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Technical Software Engineering

How does it work …
… with *WinPC-NC* ?

Connection and first setup at your machine

X	Light
X	USB
X	NET
X	Professional

This document contains an excerpt from the version V5 manual, which describes the exact connection of the control hardware to the machine, the pin assignments of the connectors and the individual steps for the initial setup of the machine.

For further information, such as details on all available signals and the functions of *WinPC-NC*, please refer to the complete manual, which is installed on your computer as a PDF document with every *WinPC-NC* license and can be accessed within the program under Help > Manual.

You are welcome to order a printed version of the manual from our web shop for a small fee.

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6. Setting up a New Machine

Adaptation to the machine

Once the ***WinPC-NC*** software has been installed, a new machine must be set-up and tested before it can be used for production work. The set-up procedure generally only has to be done once.

If your machine came bundled with ***WinPC-NC*****,** the set-up procedure can be skipped. Follow the instructions that came with the machine to load the parameters appropriate to your machine.

ncUSB box with two LPT-compatible ports

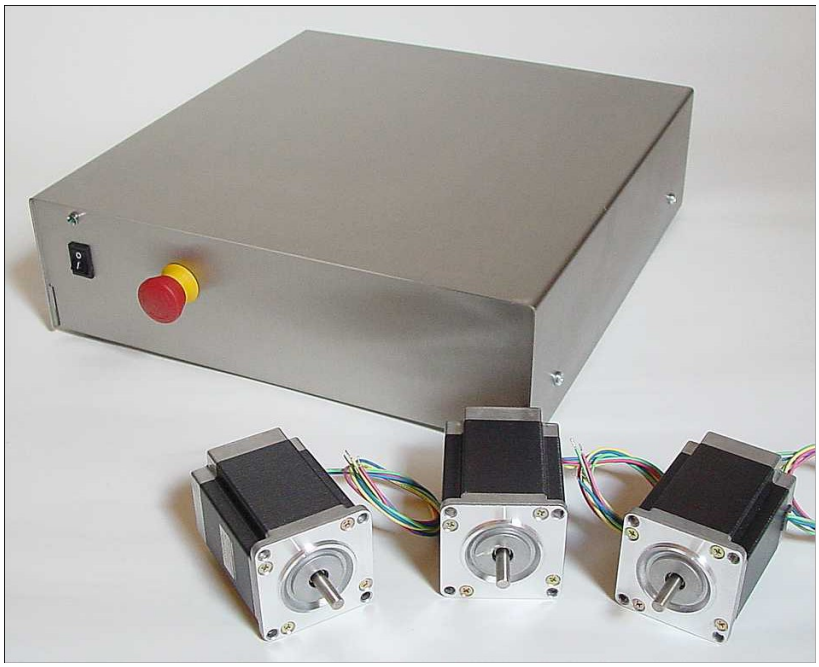
ncNET box including two LPT compatible connectors

The additional modules *ncNET* and *ncUSB* provides two LPT like ports and pin compatible interfaces. For reasons of simplification, in this document we continue to use the term LPT port.

On delivery, ***WinPC-NC Professional*** comprises the axis controller CPU ***CNCCON***. Different types of constructions are available, either as pure CPU card for being integrated in control units or as standard casing with external power supply unit.

Axes controller in standard housing, ***CNCCON-S***

However, it is also possible to use our ***CNCMAX*** control units comprising, besides the CPU, amplifiers for 3-4 step motor axes.



Controller ***CNCMAX*** with axes logic and stepper drivers included

WinPC-NC Professional *optional with opto-coupled signals*

Optionally each axis controller CPU can be equipped by an expansion card providing control cabinet compatible 24V signals and 24 opto coupler inputs, 8 opto coupler outputs and an analog output 0-10 V.

6.1. Connect *ncUSB*, *ncNET* or axes controller to your machine

After software installation and connecting the additional module ncUSB or the machine to the computer, automatic hardware recognition should be started and, after a short moment, a message is displayed with the information that the new hardware is ready for use.

Warning !

For energy saving reasons all Windows operation systems provide the option to set USB ports OFF or to reduce 5V power supply on the USB ports. However, this may result in faults and aborts in communication.

Therefore please deactivate energy saving functions on USB ports in the device manager of your system.

Connection of your machine is possible at first LPT connector at ***ncUSB***, ***ncNET*** or axes controller only.

Warning !

***WinPC-NC* is a software that controls hardware. The hardware must be properly connected to the PC and configured in *WinPC-NC* for correct machine operation. The user is responsible for making all connections, performing all safety procedures, and operating the machine.**

Care must be taken to correctly connect and test each wire, switch, sensor, or output. Everything should be checked multiple times; having another person review things while you work is a good idea.

Warning !

Care must be take to avoid damage due to static, incorrect signal assignments, and incorrectly inserted plugs/cables/wires.

Do not attempt to set-up the machine until you have familiarized yourself with this manual and the set-up procedures, are rested, and have plenty of time to set-up the machine.

Warning !

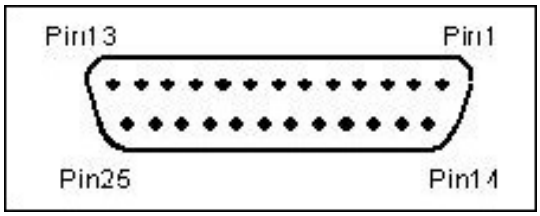
It is hightly recommended that the first signal connection is the emergency stop I247 E-STOP. This way, any unexpected actions can be stopped before damage occurs.

The assignment and use of the available input and output signals to the interface pins is described in the following chapter. For the initial setup, you either do not need any signal inputs at all, or, for simplicity's sake, you can use the predefined ones.

Warning !

The *WinPC-NC* software is merely a control component used within a system. This means that the system only becomes a fully functional machine once it is equipped with a PC, a machining unit, drive systems, and mechanical components. The operator is responsible for ensuring safe operation.

6.2. Pinning of all connectors



IEEE 1284 parallel port (LPT) pins

Pinning LPT1

All pins at LPT connectors adhere to the 5V TTL standard for inputs and outputs. LPT1 is available on the ***nc100***, ***ncNET***, ***ncUSB*** modules and axes controller ***CNCCON***. The default pin assignments are:

Pin 2	out	Direction axis X
Pin 3	out	Clock axis X
Pin 4	out	Direction axis Y
Pin 5	out	Clock axis Y
Pin 6	out	Direction axis Z
Pin 7	out	Clock axis Z
Pin 8	out	Direction axis 4 (ie. Tangentional axis)
Pin 9	out	Clock axis 4 (ie. Tangentional axis)
Pin 1	out	Spindel on/off (default)
Pin 14	out	Cooling on/off (default)
Pin 16	out	Motor current reduction (default)
Pin 17	out	Job running (default)
Pin 10	in	Homing switch axis X (default)
Pin 11	in	Homing switch axis Y (default)
Pin 12	in	Homing switch axis Z (default)
Pin 13	in	Sensor/Surface block (default)
Pin 15	in	free
Pin 18-25		Ground 0V

Depending on the hardware modul the LPT2 pinning is different.

*pinning LPT2 at **ncUSB** up to serial no 15999*

Pin 2-9	out	Analoge output, 256 steps binary coded
Pin 1	out	free
Pin 14	out	free
Pin 16	out	free
Pin 17	out	free
Pin 10	in	free
Pin 11	in	free
Pin 12	in	free
Pin 13	in	free
Pin 15	in	free
Pin 18-25		Ground 0V

*pinning LPT2 at **ncUSB** from serial no 16000 and at **ncNET***

Pin 2-9	out	Digital output, free
Pin 1	out	free
Pin 14	out	free
Pin 16	out	free
Pin 17	out	free
Pin 10	in	free
Pin 11	in	free
Pin 12	in	free
Pin 13	in	free
Pin 15	in	free
Pin 18-25		Signalmasse (0V GND)

free definable signals to pins

Each LPT port has pins 10, 11, 12, 13, and 15 available for inputs and pins 1, 14, 16, and 17 available for outputs.

***WinPC-NC USB* and *WinPC-NC NET*:**

The signal Q218 Spindle Speed/PWM may only be connected to pins LPT1:14 or LPT1:17.

The signal Q219 Toggle/Charge pump may only be connected to pins LPT1:16 or LPT1:17.

WinPC-NC Professional :

All addon signals can be assigned to any input or output at axes controller.

The ***CNCCON*** axis controller from ***WinPC-NC Professional*** can be equipped with either just an LPT interface, an additional LPT2 interface, or the ***EA160802*** expansion card, which features opto-coupler signals (e.g., 24 V DC, suitable for control cabinets) and a 0–10 V analog output. This expansion card features a 25-pin subD connector for the inputs and a 15-pin subD connector for the outputs.

*pinning LPT2 at **CNCCON***

Pin 2-8	out	Digital output, free
Pin 9	out	Not free, wired to pin 14
Pin 1	out	free
Pin 14	out	Not free, wired to pin 9
Pin 16	out	free
Pin 17	out	free
Pin 10	in	free
Pin 11	in	free
Pin 12	in	free
Pin 13	in	free
Pin 15	in	free
Pin 18-25		Ground 0V

*pinning **EA25** at **CNCCON** with built in **EA160802** card*

Pin 14	DI0	Digital input (24V), free
Pin 15	DI1	Digital input (24V), free
Pin 16	DI2	Digital input (24V), free
Pin 17	DI3	Digital input (24V), free
Pin 18	DI4	Digital input (24V), free
Pin 19	DI5	Digital input (24V), free
Pin 20	DI6	Digital input (24V), free
Pin 21	DI7	Digital input (24V), free
Pin 22	DI8	Digital input (24V), free
Pin 23	DI9	Digital input (24V), free
Pin 24	DI10	Digital input (24V), free
Pin 25	DI11	Digital input (24V), free
Pin 13	DI12	Digital input (24V), free
Pin 1	DI13	Digital input (24V), free
Pin 2	DI14	Digital input (24V), free
Pin 3	DI15	Digital input (24V), free
Pin 5-12	0V/GND	Ground of external opto couplers supply, 12-30V

*pinning **EA15** at **CNCCON** with built in **EA160802** card*

Pin 9	DO0	Digital output (24V), free
Pin 10	DO1	Digital output (24V), free
Pin 11	DO2	Digital output (24V), free
Pin 12	DO3	Digital output (24V), free
Pin 13	DO4	Digital output (24V), free
Pin 14	DO5	Digital output (24V), free
Pin 15	DO6	Digital output (24V), free
Pin 8	DO7	Digital output (24V), free
Pin 4-6	12-30V	External opto couplers supply, 12-30V
Pin 7	0V/GND	Ground of external supply, 12-30V
Pin 1	0V/GND	Ground of analog output
Pin 2	AO0	Analog output 0-10V
Pin 3	AO1	reserved

6.3. Determination of axis resolution

For calculating the required distances and speeds it is necessary to tell ***WinPC-NC*** precisely the definition of the axis resolution.

axes resolution defined by two parameters

Please open the parameter dialog box *parameter - basic settings - axes* and determine the exact data of your mechanics and drives for each axis by the first two parameters.

The parameter axis resolution defines the number of steps or increments per rotation for the corresponding motor. Please consider the electronic settings relating to the macro/micro stepping operation and a possibly integrated reduction ratio.

Motor steps and distance per rotation

The required value is the number of motor steps ***WinPC-NC*** has to create in order to carry out exactly one rotation round the spindle or the shaft.

The second parameter distance per rotation defines the distance which is made exactly by the number of above specified motor steps. With spindles it is the spindle rise; with belts or gear racks it is the graduated circle size of the pinion.

In our homepage in *Help - HowTo* we present a tutuorial concerning correct settings of axis resolution with new or unknown machines.

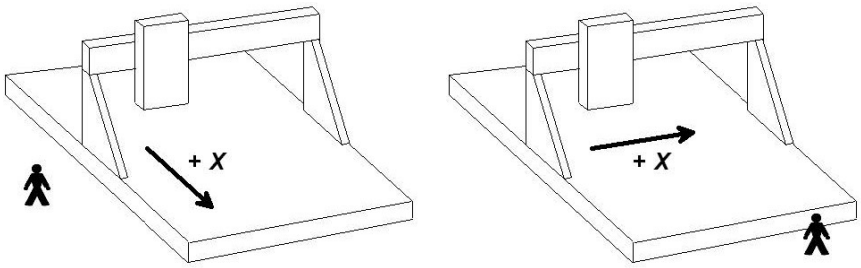
Incorrectly set axis resolutions will cause dimensional inaccuracies and inexact speeds.

6.4. Determination of direction

Select JOG MOVE and study the buttons. Each axis is to be carefully tested for forwards and backwards motion. Each motion must move exactly as expected.

Start with X axis.

Arrow keys on the right are for motion in the positive direction; on the left for negative motions. Check your machine documentation for where to stand:



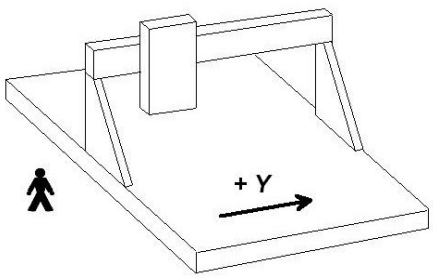
Carefully attempt a positive motion first. If successful, attempt a negative motion.

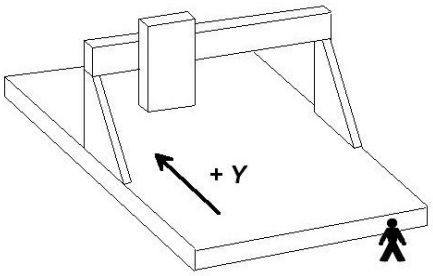
If the expected motions do not occur, here is a table of common errors, causes, and solutions:

Error	**Possible Cause**	**Solution**
Machine does not move	Cable not connected	Connect the cable
	Cable not connected to the correct LPT port	Connect the cable to correct LPT port
	Incorrect pin assi-gnment	Correct the pin assi-gnment
	Machine off	Check if the machine and/or its motion con-troller are powered on.
Unexpected movement (wrong axis moves)	Incorrect pin assi-gnment	Correct the pin assi-gnment
Axis moves in opposite direction expected	Direction signal works with inverted logic	Change the parameter INVERT MOVE DIRECTION under machine parameters

Once the X axis appears to be working as expected, repeat the testing procedure on the Y axis. Correct any issues until the X and Y axes appear to be working as expected.

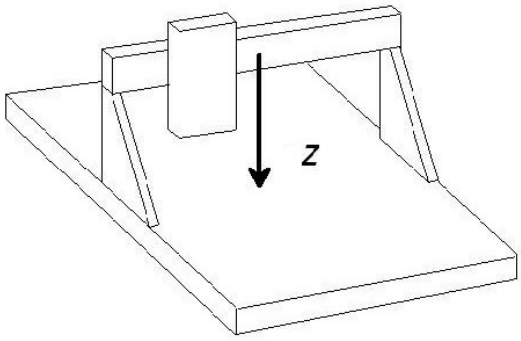
Arrow keys up must move the Y axis back.





Now test the Z axis.

The down arrow key moves the Z axis downward. You can specify the direction of movement in the parameters. You can set it to move downward in the standard **Z$_{minus}$** direction, or to move downward in the **Z$_{plus}$** direction for compatibility with older versions of ***WinPC-NC***.

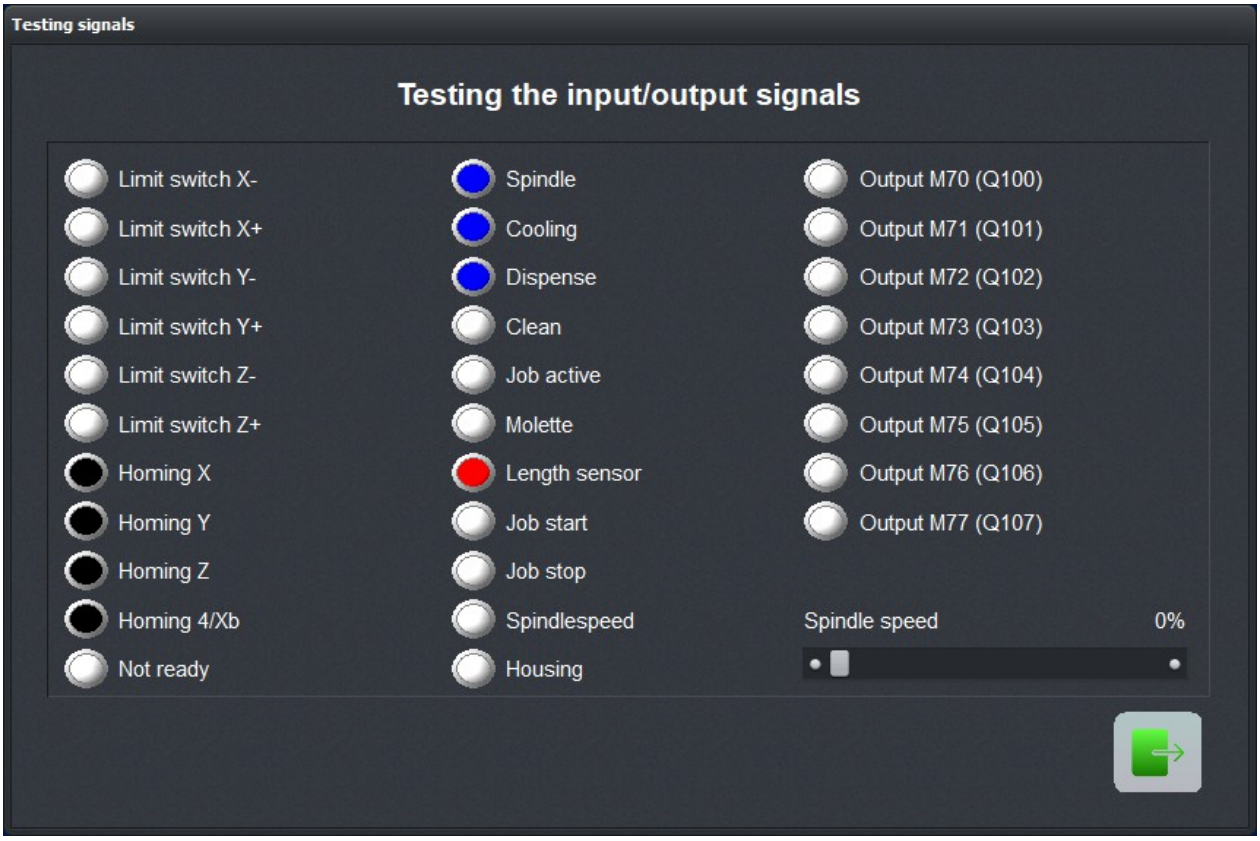


For a direction reversal of one axis it is only necessary to change the parameter INVERT MOVE DIRECTION.

Movement directions are relative to the movement of the tool above a work piece. Movement is opposite that of the arrow keys in order to guarantee the correct movement direction of a tool above the work piece.

6.5. Home and limit switch adjustment

The home and limit switches can easily be checked with the SPECIAL FUNCTIONS - SIGNAL TEST.



Testing signals

Manually activate switches

Manually activate each switch (home and limit) and check the signal LED in the *Signal test* window.

The expected LED should be black until it is activated; red when it is activated

Depending on the used switch (NO contact - NC contact) the switching logic may be misapplied, i.e. red colored with the un-pressed switch and black colored with the pressed switch. If this proves to be true, the switching logic of the reference switch must be changed by parameter.

Set switching logic

Please follow the following procedure:

1. Open parameter - basic settings - signal wizard
2. Select the input signal to be defined in upper left window

3. Open dropdown menu and select the connected pin no and assign it to the input signal. If the switch is a NO contact the assignment must be inverted, i.e. LPT1 Pin10 inv instead of LPT1 Pin10.

4. Test all assignments and control it again with SPECIAL FUNCTIONS-SIGNAL TEST.

A detailed listing of all available input and output signals can be found in next chapter.

6.6. Setup of homing movements

Now that the home and limit switches are installed and work as expected, it's time to let ***WinPC-NC*** know where they are, how fast they can be located with search and moving free speeds and in what order the home switches are located.

Please follow the following procedure:

1. From the Parameters menu, select the *Basic setting - Homing* tab.

2. Specify the home switch location for each axis of your machine. This will at the positive or negative end of your machine. If you're unsure which is the positive or negative end of your machine, change to JOG MOVE and move your machine in both directions, observing the position counters and noting which direction the axes move as they approach a home switch.

3. Set the appropriate search and free speeds. These should be on the slow side as one does not want to collide with the switches too fast, potentially damaging them.

4. Set the appropriate axis search order. It is usually best to stay with the default (Z Axis first).

5. Set the machine zero point. It's best to set this at a small distance from the reference position.

6. Start the machine initialization sequence. One axis at a time will move.

7. If one or more axes have their homing switch at positive axis end it might be useful to define the Reference point NOT as a zero point but to the maximum possible distance of this axis.

Warning!

The orientation and counting direction of the Z axis are defined solely by this single setting for the reference direction. The Z axis ALWAYS moves upward to its limit/homing switch, and if that is the positive direction, then the Z axis counting direction is set to comply with the standard, i.e., ZPLUS is up and ZMINUS is down.

However, if you define a negative direction as the reference direction for Z, then the counting direction is NOT standard-compliant but compatible with older versions, i.e., ZPLUS down and ZMINUS up.

Warning!

If you change the Z axis counting direction after the fact and the machine and *WinPC-NC* were already fully configured, you must very carefully check and adjust all previous settings. This applies in particular to…

- the machine dimensions for monitoring
- the auxiliary points, park positions, and zero points
- the reference positions and offsets
- defined macros with movement commands
- magazine positions for a tool changer
- the *Invert Z Coordinate Data Format* setting
- the probe settings and probe measurement
- any saved tool lengths
- any existing MES files with probe readings
- and other Z coordinates and Z movements

6.7. Control of settings

Before attempting to initialize the machine for the first time, double check all of your settings. Press function key `[F8]` or select the corresponding function from the menus, and save your settings.

Activate homing procedure for checking the settings

During the initialization procedure, your machine will move one axis at a time. Initially, each axis will move towards its home switch, until it activates. It will then move away from its home switch at a reduced speed until the home switch ceases to activate. This is the reference point for that axis.

If everything has been done correctly, the initialization procedure of your machine should finish without any problems. If an error occurs or your machine moves in an unexpected way, review your settings, make the necessary adjustments, save your parameters, and try again.

Error	**Solution**
Axis moves in the wrong direction	Define the reference switch at the other end
Axis moves in the correct direction, but very slowly	Switching logic has been adjusted incorrectly and has to be inverted and define the reference switch at the other end
Axis moves slowly in the correct direction, but stops on the switch	Switching logic has been adjusted incorrectly and has to be inverted and define the reference switch at the other end
Axis moves very slowly in the wrong direction	Switching logic has been adjusted incorrectly and has to be inverted

6.8. Additional steps

Once the basic connections and motions have been made and verified, it’s time to finish the set-up procedure:

1. Determination the optimal motor ramp and traverse speeds for each axis using SPECIAL FUNCTION-MOTOR TEST.
2. Define these speeds for homing and manual movements.
3. Enable the needed functions and technologies or the available equipment.
4. Connect any remaining input and output signals and verify them via the Signal Wizard.