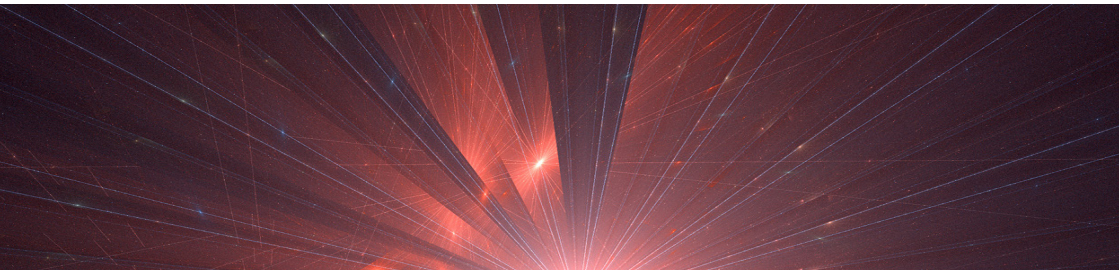
NC SOFTWARE



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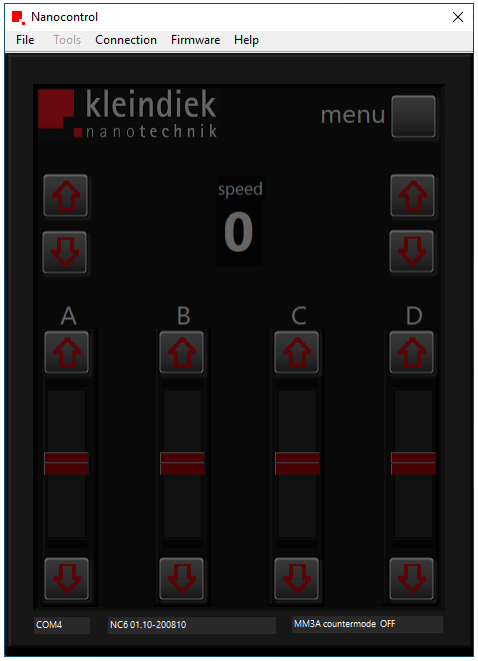
NanoControl Software Handbook version 20.11

Contact support@kleindiek.com with questions or for further information

Contents

User interface

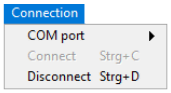
Main window

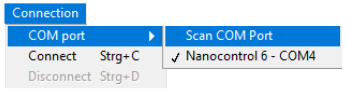


Interface prior to connection

Interface after connecting to an NC

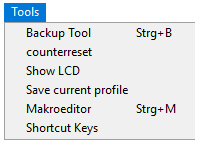
Upon launch the software will look for COM ports that are associated with NanoControllers and automatically connect to the first controller found. The connection can be severed (`ctrl+D`) and reestablished (`ctrl+C`) from the **Connection** drop-down menu. From here it is also possible to initiate a COM port scan (after disconnecting) and subsequently choose the desired COM port. The connection can then be established from the Connection menu or by using the keyboard shortcut.





The NC software replicates the operations performed using the NC's hardware interface (knobs, buttons, OLED display). It represents the menu and up/down buttons in the same configuration as on the NC's front panel. The four knobs are visualized as sliders for continuous motion and up/down buttons for single increments or for adjusting settings within the firmware menus. Executing the Amplitude Wizard is not possible from the NC software.

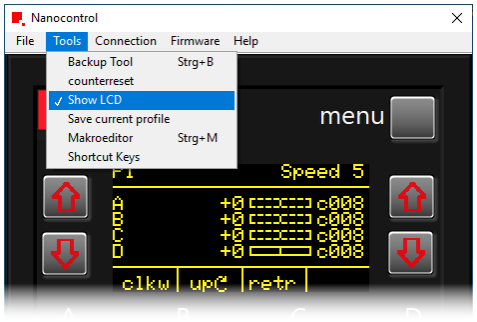
Tools



Once the software is connected to an NC, the **Tools** drop-down menu becomes available. This menu provides access to various tools and options for interacting with the NC.

The **Backup Tool** (`ctrl+B`) allows saving all six profiles from the NC to a folder on the connected computer and restoring these at a later point in time.

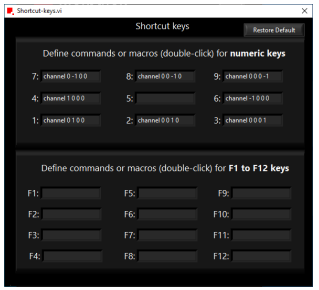
The **counterreset** option executes the same command as long-pressing the menu-button on the NC when the main screen is showing: All step counters or encoder counters are reset to zero.



The images on page 4 show the NC software's default display mode. By choosing **Show LCD** from the **Tools** menu, the software will switch to mirroring mode and display the contents of the NC's OLED screen. Please note that this requires constant polling of the NC via the USB connection which may slow down the execution of motion commands from within the software.

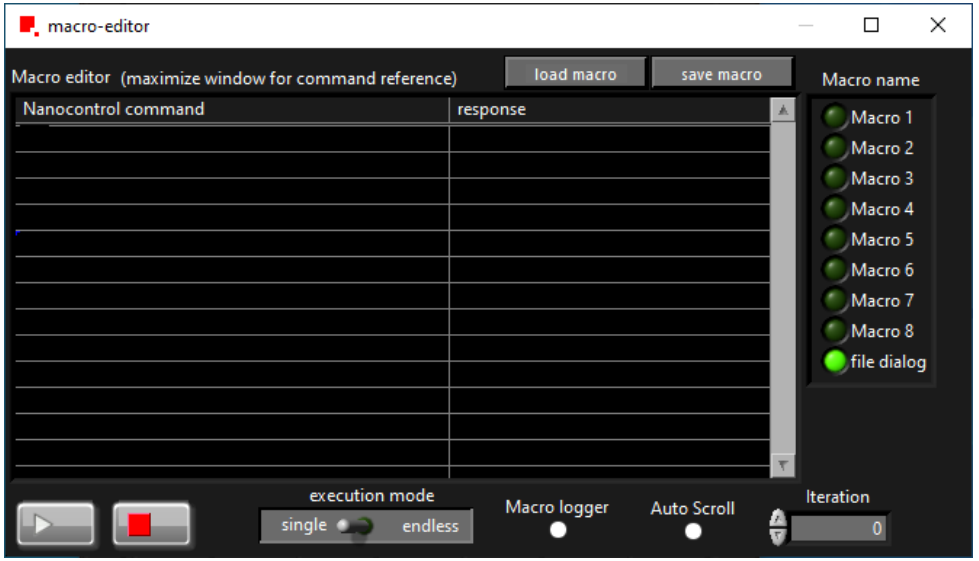
The **Save current profile** option executes the same command as long-pressing the menu-button on the NC from within the menu: The current settings are saved to the active profile..

Macro Editor (`ctrl+M`) calls the macro editor window. The macro editor is described below.



Shortcut Keys opens a window that allows assigning specific commands or macros to a number of keys. Simply double-click in one of the fields and reference the path to a previously generated macro file.

Macro Editor



The macro editor allows executing single commands or a series of commands that can be stored and recalled as needed. Up to eight macros can be assigned to the radio buttons for quick access. The '**file dialog**' option allows storing and recalling further macros.

Maximizing the macro editor window reveals a list of frequently used commands as well as a number of usage examples.

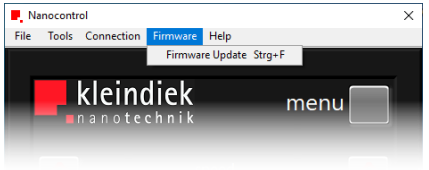
The **execution mode** toggle switches between single and looping execution. The **iteration** counter will indicate the number of loops that have been performed.

Activating the **Macro logger** will record the executed commands as well as the received responses in a time-stamped text file in `..\Documents\Kleindiek Data\NC6\macros`.

The **Auto Scroll** option ensures that the command currently being executed is visible in the macro list, should the list be so long as to exceed the page.

After entering one or more commands into the field(s) in the column **Nanocontrol command**, The macro is initiated by pressing the play button. Macro execution is halted when pressing the stop button - the current command is completed, subsequent commands are aborted. Each command returns a message that is listed in the **response** column.

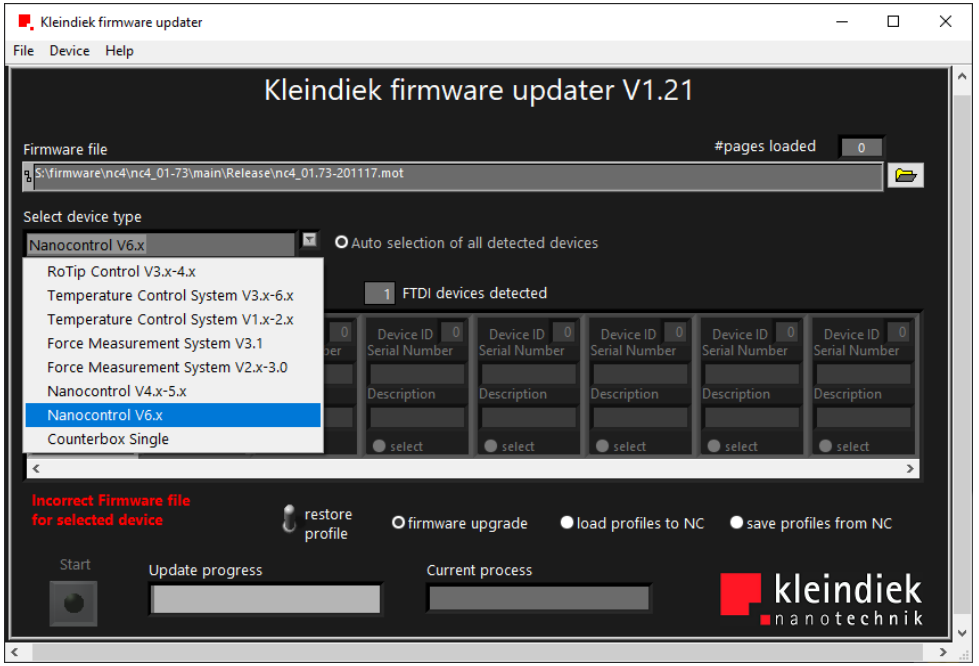
Upgrading the firmware



Upgrading the firmware is done using the Kleindiek firmware updater. The tool is also bundled with the NanoControl 6 software package and accessible from the **Firmware** drop down menu:

Alternatively, it can be downloaded from our website: www.kleindiek.com/firmware.

- Upon software launch, all connected devices of a given type are displayed. The device type can be chosen from the drop down menu.
- Use the folder button to select the firmware file on your hard disk. Should the firmware file not exist at the specified location or not match the selected device type, an error message will be displayed.
- Before initiating the update by clicking on the Start button, choose whether or not to restore the firmware settings (profiles) using the toggle switch.
- The radio buttons along the bottom of the window allow utilizing the software for firmware updates or for manually loading profiles onto the NC or saving them to the PC.



Command reference

Syntax

- Parameters must be separated by blank spaces (ASCII character 32).
- Every command must be terminated by carriage return (ASCII character 13).
- Lines in macros can be commented out using '#'.

Connection parameters

The NanoControl communicates via serial commands using the following parameters:
115200 Baud, 8, N, 1

Output

The NanoControl sends a carriage return terminated line after execution of a command:

<status char><tab><message string><CR>

<status char> can have one of the following values:

'o' for okay, 'e' for error, 'i' for info (e.g. Piezo Voltage Breakdown)

Info messages may be sent at any time without a preceding command

<message string> is either empty, returns a value described below or returns an error description.

Abort

Commands can be aborted during execution by sending 'stop<CR>'.

Examples

Command	Output	Description
coarse A +100	o<tab><CR>	Executes 100 positive coarse steps in channel A.
coarse A ?	o<tab>100<CR>	Returns value of coarse step counter for channel A.
fine C -10	o<tab><CR>	Sets the fine position of channel C to –10.
fine ?	o<tab>0 0 -10 0<CR>	Returns fine position A to D separated by blanks.

Examples (positional encoder systems)

Command	Output	Description
moveabs 0 0	o<tab>0 0<CR>	Moves substage to origin.
moveabs 100000 100000	o<tab>100000 100000<CR>	Moves substage 100 µm in each axis in a positive direction relative to the origin.
moveabs -100 -100	o<tab>-100 -100<CR>	Moves substage 100 nm in each axis in a negative direction relative to the origin.

Valid commands

Command	Parameters	Description
Movement		
coarse	<A..D> <-65536..65535>	Executes <-65536..65535> coarse steps in channel <A..D> at the current speed.
coarse	<A..D> <-65536..65535> <1..6>	Executes <-65536..65535> coarse steps in channel <A..D> at speed <1..6>.
coarse	<A..D> ?	Returns value of coarse step counter in <message string>.
coarse	?	Returns values of coarse step counters for channels A to D in <message string> separated by blanks.
coarsereset	<A..D>	Resets coarse step counter in channel <A..D> (no parameter resets all counters).
fine	<A..D> <-2048..2047>	Sets fine position to <-2048..2047> in channel <A..D>.
fine	?	Returns fine positions for all channels in <message string> separated by blanks.
fine	<A..D> ?	Returns fine position for channel <A..D> in <message string>.
fine16	<A..D> <-32768..32767>	Sets fine position to <-32768..32767> in channel <A..D>.
fineu	<A..D> <-80000..80000>	Sets fine position to <-80000..80000> in channel <A..D>.
finestep	<A..D> <-2048..2047>	Performs a relative movement of the fine position by the set number of digits <-2048..2047> in channel <A..D>.
finestep16	<A..D> <-32768..32767>	Performs a relative movement of the fine position by the set number of digits <-32768..32767> in channel <A..D>.
speed	<1..6>	Changes to speed <1..6>.
speed	?	Returns the current speed in <message string>.
speed	<1..6> <f01..c64> <f01..c64> <f01..c64>	Sets the number of fine or coarse steps to be executed for speed <1..6> in channels A to D.
knob	<ticks A> <ticks B> <ticks C> <ticks D>	Simulates tuning the knobs by the specified amount of ticks.
channel	<steps A> <steps B> <steps C> <steps D>	Steps in the range <-100..+100> for each channel are executed at the current speed. Will use fine with coarse if it is enabled.

Command	Parameters	Description
Movement		
go	<steps A> <steps B> <steps C> <steps D> <ms>	Steps in the range <-100..+100> for each channel are executed every few milliseconds <ms> at the current speed. Loop will continue until <stop> is sent. Will use fine with coarse if it is enabled.
stop		Stops any commands that are currently being executed by the NanoControl. Command itself returns an output. Thus two outputs are returned. Output from the stopped command and from stop.
stopnack		Stops any command. Command itself returns no acknowledgement.
Counter (only for systems with positional encoders)		
countermode	<OFF, XEYE, XEYEZE, XEYEZE5, X2EY2E, X2EY2E5, XEYE5, RAW, TILTT, T13, RETE, TOLD, MM3Ev1>	Sets the counter mode.
countermode	?	Returns the current counter mode.
counterread		Returns the values of the counters in <message string> separated by blanks. Counter values are in nanometers.
counterwrite	<A..D> <value>	Writes the given value to the specified counter.
counterreset		Resets all counters to zero.
moveabs	<A..D> <position>	Moves axis <A..D> to absolute position <position> and executes counterread.
moveabs	<position x> < position y> < position z>	Moves multiple axes to specified absolute co-ordinate position and executes counterread.
amplwizard		Starts the automatic amplitude detection routine.
relax	<A..D>	Relaxes channel <A..D>. No parameter relaxes all. This command only applies to the LT12830X2EY2E.
backlash	<-100..+100>	When a moveabs command is sent, an offset of <-100..+100> µm is used to ensure that the co-ordinate is always approached from the same direction. Value must be set via PC and is not permanently saved in NanoControl settings. Backlash 0 to deactivate.

Command	Parameters	Description
MM3E only		
goto	<ch> <position> [mode]	See next command.
goto	<pos A> <pos B> <pos C> <pos D> [mode] [mask]	mode = 0: move exactly to target position including fine movement mode = 1: move only with coarse steps to target position. May not reach exact target position mode = <2..100>: limits number of motion iteration loops to given number mask = <bitmask> enable specific axes only. Values can be any combination of A=1, b=2, C=4, D=8 Example: '15' moves all axes (1+2+4+8) '5': moves only axes A and C (1+4)
gotohome	<A..C> <direction ±1>	Moves the given channel in the stated direction until a mechanical limit is reached.
mgs	<-2047...2048>	Additional voltage bias for MicroGripperSystems.
mgs	?	Returns the current bias for MicroGripperSystems
Configuration - all configuration commands can be issues with the **?** parameter to read back the current status		
devicemode	<NM, MM3A, LT>	Sets device mode.
frequency	<300..20000> <300..20000> <300..20000> <300..20000>	Sets the frequency for channels A to D.
minamppos	<1..79> <1..79> <1..79> <1..79>	Sets the positive min. amplitude for channels A to D.
minampneg	<1..79> <1..79> <1..79> <1..79>	Sets the negative min. amplitude for channels A to D.
stepsize	<1..79> <1..79> <1..79> <1..79>	Sets the step size for channels A to D.
pulsewidth	<value A> <value B> <value C> <value D>	Experimental pulse-drive setting. Default is -1 for off.
reversalcorrection	<0..80> <0..80> <0..80> <0..80>	Sets reversal correction for channels A to D.
finewithcoarse	<0..3> <0..3> <0..3> <0..3>	Enables/disables fine-with-coarse functionality for channels A to D: 0=off, 1=Speed3, 2=Speed2-3, 3=Speed1-3
knobinversion	<0,1> <0,1> <0,1> <0,1>	Enables/disables knob inversion for knobs 1 to 4.

Command	Parameters	Description
knobmapping	<A..D> <A..D> <A..D> <A..D>	Maps knobs 1 to 4 to channel <A..D> .
joypadinversion	<0,1> <0,1> <0,1> <0,1>	Enables/disables joypad axis inversion for joypad axes 1 to 4.
joypadmapping	<A..D> <A..D> <A..D> <A..D>	Maps joypad axes 1 to 4 to channel <A..D> .
cubeinversion	<0,1> <0,1> <0,1>	Enables/disables dial inversion for cube dials 1 to 3.
cubemapping	<A..D> <A..D> <A..D>	Maps cube dials 1 to 3 to channels <A..D> .
knbus	<1..31> <0..2>	Set the KN Bus parameters and map the NCs position in the SEM image frame. First parameter defines the NC's position on the Display unit. Second parameter defines the NC's bus-state: 0=off, 1=host, 2=client. ID 31 is reserved for substages.
Profile		
profile	?	Screen prints the current NanoControl configuration.
saveprofile	<0..6>	Stores the current configuration into the specified profile. No parameter stores settings to the current profile. Parameter 0 stores into the factory settings profile.
saveprofile	*	Stores the current configuration to all profiles (including factory settings).
loadprofile	<0..6>	Loads the configuration settings from specified profile. No parameter reloads the current profile. Parameter 0 loads factory settings.
initprofile		Sets the current profile to the default configuration.
Miscellaneous		
version		Returns the firmware version number and build date.
pause	<milliseconds>	Allows you to create timed breaks in the execution of a macro. Only works with NanoControl software.
ping		Turns the NC's screen black for 2s.
beep	<frequency> <duration in ms>	Commands the NC's speaker to beep.

Command	Parameters	Description
Controlling encoded rotation and tilt axes		
rotate	<-3600..3600>	Moves the rotation axis to the desired rotation angle. Values are given in 0.1° degre increments, e.g. 180 yields a rotation angle of 18° and 3600 yields 360°.
rotate	?	Returns the current rotation angle in the form: <code> <TAB> <value> <CR> <code> is either "o" for ok, "i" for info or "e" for error <value> is the current tilt angle (see above).
tilt	<-900..0..900>	Moves the tilt axis to the desired tilt angle. Values are given in 0.1° degre increments, e.g. 455 yields a tilt angle of 45.5° and -876 yields -87.6°.
tilt	?	Returns the current tilt angle in the form: <code> <TAB> <value> <CR> <code> is either "o" for ok, "i" for info or "e" for error <value> is the current tilt angle (see above).

Additional commands for Life Science applications

Some functions are legacy and may not work on current systems. Please contact support@kleindiek.com for details.

Command	Parameters	Description
efinepos	<A..D> <-2047..2048> <stepsize> <delay>	Moves the given channel from current fine position to the target fine position given using <stepsize> and with each step delayed by <delay (ms)>.
rfinepos	<A..D> <-2047..2048> <stepsize> <delay>	Moves the given channel from current fine position to current fine position plus the given number of fine digits using <stepsize> and with each step delayed by <delay (ms)>.
rfineramp	<A..D> <-2047..2048> <stepsize> <delay>	Moves the given channel from current fine position to current fine position plus the given number of fine digits using <stepsize> and with each step delayed by <delay (ms)> and returns to the initial position.
fine_wft	<A..D> <-2048..2047>	Sets fine position to <-2048..2047> in channel <A..D> after receiving a trigger signal (custom NC required).