



Commissioning Manual

PD 400 CNC

Ver. 3.0
21.12.2011

Commissioning Manual PD 400 CNC

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1. Some generalities in advance...

Dear Customer!

Before you set up and commission your machine, please read through the manual and make sure you have understood everything. This is a very complicated device which poses the danger of injury or can cause damage to property if handled improperly.

Help to prevent this and familiarise yourself thoroughly with the machine and its associated electronics without rushing matters.

The use of these instructions

- makes it easier to become acquainted with the device,
- prevents malfunctions due to improper handling, and
- increases the service life of your device.

Always keep these instructions close to hand.

Only operate this device with exact knowledge of it and comply with the instructions.

PROXXON will not be liable for the safe function of the device for:

- handling that does not comply with the usual intended use,
- other application uses that are not stated in the instructions,
- disregard of the safety regulations.

You will not have any warranty claims for:

- operating errors,
- lack of maintenance.

For your safety, please comply with the safety regulations at all costs.

Only use original PROXXON spare parts.

All rights reserved for further developments within the meaning of technical progress.

We wish you much success with the device.

2. The technology of your PD 400 CNC at a glance

Dear User,

With this PD 400 CNC lathe, you have acquired a powerful, precise processing machine that fulfils the highest demands on ease of use, precision and reliability:

The mechanical basis is the successful PD 400 lathe from the company PROXXON.

The electrical control of the feeds of both tool axes by computer, however, comprehensively expands the options of a conventional, i.e. manually controlled lathe:

The geometrical data of the desired work piece shape is constructed or programmed by the NCCAD 8 software especially developed for this machine and can then be reproduced automatically and any number of times on the PD 400 CNC.

The hand wheels of the PD 400 are replaced with electrical stepping motors whose force is converted in the feed of the carriages with highly precise recirculating ball screws.

The stepping motors are actuated by the CNC control that is "operated" and monitored by the control computer.

All components are meticulously interfaced and thus offer optimum performance and the basis for trouble-free operation.

For this state to remain, certain knowledge of how the machine and the software is set up is required on the one hand and the interaction of these components on the other.

That is precisely what this manual is to convey at first: Not primarily the instruction into the many "secrets" of the CNC program, but rather a solid knowledge base on the commissioning of the machine.

Naturally it is also necessary to generally concern oneself with the possibilities of the program and its structure, just to be able to use the many possibilities, to be more efficient and to prevent dangerous situations from occurring.

We have integrated an "electronic manual" within the program just for that purpose. It contains all the necessary information in a clearly structured and comprehensively illustrated form and goes into exhaustive detail of the possibilities offered by the program.

This is called up by clicking the "Help" menu and then clicking "Help Topics" in the next window.

Finally, this manual can be used as a "Help" function to solve rather concrete and current problems with an application with the help of a sophisticated navigation window.

This omits the annoying paging back and forth in a voluminous printed work: the answers to specific problems are found quickly and precisely.

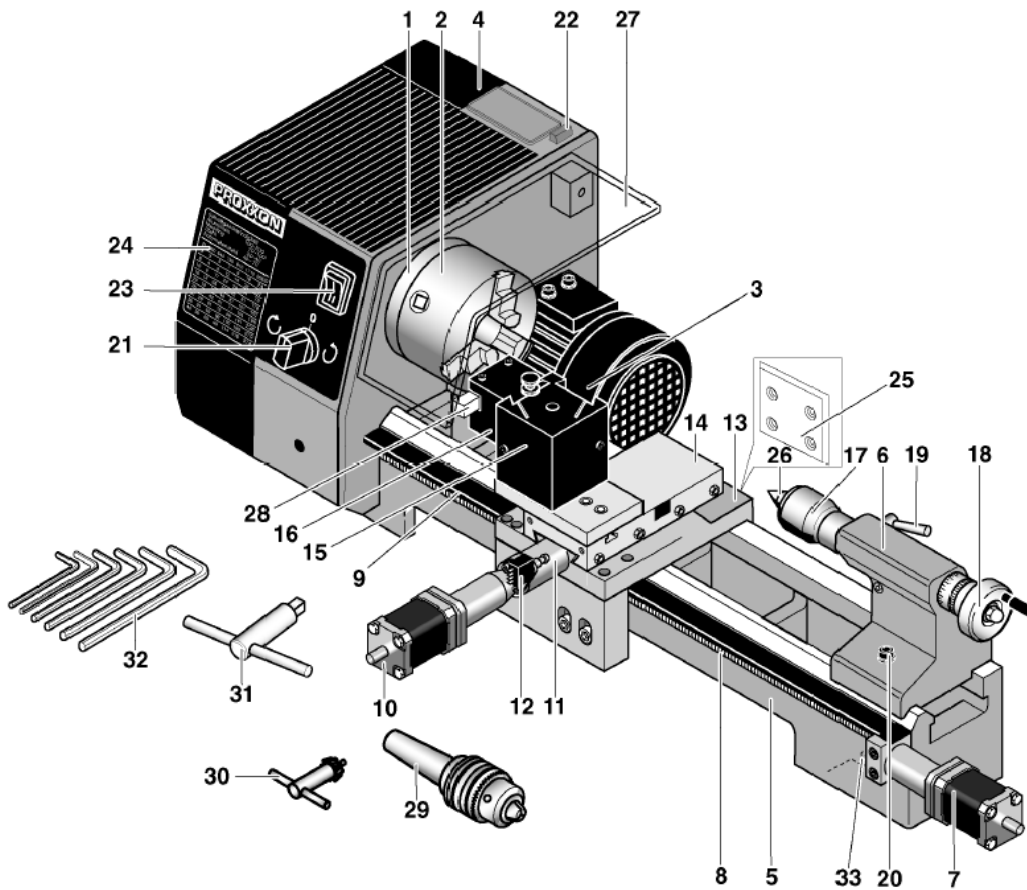
You will find notes on how to use the "Help" function further along in this manual.

2 The technology of your PD 400 CNC at a glance

Furthermore, we offer specific notes on what you can do to not only use the excellent features of the machine, but to maintain it for a long time.

If a malfunction occurs despite all these things, the error table at the end of the manual will provide some help. We will also offer direct assistance in case of particularly stubborn cases.

3. View of the machine with its elements



- | | | | |
|----|------------------------|----|---|
| 1 | Main spindle | 18 | Sleeve adjusting wheel |
| 2 | Lathe chuck | 19 | Clamping screw for sleeve |
| 3 | Multiple tool holder | 20 | Clamping screw for tailstock |
| 4 | Gearbox | 21 | Direction of rotation switch |
| 5 | Machine base | 22 | Operational display |
| 6 | Tailstock | 23 | Multiple-contact switch for speed adjustment |
| 7 | Drive for Z axis | 24 | Speed table |
| 8 | Spindle for z axis | 25 | Flange surface for milling unit PF 400 (optional) |
| 9 | Position switch z axis | 26 | Travelling lathe centre |
| 10 | Drive for X axis | 26 | Ring gear drill chuck |
| 11 | Spindle for x axis | 27 | Chuck guard |
| 12 | Position switch x axis | 28 | Cutting tool |
| 13 | Support | 30 | Key for chucks |
| 14 | Cross slide | 31 | Key for lathe chuck |
| 16 | Tool holder element | 32 | Allen key |
| 17 | Sleeve | 33 | Drill holes for fastening to table |

4. CNC control MCS with operating elements

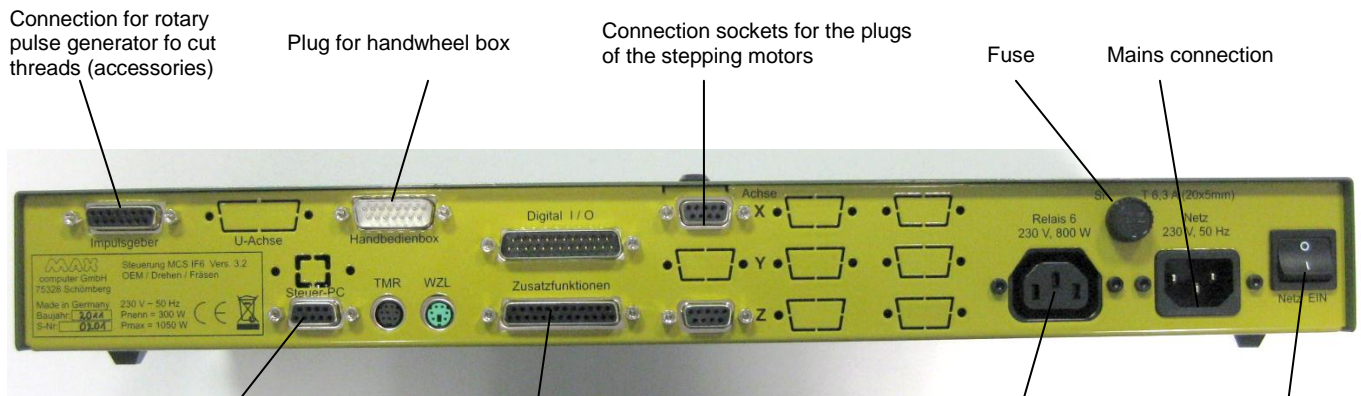
Front side:



Status indicator

"Emergency Stop" locking switch

Rear:



Connection for rotary pulse generator fo cut threads (accessories)

Plug for handwheel box

Connection sockets for the plugs of the stepping motors

Fuse

Mains connection

Connection for communications cable to PC

25-pin plug to control additional functions (coolant pump, or similar)

Connection for lathe mains connection

Master switch

5. Technical data

5.1. Lathe:

Length between centres:	400 mm
Height of centres:	85 mm
Maximum work piece diameter:	116 mm
Machine base:	Cross-ribbed surface, high-quality cast iron with ground prismatic guide
Spindle:	Oversized main spindle, supported with 2 adjustable taper roller bearings
Spindle receiver:	MK3
Spindle drill hole:	20.5 mm
Spindle concentricity:	5/1000 mm
Chuck (series):	Precise RÖHM-3 jaw chuck, centrally clamped, 100 mm diameter
Sleeve receiver:	MK2, retractable sleeve with scale
Spindle speeds:	Adjustable with switch (two-stage) and by shifting the drive belt (three-stage)
Switch setting 1:	80 / 330 / 1400 rev/min
Switch setting 2:	160 / 660 / 2800 rev/min
Motor rating:	550 W
Motor type:	Induction motor
Size (L x D x H):	900 x 400 x 300 mm
Weight (complete):	approx. 45 kg

5.2. Drives of the tool axes

Spindle drive Z axis	
(Leading spindle, longitudinal drive, support):	Recirculating ball screw with 4mm pitch, effective diameter 12mm. Stepping motor 1.8A, holding torque 50Ncm
	Traverse path: 300mm
Spindle drive X axis	
(Transverse drive, support):	Recirculating ball screw with 2mm pitch, effective diameter 8mm. Stepping motor 1.8 A, holding torque 50 Ncm
	Traverse path: 70mm
Activation of stepping motors:	Through CNC control unit (included)
Power supply:	Mains unit, output 35V (included)

5.3. Software and stepping motor controllers

Power supply	230V +-5%
Power consumption	min 150W
Gate	Serial interface- Connection cable to PC included
Stepping motor controller	Current control, pulse width modulation Current reduction during standstill, clocking independent of PC, microstepping

5.4. General data

Ambient conditions:	5 - 40°C (Class 3K3), max.60% relative humidity
User group	Persons as of 14 years of age

6. Scope of delivery

1 Qty.	Lathe with attached stepping motors
1 Qty.	CNC control unit MCS
1 Qty.	CD with program software (including electronic manual)
1 Qty.	Mains cable for CNC control unit MCS
1 Qty.	Connecting cable for computer / CNC control unit MCS
1 Qty.	Three-jaw chuck (Ø 100mm)
1 Qty.	Travelling lathe centre
1 Qty.	Ring gear drill chuck (clamped up to 10mm)
1 Qty.	Operating tool
1 Qty.	Multiple tool holder with 2 tool holder elements
1 Qty.	Three-jaw chuck (Ø 100mm)
1 Qty.	Lathe chuck guard

7. Unpacking and setting up the machine

Please note:

The information given in this manual and the knowledge it conveys is indispensable for the safe commissioning and the safe operation of the machine and the controls!

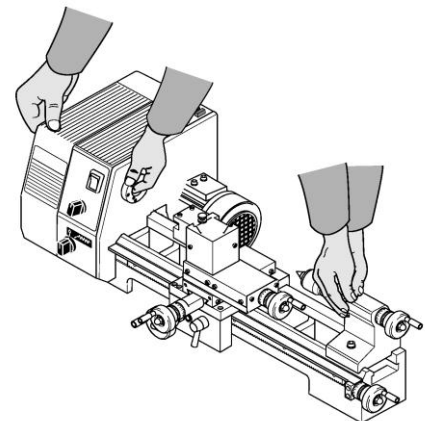
Please read the manual attentively and make sure you have understood the contents!

Carefully unpack the individual components from the Styrofoam packaging. Please check for completeness of the delivery by using the list in the chapter "Scope of Delivery".

Caution!

Do not grasp the gear case, the motors, or the cover of the motor to lift the machine out of the Styrofoam packaging. The plastic caps could break.

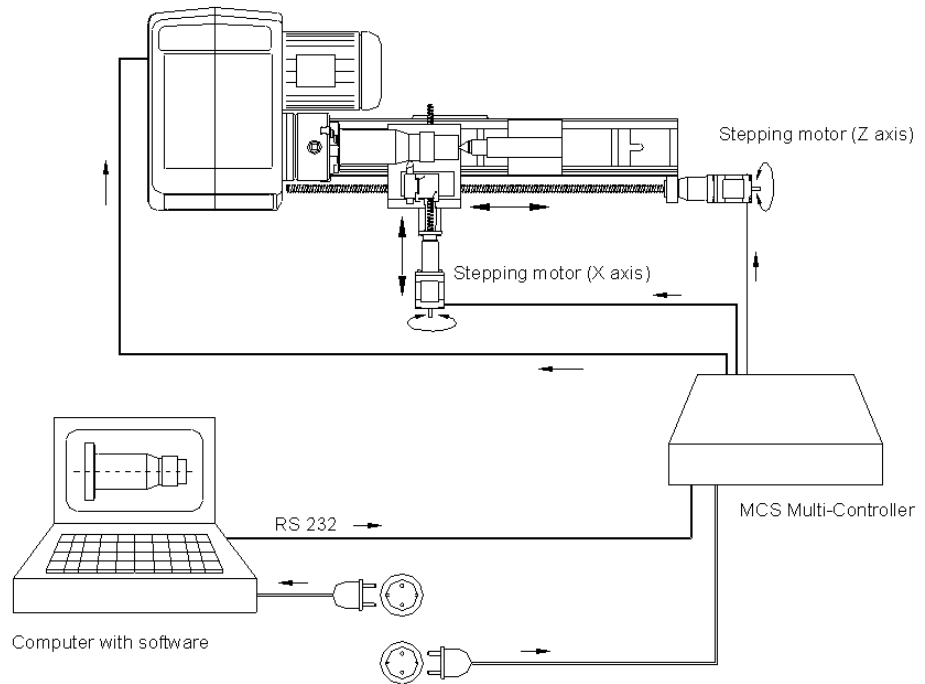
Please enlist the aid of a helper to lift your PD 400 CN out of the package as illustrated in the figure on the right.



8. Basic tips on setting up and assembling the machine

The machine may only be set up and operated in dry and well-ventilated rooms. The configuration of the components is illustrated in the schematic figure on the right.

The setup site must be level and sufficiently stable to absorb the vibrations that occur during work. The machine must be fastened to a fixed, level underlay using the drill holes intended for this purpose.



Please make sure the mains cable is outside the hazard area and cannot be crimped or otherwise damaged.

Mount the lathe chuck with its 3 screws on to the main spindle. Make sure that the seat of the chuck is free from dirt and that the chuck is properly centred.

Please also read the separate, enclosed clamping chuck instructions!

Please note:

All blank metal parts of the machine are delivered conserved with corrosion protection. This protection is not intended as lubrication but only as conservation and must be removed before first use, such as with a lint-free cloth saturated with petroleum.

All guides must be checked, and in rare cases adjusted as necessary. (See chapter "Maintenance").

The blank guides and spindles must then be oiled with suitable machine oil.

8.3. Connecting the cabling

Caution!

Connect the mains cable to the CNC control MCS at the very last and make sure the mains switch at the rear of the CNC control is set to "O", meaning switched off! Do not in any case switch on any electrical device, be it the computer, the CNC control, or the machine itself before the connection of the cables is completed!

The connection sockets on the CNC control are all located at the rear of the housing: The connection cable of the two stepping motors is inserted in the provided sockets of the CNC control. They are identified accordingly as "X" and "Z" of the respective CNC axes. For your information: The X axis is the axis diagonal to the machining direction, and the Z axis is the axis that is longitudinal to the machining direction.

The mains cable of the lathe is inserted in the provided socket at the rear of the CNC control. The main spindle motor is switched on and off by the CNC programs.

Please leave the insertion of the mains plug of the computer and the CNC control in the mains socket outlet for the very last.

The communications cable included in the delivery is used to connect the CNC control to the control computer. It is inserted in the appropriate socket at the control and connected to a serial interface at the computer.

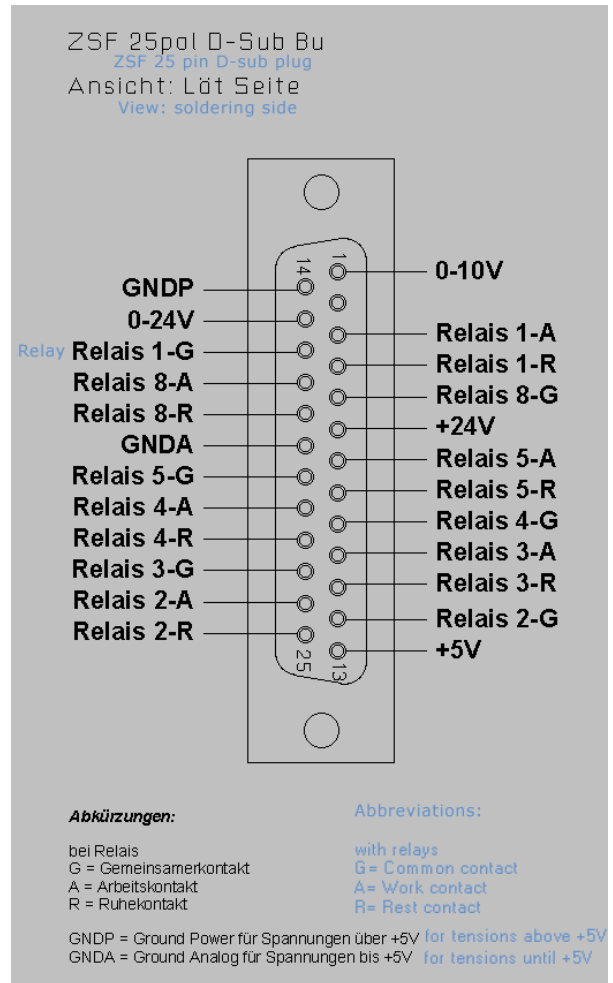
These are often called "serial" or "COM" and usually have 9 pins. If the connector at your computer has 25 pins instead of 9, you will need a corresponding adapter.

8.4. Additional connection options

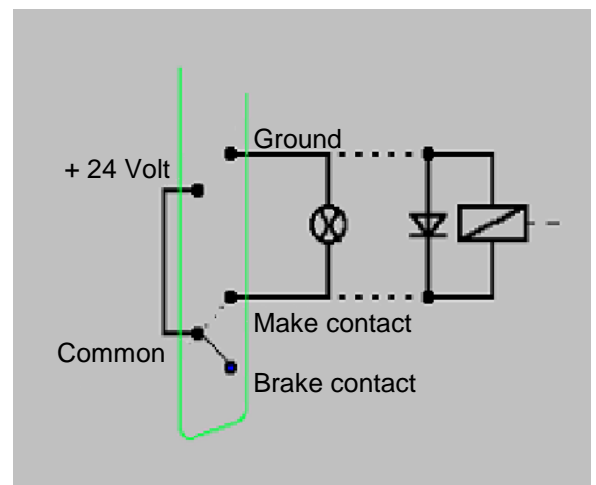
Several additional functions can be electronically driven upon request, such as a coolant pump, working light, or similar.

The inside of the control has centre-zero relays whose connections can be executed through the 25-pin socket at the rear of the control. Each relay has three pins that are identified by the letters A, R and G. These letters stand for:

- A: Make contact
- R: Break contact
- G: Common contact



The circuit design mode of operation is illustrated in the picture on the right; both Relays 3 and 4 are available.



9. Installing the software

9.3. Minimum hardware requirements

The NCCAD software is very comprehensive and powerful, therefore there are certain minimum requirements to the utilised control computer:

Simple operation and controller PC:

- Windows 98/2000/XP/7
- RAM: at least 16MB
- Free hard disk capacity: at least 60MB
- Graphics resolution 1024 x 768 pixel

Extended functionality (OpenGL simulation, manual control):

- Graphics resolution 1024 x 768 pixel
- Fast graphics card with chipset, at least Gforce4 or similar

9.4. Installation procedure

The software is included on the enclosed CD. After being inserted in the drive, the Explorer will display the following image:

Double-click the "Installation" directory, then "setup.exe".

This starts the installation procedure. Simply follow the entry instructions.

Name ^	Änderungsdatum	Typ	Größe
^ Momentan auf dem Datenträger vorhandene Dateien (8)			
Beispiele_nccad8	01.09.2011 12:08	Dateiordner	
Firmware	01.09.2011 12:08	Dateiordner	
Help	01.09.2011 12:08	Dateiordner	
Hilfsprg	01.09.2011 12:08	Dateiordner	
Installation	01.09.2011 12:08	Dateiordner	
LemVideos	01.09.2011 12:08	Dateiordner	
ZusatzSoftware	01.09.2011 12:08	Dateiordner	
ReadMe.txt	25.03.2009 11:28	Textdokument	1 KB
^ Dateien, die auf den Datenträger geschrieben werden sollen (1)			
desktop.ini	21.10.2011 08:46	Konfigurationseinstell...	1 KB

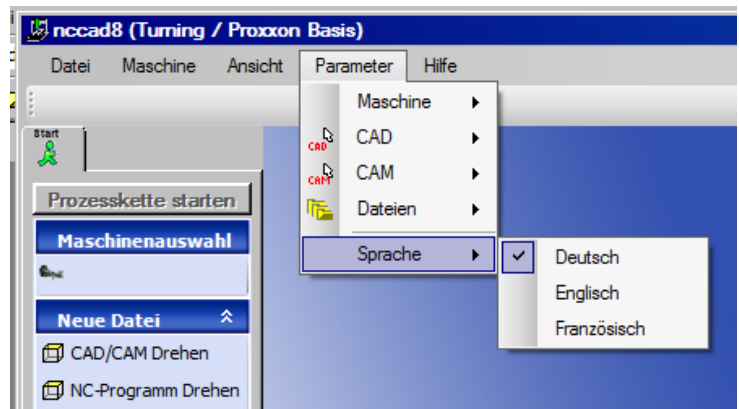
The program is now written to a directory that contains the necessary files. The program icon will be installed automatically to your desktop.

9.5. Starting the software nccad 8

After the program was successfully installed, it can be started just as you are used to from other applications on your computer. Simply select the "Start" button on the screen with your cursor and select the desired file in the program title bar. It's even easier if you simply clic

9.6. Selection of the language

German language is set by default. But after starting the application, you can change the language easily: Click "Parameter" in the upper toolbar, then you can select the requested language as shown on the illustration.



9.7. Parameter settings

The specific machine data (travel paths, limit values, working conditions, equipment, etc.) are stored in the parameter files. These can be recognised by the ending "*.ini" in the Windows Explorer.

Caution!

The values stored there are especially adapted to operation with the PD 400 CNC and should not be changed without experience and knowledge of the program.

No changes may be made here especially before commissioning! False entries can lead to system errors and dangerous operating states!

9.8. The status display at the CNC control MCS

There are three different coloured lights on the panel of the CNC control; see picture. They indicate the operating status of the CNC lathe.



- **Yellow:** Caution (in action) – command execution running, even if the axis or spindle are not currently moving. Do not reach into the CNC machine; it is possible that the command "pause" is running down and machining can continue at any time.
- **Green:** Free (to receive commands) – Communications with the PC is possible, commands can be received.
- **Red:** Locked (or error) – The movement and command receipt of the CNC machine are locked. This could be the case if the EMERGENCY stop was activated or if an error occurred in the system (e.g.: communications error, PC no longer completely functional).
- **All:** After the CNC machine is switched on as a lamp test for a period of approx. 1 second.

9.9. EMERGENCY stop / lock

The EMERGENCY stop is used to lock the CNC machine for command receipt and for command execution. Only the red status lamp will light up in the "Lock" position. The lock can be useful, for example, to prevent the execution of an unintentionally entered movement command.

The lock is removed when the switch is set to "On" and the CNC machine is ready for operation again. This is signalled by the glowing green light.



10. The nccad 8-software

The program NCCAD 8 generates the control program from the work piece geometry data, co-ordinates communications with the interface control computer/CNC control, the CNC axes, the generation of the step pulses, etc. etc.

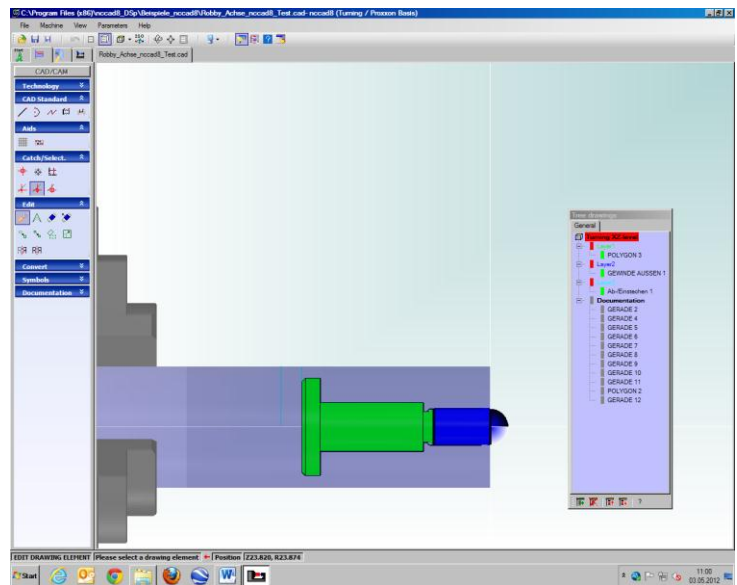
The control "translates" the signals into commands for the stepping motors.

The options the program offers are manifold; the scope is rather large. Therefore, one should consider that it takes some time until one has a complete overview of all the possibilities of the program and can confidently move between the many functions.

Much practice, and naturally some patience is helpful to be able to use the software thoroughly.

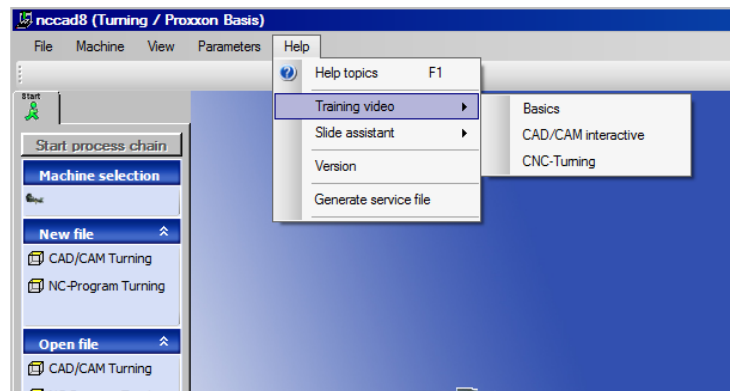
For the beginning it is helpful to know what the program can even do and that it owes its capability in principle to several "Individual" functions.

On the one hand, it is utilised to create a part in electronically drawn form (CAD), and on the other hand it then generates the control commands from that geometry for the control (CAM) which it then processes as electric signals for the motors of the spindle drives.



10.3. The integrated training videos

To start the very helpful training videos, then select the "Training video"-option under the "Help"-topic.

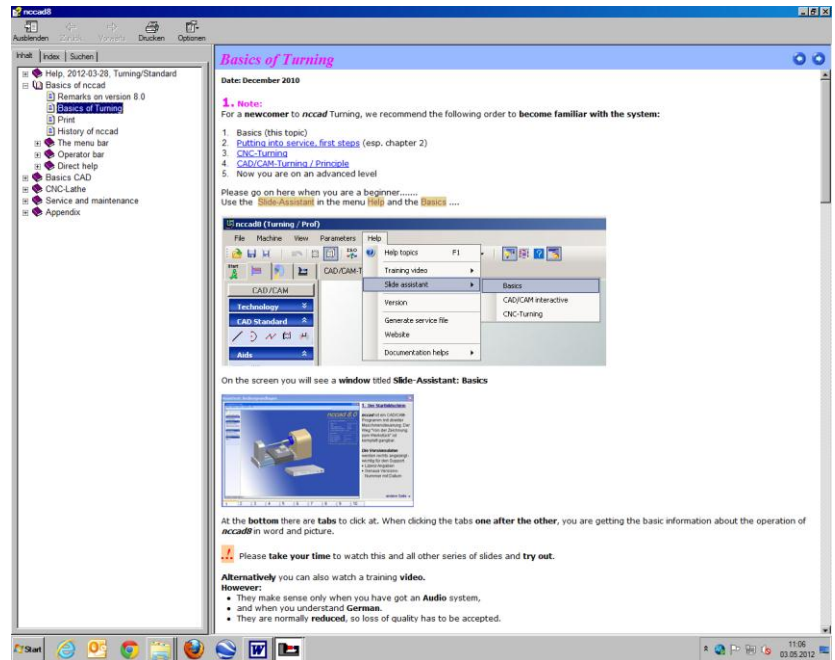


10.4. The integrated manual with the help system

We deliberately refrained from using a printed form of the manual and, as already mentioned above, have consolidated the necessary contents in a help function within the program itself.

A much more practical and neat possibility than having to handle a mountain of paper:

The structure of the topics has been optimised for an intuitive and self-explanatory entry; important things are recognised first and navigation afterwards is effortless:



In the normal view, click on **Help** in the menu line at the top right to start the "Help Function". A submenu appears: click here on **Help Topics** and then the Help window will appear.

10.5. The structure of the "Help Topics" window

On the left there is an orientation window with a few tools to help you quickly find what you want to know and which offers you three different search methods. The actual help text appears on the right.

10.6. Search methods

In the **orientation section** at the top there are three tabs labelled "Contents", "Index" and "Search". Three different search principles are possible:

10.6.1. Contents

The entire table of contents is illustrated as structure tree where one simply clicks on the desired entry. Many others are tiered in several levels and branch out to several alternatives, which can also be clicked. This gives the user all the possibilities to specifically target the solution to his problem.

10.6.2. Index

This offers you the option of the Index search. Certain important keywords are collected in an index directory. If a letter is entered in the entry line, the index register moves up by the corresponding amount, and the term is isolated further for every added letter. So-called generic terms offer additional entries illustrated in the directory, inserted on the right. Simply click on one of the terms to open it.

10.6.3. Search

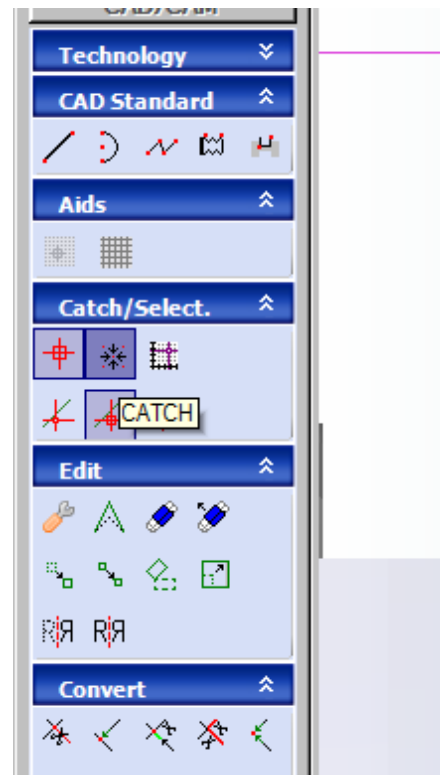
The search term is entered in a blank line and the "List Topics" button is pressed. The hit (or hits) appear in the window and can be clicked. Important: Select the options "Search for Previous Results", "Search for Similar Words", and "Only Search for Titles".

10.6.4. Explanation of the icons

Select <File –CAD/CAM> in the menu. An empty drawing surface appears with an icon menu next to it.

Move the cursor over one of the icons and wait for a moment without clicking any icons. A brief explanatory text appears – see figure at right.

If you also press the function key F1, a help window with a detailed explanation to this icon will appear.



10.7. Online support

In case of malfunctions that cannot be handled despite thorough perusal of this manual as well as the utilisation of the help system, we would be happy to help you directly.

Simply write an e-mail to the address technik@proxxon.com. You will receive a response within 3 working days.

11. Important note for working in practice

11.3. Simple stopping of the machine and the Emergency-Off switch

Press any key of the PC keyboard to stop the carriage movement and to switch off the lathe. The system will then wait for further commands.

This "Keyboard Stop" is helpful during the test phase and for disruptions of machining (e.g. wrong infeed, wrong feed).

11.4. Safety stop, lock

Press the "Lock" switch of the CNC control to stop the carriage movement and to switch off the spindle. The system will not accept any further commands until the switch/pushbutton is returned to the "ON" setting.

11.5. Direction of rotation switch

Your CNC machine no longer has a separate mains switch as it is controlled directly via control electronics. However, during normal work, make sure that the direction of rotation switch of the machine (shown in the figure on the right) is not in the "0" setting, but is set to the desired direction of rotation. Otherwise the machine will not start.

That is why it also may not be set to "0" during a machining procedure, as the spindle movement will be interrupted.



11.6. Room EMERGENCY Off

Room EMERGENCY Off: An EMERGENCY Off switch that disconnects the power supply in the entire room must be installed in the room where the machines are operated. This red/yellow coloured mushroom-shaped pushbutton must be easily accessible and arranged far enough away from the possible hazardous area.

12. First steps: The "Basic of turning"-chapter

At this point, we would like to reiterate that all steps relevant to commissioning the machine are found in the "Help" function of the program and it is vital to familiarize oneself with these functions before the commissioning.

The figure on the right illustrates the screen view that you will see if you have clicked "Basics of turning".

This explains in great detail what you need to know in order to handle the machine.

Basics of Turning

Date: December 2010

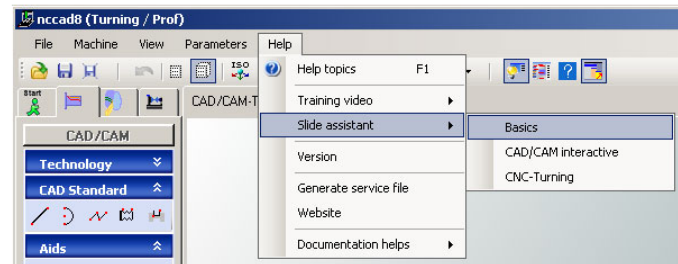
1. Note:

For a newcomer to nccad Turning, we recommend the following order to become familiar with the system:

1. Basics (this topic)
2. [Putting into service, first steps](#) (esp. chapter 2)
3. [CNC-Turning](#)
4. [CAD/CAM-Turning / Principle](#)
5. Now you are on an advanced level

Please go on here when you are a beginner.....

Use the **Slide-Assistant** in the menu **Help** and the **Basics**

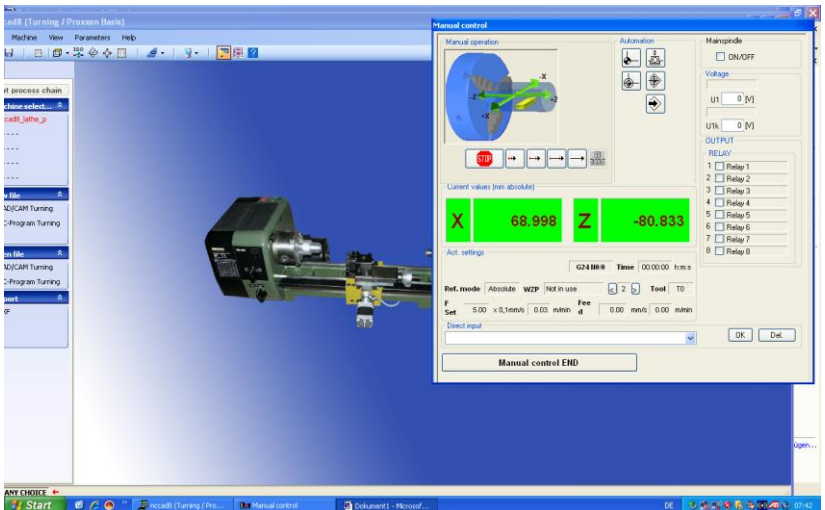


On the screen you will see a window titled **Slide-Assistant: Basics**

12.3. Simple test of the machine

In the nccad menu "Machine" select the option "Lathe" and observe the status display: the lamps must flash briefly and the green lamp must stay on. At the same time, the "Manual control" window must appear on the screen – see figure at right.

Always press the button "Approach reference point" after every program start as shown in the figure.



A reference point approach of the carriage is carried out with the purpose of activating the position switches in both axes. This is used for the "definition of position" of the carriage: The control now knows exactly where the carriage is and can now calculate the commands for the stepping motors accordingly.

If an error message appears instead of the "Manual control" window, the interface may be incorrectly set.

To remove this error, it is usually sufficient to readjust the interface in the "Parameter" menu.

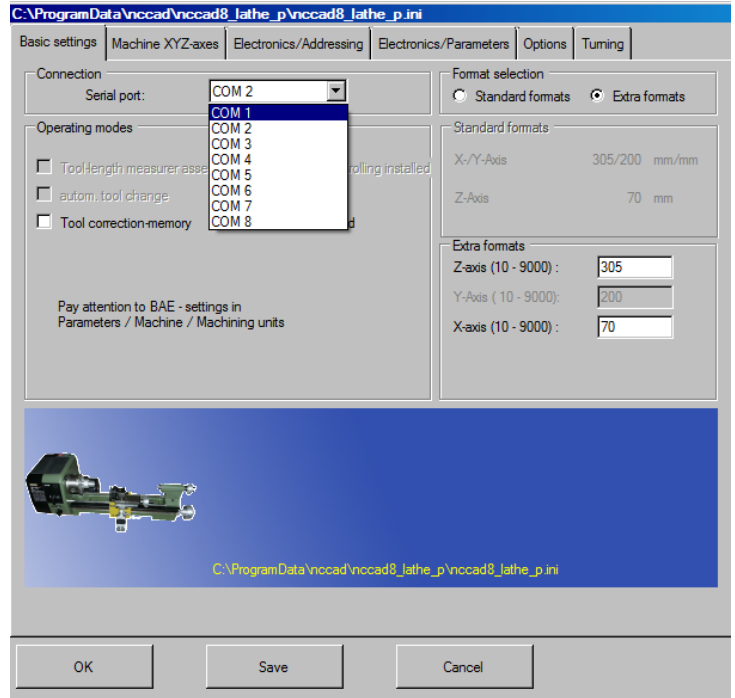
First click "Parameters", then "Machine" and after that "Edit parameters".

The window shown in the figure on the right appears.

Readjust the interface in the "Serial port" pulldown-menus as shown and then try again (Normally "COM 1" must be selected, but it could be necessary to try some other comports as well).

Then press "ok" and "save" and close the application.

The program be restarted then. If it still does not work, please review the notes in the chapter "Errors and their removal".



13. Fundamentals on working with the machine

Caution!

Before switching on the machine for the first time, make sure the screws of the lathe chuck are properly tightened, that the key for the lathe chuck is not inserted and that there is sufficient clearance between the support and the lathe chuck.

Caution!

Practice first without a clamped work piece and with the machine turned off. This will decrease the risk of injuries or damage.

Caution!

Please note that due to the construction type, the motor can become very hot if left in idle operation for a longer period. This is not an indication for a motor defect; still, it is recommended to avoid this operating state and not to leave the machine unnecessarily in idle operation.

13.3. Fundamentals on turning and the PD 400 CNC lathe

13.3.1. Straight turning

Straight turning is the type of turning whereby the cutter moves on a path parallel to the work piece axis, the "longitudinal feed".

The cutting depth, also called "infeed" is the amount by which the cutter dips deeper into the material for every turning cycle.

"Feed" is the distance per revolution of the work piece which the tool travels on its path.

The cutting cross-section is therefore the product of feed and cutting depth. Straight turning is the most common machining type.

13.3.2. Grooving and parting

Grooving is the manufacture of fine grooves through radial infeeding of the cutting tool without longitudinal feed.

If the tool is infeed so much that the work piece is thus "cut through" (meaning up to the rotary axis or the centre of the work piece), then this is called "parted".

In principle:

The height of the cutting edge of the parting tool must be adjusted precisely to the height of the centre of the work piece! Also, the tool must be clamped as short as possible:

Too much free length always means deformation and susceptibility to vibrations! This naturally applies to straight turning as well.

Use a low speed and lubricate the tool if possible with a bit of machine oil.

13.4. Various cutting tools and their properties

For various work tasks there are special tools that are optimally co-ordinated to their respective intended use due to their form. The right choice of tool is thus not only essential for the perfect quality of the work result, but some machining can only be done with certain tool forms from the outset.

We will briefly introduce the most important forms:

13.4.1. Roughing tools (1)

are used to wear off as much swarf as possible in a short time (regardless of the finish of the work piece surface).

13.4.2. Finishing or pointed tools (2)

are used to achieve a clean surface.

13.4.3. Right (3) or left cutters

are used for longitudinal and face turning as well as for boring acute angles in right or left machining direction.

13.4.4. Parting tools (4)

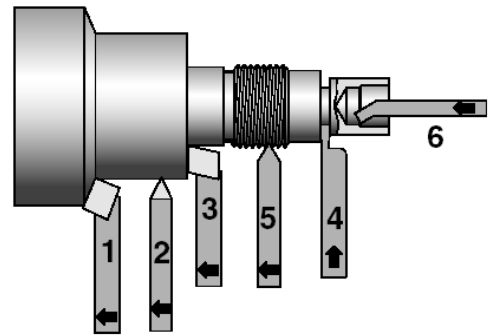
are used to groove flutes and to separate the work pieces.

13.4.5. Threading tools (5)

are used to cut external threads.

13.4.6. Inside turning tools (6)

for boring, i.e. to manufacture cylindrical hollow spaces



13.5. Inserting the cutting tool in the tool holder

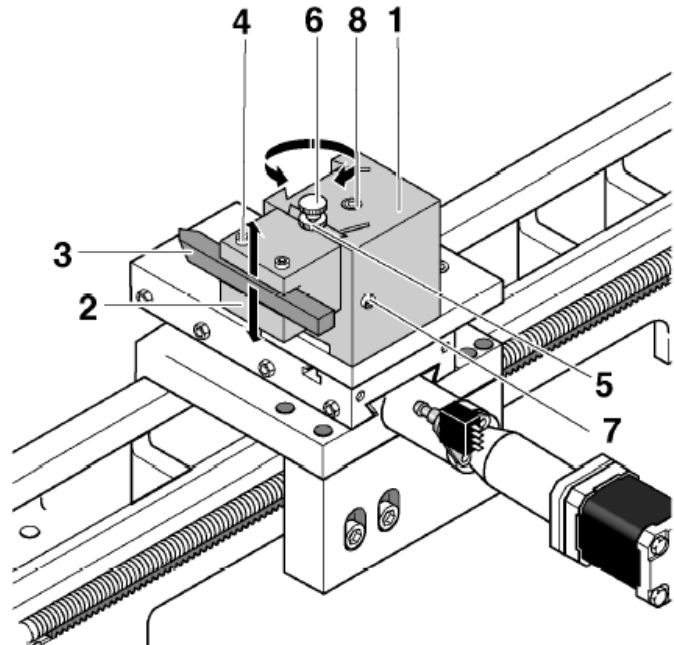
The basic equipment of the PD 400 includes a multiple tool holder consisting of tool holder block **1** and two tool holder elements **2**. The tool holder elements can be adjusted in height: Turn the knurled screw **5** up or down until the tool centre is exactly in the centre, meaning at the same height as the work piece axis. The exact height setting is very important. This is the only way to guarantee the optimal geometrical conditions at the cutting edge. Otherwise vibrations and a bad work result would be the result.

The position set in this way can be "memorized" by tightening with knurled screw **6** and can be reproduced by repeatedly inserting the tool holder in the dovetail guide. Often different cutting tools are required for different work processes. If they are already "pre-mounted" in the tool holder and adjusted correctly, they can be easily exchanged in the dovetail guide after loosening screw **7**. The correct height is set automatically when the knurled screw hits the top side of the tool holder.

1. Insert cutting tool **3** in tool holder element **2**. Firmly tighten both screws **4**.
2. Insert tool holder element in tool holder block **1**. Adjust the height of the cutting tool with nut **5** and tighten with nut **6**.
3. Please adjust the height of the cutting edge with the lathe centre in the tailstock.
4. Clamp tool holder element with screw **7**.

Note:

The entire holding block can be swivelled after release screw **8**.



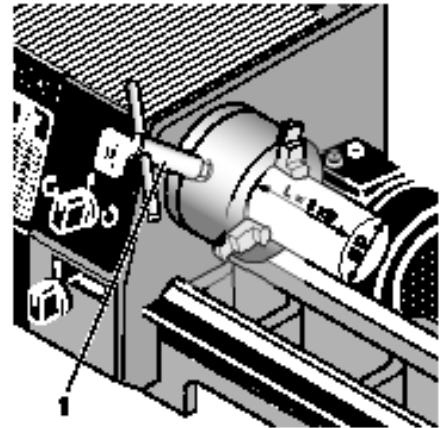
13.6. Clamping in the lathe chuck

Caution!

Please comply with the enclosed operating instructions of the chuck manufacturer as necessary!

Caution!

If work pieces are only clamped in the lathe chuck without counter-bracket by the tailstock, the projection may not be greater than the three-fold diameter of the material ($L = 3 \times D$), see figure at right.



13.7. Determining the correct spindle speed

The cutting speed is a decisive parameter during machining. Too high or too low cutting speeds affect the good end result, so the choice of spindle speed – which is decisive for the cutting speed – is very important for a good surface and clean metal removal.

Another determining factor is the diameter of the work piece: the greater it is, the greater the relative speed is at the circumference at constant speed. The relation is characterised by the following equation:

$$n = V_c \cdot 1000 / (D \cdot 3.14)$$

whereby:

- n: Rotational speed
- V_c: Cutting speed
- D: Diameter

The table on the gear case of the machine offers help in choosing the right cutting speed. For known cutting speed "V_c" and known work piece diameter "D", the necessary spindle speed "n" can be calculated.

An example:

An aluminium work piece with a 30mm diameter will be machined. The necessary cutting speed according to the table is 100–180m/min. We will calculate 132m/min.

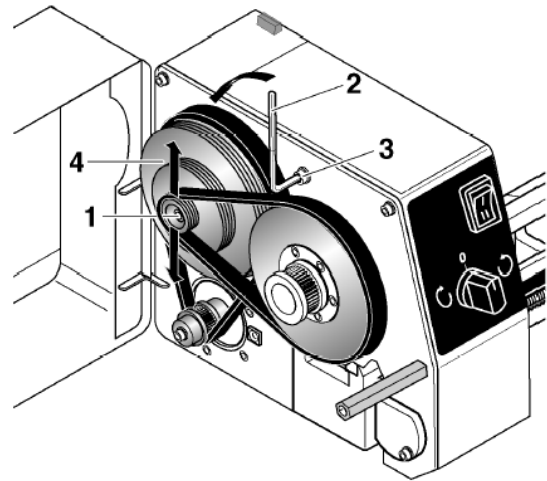
$$n = 132 \times 1000 / (30 \times 3.14) = 1400 \text{ rev/min}$$

This result can be read directly in the table on the gear case.

13.8. Setting the spindle speeds by shifting the drive belt

The spindle speed can be changed by shifting the motor (multiple contact switch **1** Fig. 4). The speed is halved or doubled. On the other hand, the speed can be changed by shifting the drive belt in the spindle box at the left.

1. Switch off the CNC control at the mains switch and open the gear case with the Allen key.
2. Loosen clamping screw **1** by $\frac{1}{2}$ a turn.
3. Use the Allen key **2** to turn screw **3** to the left. This releases the intermediate belt pulley **4**.
4. Now change the belt according to the graphic shown below.
5. Use the Allen key **2** to turn screw **3** to the right to tension the belt again.
6. Remove Allen key **2** and tighten clamping screw **1**.
7. Close the gear case and put the machine into operation.

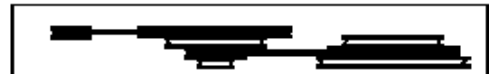


The following speeds shown in the configuration can be set:

80/160 min⁻¹



330/660 min⁻¹



1400/2800 min⁻¹



Note:

It could occur that the motor will not always start when the multiple contact switch is set to Stage II. In this case, please start with Stage I and then switch to Stage II.

13.9. Machining longer work pieces with tailstock and lathe centre

Longer work pieces (chuck projection greater than the 3-fold work piece diameter) must be held at the right end by the tailstock and the travelling lathe centre. To do so, please affix a centring hole on the right side:

1. Carefully face turn the right face side.
2. Insert drill chuck **1** (Fig. 12) in the tailstock and clamp the centring drill.
3. Move the tailstock up to the work piece and fix with clamping screw **2**.
4. Switch on the machine and create the centring hole using the sleeve feed (hand wheel **4**).

You can now replace the drill chuck with the travelling lathe centre. Place the centre in the centring hole and carefully infeed until there is absolutely no play. Now fix the sleeve with toggle **3**.

14. Service and Maintenance

Caution!

Before doing any maintenance and cleaning work, always switch off the machine with the master switch. Do not use compressed air for cleaning otherwise swarf could get into the guides.

In general

Therefore, please keep the machine clean and handle with care. Please keep in mind that "healthy" mechanics are decisive for the quality of the working result.

The guides play a very important role here: They are important machine elements and must be handled with special care.

Cleaning the machine after every use and the regular application of oils and lubricants is always a part of caring for the machine.

14.3. Cleaning

For cleaning, such as swarf, please use a proper hand brush or a brush. Please make sure that no swarf gets into the guides or other moving parts.

Of course you may use a cloth. These, however, must be lint-free to avoid contaminating the guides.

Never blow off the machine using compressed air: Dust and above all swarf can be blown into guides or other moving parts and damage them!

When using cleaning agents, make sure the saturated wiping cloths are disposed of in an environmentally-compliant manner. Do not dispose of in household waste.

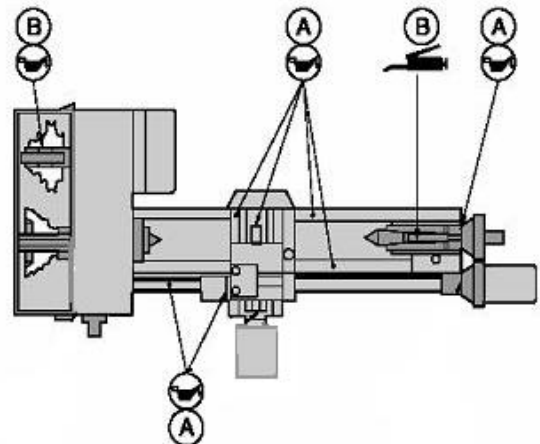
14.4. Lubrication

Grease or oil all parts according to the lubrication schedule. When oiling the sliding surfaces, move the carriages back and forth by hand several times so that oil can run into the guides.

A = Oil/lubricate before every use

B = Oil /lubricate monthly

The regular and careful lubrication will decisively reduce friction between two moving parts and



will thus contribute to a long service life of the guide and a good mechanical condition of the machine.

To properly apply the lubricant, use an oil can or a lint-free cloth saturated with oil or grease. Please treat the guides and all moving and blank parts in the same manner. Please also comply with the instructions of the lubricant manufacturers!

14.5. Adjusting the play of the guides

Even if the guides are regularly oiled, cleaned and properly adjusted, the guides will show play after some time.

1. Release the counter nuts **1** (Fig. 18) of the adjusting screws for upper carriage **2**, turn in all adjusting screws **3** evenly until the play is eliminated and then retighten the counter nuts.
2. Repeat the same procedure for the cross slide **4**. Note: The guide can be clamped with the help of screw **5**.
3. Turn the machine upside down and unscrew the threaded pin **1** (Fig. 19) somewhat.
4. Lightly retighten clamping screws **2** to reduce play.
5. Check if the support can still be moved easily. The drive motors could stall if the support is too stiff. These will then emit "peeping" noises. In this case, increase play somewhat.

14.6. Main spindle

The bearing assembly of the spindle through 2 taper rolling bearings is maintenance-free for at least 6,000 hours at minimum speed and 1,800 hours at maximum speed. If there is slight play after this period has elapsed, a specialist can readjust the bearings.

The CNC machine should always be in a clean condition, i.e. carefully cleaned after every working stage.

Some elements affect the precision and work safety and must therefore be checked regularly. Here the following checklist for this purpose:

- Guides – clean and dry?
- Shafts free from machining residues?
- Fastening screws are tight?
- Alignment: Are tables at right angles?
- Open the spindle covers for inspection: must swarf be removed by vacuuming?

If required, the following maintenance activities are necessary:

- Clean the shafts, rub them dry, open the covers and clean or oil the spindle system.
- Readjust the guides in case the carriages have play
- Rub aluminium surfaces with acid-free oil.

If the CNC machine will be decommissioned for a longer period of time, it should be stored in a dry room at a minimum temperature of 5°C.

A cover to protect from dust and environmental effects is sensible.

In case of a major repair, please send the machine back to us. The address is:

PROXXON G. m b. H.
Zentralservice
Im Spanischen 18-24
D-54518 Niersbach/Eifel, Germany

15. Disposal:

Please do not dispose of the device in the household waste! The device contains valuable substances that can be recycled. If you have any further questions, please contact your municipal disposal company or other appropriate municipal institutions.

16. Errors and their removal

Mains switch does not light up	Mains switch not switched on Mains supply interrupted Mains plug in control not properly inserted Mains line-side fuse interrupted	(Subsequent error)
Red LED still lit 5 sec after switching on	Switch (pushbutton) for EMERGENCY stop (lock) was activated Installed microcontroller does not match the software version	
Red LED lights during machining	Switch (pushbutton) for EMERGENCY stop (lock) was activated Communications error (see below) Connection to PC was interrupted	
All 3 status indicator LEDs permanently lit (flash)	Switching the control on and off occurred too quickly in succession	
Message "Machine not ready"	Switch (pushbutton) for EMERGENCY stop (lock) was activated COM interface set incorrectly CNC machine not switched on Connecting cable between PC and control is interrupted or not inserted correctly Wrong connecting cable (not the original cable delivered by PROXXON GmbH) Set interface is not available in PC	

<p>Change to "Manual control" and then no mouse function</p>	<p>COM interface for machine and mouse are identical Mains switch is lit, LEDs are not lit, stepping motors are not humming</p> <p>External load of socket "Additional function" is too great</p>	<p>Allocate a non-identical interface to both</p> <p>Internal fuse is interrupted</p>
<p>During "Manual control", an axis autonomously moves away from the machine zero point</p>	<p>Position switch does not open</p> <p>Position switch mechanically destroyed</p>	<p>Switch (pushbutton) for EMERGENCY stop (lock) must be activated</p> <p>Replace position switch</p>
<p>Communications error or Time Out</p>	<p>Bad connection between PC and CNC machine, COM interface defective</p> <p>Sources of interference exist</p> <p>Utilise original connecting cable</p>	<p>Repair</p> <p>External sources of interference (interfering pulse, EMC-interferences)</p> <p>(Cable length max. 2m)</p>
<p>Work piece zero point is lost</p>	<p>Machine zero point/reference point is not approached</p> <p>Incorrect zero point selected from table</p> <p>Speed factors too high</p> <p>Spindle contaminated</p> <p>Mechanical stiffness of spindle</p> <p>Feed in material too great</p> <p>Speed of machining unit not co-ordinated to tool, material and infeed</p> <p>Mass to be moved is too great</p> <p>Fastening screw of the axis to be moved is too loose</p>	<p>First remove the causative error.</p> <p>Do not in any case set a new work piece zero point.</p> <p>Approach the machine zero point by pressing the "POS1" key. This re-establishes the initial work piece zero point.</p>

17. Compilation of safety notes

As with any other machine, there are some things that need to be observed when operating the CNC lathe PD 400 CNC so that dangers to humans and the environment cannot occur.

In this context, please also observe the separately enclosed pamphlet with the safety notes.

Special noise protection This can be achieved through ear protection, a protective cell, or a closed room. Also, clamp the tools short so they do not vibrate so strongly

User group Persons above the age of 14 may use the system; instructions on safety and compliance with the safety notes is always required.

Caution!

Risk of injury! Always keep your fingers away from the rotating work piece while turning! Never measure the work piece during operation with a sliding calliper or similar! Do not process the work piece during operation with a rasp or sandpaper!

Setting up the workplace: No spatial narrowness
EMERGENCY Off pushbutton in the room
Vacuum cleaner, permanently installed
PC and machine next to each other,
Connecting cable, max. 1.5m

User group Technically capable persons who are at least 14 years of age.
Familiarize yourself using the documents or by being instructed.

Machining unit Due to the safety regulations, a machining unit for clamping processing is delivered.

Changing work pieces Please observe at all costs that the machine is protected against unintentional actuation while changing the tools or clamping work pieces in the respective clamping device!

When changing the tools, the mains power input for the machining unit must be removed from the mains socket!

Clamp the lathe tool as short as possible!

Eye and
contact protection

Wear protective goggles in the immediate vicinity and make sure that the chuck guard is in the correct position when operating the machine.

Software safety measures:

Locking and stopping
the machine:

Machining, or movement, can be **interrupted at any time** (software STOP):

- By pressing any key of the alphabetic and numeric keypad or any mouse button.
- Activate the switch/pushbutton "Lock" at the CNC control MCS to the "Lock" position.

18. EC Declaration of Conformity

We herewith declare in sole responsibility that the following designated product in the design which we have marketed complies with the principle safety and health requirements of the applicable EU Directive.

This declaration shall lose its validity if unauthorised changes were made to the system.

Address: Proxxon GmbH
Industriepark Region Trier
Dieselstraße 2-3
D-54343 Föhren

Product designation CNC Lathe

Type designation PD 400 CNC
Article number 24500

Applicable Guidelines and Standards:

EC EMC Directive 2004/108/EG

DIN EN 55014-1 / 02.2010
DIN EN 55014-2 / 06.2009
DIN EN 61000-3-2 / 03.2010
DIN EN 61000-3-3 / 06.2009

EC Machinery Directive 2006/42/EG

DIN EN 61029-1 / 01.2010

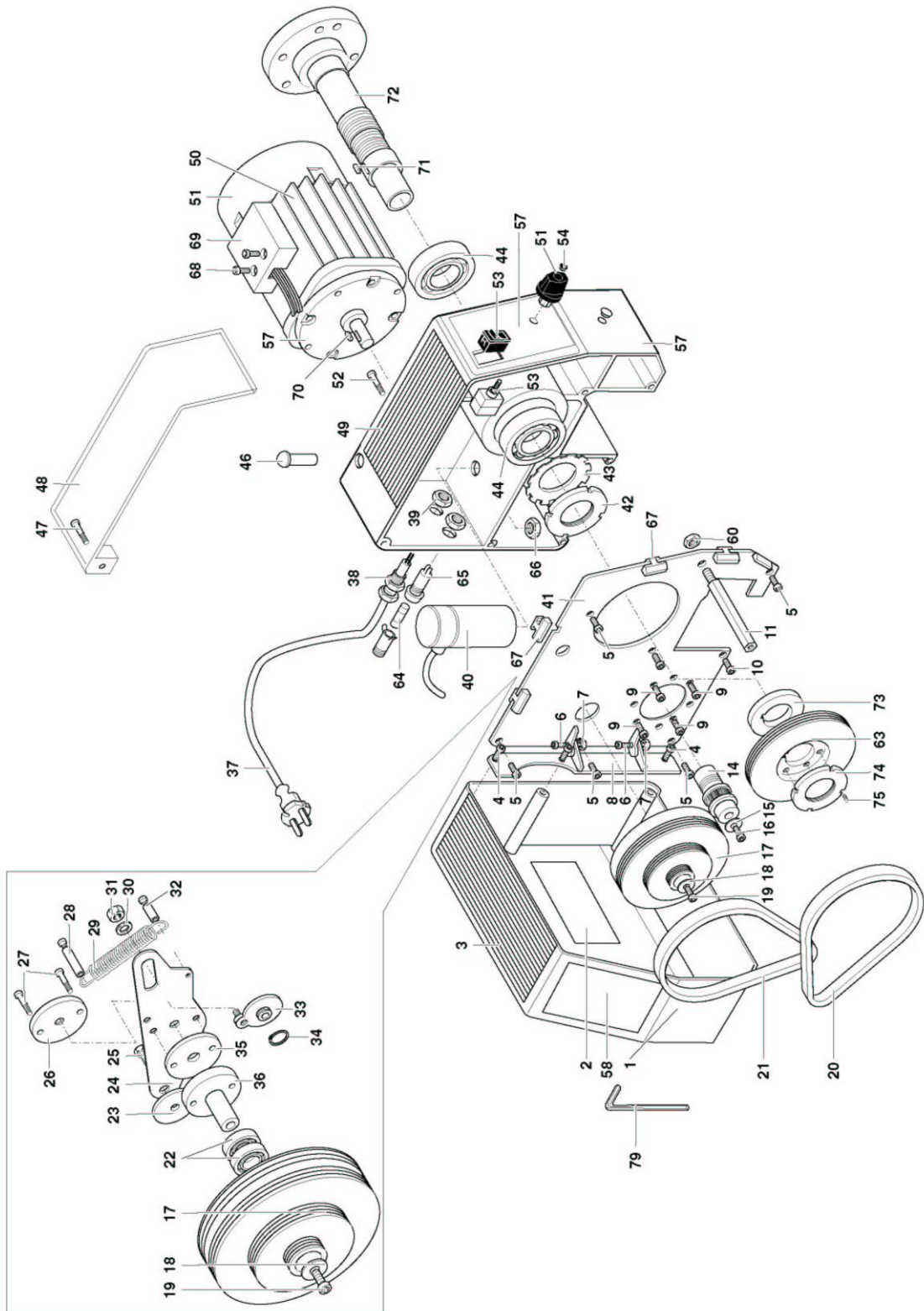
Jörg Wagner
21.12.2011

Machine Safety Department
The CE document authorized agent is identical with the signatory.

19. List of components and exploded views

Please order spare parts in writing from the PROXXON Central Service (address at the back of the instructions)

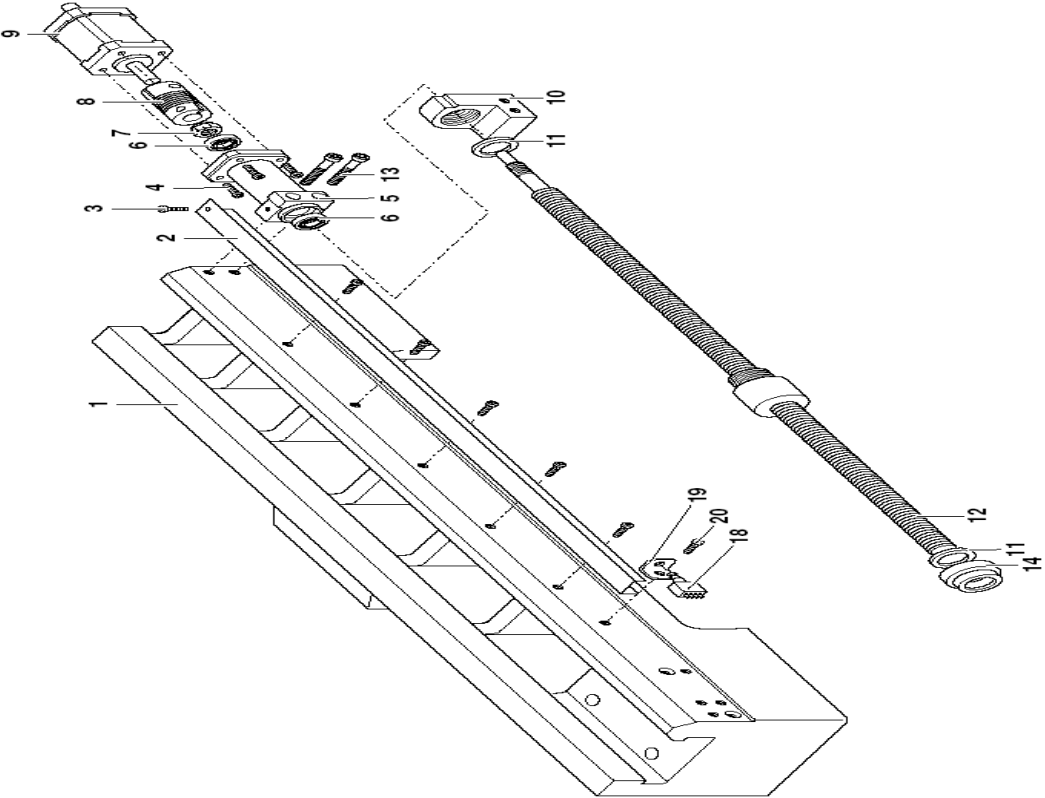
19.1. Assembly group 01 Headstock



ET No.:	Designation
24500 - 01 - 01	Gearbox
24500 - 01 - 02	Table thread pitch
24500 - 01 - 03	Placement pad for cover
24500 - 01 - 04	Screw for hinge
24500 - 01 - 05	Screw for gear plate
24500 - 01 - 06	Screw
24500 - 01 - 07	Nut
24500 - 01 - 08	Hinge
24500 - 01 - 09	Screw
24500 - 01 - 10	Screw
24500 - 01 - 11	Bolt
24500 - 01 - 14	Belt pulley motor
24500 - 01 - 15	Washer
24500 - 01 - 16	Screw
24500 - 01 - 17	Intermediate belt pulley
24500 - 01 - 18	Washer
24500 - 01 - 19	Screw
24500 - 01 - 20	Belt main spindle
24500 - 01 - 21	Belt motor
24500 - 01 - 22	Bearing
24500 - 01 - 23	Plate
24500 - 01 - 24	Sheet
24500 - 01 - 25	Screw
24500 - 01 - 26	Plate
24500 - 01 - 27	Screw
24500 - 01 - 28	Bolt
24500 - 01 - 29	Spring
24500 - 01 - 30	Nut
24500 - 01 - 31	Disc
24500 - 01 - 32	Bolt
24500 - 01 - 33	Plate with hexagon
24500 - 01 - 34	Seeger circlip ring
24500 - 01 - 35	Plate
24500 - 01 - 36	Flange
24500 - 01 - 37	Mains cable
24500 - 01 - 38	Strain relief
24500 - 01 - 39	Nut for strain relief
24500 - 01 - 40	Capacitor
24500 - 01 - 41	Gear plate
24500 - 01 - 42	Grooved nut
24500 - 01 - 43	Locking washer
24500 - 01 - 44	Taper rolling bearing
24500 - 01 - 45	Rotary switch running direction (including axis and screws)

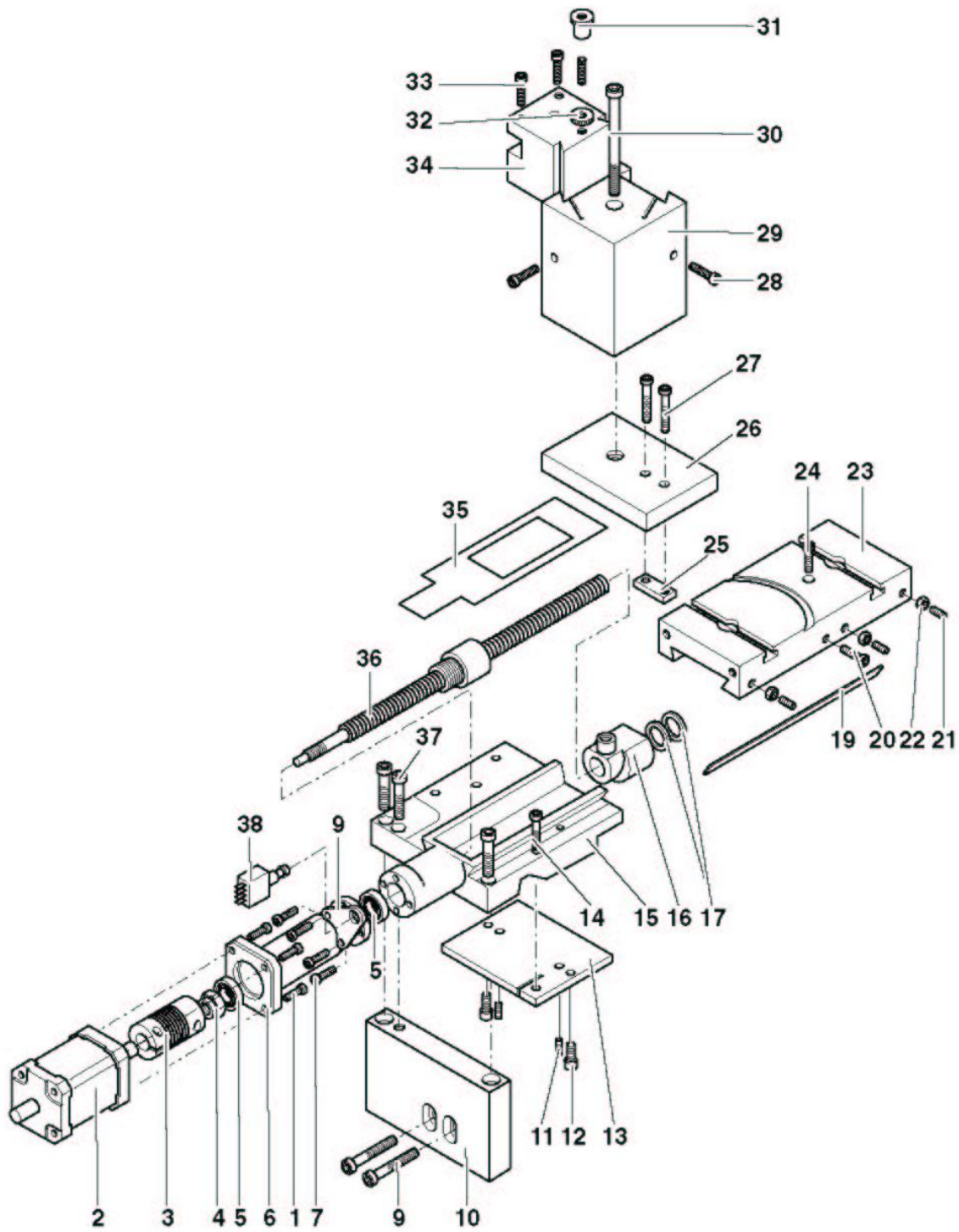
24500	-	01	-	46	Ready indicator
24500	-	01	-	47	Screw for chuck guard
24500	-	01	-	48	Chuck guard
24500	-	01	-	49	Placement pad headstock
24500	-	01	-	50	Motor (complete with cover plate)
24500	-	01	-	51	Cover plate for motor
24500	-	01	-	52	Stop screw
24500	-	01	-	53	Changeover switch for speeds
24500	-	01	-	54	Cap for rotary button
24500	-	01	-	55	Headstock
24500	-	01	-	56	Nut
24500	-	01	-	57	Spindle box sticker
24500	-	01	-	58	Sticker for gear case
24500	-	01	-	59	Lathe chuck (not pictured)
24500	-	01	-	60	Key for lathe chuck (not pictured)
24500	-	01	-	61	Fastening screw for lathe chuck (not pictured)
24500	-	01	-	62	Complete set of tools (not pictured)
24500	-	01	-	63	Belt pulley
24500	-	01	-	64	Lead fuse
24500	-	01	-	65	Fuse holder complete
24500	-	01	-	66	Nut
24500	-	01	-	67	Positioning plate
24500	-	01	-	68	Screw
24500	-	01	-	69	Terminal box cover
24500	-	01	-	70	Fitted key
24500	-	01	-	71	Fitted key
24500	-	01	-	72	Main spindle
24500	-	01	-	73	Spacer ring
24500	-	01	-	74	Grooved nut
24500	-	01	-	75	Headless screw
24500	-	01	-	76	Article packaging (not pictured)
24500	-	01	-	77	Operating instructions and safety regulations
24500	-	01	-	78	Shaft
24500	-	01	-	79	Allen-type wrench

19.2. Assembly group 02: Bed with drive for Z axis



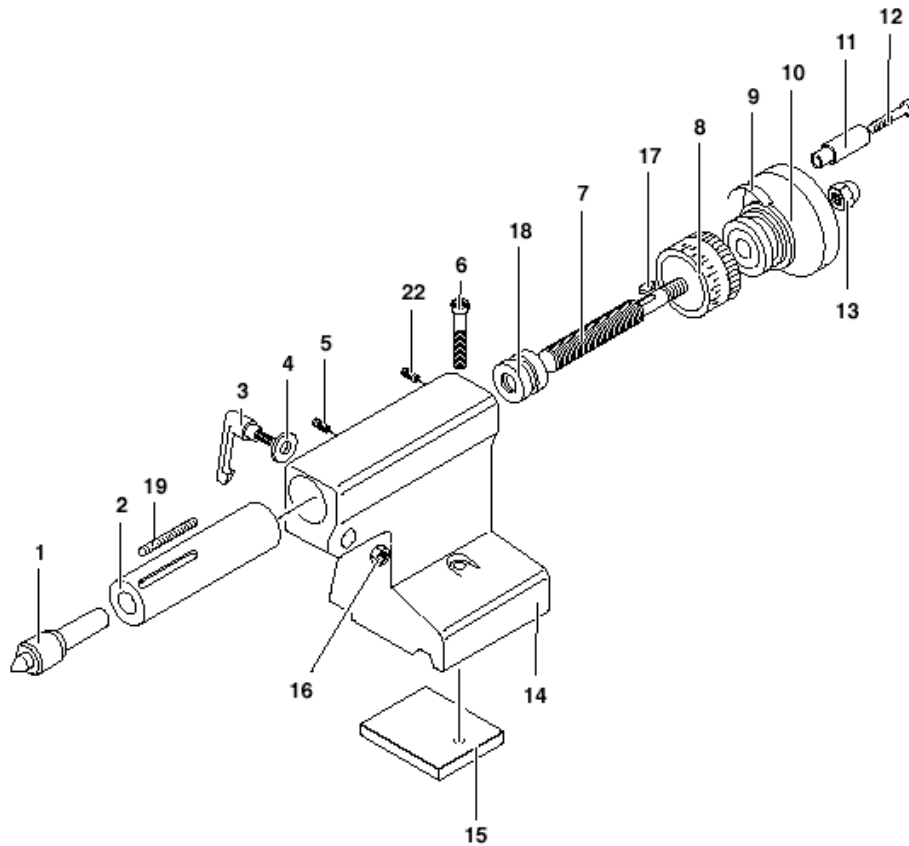
ET No.:	Designation		
24500	- 02	- 01	Bed with ground guide
24500	- 02	- 02	Cover plate
24500	- 02	- 03	Screw for cover plate
24500	- 02	- 04	Screw for motor mounting
24500	- 02	- 05	Flange for motor mounting
24500	- 02	- 06	Ball bearing
24500	- 02	- 07	Nut
24500	- 02	- 08	Coupling
24500	- 02	- 09	Motor
24500	- 02	- 10	Mount
24500	- 02	- 11	Felt ring
24500	- 02	- 12	Spindle
24500	- 02	- 13	Screw
24500	- 02	- 14	Cover
24500	- 02	- 15	Screw
24500	- 02	- 16	Sleeve
24500	- 02	- 17	Pillow block
24500	- 02	- 18	Position switch
24500	- 02	- 19	Mount for position switch
24500	- 02	- 20	Screw

19.3. Assembly group 03: Support with drive for X axis



ET No.:	Designation
24500 - 03 - 01	Screw
24500 - 03 - 02	Motor
24500 - 03 - 03	Coupling
24500 - 03 - 04	Nut
24500 - 03 - 05	Ball bearing
24500 - 03 - 06	Flange
24500 - 03 - 07	Screw
24500 - 03 - 08	Mount
24500 - 03 - 09	Screw
24500 - 03 - 10	Plate
24500 - 03 - 11	Screw
24500 - 03 - 12	Screw
24500 - 03 - 13	Counter plate
24500 - 03 - 14	Screw
24500 - 03 - 15	Carriage
24500 - 03 - 16	Connector
24500 - 03 - 17	Felt washer
24500 - 03 - 19	Sheet
24500 - 03 - 20	Screw
24500 - 03 - 21	Screw
24500 - 03 - 22	Nut
24500 - 03 - 23	Upper carriage
24500 - 03 - 24	Screw
24500 - 03 - 25	Speed nut
24500 - 03 - 26	Block
24500 - 03 - 27	Screw
24500 - 03 - 28	Disc
24500 - 03 - 29	Tool holder
24500 - 03 - 30	Screw
24500 - 03 - 31	Knurled screw
24500 - 03 - 32	Knurled screw
24500 - 03 - 33	Screw
24500 - 03 - 34	Tool holder element
24500 - 03 - 35	Cover
24500 - 03 - 36	Spindle
24500 - 03 - 37	Screw
24500 - 03 - 38	Position switch

19.4. Assembly group 04: Tailstock



ET No.:	Designation
	Travelling lathe
24500	- 04 - 01 centre
24500	- 04 - 02 Sleeve
24500	- 04 - 03 Toggle
24500	- 04 - 04 Washer
24500	- 04 - 05 Threaded pin
24500	- 04 - 06 Screw
24500	- 04 - 07 Spindle
24500	- 04 - 08 Graduated collar
24500	- 04 - 09 Spring
24500	- 04 - 10 Hand wheel
24500	- 04 - 11 Grip
24500	- 04 - 12 Screw
24500	- 04 - 13 Cap nut
24500	- 04 - 14 Tailstock
24500	- 04 - 15 Plate
24500	- 04 - 16 Nut
24500	- 04 - 17 Fitted key
24500	- 04 - 18 Limit stop
24500	- 04 - 19 Scale
24500	- 04 - 22 Threaded pin

PROXXON

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