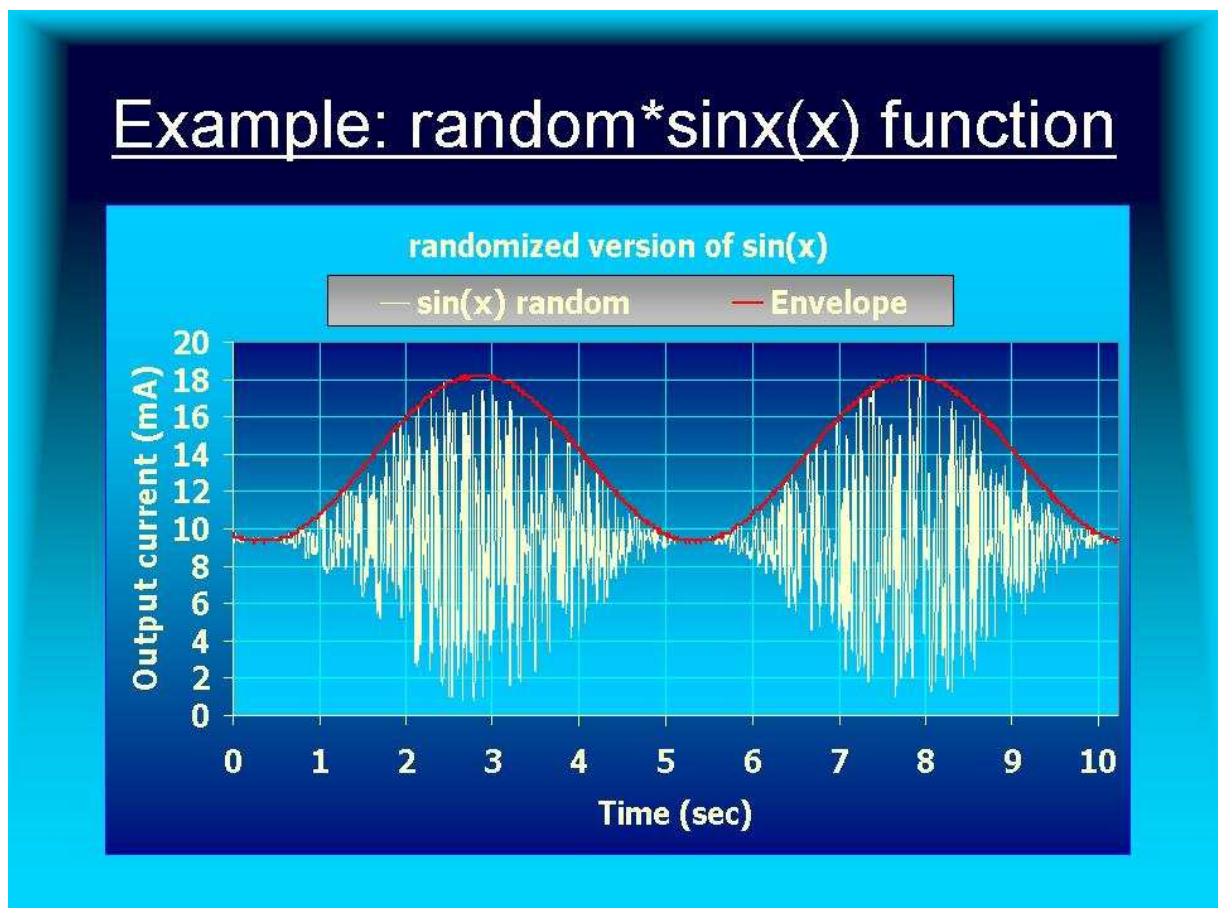
The functions and their variants implemented in this software version are the following:





To select the sub-type for the given function, press "F" then S-TYPE keys. If we were in the basic display mode (with the currents and values of the channel) it will jump to the generator's display page. If we were in the generator's page, the cursor will jump to the field of the variant and we can select it with the wheel. In some cases (ex. sawtooth) the function has one more parameter to edit, so please use the \leftarrow keys to select the sub-type or the third parameter. To edit the third data use the wheel again.

All function can be combined with a random-value generator. In this case the original function selected acts as an envelope and the randomized values are restricted in the range determined by the envelope. Thanks to this function the user can make very complex measurements. To activate or deactivate the randomized function, select the main waveform setting mode (S-WF). With the \leftarrow key the cursor jumps to the field showing WF or RN. The first indicates that the function is not in random mode and if RN is selected, the generator uses the function as envelope for the random-generator. To toggle between the two states use the wheel. To return to basic waveform setting press the \rightarrow button.



3.3.2. Minimum and maximum values

These are the lower and upper limits in which the generator modifies the output value. To set these values please use the numeric pad as it is described in the current setting section.

Warning! Pressing the CE/NO key for a longer time, we not only exit from the value editing but from the whole generator-parameter edit function too!
The minimum and maximum values are physical and never current values!

3.3.3. Setting the period time of the function

To define the functions period-time it must be given by numeric entry. The editing only differs from the normal numeric entry that if you press the < > keys the cursor will move between the editing positions and it is possible to correct the values pressing the number again. To define the time, you must enter it in the *hours, minutes, second*. format. The seconds are in decimal (xx.x) format. The longest time is 100 hours minus 0.1 sec. The generator refreshes the function sample on every 10mS. Giving too short period times, the steps of the function values will be too coarse, with big jumps. The recommended shortest period time is 1 second. In this case 100 steps are appropriate for the function values to get smooth values.

3.3.4. Inter-channel synchronization and starting, stopping the generator

In the normal display mode pressing "F" and the SWEEP/CH-4 keys, toggles the function generator between ON and OFF states. If ON selected the output begins to follow the value defined by the generator. It was appropriate to make a system with the possibility to start all channels function generator at the same time. To achieve this, we must setup this synchronization system at the same time when editing the parameters of the generator. To do this:

1. Select any parameter of the generator to edit (this will recall the generators editing page)
2. Press "F" then the SWEEP/CH-4 key. The cursor will jump to the field SY-x with one of the following x values: M, 1, 2, 3, 4. If M is shown, this means that this channel is the master, so you can toggle the ON/OFF state of the generator with the SWP key in the basic display mode. If there is a number between 1 and 4 for x, this means that the channel is in slave mode and its ON/OFF state depends on the state of the channel-x. This method ensures the synchronized start/stop of all slave channels assigned to the master. You can use any channel as master and can assign any other channel as slave. It is possible to define more than one master but a master can never be slave for another channel.
3. The selection as slave or master is made by the wheel.

3.4. Beep control

When pressing any key there is a short beep signal as an acusting feedback. If this sound is disturbing, it can be switched off. To toggle this (on and off), press the I-VAL/U-LIM key immediately after powering on the instrument (while the version info is on the display).

4. Serial communication RS232

The instrument can be connected to a computer via the RS232 interface. This gives more advantages to the user working with it:

- Possibility to save and load the data of the 17 memory places, multiplying the number of configurations.
- With dedicated software all parameters of the four channels can be visualized at once, easing the overview and the handling of the system.
- The unit can be used as if it would be an external four-channel current generator interface for a PC, so it is useful for automated measurements.
- Using this computer link it can expand the capabilities of the built-in function generator using user defined functions.
- Possibility to upgrade the internal software by the user via the RS232 link.

4.1. Connector pinout and communication parameters

For communication there is a DSUB-9 female connector on the rear side of the instrument, for the standard RS232 connection. To connect with a PC use the following table*:

NSIG4		Connection	PC	
Pin number	Function		Pin number	Function
1	**	Connected	1	DCD
2	TXD	Connected	2	RXD
3	RXD	Connected	3	TXD
4	**	Connected	4	DTR
5	GND	Connected	5	GND
6	**	Connected	6	DSR
7	CTS	Connected	7	RTS
8	RTS	Connected	8	CTS
9		Not used	9	RI

*To connect more instrument in cascade mode (see chapter 3.1.3.4 fejezet) please ask our team for the possible solutions!

**Connected internally

4.2. Communication Protokoll

4.2.1. Parameters of communication

The serial link works with 8bit, 1stop, no parity configuration with selectable Baud rate. To select the speed:

1. Press "F" then the BAUD/< keys
2. Using the wheel, select the desired communication rate from: 1200, 2400, 4800, 9600, 14400, 19200, 28800, 38400 and 57600bit/sec.
3. Press ENT/YES key to terminate the procedure. To exit without modification press the CE/NO key

4.2.2. Commands accepted by the unit and structure of the answers

The basic structure of the commands to control the instrument is a character string nested to a well-defined frame of characters, that is:

!.....(CR)

where (CR) is the carriage return character HEX \$0D in the ASCII code table. The command string is between the starter character (!) and the ending character (CR).

Commands used in the system:

!INMXYZU (CR)

Sets the current and state of the given channel:

I (HEX \$49) command code
N the number of the channel to control (HEX \$30-33) CH-1,2,3,4
M mode control (HEX \$3X) where bits of X are:
 BIT0-2: not used
 BIT3: Channel 0=OFF/1=ON
XYZU: ASCII hexadecimal characters (0-9, A-F). They forms the 2 byte word of the Digital Analog Converter. X is the most significant nibble of the word and U is the least significant nibble of the word. The current value is calculated by the formula:
 $(i)=20.48*(XYZU/65536)[mA]$

!PX (CR)

!WX (CR)

recalls (P) or stores (W) the program data from the EEPROM memory position (X). It has the same function as the LOAD and SAVE commands.

P (HEX \$50) and W (HEX \$87) the command code
X (HEX \$40-51) the lower 5 bits of the byte defines the number of program place

!SXXXXXXXXXXXXXXXXXXXX (CR)

defines the name of the program to save. Use before the !WX command.

S (HEX \$53) command code
X (HEX \$00-10) length of the name string
Y The name itself. Together with the X defines the name as a Pascal type string. The maximal length of the string is 16 characters.

!V (CR)

requests the software version of the unit.

V (HEX \$56) command code

As reply the unit will send the following data to the PC:

'version-string'.(CR)

!O (CR)

resets the over-voltage state. It acts as the CE/NO key in normal mode.

V (HEX \$56) command code

!D (CR)

sends the temporal parameter area to the PC.

The structure of the answer is:

```
# igendata baud-rate (CR)
```

that is:

```
#D 1.ch. data, 2.ch. data, 3.ch. data, 4.ch. data baud-rate (CR)
```

The data of this structure defines all data for a given program. The first record (`channeldata`) is the data for one channel. The type (`igendata`) defines the four channels.

```
type channeldata=record
  currval:word;           //DAC value to set the current
  usr1:word;             //DAC value of the current stored in USR-1
  usr2:word;             //DAC value of the current stored in USR-2
  preset:word;           //DAC value of the current stored in PRESET
  smax:word;             //max. current supplied by the fx.gen
  smin:word;             //min. current supplied by the fx.gen
  maximum:int64;         //physical value assigned to 20mA *1
  minimum:int64;         //physical value assigned to 0mA *2
  stype:byte;            //sub-type of fx. gen function *3
  icursor:byte;          //position of the cursor
  swf:byte;              //control of the function generator (fx.gen)*4
  ulim:byte;             //output voltage limit n*0.5+1(volt)
  mode:byte;             //working mode of the channel *5
  stm:array[0..2] of byte; //period time of the fx.gen n*0.1 sec *6
  valname:string[8];     //name of the channel
  units:string[7];       //unit name string
end;

type igendata=array[0..3] of channeldata;
```

baud: one byte that defines the current baud rate with a number between \$00 and \$08. For the values defined by the number please check the baud rate values in the section 4.2.1.

*1 value*2³² (fixed point integer, 4 bytes for fraction part and 4 byte for integer part)

*2 value*2³². Only used from version V04!

*3 depends on the wave type. Please ask for values!

*4 bit7-6 number of channels for synchronization in fx.gen.

bit5-4 mode of the random generator: 00-off, 01-on, 10,11 not used

bit3-0 main waveform(0-sawtooth, 1-square, 2-sin, 3-sin(x)/x, 4-special, 5-15 not used)

*5 bit7: channel 0=OFF/1=ON

bit6: range 0=0-20mA/1=4-20mA

bit5: function generator 0=OFF/1=ON

bit4: edit mode 0=direct current/1=editing value

bit3-0: number of integer digits of the entered value

*6 maximum value: 3599999 (99h 59m 59,9s)

!CN ddd (CR)

This command overwrites the temporal area of the selected channel (N). For structure see the `channeldata` description.

C (HEX \$43) command code
N the number (HEX \$30-33) of the channel to modify
ddd data of the a channeldata area

!RN (CR)

request of the channel (N) parameters. The answer is a message to the PC.

R (HEX \$52) command code
N the number (HEX \$30-33) of the channel to send

Answer: # ddd (CR) where ddd=channeldata

!N (CR)

requests the names of the stored programs. The answer is a list of the 17 name string sent to the PC.

N (HEX \$4E) command code

Answer: # name-1.....name-n (CR) where name-x is the name string of the program in Pascal format: first character the length, all others the characters of the name

!T (CR)

This command separates the instrument from its own R-CALIB output.

T (HEX \$54) command code

There is no reply for the command but it is sent always when the user presses the CH-1..CH-4 keys in *Auto-select cascade mode* (see chapter 3.1.3.4).

4.3. Software update

In some cases, it may be necessary to upgrade the unit's operating system. As mentioned in the description of the RS232 serial interface, via this connection it is possible to upgrade the software of the instrument. To do this you must use the little software running on PC in Windows environment named UPDATER.EXE. It can be found on the CD supplied with the instrument or download from our WEB page.

To use this program:.

1. System requirements: PC with serial connection, WIN98, 2000, XP or higher, 1MB on hard drive.
2. Install: copy the UPDATER.EXE file to the harddrive. You can choose any existing or created directory.
3. Power off the instrument.
4. Connect the instrument via standard RS232 cable to the computer.

5. Start the UPDATER.EXE program file. It is a standalone program that will not use the registry or other common directory in your system.
6. In the PORT menu of the program select the COM port (COM1-COM8) connected to.
7. Turn on the instrument holding the < > keys. The display will show the following text informing about the version number of the loader. The lower line will hold the size of the file, the checksum value and the state of the downloading procedure. Until the beginning of the download these three fields remain empty.

NANOSPACE NS-IG4 BOOTLOADER BTL-V2.0 FSIZE=\$.... CHKSM=\$.... WAIT CONNECTION

8. Press the CONNECT button inside the PC software. The TXB signal will flash on every second trying to connect to the unit. If the connection is established the yellow ACK signal will flash too informing about the good connection. If it is missing, please check the connection, the cable or the selected port. You must use a COM port not used by any other software! About the succesfull connection the unit will inform you with the following text:

NANOSPACE NS-IG4 BOOTLOADER BTL-V2.0 FSIZE=\$.... CHKSM=\$.... CONNECTED

9. Now in the PC program please select the SEND command inside the File menu group. It will open a dialog window to choose the file to be sent into the instrument, previously downloaded from our WEB page or procured by other media. Generally the file name must be NSIG4.SOP or similar, but always with file extension .SOP. After selecting and opening it - if there is no error -, the PC program will show a progress bar while the purple BLK signal is signaling the download procedure. Meanwhile the display of the instrument will show the file size and checksum information. At the end of the download the instrument will check the received and expected checksums and will inform the user if it was correct or not.

NANOSPACE NS-IG4 BOOTLOADER BTL-V2.0 FSIZE=\$E000 CHKSM=\$4651 CHECKSUM-OK

10. When the download has finished, the PC will ask if it can abort the connection or not.
11. As the last step switch off the instrument and after 5-10 seconds turn it on again. If the the new software was successfully downloaded the system will begin to work.
12. Please click the Disconnect button on the PC software and close the window.

5. Test mode

To enter test mode press and hold the ENT/YES key while powering up the instrument. After the short initial welcome text the unit will be in test mode, where it is possible to check the functionality of some hardware modules and do some special settings. To exit from the test mode either power off the unit, then power on it again or press the CE/ENT key for approximately 1 second.

To select the desired test function use the data entry wheel.

5.1. KEYBOARD TEST

This test checks the keys of the keyboard. After selecting this test press the ENT/YES key to enter this mode. Pressing the keys or rotating the wheel the display will show the internal key-code of the key. To exit one level up (to test selection) press the CE/NO key.

5.2. DISPLAY & LED Test

After selecting and entering this mode with ENT/YES key, the display begins to show the ASCII code table shifting all characters one place to the left every half second. All LED indicating the channel selection must be red and the LEDs above the channels ON/OFF and RS232 must be orange. To test the LED on the right side of the „F” key press this key. To exit press CE/NO.

5.3. Test of RS232 line

Please connect a "NULL" modem connection to the RS232 connector. Entering the RS232 test mode the system will send data out serially and if the received data is the same as the sent data, test will pass. The test checks sending/receiving in all possible baud rates. After the data testing the unit tests the RTS/CTS lines too. In the case of any error the display will show the failure information. To exit from the test press CE/NO.

5.4. EEPROM Initialization

This mode will reset all internal program places in the internal EEPROM memory to its default values. It will include the 17 program places, the communication parameters and output states. After entering this mode, the unit will show a warning text about the operation. It is the decision of the user to proceed or to abort the process. ENT/YES or the CE/NO button serves as proceed or abort controls.

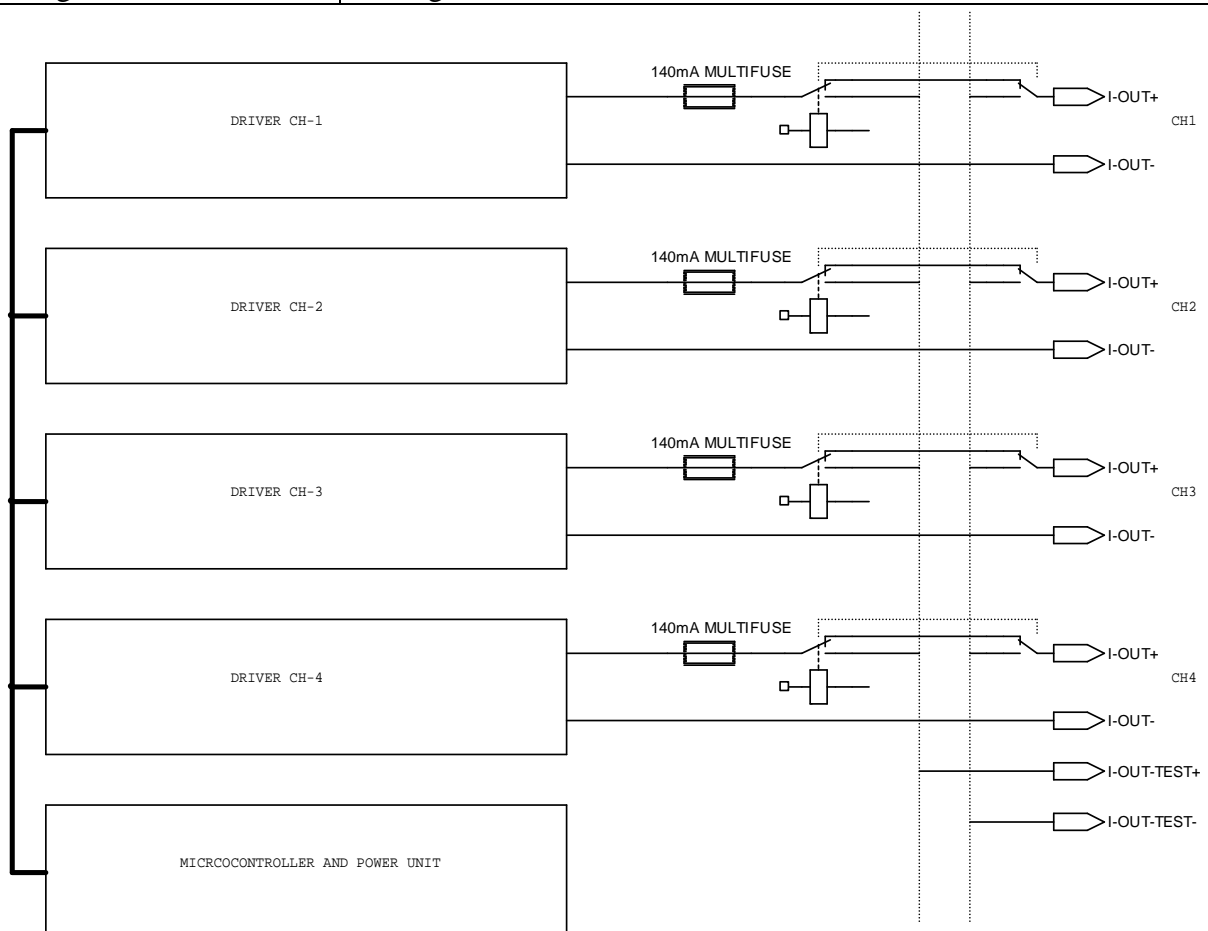
Warning! This function will clear all setting of the channels previously stored! It is strongly recommended to not use this function unless it is not definitely required! This may be for example if there is a software failure.

5.5. UNIT'S Identification (serial number)

Selecting this mode, the display will show the serial number of the product. It is not possible to make any modification! To exit from this mode press key CE/NO.

6. Technical Data and schematic

Power supply:	230VAC/50Hz
Max. power:	14VA
Fuse:	160mAT
Number of channels:	4 channels, separated galvanically $U_{insulation} = 200VDC$ max.
Output current:	0-20.4797mA
Output voltage:	max 30VDC (no load, and if $U_{lim} > 25.5V$)
Output accuracy:	312.5nA/step +/-2.5 uA absolute deviation (in full temp. range)
No. of memory places:	17
RS232 parameters:	Selectable 1200, 2400, 4800, 9600, 14400, 19200, 28800, 38400 and 57600 bauds, fixed: no parity, 1 stop and 8 data bits
Output and test connectors:	4mm-banana pods. Red positive, black negative side
Display:	2x40 character Liquid Crystal Display (LCD) with green backlight
Refresh time of the outputs:	10ms
Period time of the function generator:	Adjustable between 0.1 sec and 99h 59m 59.9sec közt by 0.1sec steps
Size:	260x90x200mm (width * height * depth) without the connection pods
Weight:	2,75Kg without accessories and cables



WARNING!

The content of this manual is property of NANOSPACE Bt!

Copying or electronic transmission of any part of this manual is forbidden without prior written consent or permission of the author.

We preserve the rights to change the parameters of the instrument and the content of the user manual without any previous notification!

NANOSPACE Bt.
1067 Budapest,
Csengery u. 71. 1/8
Tel.:+36-1-312 73 29
Mob.:+36-20-944 44 93
www.nanospace.hu
info@nanospace.hu

