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NAN Drive User's Manual Ver. 0.64 Rev. 4





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1 Safety instructions

WARNING

Warning denotes a hazard. It calls attention to procedure which, if not correctly performed or adhered to, could result in injury or loss of life. Do not proceed beyond a warning note until the indicated conditions are fully understood and met.

CAUTION

Caution denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in damage or destruction of the instrument. Do not proceed beyond a caution sign until the indicated conditions are fully understood and met.

WARNING: the power supply coed must be connected to a building socket-outlet with valid earth connection. Make sure that building socket-outlet is provided with earth fault and overcurrent protection. Any interruption of the protective conductor inside or outside of the product is likely to make the product dangerous intentional interruption is prohibited.

WARNING: The building socket-outlet must be installed near the equipment and must be readily accessible.

WARNING: Use only national safety certified power cord (with earth pin in plug and socket). The power cord must be rated 250vac (for Europe); 125 VAC (for US/CANADA); 7A min.

WARNING: for continues fire protection replace only with the same type and rating of fuse – Schurter SMD_FST 5x20, 1A/250 VAC, time Lag.

WARNING: No user serviceable parts inside. Refer servicing to qualified personnel. To prevent electrical shock do not remove covers. Disconnect power cord and appliance coupler from mains before servicing.

WARNING: never insert objects (thins screwdrivers, wires, etc) inside the housing.

CAUTION: do not impede enclosure top, side and bottom openings.

Climate Conditions:

- In house stationary mounted use, the maximum ambient temperature may not exceed 30° C.
- It must not be mounted in a location exposed to direct or excessive solar and /or heat radiation.



- It must not be exposed to heat trap conditions and must not be subjected to water or condensations.
- It must not be installed in Pollution Degree 2 environment.

2 Introduction

2.1 Functionality and Purpose of Use

The NAN Drive is a modular electrode micromanipulator system designed for use in extra-cellular recording from the brain. The system provides individual control over the vertical positioning of up to 64 electrodes with variable speed range from 1 to 200 micron/sec providing high step resolution of 1 micron/sec.

In addition, this unique, patent pending, device allows independent positioning of each electrode in the XY planes, enabling the user to easily setup any required electrode layout without the need for a special manifold.

2.2 Main Features

- Each electrode is independently manipulated in the XY planes, within a user defined working range.
- Each electrode is independently manipulated in the Z direction within a user defined working depth (up to 150 mm) and a variable speed range from 1 micron/sec to 200 micron/sec and a high resolution of 1 micron.
- Modular number of Electrode Towers in resolution of 1.
- Light weight.
- Special cover that enables to seal the system hermetically during use.
- User-friendly computer controlled system.
- Accurate – up to 1 micron accuracy during one way movement.
- No Backlash – the motor is directly coupled to the electrode, therefore there is a minor-fixed backlash that could be reduced using a special feature in the software.
- Flexible – can manipulate standard or non-standard electrodes, tetrodes, probes and needles.

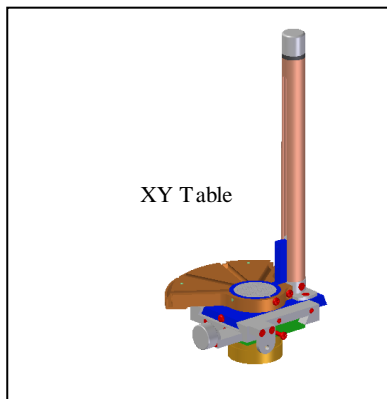
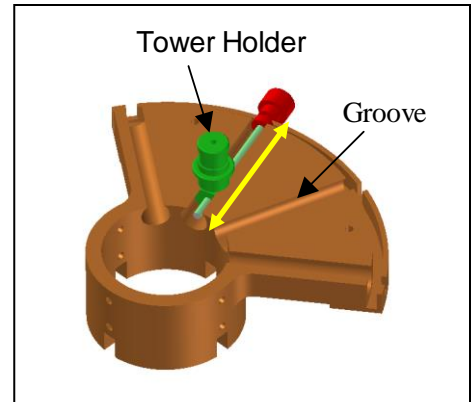
2.3 Design Concept

The NAN Drive system is assembled of two mechanical components and a DSP based controller.

Base:

The Base may be round, rectangular or have any other suitable geometric shape. The grooves on the Base allow the Tower Holders to be moved forward and backward while the Tower's ability to rotate enables circular movement.

The Base can sit on a chamber, a stereotactic frame, a robot's arm or any other suitable adaptation arrangement.

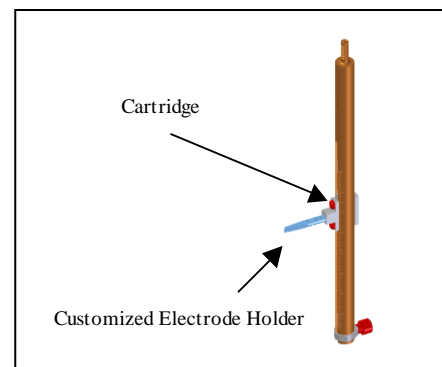


For smoother controlled penetration into the tissue we recommend an optional XY Stage. The XY Stage holds the base and enables the user to manually control vertical and horizontal coarse electrode positioning in the Z direction and XY planes.

Tower:

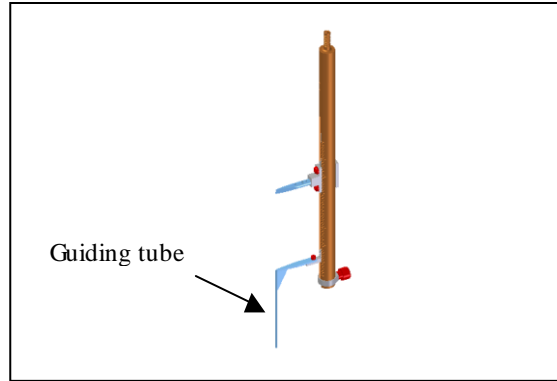
Each Tower includes a miniature motor coupled to a driving screw that moves a cartridge. The cartridge can be customized to hold a microelectrode, probe, needle, dagger electrode, Tetrode or a group of electrodes.

The direct coupling of the cartridge to the motor provides reliable and accurate movement.



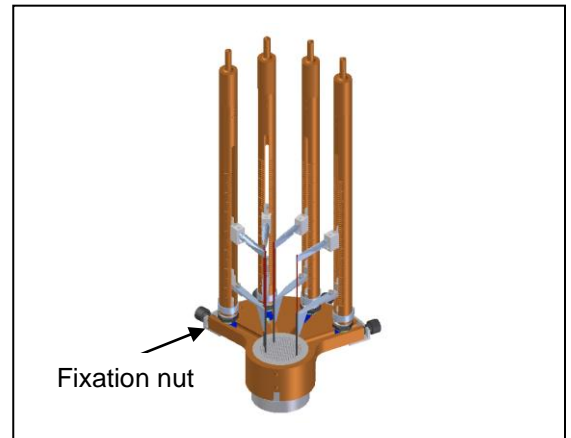
A second cartridge attached to the Tower holds the Electrode Guiding Tube. This Guiding Tube is made in a special manner in order to enable the electrodes/probes to get near each other. More than one electrode may be inserted into one tube. More than one tube may be mounted on the same Electrode Tower.

The Tower may be connected to the Base with a ball joint to allow angular positioning.



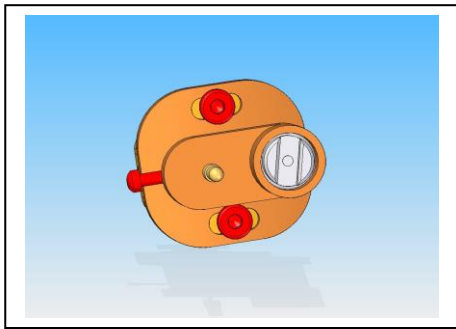
The Tower mounts on the movable holder of the Base and may be rotated on its axes. This special mechanism allows the Towers, and therefore the electrodes, to be arranged in various positions, each being distanced differently from the center of the Base and individually being located in the XYZ planes.

To enable the tower to move in the radial in the groove release the fixation nut of the tower holder.

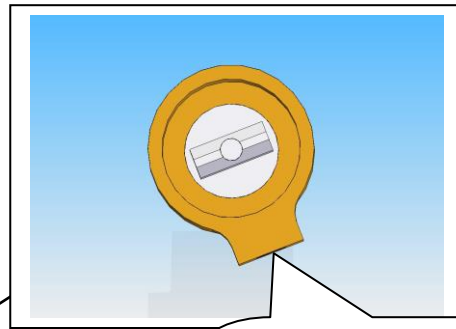


3 Mini Drive Angled Positioning

3.1 Motor assembly:



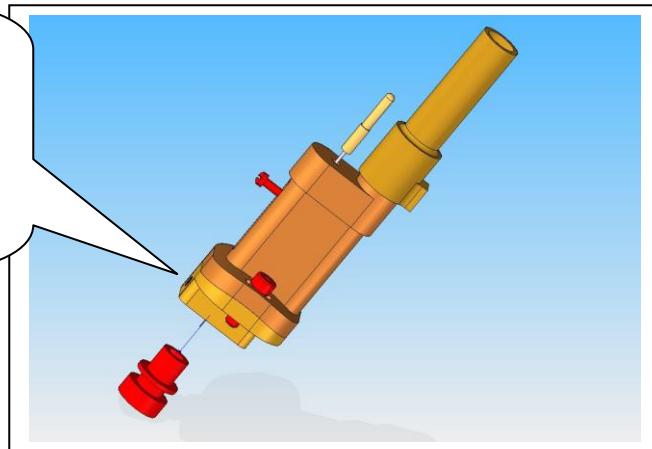
When Reassemble the Motor on the Drive. Align the coupling on Both sides



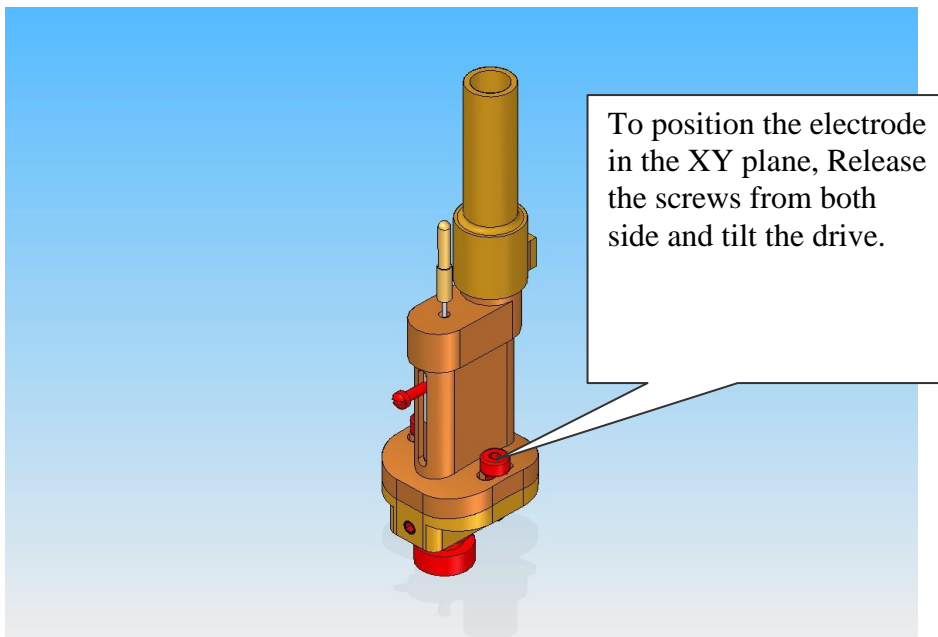
To remove the Motor Release the screw. (Set Screw #080, Hex Pocket, Cup Point)

3.2 Chamber:

To remove the Drive off the chamber release the set Screws at both sides. (Set Screw #080, Hex Pocket, Cup Point)

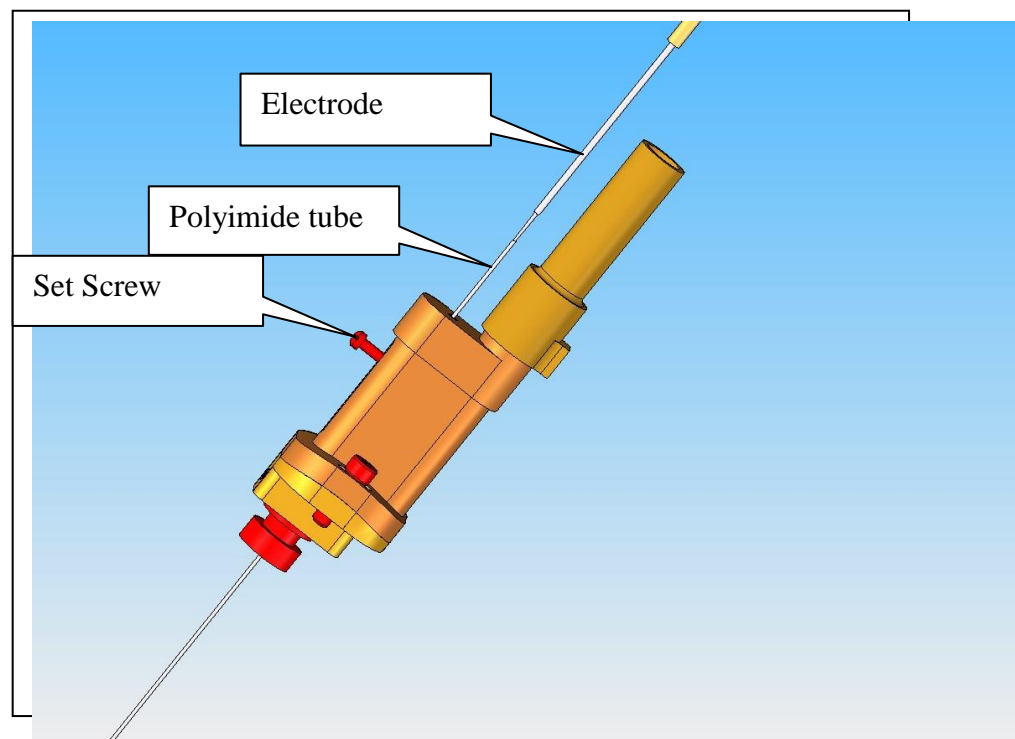


3.3 XY Positioning:

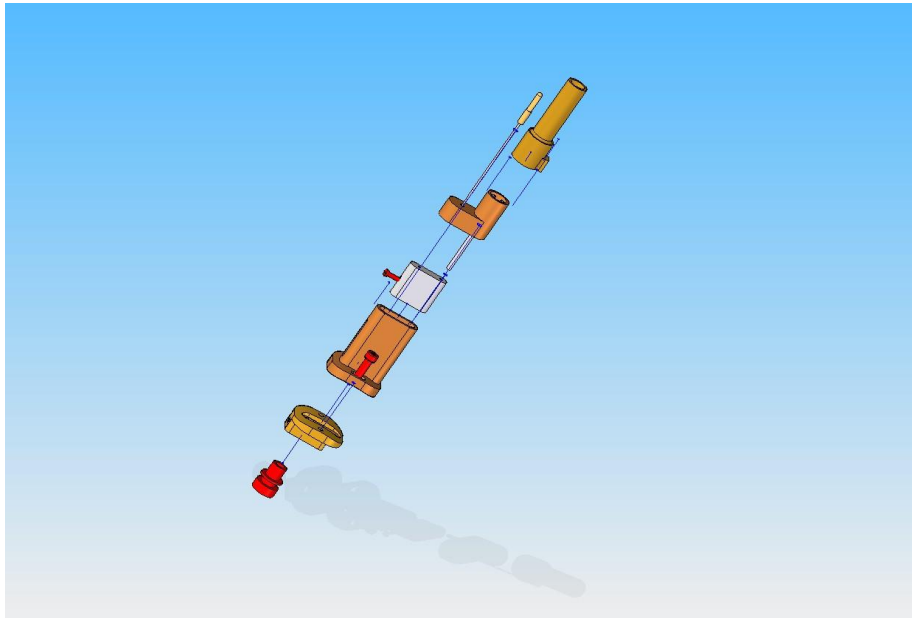


3.4 Electrode assembly:

Insert Polyimide tube then insert the electrode tip into the polyimide tube and push the assembly into the drive then tighten the electrode with the set screw (#000120, Slotted Drive, Fillister Head).



3.5 EXPLODE VIEW



Hardware:

19" Rack Mount control box that includes:

- i. DSP Card Controller – Driver: can run from 1 to 64 DC Brushless motors. The control box communicates with the PC via RS232/RS485.
- ii. Digital Inputs: optional feature of 16 optisolated inputs. The inputs can come from an external device to provide additional or alternative control of the system. The functions of these inputs can be programmed with a provided programming tool.
- iii. Digital Outputs: 6 programmable optisolated outputs.



Software:

The NAN Drive is operated by user-friendly software that communicates with the control box via RS232 or RS485.

PDL (Process Description Language) – This script program gives the user the ability to perform specific predetermined controller tasks and scenarios.

4 Installation Guide

4.1 Unpacking

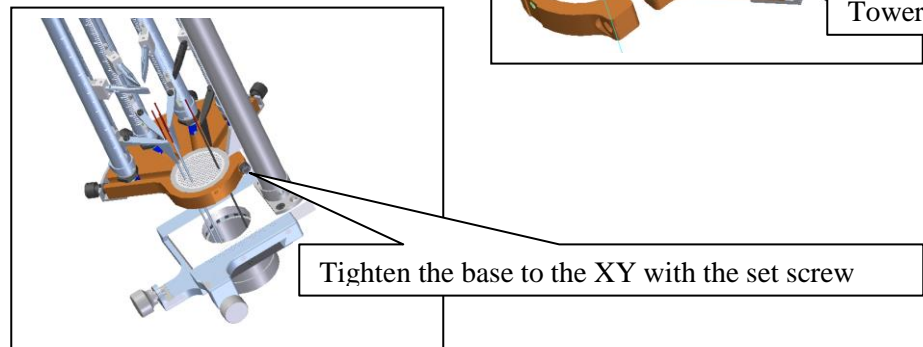
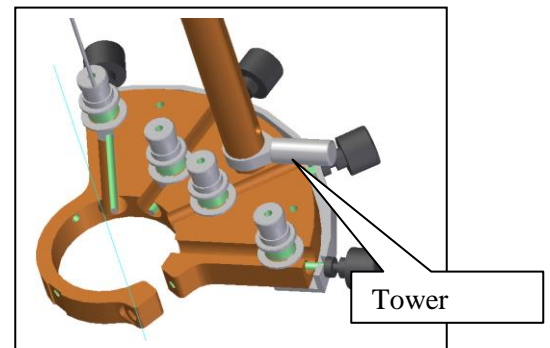
The NAN Drive includes the following components:

1. Software CD
2. Control box
3. Cable labeled "Motors extended cable" (one for each 4 channels)
4. RS232 cable
5. Power cord
6. NAN Drive components
7. Tools and spare screws

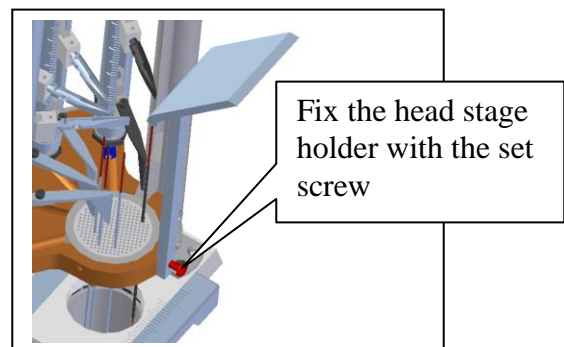
4.2 Mechanical Installation

Carefully unpack the system and follow the below steps:

1. Take the Tower and position it in place on the Base.
2. Tighten the setscrew to fix the Tower in place.
3. Repeat steps 1 and 2 for each Tower.



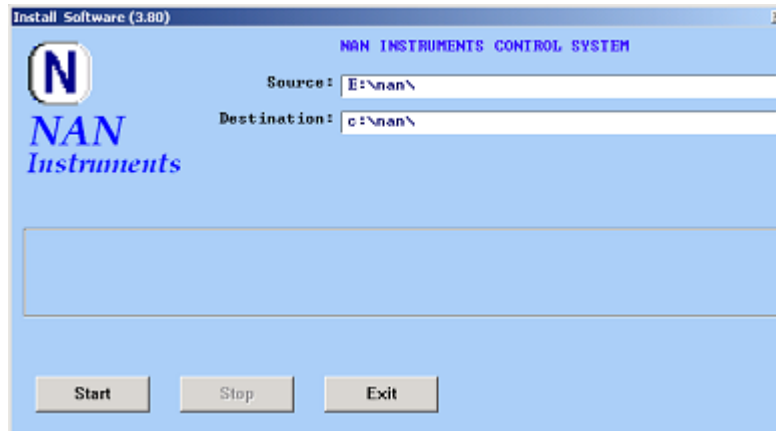
4. If exists, assemble the XY Stage to the Base by screwing in the setscrew.
5. Attach the Head Stage holder



4.3 Software Installation

Run software setup. (Setup.exe under directory "nan")

The software installation will appear:



The destination must be c:\nan\

The software will be installed in C:\nan\ directory.

Click the Start button to begin installation.

When installation is complete the message "Installation ended successfully" will appear.

Connect the control box to the computer and start the NANMDR Application.

The software will choose a COM PORT by default. In case the COM PORT is not available an **error** will happen and the software will not be loaded. In this case click **com** in the menu then **setup**, the setup window will open, go to the **Port** tab to get a list of available ports. Choose one of the ports and click **apply**, then **close**. Restart NANMDR application.

4.3.1 Installing the Hand-Held Remote Control System

Note: During driver installation do not connect the Remote System to the computer.

The Driver installer is located in nan directory - path:
 \nan\nanremote\NANRCT2\

Click the **NANRCTDriverInstaller.exe** to start the installation. Follow the installation wizard, When asked, click "Continue any way"

When installation is complete, connect the Remote System to computer. A window for new hardware will open: *Can windows connect to windows update to search for software?* Choose the option *No, Not this time*, then next. In the next window Choose *install the software automatically*. When asked, Click "Continue any way".

4.4 Hardware Installation

Control box rear panel

- **“RS232 MAIN”**: Connected to the computer via the provided RS232 cable for communication between the PC (GUI) and the Controller.
- **“RS232 DEBUG”**: Used for debugging and/or for connecting the control box to an additional computer. No cable is provided for this connection – For technician use only.
- **“MOTORS 1 - 4”**: Connects the motors 1 to 4 with the drivers via the provided “Motors extended cable”.
- **“MOTORS 5 - 8”**: Connects the motors 5 to 8 with the drivers via the provided “Motors extended cable”.
- **Power**: Connection to line via provided power cord.

Control box front panel

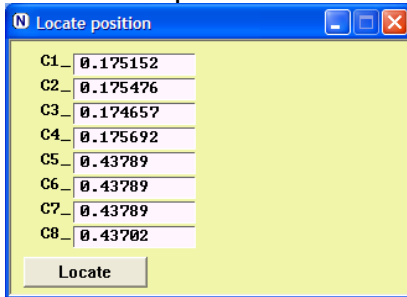
- POWER: ON OFF SWITCH
 - +12V: Indicates the availability of 12 Volts
 - -12V: Indicates the availability of -12 Volts
 - STATE: Indicates the proper functioning of the controller.
1. Connect the RS232 cable to the RS232 Com port of the computer and to the rear panel of the Control Box at “RS232 MAIN”.
 2. Connect the Motors extended cables to the rear panel of the Control Box at “Motors 1-4”. Additional motors will be connected to “Motors 5-8” and so forth.
 3. Connect the Power Cord.
 4. Connect all motors to the Motors extended cable.



5 Operating the NAN Drive

5.1 Locate position:

Each time the system is turned off and then turned on again we assume that there is a chance that the position of the axes in the GUI is not compatible with the real position on the electrode tower. Therefore when the GUI is opened a small window appears



Insert in the window the real position of the axes and press locate. Note: Before applying this command make sure that the Z box is set to absolute depth value (See Z Feature below)

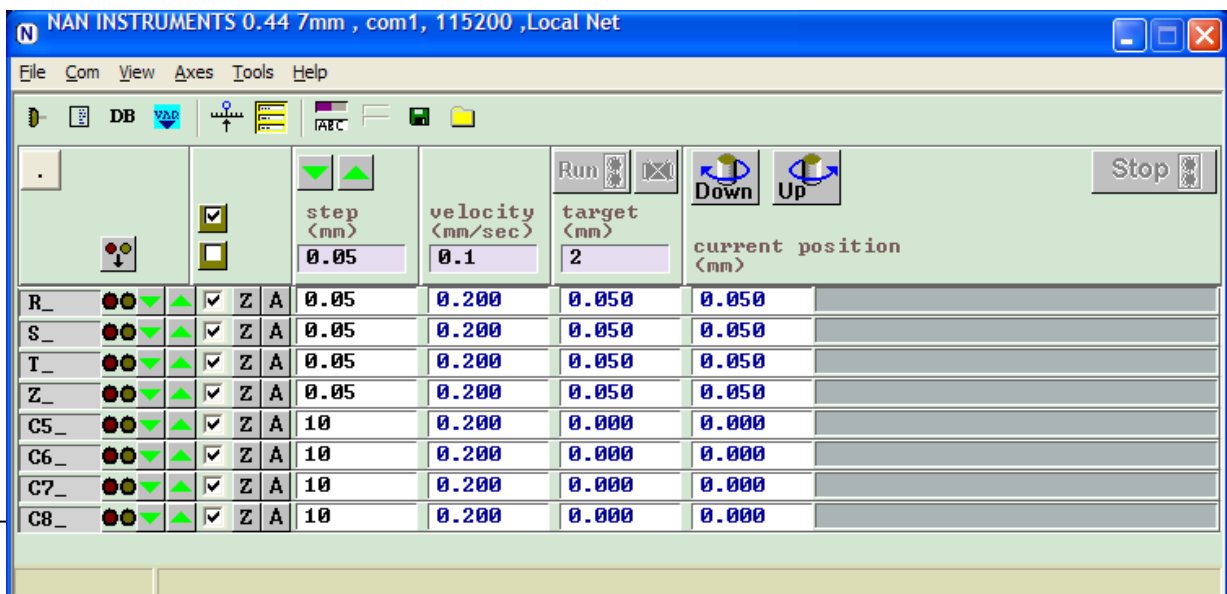
Note: The software saves the position of the axes so in usual manner the position should be correct.

5.2 Software Interface

Click the NAN Drive icon on the desktop to start the program.

The NAN Drive window is opened.

GUI Commands





When pressed converts to “T” (top). Keeps the NAN Drive window in front of all other applications.

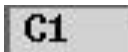


Red Light – lights when the drivers in the Control Box are over heated.

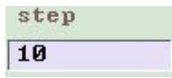
Yellow Light – lights when the motors face unusual mechanical resistance. **CAUTION: In this case check and confirm the position of the axes if it is compatible with the position on the GUI.**



Turn of lights.



Channel name – Type the channel name in this box. To reset all names: go to VIEW → SET AXES NAMES TO DEFAULT.



step box - In millimeters - defines a step movement.



Move **all** active (checked) axes down by the value in “step” box. *Note: each ax could have a different step value.*



Move **all** active (checked) axes up by the value in “step” box. *Note: each ax could have a different step value*



Move the specific ax down by the value in the relative step box.



Move the specific ax up by the value in the relative step box.



Activate all axes.



Deactivate all axes.



When checked the relative axes are active.



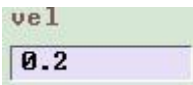
Apply zero value to the current position. This is a relative zero value. To return to the Absolute Value see next feature.



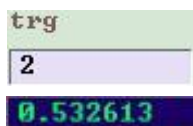
“A” means that the position appears in the “current position” field is absolute and compatible with the scale that actually appears on the Electrode Tower.



“R” means that the position appears in the “current position” field is relative to the Zero that was determined by the previous “Z” feature.



Velocity in millimeters – Note that maximum velocity is 0.2 mm/sec.



Target value to move to. In this box type the value and click Enter to apply this value to all checked axes then click RUN to move all active axes to the given target.

← When the target value is typed straight into a specific box hit Enter to move the specific axes to this target.



When a new value entered in “trg” box this bottom is activated – click it to move all active axes to target.



Undo – remove the target value that was last entered.



While pressed, all active axes move down.



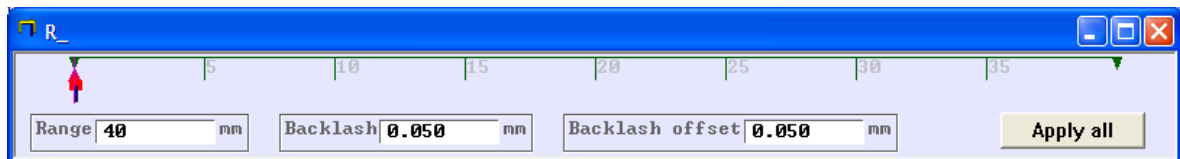
While pressed, all active axes move up.



Click to stop movement

5.3 Backlash and Range

Double click on the most right window in the GUI to apply the Backlash and Range window.



The user may define two parameters in this window:

Range (in millimeters)

The range is the maximum space in which the Electrode holder could travel. This depends on the length of the tube. The default range that the GUI provides is the maximum range; however, the user may change the range in the box assigned “Range”. Pressing the “Apply all” will apply the new value to all axes, other wise it will be applied the specific axes where the window opened from.

Backlash (in millimeters)

When the direction of movement is changed, there is a tolerance in the mechanical system that may make a difference between the distance requested to be moved and the real distance that the Electrode holder actually moved. The user may define a value of backlash that the system will over move in order to compensate on the tolerance.

5.4 Menu Options

File

- **Save/append to file:** saves position of electrodes and comment in the following format:

----- 05 April 2005 19:31:35 -----

```
C1 35.591 COMMENT1
C2 35.591 COMMENT2
C3 35.591 COMMENT3
C4 35.592 COMMENT4
```

The first time this command is used the user will have the option to change file name and path of the file. Each additional click will add a block of information.

In order to save the additional block of information into a different file: use the command **Save/append to new file**.

- **Save/append to new file:** saves the information described in the previous command into a new file.
- **Update controller database:** This menu option is for debugging use only.
-

Com

- **Setup:** Use this menu option to call the Communication Setup dialog and set Com port parameters. The software uses Com #1 by default however if this port is not available a Communication Error message appears. In this case an alternative port needs to be set. Click the "Port" field in the Communication Setup dialog box and select a new available port.



Communication Setup	
BPS: 115200	<input type="radio"/> RS485
Port: COM1	<input checked="" type="radio"/> RS232/USB
Parity Even	<input type="radio"/> CAN
Time out 150	CAN Tr id 00000120
Lock time 200	CAN Rc id 00000160
Try again 6	<input checked="" type="radio"/> Standart
	<input type="radio"/> Extended
	Pipe level 1
<input checked="" type="checkbox"/> Communication enabled <input checked="" type="checkbox"/> Local communication enabled <input checked="" type="checkbox"/> Accept messages <input checked="" type="checkbox"/> Accept msg with parameters	
<input type="button" value="Apply"/> <input type="button" value="Close"/>	

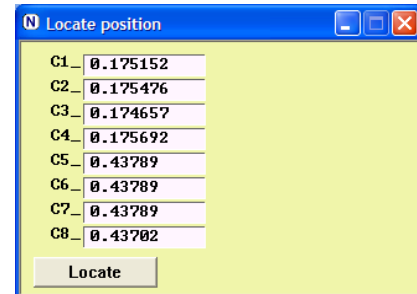
- **Status:** This command is used for debugging.

View

- **8 axes:** The NAN Drive interface displays 8 rows, one for each ax. The 16, 32 and 64 axes are used accordingly.
- **Only valid axes:** Display only the valid axes available in the Control Box. The minimum axes number supplied with the system is 8.
- **Set axes name to default:** the name of each channel appears on the left side of the NAN Drive GUI. The user can change this name by typing a new name into the box. Applying this command will reset the axes name to default.

Axes

- **Zero all axes:** Sets all axes position to Zero. This zero is absolute and refers to the real scale that appears on the electrode Towers. Therefore before applying this command all axes are taken back to real zero position.
- **Locate position:** This command is used to update the system with the real position of the axes. When applied a widow is opened. Insert in the window the real position of the axes and press locate. Note: Before applying this command make sure that the Z/U box is set to “Z” and that “U” is disabled (See **Z** and **U** feature above)
- **Reset controller:** This command is for debugging and not to be used in normal electrode positioning. **CAUTION:** It will reset all the data in the Controller including velocity and **position**.



Tools

For debugging use only.

Help

View software version and details.



5.5 Technical specifications

Power requirements:

AC mains supply: 100-240V, 50/60Hz (TN-S system, overvoltage category II)

Rated current: 1A

External fuse: Schurter SMD-FST 5x20, 1A/250VAC, Time lag

Ambient temperature range: 5-30° C

6 Remote control (Computer)

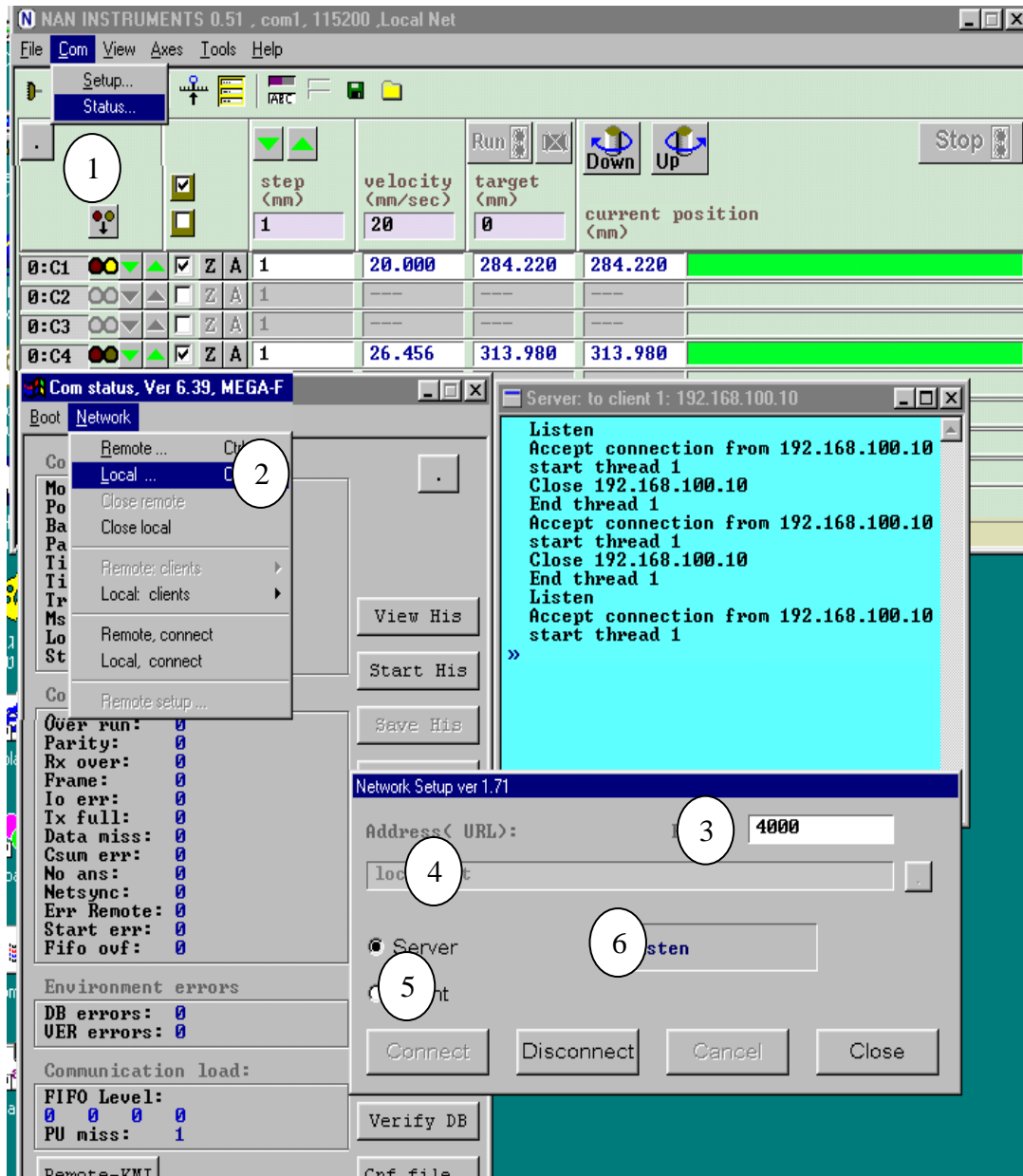
Controlling the NAN drive from two different computers - via network

A) Main computer (connected to NAN controller)

Open NAN Application and follow the Steps bellow

Note: for each step see relative number in image.

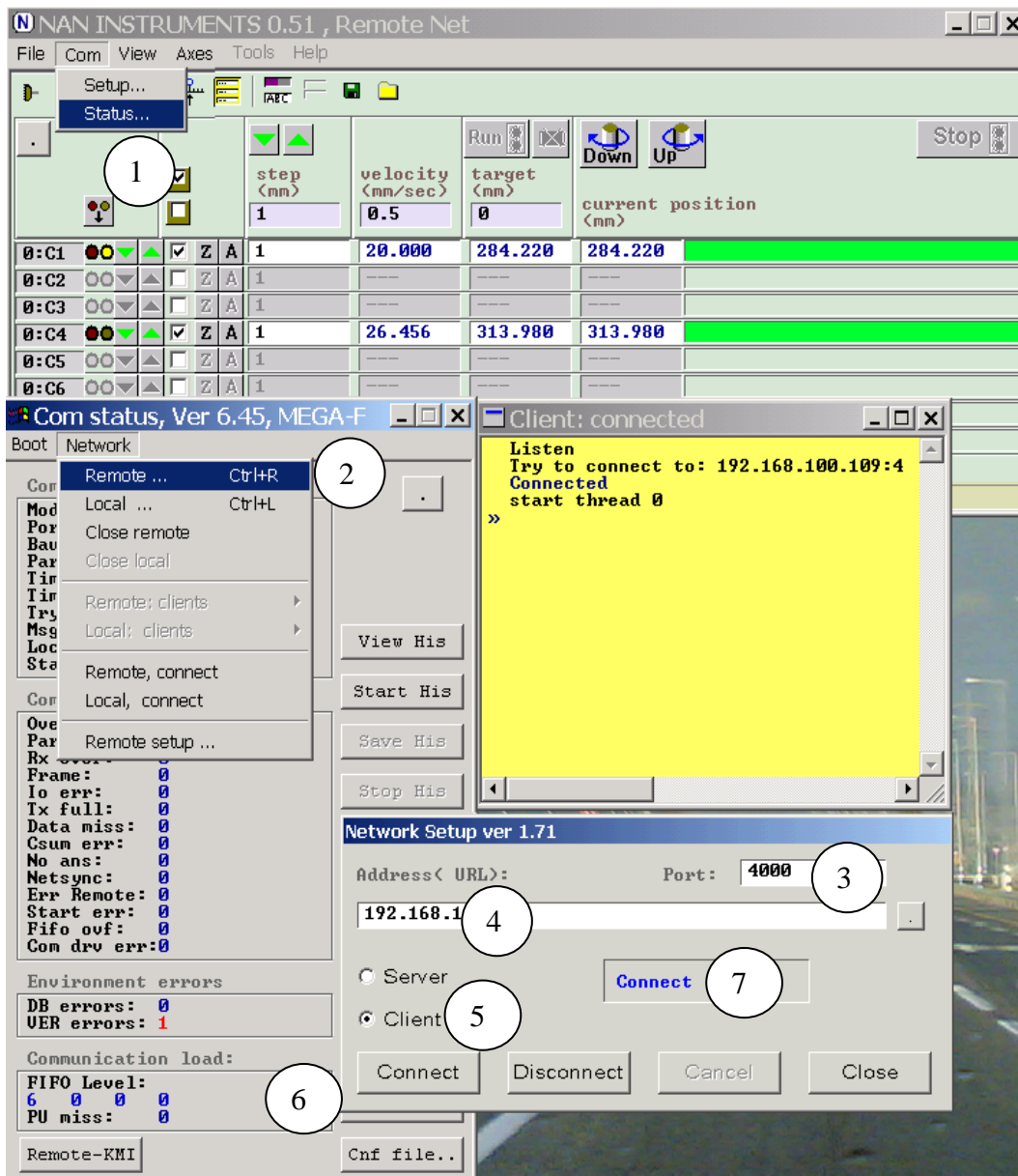
- 1) Click **Com** => **Status**
- 2) Click **Network** => **Local**
- 3) Choose a free TCP/IP address in the computer – Usually 4000 and 5000 are free.
- 4) Check **Client** and choose **localhost**
- 5) Check **Server**
- 6) Must be in **Listen** status.



B) Remote computer

- Install the NAN application in the remote compute and open it. You will get an error message saying no communication – Ignore it.

- 1) Click **Com =>Status**
- 2) Click **Network => Remote**
- 3) Choose the same Port like in the main computer
- 4) Copy the IP address of the main copmputer.
- 5) Check **Client**
- 6) Click **Connect**
- 7) Must be in **Connect** status.



7 Remote control (Hand Held)

Display: The display Shows 2 different formats:

Format a: One channel is displayed

M		#	#		v/x				P		#	#	#	#	#
N		#	#	#	#	#			S		#	#	#	#	#

M = Motor number

v/x = Motor checked (Enabled = v) or unchecked (Disabled = x)

P = Position

V = Velocity

S = Step value

T = Target

During SET TARGET "S" will be replaced by "T".



Format b: All channels are displayed

1		3		5	6	7	8	9	A	B	C	D	E	F	G
S	e	t		T	a	r	g	e	t		#	#	#	#	#

The upper line displays the enabled channels (disabled channels will be blank, like the example channels 2 and 4 are disabled).

The lower line stays blank, unless doing set velocity/target/step, showed in the last 5 cells.

Functions:

- **SELECT MODE:** Use with buttons "+" or "-" to change the displayed channel
- **SET STEP:** Use with buttons "+" or "-" to change step value of the displayed channel
- **SET TARGET:** Use with buttons "+" or "-" to go to a target. **NOTE: The motor starts moving while changing the target value.**
- **SET VEL:** Use with buttons "+" or "-" to change Velocity value of the displayed channel
- **Check: Enable/Disable** the displayed channel
- **UP:** While pressed, the displayed motor moves up
- **DOWN:** While pressed, the displayed motor moves down
-  : Move the displayed channel DOWN by the step value
-  : Move the displayed channel UP by the step value
- **Rotary Key:** Moves the selected motor up and down. Each click in the rotation equals one step value.
- **Blank button:** Stops the moving motors.

Note: In case all channels are displayed then the above functions are effective for all the enabled channels.