

Instructions for Use  
and Maintenance

Edition  
en-0210a

# SWAN

Coordinate measuring machines



**COORD3**



## SWAN – Instructions for Use and Maintenance



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Instructions for Use and Maintenance

**SWAN**

Coordinate measuring machines





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# 1. Introduction

This chapter lists the subjects dealt with in these instructions and shows the symbols used. Reading this chapter is of vital importance for the safety of persons and to avoid damage to the machine.

## Instructions for Use and Maintenance

The Instructions for Use and Maintenance are a collection of information about the machine. In particular, the following subjects are dealt with:

- machine marking .....(on page 7)
- foreseen conditions of use .....(on page 10)
- work stations occupied by operators .....(on page 12)
- instructions for transport .....(on page 17)
- instructions for installation .....(on page 19)
- instructions for assembly and disassembly .....(on page 22)
- instructions for set-up .....(on page 28)
- instructions for use .....(on page 30)
- instructions for adjustment .....(on page 32)
- instructions for maintenance .....(on page 35)
- instructions for training .....(on page 40)
- characteristics of the tools to be fitted .....(on page 42)
- technical details .....(on page 44)
- recommended spares .....(on page 55)

All the subjects are dealt with taking the utmost consideration of safety issues, in accordance with current European regulations and the corresponding national laws that acknowledge them.

### Purposes of this manual

The Instructions for Use and Maintenance are an integrating part of the supply. It must accompany the machine throughout its life cycle, up to final dismantling. You are strongly advised to read through this manual completely before using the machine, paying particular attention to the instructions concerning safety.

The information contained in the manual are to be integrated with the instructions given on the machine and its accessories, with all the information signalled by the measuring software and with anything else informed by word of mouth or in writing by the Manufacturer, its installation and service personnel.

For certain operations described, namely the more demanding ones, the manual should be considered as a memo of the main operations, referring to the need to apply to specifically trained and skilled personnel.

**CAUTION:**

Coord3 considers all instructions concerning the procedures for safety, use and maintenance of the machine as compulsory: the Manufacturer declines any liability concerning injury to persons and damage to things deriving from the failure to comply with such instructions.

**CAUTION:**

Behaviour in contrast with the specifications of this manual, in the broadest of meanings, may involve a source of danger for the person using the machine and anyone else in its immediate vicinity.

**CAUTION:**

The only professional figure authorised by the Manufacturer to work on the machine is the coordinate measuring machine Operator. This qualification is granted after attending the measuring software course held by the Manufacturer's Technician. In no case may the Instructions for Use and Maintenance substitute the training course.

---

## Symbols used in this manual

---

### Warnings concerning safety and danger of damaging the machine

---

This manual includes warnings under the headings **CAUTION**, **WARNING** and **NOTES**. These warnings are used as follows:

**CAUTION:**

This is a warning against something which, if ignored, may cause personal injury. Information is given of what to do or not to do to eliminate or reduce the risks run by the user or by other persons.

**WARNING:**

This is a warning to alert against something which could cause damage to the system or its accessories. Information is given of what to do or not to do to eliminate or reduce the risk of damaging the system and its accessories.

**NOTES:**

This notice gives helpful information.

## 2. Machine marking

This chapter contains a summary of the indications foreseen for machine marking, identification data and the references to the Standards adopted for manufacturing it. Instructions are also given for contacting Coord3's Service.

### Identification data

SWAN SERIES measuring machine  
manufactured by Coord3 S.p.A.  
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Tel. (+39) 0119635511  
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E-Mail: info@coord3.com  
Web: www.coord3.com

The machine meets EEC directives on machinery safety: directive 98/37/CE, directive 73/23/EEC and directive 89/336/EEC.



#### CE Marking

The machine is fitted with the data plate shown in [Figure 1](#). This plate shows the CE marking and contains the information about the machine required by current regulations.

For models of the L version (with side guide) the machine data plate is located on the rear of the upright as shown in [Figure 2](#). Also for models of the SI version (with independent guide) the data plate is located on the rear of the upright as shown in [Figure 3](#).

#### Residual dangers

Following risk analysis carried out by the Manufacturer, it has been decided to use special notices to highlight the residual dangers connected with use of the machine that cannot be eliminated during design. In particular the following notices alert the user of residual

dangers connected with machine handling. The graphic symbols used for this purpose are shown in [Figure 4](#) and in [Figure 5](#).

Figure 1 – Machine data plate

<b>COORD3</b>		Coord3 S.p.A. S.S. del Moncenisio km 42,200 BRUZOLO (TO) - ITALIA		<b>CE</b>	
TYPE	<input type="text"/>				
SERIAL	<input type="text"/>				
YEAR	<input type="text"/>	MASS	<input type="text"/>	kg	
VOLTAGE	<input type="text"/>	V	FREQUENCY	<input type="text"/>	Hz
MAX.CURRENT	<input type="text"/>	A	POWER	<input type="text"/>	W
CMM PRESSURE	<input type="text"/>	MPa	AIR FLOW	<input type="text"/>	NI/min
NI/min = normal liters per minute					

Figure 2 – Location of machine data plate on L models

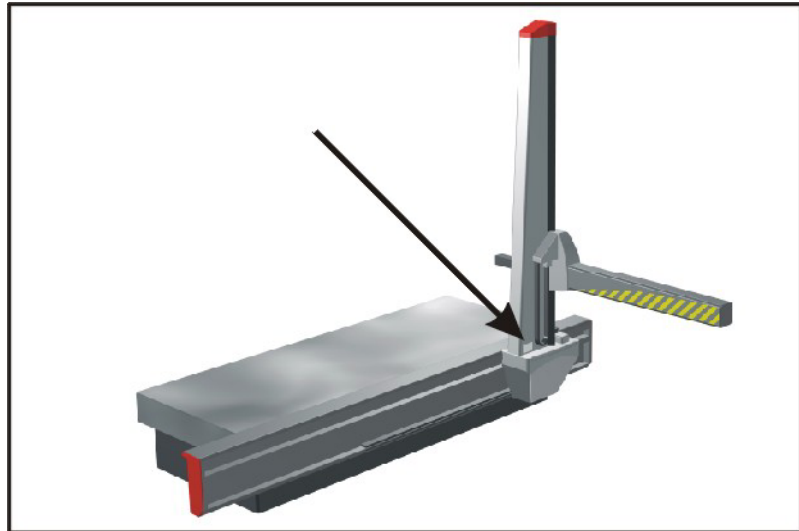


Figure 3 – Location of machine data plate on SI models

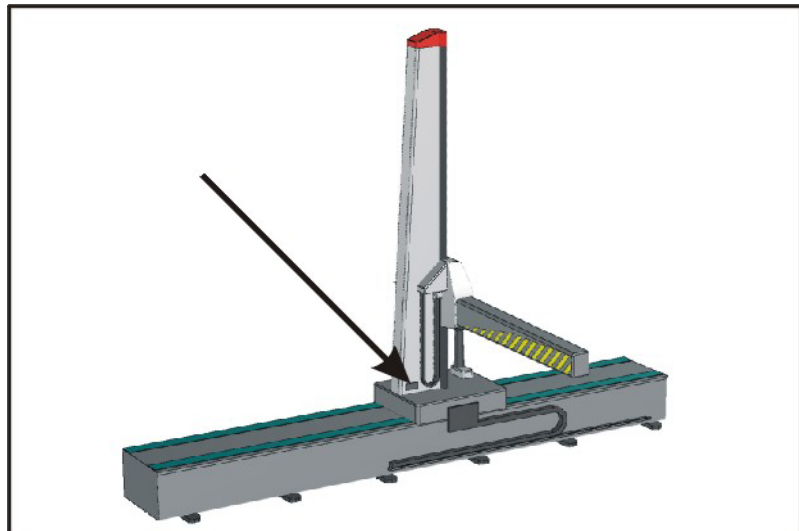
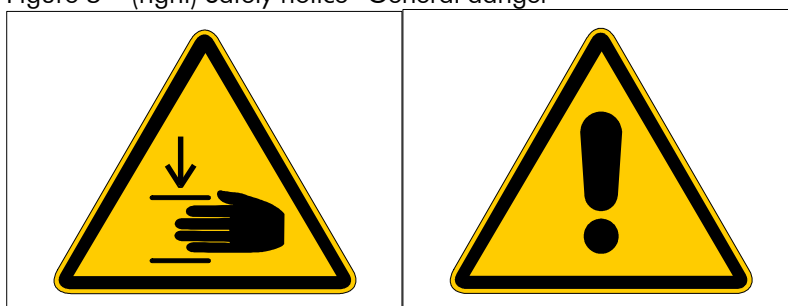


Figure 4 – Safety notice “Danger of trapping fingers”

Figure 5 – (right) Safety notice “General danger”



### Reference Standards

The machines of the SWAN series have been designed and built in accordance with directive 98/37/CE (Machines), directive 73/23/EEC (Low Voltage) and directive 89/336/EEC (Electromagnetic compatibility). The HERA machines therefore have the CE marking in the machine data plate.

### NOTES:

You are advised to check that the documents accompanying the machine include the “EC statement of conformity for machines”.

## Coord3's service

During use of the machine, should abnormal situations arise that are not due to normal operating conditions, and for solving which, the ordinary maintenance operations or the information given in the chapter [Instructions for maintenance and repair](#) are not sufficient, please contact one of the following service centres.

For all countries:

#### Coord3 S.p.A.

Strade Statale del Moncenisio, km 42,200

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Tel. (+39) 0119635511 Fax. (+39) 0119635566

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Tel. (+55) 11 66042277 Fax. (+55) 11 660042303

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For China and Hong-Kong:

#### Coord3 Beijing Representative Office

Tel. (+86) 10 65102926 Fax. (+86) 10 65102925

E-Mail: [coordcn@public3.bta.net.cn](mailto:coordcn@public3.bta.net.cn)

For Japan:

#### Coord3 KK

Tel. (+81) 42 7664748 Fax. (+81) 42 7024741

E-Mail: [qw4m-oost@asahi-net.or.jp](mailto:qw4m-oost@asahi-net.or.jp)

## 3. Foreseen conditions of use

This chapter describes the foreseen conditions of use and also lists the forbidden operations that may be dangerous for persons and cause damage to the machine.

### Allowed operations

---

The machines of the SWAN series have been designed as highly accurate coordinate measuring machines. Because of this, the only operations recommended by the Manufacturer concern the measurement of parts and scanning surfaces, in addition on manual versions or manual/motorized machines operating in the manual mode, it is possible to carry out tracing operations. In any case, the parts to be measured must be fastened to the machine surface plate using suitable clamping equipment.

#### Measuring operations

---

It is possible to make dimensional and geometrical measurements on physical parts whose mass and volume do not exceed the limits set by the Manufacturer (see [Technical details](#) chapter). Part measuring may take place by touch, optical or laser probes, provided that the measuring accessories are among the models foreseen by the Manufacturer (see [Characteristics of the tools to be fitted](#) chapter). The purpose of the machine is to adequately match the measuring accessory with the part, manage the resulting signals, generate, store and display the acquired data.

#### Scanning operations

---

On the motorized versions it is possible to scan the surfaces of objects whose mass and volume do not exceed the limits set by the Manufacturer (see [Technical details](#) chapter). Digitizing (or *scanning*) parts may be carried out using touch, optical or laser systems, provided that the measuring accessories are among the models foreseen by the Manufacturer (see [Characteristics of the tools to be fitted](#) chapter). The purpose of the machine is to adequately match the scanning accessory with the part, manage the resulting signals, generate, store and display the acquired data.

#### Tracing operations

---

On manual or manual/motorized versions it is possible to perform tracing operations on the surfaces of objects whose mass and volume do not exceed the limits set by the Manufacturer (see [Technical details](#) chapter). Parts may be traced using the tracing accessories included among the models foreseen by the Manufacturer (see [Characteristics of](#)



[the tools to be fitted](#) chapter). The purpose of the machine is to suitably match the tracing accessory with the part in the point required.

## Forbidden operations

---

Although completion is impossible, below we are listing the operations and conditions of use that are forbidden by the Manufacturer due to design or safety reasons.

- Using the machine for welding and painting.
- Using the machine for heavy mechanical machining in general such as blanking, punching, drilling, cutting and milling (even if light).
- Using the machine for tracing operations (for motorized versions only).
- Using the machine for lifting and/or handling loads, even if light.
- Assembly and use of measuring, scanning or tracing accessories not authorized by the Manufacturer.
- Assembly and use of laser devices not certified or not authorized by the Manufacturer.
- Removing any safety device.

### **CAUTION:**

Any machine use not explicitly mentioned in this manual is to be considered as forbidden by the Manufacturer.

## 4. Work stations occupied by operators

For the coordinate measuring machines of the SWAN series the Manufacturer foresees the use of only one operator for the single-arm versions. While for dual arm versions, the Manufacturer envisages the use of two operators. The diagram below shows the work stations in the different possible operating modes.

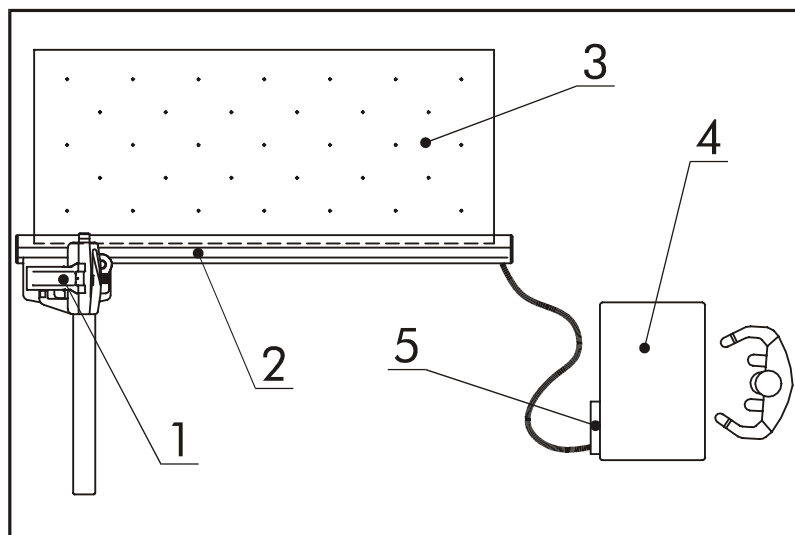
### System layout

The machines of the SWAN series are available in two separate versions: SWAN L and SWAN SI. In addition, each version may have a single arm (single machine) or dual arm (two opposed machines).

#### SWAN L with single arm

The machine is composed of the machine body which runs along the axis X guide fastened on the side of the machine surface plate, the actual machine surface plate and the control rack (motorized versions) which contains the interface devices between the machine and the operator. [Figure 6](#) shows the ideal system layout.

Figure 6 – Composition of the SWAN L system

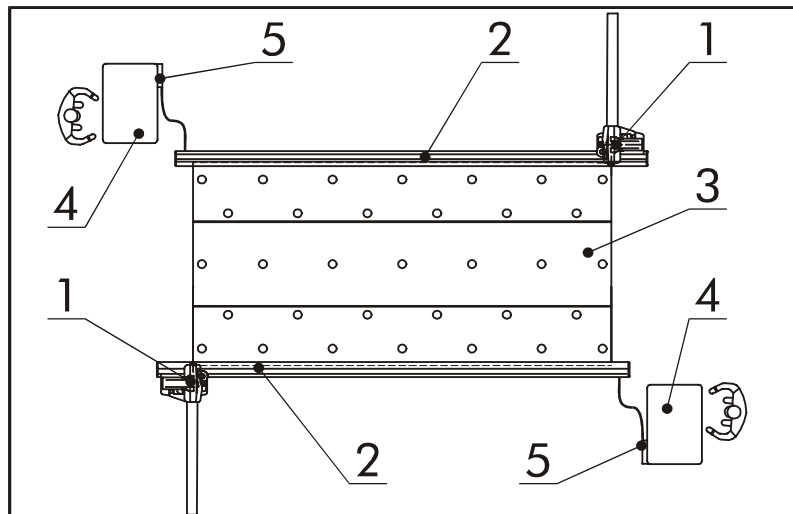


Ref.	Description
1	Machine body
2	Axis X guide
3	Machine surface plate
4	Integrated table
5	Control rack with pneumatic and electrical connections

**SWAN L with dual arm**

The system is formed of two SWAN L machines with single arm working on the same surface plate but from opposite sides. **Figure 7** shows the ideal system layout.

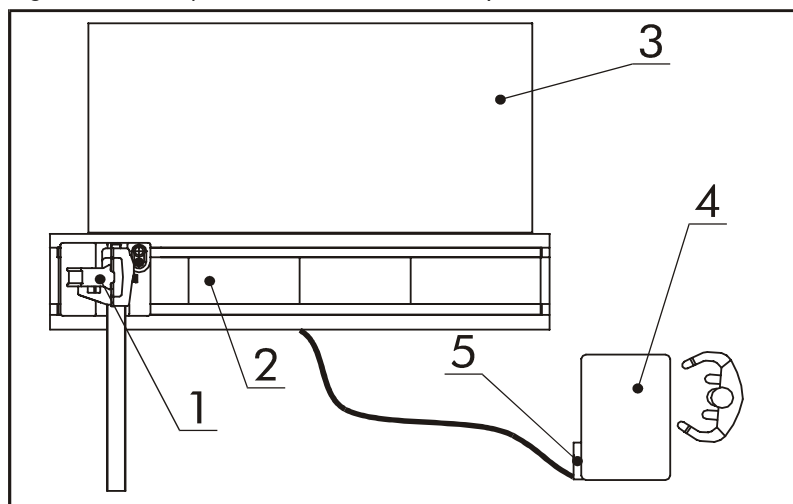
Figure 7 – Composition of the SWAN L system with dual arm



Ref.	Description
1	Machine body
2	Axis X guide
3	Machine surface plate
4	Integrated table
5	Control rack with pneumatic and electrical connections

**SWAN SI with single arm**

Figure 8 – Composition of the SWAN SI system



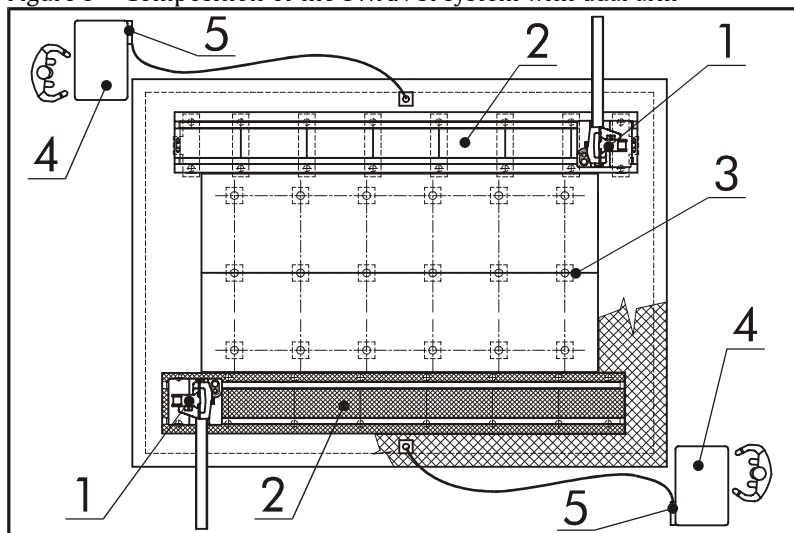
Ref.	Description
1	Machine body
2	Axis X guide
3	Machine surface plate
4	Integrated table
5	Control rack with pneumatic and electrical connections

The machine is composed of the machine body which runs above the X axis guide independent of the machine surface plate, the actual machine surface plate and the control rack (motorized versions) which contains the interface devices between the operator and the machine. **Figure 8** shows the ideal system layout.

### SWAN SI with dual arm

The system is formed of two SWAN SI machines with single arm operating on the same surface plate but from opposite sides. **Figure 9** shows the ideal system layout.

Figure 9 – Composition of the SWAN SI system with dual arm



Ref.	Description
1	Machine body
2	Axis X guide
3	Machine surface plate
4	Integrated table
5	Control rack with pneumatic and electrical connections

## Types of motion

Each machine version may be fitted with manual, or motorized, or manual/motorized axes motion.

### Manual machine

The manual machine can move the axes manually only, meaning that the operator guides the motion of the axes using the control knobs on the machine body (see **Figure 10** and **Figure 11**). In this condition the operator is near the machine body and acts with his hands on the control knobs on the head and on the base of the upright. It is possible to clamp or release the axes using the three axes clamping levers (or buttons).

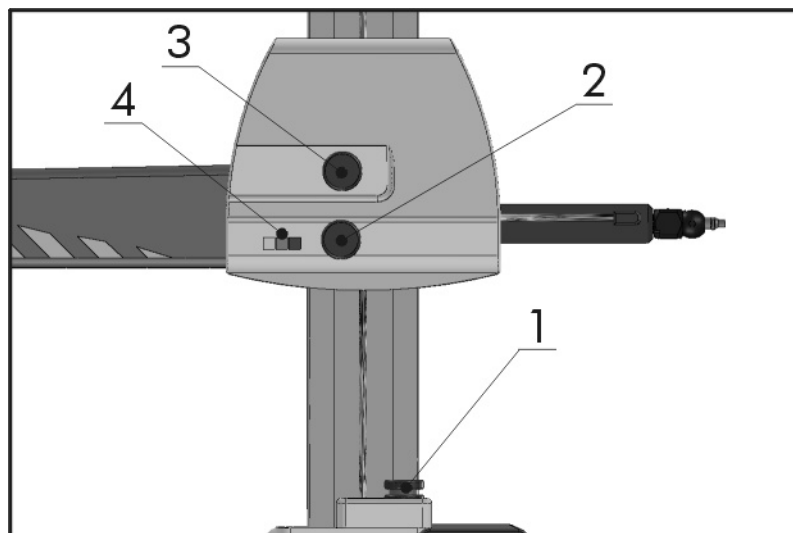
**NOTE:**

Manual versions may not be used for scanning operations.

**NOTE:**

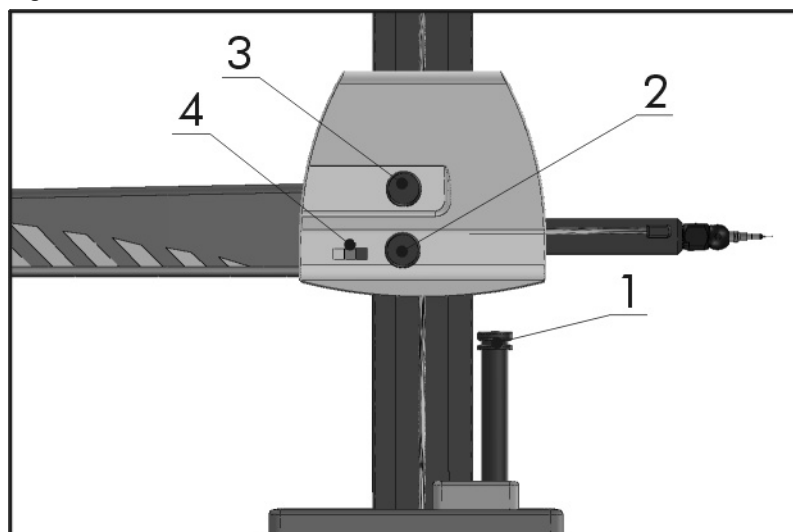
On manual versions the axes clamping levers must not be actuated during measuring operations. The axes clamping levers only serve to lock the corresponding machine axes. If during measuring one or more axes are locked, the measure will not be true.

Figure 10 – Manual/motorized SWAN L axes motion



Ref.	Description
1	X axis motion knob
2	Y axis motion knob
3	Z axis motion knob
4	Axes clamping/release buttons

Figure 11 – Manual/motorized SWAN SI axes motion



Ref.	Description
1	X axis motion knob
2	Y axis motion knob
3	Z axis motion knob
4	Axes clamping/release buttons

**Motorized machine**

The motorized machine can move the axes either manually or automatically. In the manual mode the operator controls the axes motion using the portable joystick. In this condition the operator is in a position that cannot be defined beforehand, but in any case comfortable for following the movements of the measuring or scanning accessory.

In the automatic mode the operator is near the control rack from where he supervises the performance of the machine working cycles. In any case, the operator is not within the machine working volume.

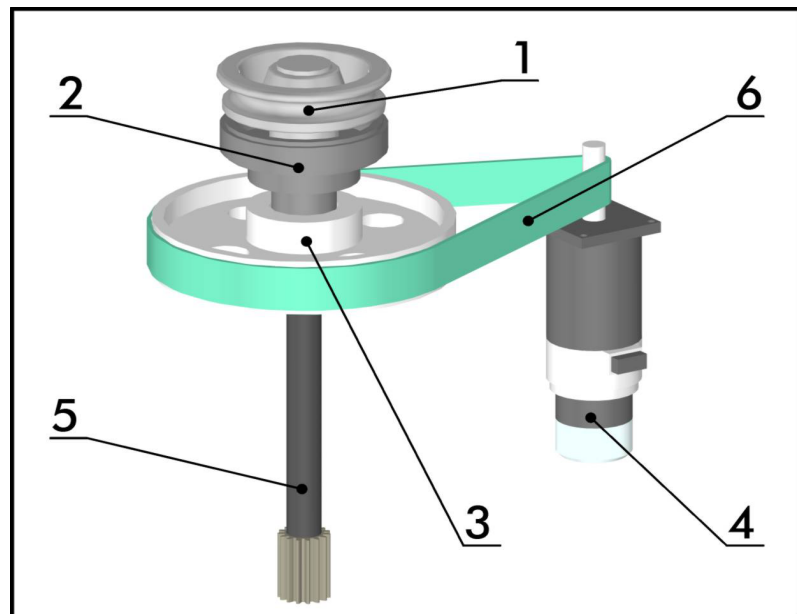
**NOTE:**

The motorized versions cannot carry out tracing operations.

**Manual/motorized machine**

The manual/motorized machine can work both as manual machine and as motorized machine. Each control knob comprises a dual knob. **Figure 12** shows a control knob with the motorizing release ring. Slackening the ring, disconnects the pulley from the shaft cutting off motorizing. Tightening the ring, the pulley is restrained to the drive shaft and the motor unit is able to move the axis.

Figure 12 – Motor drive cut-off knob



Ref	Description
1	Manual axis motion knob
2	Ring
3	Pulley
4	Motor
5	Pin
6	Belt

## 5. Instructions for transport

This chapter describes how to handle the supply safely and without causing damage to the machine. It also contains the data required for arranging for the suitable hoisting equipment.

### Appearance of supply

---

The machine is supplied in a closed wooden crate. Due to reasons of size and safety, some parts of the supply are disassembled. The machine body is disassembled from the X axis guide and restrained to it. The spindle is also removed from the head. The table and guards are disassembled, while the monitor, printer and other accessories are in their original packing. All the parts in view are protected by a transparent film. The whole supply is then contained inside a sealed, protective bag in which a moderate degree of vacuum is created. This, together with the large number of moisture-absorbing salt bags inside the protective bag, preserve the entire supply from the weather during transport. Then the wooden crate is built around the bag. The crate may also be reinforced with cross beams if necessary for shipment. The use of a bridge crane is necessary for lifting the machine body and the X axis guide.

When foreseen, the machine surface plate is always contained in a separate crate. For transport and handling the machine surface plate, reference should always be made to the instructions provided by the manufacturer of the surface plate itself.

#### Dimensions

---

The sizes of the shipping crate are given in the [Technical details](#) chapter in the [Dimensions](#) paragraph.

#### Weights

---

The masses of the shipping crate and its contents are given in the [Technical details](#) chapter in the [Masses](#) paragraph.

### Handling

---

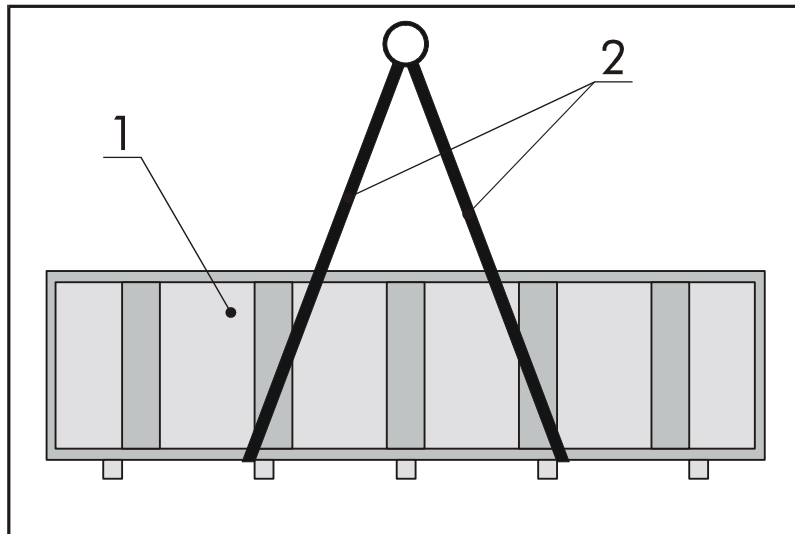
The crate containing the supply must be handled using a bridge crane of suitable capacity. Check the mass of the supply corresponding to the machine model purchased in the [Technical details](#) chapter in the [Masses](#) paragraph.

**Hoisting devices**

Hoisting operations are to be carried out by skilled personnel and throughout the handling stages the safety regulations in force must be strictly adhered to in order to prevent accidents or damage to property. You are recommended to carry out handling operations very carefully and without jerking to avoid stressing the machine structures. Should it be necessary to use a bridge crane for handling the machine, the crate should be braced with two ropes of adequate length and strength, as shown in [Figure 13](#).

**Lifting points**

Figure 13 – Handling the crate using a bridge crane



Ref.	Description
1	Shipping crate
2	Lifting ropes, chains or straps

**CAUTION:**

Coord3 advises the presence of a Manufacturer’s Technician throughout all the supply handling operations, who can offer helpful information to the handling personnel to prevent accidents or damage to property.



## 6. Instructions for installation

This chapter describes the characteristics of the place of installation recommended by the Manufacturer. Correct positioning of the parts needed to ensure ergonomic working conditions for the operator are also shown.

### Environmental characteristics of the place of installation

---

The place chosen for installation of the machine must possess very precise characteristics in order to ensure the metrological performance declared by the Manufacturer. The temperature values must be kept under control and the vibration levels must be restricted because they affect the metrological performance of the machine. A too damp, too dry and dusty environment may adversely affect the life of the system. Lighting and noise affect the operator's working conditions.

The [Technical details](#) chapter contains the permissible values for temperature, vibrations, humidity in the different conditions of use. Below are some subjects to be taken into consideration when choosing the place of installation of the system.

#### Temperature

---

As is known, a change in temperature of 1°C produces an elongation of 0.01 mm in a 1 m long steel part, regardless of the shape and section. If a thermostatic chamber is not available, it is necessary to avoid draughts and excessive changes in temperature between day and night. Pay particular attention to sources of heat that may warm the different parts of the measuring machine unevenly, possibly causing distortion. All machines should be protected from radiating sources by special screens, e.g. windows exposed to sunlight should have curtains or blinds.

Also not to be underestimated is leaving parts to be measured at room temperature for a certain length of time before starting tests. The waiting time depends on the size of the parts and should allow the part and machine to assimilate the same temperature.

#### Vibrations

---

In industrial areas the ground is generally subject to vibrations which may have different origins: machine tools, presses, handling and hoisting equipment, etc., in fact, excessive vibrations can generate errors that affect machine performance.

A ground in which vibrations do not exceed an amplitude of 1  $\mu\text{m}$  for any frequency does not affect machine performance.

Before installing the machine, it is therefore advisable to have the amplitude and frequency of the vibrations present checked by

specialised personnel using suitable instruments to make sure that they are within the limits specified in the [Technical details](#) chapter. If higher values are noted, the machine must be fitted on vibration dampers.

---

### Humidity

The relative humidity in the place of installation should be kept under control. An environment that is too dry aids the formation of dust; too much humidity enhances the rusting of metal parts.

The permissible relative humidity values in the different conditions of use are given in the [Technical details](#) chapter.

---

### Dust

The presence of dust in the place of installation may cause premature downgrading of machine performance levels. Dust causes damage to the air bearings and runner guides. The presence of grinding machines, grinding wheels or other similar machines in the vicinity of the measuring machine should absolutely be avoided.

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### Magnetic fields

Electronic devices need a certain amount of care: to avoid reading errors or disturbances on the monitor, they must be away from variable magnetic fields such as arc welding machines, transformers, knife switches or large electric resistances.

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### Lighting

No particular devices are required for lighting the working area, the normal lighting level required by safety regulations for workers in the workplace is sufficient.

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## Positioning the supply

Before installing the machine it is necessary to choose the position it will have in the chosen place (workshop, thermostatic room, etc.) to make sure that every part of it is accessible in the event of future intervention. It is also necessary to check that the existing foundations are capable of supporting the weight of the machine plus the maximum permissible load for the surface plate.

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### Foundation

The type of foundation on which to place a measuring machine considerably affects the precision and reliability of the results. The effects of the foundation on machine performance are connected with:

- Maximum machine size;
- Maximum load on surface plate;
- Type and consistency of ground below;
- Presence of vibrations from sources outside the machine.

SWAN SI machines installed in a pit call for a dedicated foundation. Coord3's Technical Dept. can let you have the guidelines for making them.

**WARNING:**

The performance ratings guaranteed by the Manufacturer are to be considered valid for a machine with the foundations made following the standard proposed by same Dept. or a higher quality standard.

The detailed design and also the making of the foundations are to be seen to by the Customer or contracted to others after suitably evaluating their equipment and capabilities. Contact Coord3's Service Dept. to obtain the appropriate dimensions of the foundations according to the machine model and size.

**CAUTION:**

Coord3 declines any liability concerning damage, injuries, faults, inaccuracies or any other unforeseen event or behavior attributable to the failure to follow the technical instructions concerning the design and development of the foundations.

---

**Minimum space for installation**

The minimum machine clearance in relation to the perimeter walls of the place of installation must be at least 1000 mm. Shorter distances may compromise accessibility to the various parts of the machine during maintenance or inspection operations. Where necessary, you are advised to cordon off the working area.

## 7. Instructions for assembly and disassembly

This chapter shows how to make the electric and pneumatic connections and briefly describes the operations for opening the packing, removing protections and assembly of parts and guards carried out by the Manufacturer's Technician.

### CAUTION:

**Due to their delicacy and the need for special tools, all machine assembly operations may be carried out only by the Manufacturer's Technician. Coord3 declines any direct or indirect responsibility deriving from the failure to heed this caution.**

### NOTES:

The detailed procedures concerning machine assembly and disassembly operations are available in the form of job instructions.

### Opening the packing

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#### CAUTION:

**Crate opening operations must be carried out in the presence of the Manufacturer's Technician.**

After positioning the supply crate near the place of installation, the Manufacturer's Technician opens it removing the lid, side walls and any reinforcement beams; he then removes the protective bag cutting it; he then checks that the contents are intact.

The crate contains the whole supply which includes, in addition to the machine body, the numerical control rack (motorized versions), integrated table, monitor, PC keyboard and mouse with any printer, WinKey remote control keypad and measuring accessories.

#### Handling the parts

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#### CAUTION:

**Due to their delicacy, all handling operations of the single parts of the machine may only be carried out by the Manufacturer's Technician. Coord3 declines any direct or indirect liability deriving from the failure to heed this caution.**

All the components of the supply are removed from the crate by the Manufacturer's technician using a bridge crane or appropriate hoisting equipment.

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## Machine assembly

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### **CAUTION:**

Due to their delicacy and the need for special tools, all machine assembly operations may only be carried out by the Manufacturer's Technician. Coord3 declines any direct or indirect liability deriving from the failure to heed this caution.

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### **Assembling the parts**

Depending on the SWAN version supplied, the machine assembly operations differ concerning the installation of the X axis guide, while the machine body assembly operations are the same for all versions and models.

#### **Machine surface plate**

At this point of operations, the machine surface plate has usually already been installed. In particular, if it is the surface plate of a SWAN SI installed at floor level, also the necessary foundations works have been carried out.

#### **X Axis guide**

In the case of a SWAN L, the X axis guide is removed from the crate with the help of a bridge crane or other appropriate hoisting equipment, and restrained to the longest side of the machine surface plate prepared to accommodate it. In the case of a SWAN SI version, the guide is laid in the housing foreseen in the foundation layout independent of the machine surface plate and then leveled.

#### **Machine body**

At this point the Manufacturer's Technician reassembles the upright on the X axis guide carriage. He then reassembles the spindle that runs in the head body. Lastly, he reassembles the guards.

#### **Control rack**

The Manufacturer's Technician places the control rack next to the machine and assembles the integrated table. He then places the personal computer, monitor, keyboard, mouse, WinKey remote control and any printer on the table, making the necessary electrical connections.

#### **Assembling measuring accessories**

Lastly, the Manufacturer's Technician fits the measuring accessory on the spindle and makes the necessary electrical connections.

After completing these operations he runs a first functional test of the machine to make sure that it is working properly. If the test result is positive, the Manufacturer's Technician performs the metrological test and, if necessary, corrects any faults noted.

## Connections

This paragraph describes the procedures to be followed for making the electrical and pneumatic connections needed to operate the machine.

### Pneumatic connection

**NOTE:**

The creation of a pneumatic supply point for the machine is to be seen to by the Customer.

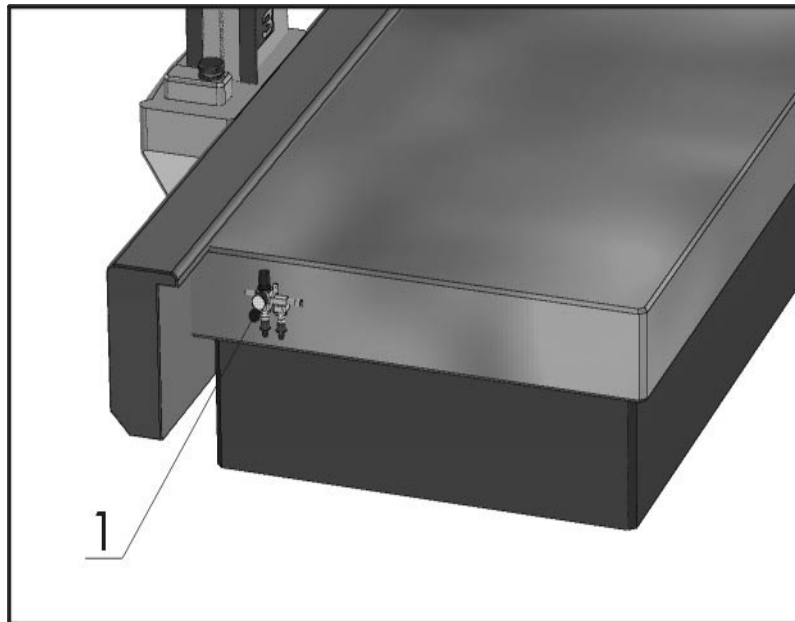
The pneumatic installation of the machine consists in connecting the filter unit supply with the main pneumatic supply. The technical specifications of the pneumatic supply point are given in the **Technical details** chapter in the **Pneumatic specifications** paragraph.

**Procedure for making the pneumatic connection (manual versions)**

Connect the light blue polyurethane supply pipe protruding from the cable holder sheath to the outlet connector of the filter unit. In manual versions the filter unit is located on one side of the machine surface plate (see **Figure 14**).

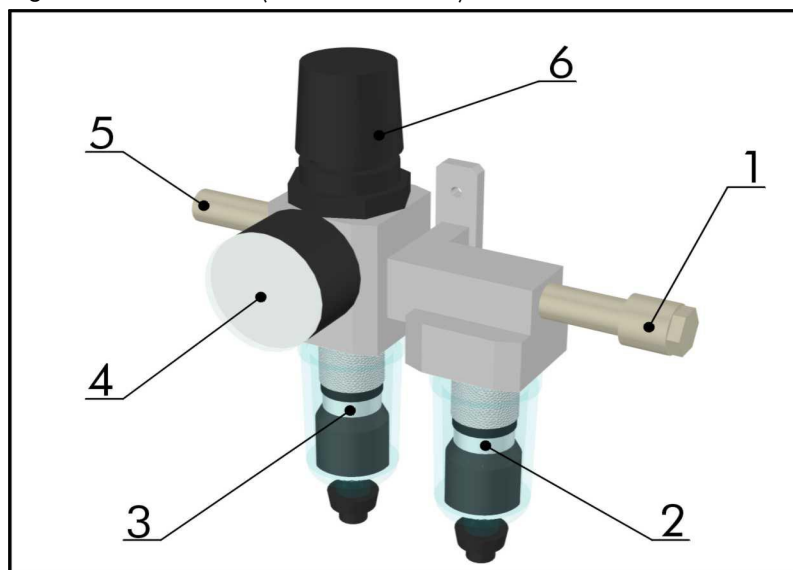
Connect the main pneumatic supply pipe to the inlet connection of the filter unit. For this type of connection it is necessary to adapt the supply pipe to the type of adapter on the filter unit. Alternatively, it is possible to replace it with another type of adapter with 1/4 GAS thread.

Figure 14 – Location of filter unit (manual versions)



Ref	Description
1	Supply, filtering and adjustment unit

Figure 15 - Filter unit (manual versions)



Ref	Description
1	To air bearing supply
2	Filter with 0.3 μm degree of filtering
3	Filter with 5 μm degree of filtering
4	Pressure regulator pressure gauge
5	Pneumatic supply inlet (1/4")
6	Pressure regulator

#### Procedure for making the pneumatic connection (motorized versions)

See “Instruction for Use and Maintenance” of the Numeric Control Unit supplied with the machine.

#### Electrical connections (manual versions)

##### NOTE:

The creation of an electrical supply point for the machine is to be seen to by the Customer.

##### CAUTION:

Operations for connecting to the mains may only be performed by skilled personnel following all the safety rules in force.

##### CAUTION:

Always connect and check the earth connections.

##### Rules for correct connection to the mains

The motorized machine is provided with panel supply plug PE 1663 SP (16 A/6h 2P + GND EEC regulations). The main machine circuit breaker has the following specifications:  $I_n = 10 \text{ A}$  Curve C;  $V_n = 400 \text{ V}$ ; 2 protected poles; Cut-off power = 6 kA. The Customer shall make the suitable connection to the mains.

The specifications the mains node with which the machine is connected must meet are the following:

- Mains voltage:  $230 \text{ V} \pm 23 \text{ V}$  at 50 Hz
- Maximum absorption 10 A, cable cross section  $2.5 \text{ mm}^2$

You are advised to choose a socket to EEC Standards, as follows:

Floating plug 1663 SV (16 A/6h 2P + GND EEC regulations. Use a wall switch devoted to the machine.

You are also advised to:

- **Avoid connecting near or in common with highly absorbing devices (e.g.: motors, compressors, etc.) that cause heavy voltage drops on starting.**
- **Avoid multiple connection points (e.g.: between several machine tools, or with several computers).**
- **Not use triple sockets, shoddy sockets or in any case failing to meet EEC Standards.**
- **Always connect the earth points and make sure they are efficient.**

#### **CAUTION:**

Coord3 declines any liability for accidents or damage to property deriving from the failure to adhere to the instructions described in this paragraph.

#### **WARNING:**

Coord3 also declines any liability for damage to the machinery supplied deriving from the failure to adhere to the instructions described until now; of course, same would also compromise the validity of the warranty.

#### **Connections of peripheral devices to the personal computer**

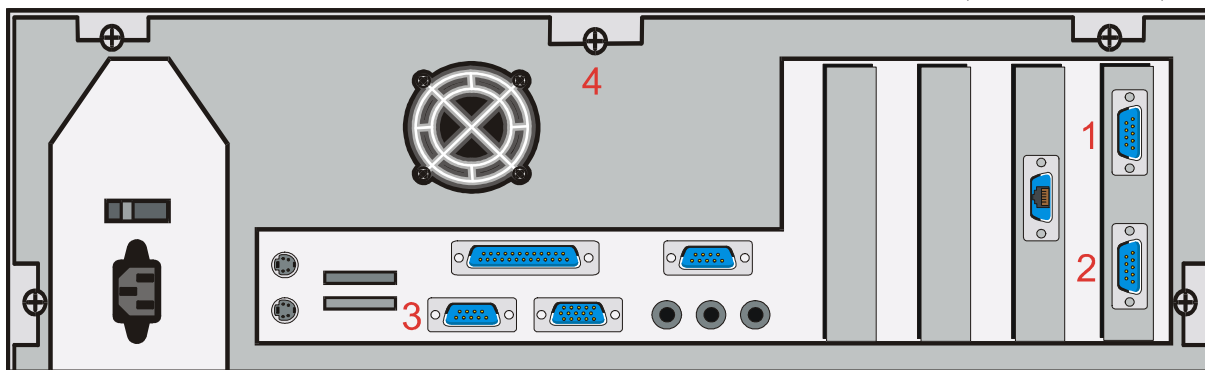
- Set up the monitor, printer and remaining accessories of the personal computer carefully following the instructions of the respective Manufacturers, contained in their original packing.
- The personal computer, monitor, keyboard, mouse and any printer should be placed on the rack table.
- Connect the peripheral devices to the PC following the instructions of the respective Manufacturers. In practice, it is a matter of connecting the connectors of the keyboard, mouse, monitor and printer to the connector panel on the rear of the PC following the symbols given on the single connectors (see [Figure 16](#)).
- Connect the power connectors of the PC, monitor and printer to the multiple socket under the integrated table top.

#### **Machine cable connections to the PC**

In manual versions, after fastening the cable holder sheath terminal to the support below the integrated table top, connect the signal cable labelled SERIAL POWER to the connector on the back of the PC (1) (see [Figure 16](#)). Connect the serial cable on one end to socket (2) and on the other to socket (3) (see [Figure 16](#)). Then connect the earth cable to the earth connector on the back of the PC (4) (see [Figure 16](#)).



Figure 16 – Connectors on the back of the PC (manual versions)



Ref.	Type of connector	Label	Signals treated	Cable connected
1	Sub D 9 pole male	SERIAL POWER	Optical transducers and probe	SERIAL POWER cable
2	Sub D 9 pole male	- - -	Optical transducers and probe	Serial cable
3	Sub D 9 pole male	COM1	Serial IN/OUT	Serial cable
4	Ground screw	GROUND	Ground	GND yellow-green cable

**Electrical connections (motorized versions)**

See “Instruction for Use and Maintenance” of the Numeric Control Unit supplied with the machine.

## 8. Instructions for set-up

This chapter shows the control, indicator and emergency devices with which the system is fitted, the machine set-up procedures and the instructions for checking that all the devices are working properly.

### Control devices (only motorized versions)

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See “Instruction for Use and Maintenance” of the Numeric Control Unit supplied with the machine.

### Switching on and checking that the machine is working correctly

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#### Manual versions

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##### System starting procedure

To start the system you are advised to follow the procedure given below:

- Check that the machine is connected to the pneumatic supply.
- Check that the personal computer is connected to the electrical supply.
- Check that the PC monitor switch is at ON.
- Turn on the personal computer.

The turning on of the machine causes the following to occur:

- Turning on of the personal computer with the sounding of one or more beeps.
- Turning on of the personal computer monitor.
- Lighting up of the red LED on the probe (if fitted).

#### Motorized versions

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See “Instruction for Use and Maintenance” of the Numeric Control Unit supplied with the machine.

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## Software starting procedure

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### Manual versions

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**CAUTION:**

If the supplied measuring software is other than WinMeil Plus, please see "User Manual" of that software to learn the measuring software starting procedure.

**Measuring software starting procedure (WinMeil Plus)****With Windows NT (or Windows 2000) operating system:**

- Access the system.
- Double click the WinMeil Plus icon to start the measuring software.
- A prompt appears asking to position the machine axes on the machine axes zero position clamping them using the axes clamping levers and selecting the YES button.
- The software is ready to work

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### Motorized versions

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See "Instruction for Use and Maintenance" of the Numeric Control Unit supplied with the machine.

## 9. Instructions for use

This chapter describes the procedures to be followed for using the machine in safety.

### Performing the operating cycle

#### CAUTION:

The only professional figure authorised by the Manufacturer to work on the machine is the coordinate measuring machine Operator. This qualification is granted after attending the measuring software course held by the Manufacturer's Technician. In no case may the Instructions for Use and Maintenance substitute the training course.

#### Recommended checks before using the system

The checks to be carried out before starting a working cycle are those given in the [Instructions for set-up](#) chapter. In addition, since these are instructions for use, it is also wise to carry out the following checks.

- Before loading the pieces to be measured on the surface plate, position the axes in such a way that they are not knocked during loading operations.
- If the pieces to be loaded are particularly heavy or sharp-cornered take care not to damage the surface of the plate.
- Always fasten the pieces to the surface plate before starting measuring or scanning operations.
- Check the accessibility of the measuring accessory in the areas of the piece concerned.
- Check that the pieces to be measured or scanned have the same temperature as the machine to avoid producing false results.

#### Starting the working cycle

The working cycle is started as described in the [Instructions for set-up](#) chapter. It is also helpful to remember the following.

- (Only for motorized versions) During the first stages of measurement or scanning move the machine axes at moderate speed to prevent any errors made during programming.
- If the machine is in a place accessible to others, do not leave the machine unattended, to avoid accidents or damage to things.
- (Only for motorized versions) During operation check that the environment parameters (temperature, vibrations, etc.) are kept as constant as possible throughout the working cycle.

**NOTE:**

On manual versions the axes clamping levers must not be operated during measuring operations. The axes clamping levers serve only to lock the corresponding machine axes. If during measurement one or more axes are locked, the measure will not be true.

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**Ending the working cycle**

Below the procedure for stopping the system is described.

**Manual versions**

- Using the axes control knobs position the bridge at about half the X axis stroke. Position the head at about half the Y axis stroke. Position the spindle in the lowered position.
- Lock the axes clamping levers to clamp the axes.
- Do not exit the measuring or scanning software without firstly saving, if required, on disk the data that have not yet been saved.
- Stop the operating system.
- Turn off the PC
- Switch off the machine using the key switch.

**Motorized versions**

See “Instruction for Use and Maintenance” of the Numeric Control Unit supplied with the machine.

# 10. Instructions for adjustment

This chapter describes the procedures required for carrying out adjustment operations entrusted to the user in safety.

## Operations to be carried out by the Operator

### Pneumatic supply pressure adjustment (manual versions)

The technical specifications of the pneumatic supply point are given in the [Technical details](#) chapter in the [Pneumatic specifications](#) paragraph. The pneumatic supply unit with the filters and pressure regulator is located on the side of the machine surface plate, as shown in [Figure 14](#) for the manual versions. Every day it is necessary to check that the unit filters are clean and the inlet pressure of the unit. If the filtering elements contain condensation they must be emptied immediately pressing the cover on the lower end of the filter upwards. If they reveal traces of oil the filtering element should be replaced immediately.

To adjust the supply pressure work on the pressure regulator until the pressure gauge gives the correct pressure reading (see [Figure 15](#) for manual versions). The correct pressure rating to be read on the pressure gauge is given in [Table 16](#) on page [49](#).

### Pneumatic supply pressure adjustment (motorized versions)

See “Instruction for Use and Maintenance” of the Numeric Control Unit supplied with the machine.

### Adjusting measuring accessories

The accessory holder device or accessory holder cube can be fitted on the end of the spindle.

#### Probe assembly on the accessory holder device

- Prepare a suitable working surface on which to carry out the assembly operations of the measuring accessories.
- Remove the measuring accessories from their packing and assemble them following the instructions of the Manufacturer provided in the measuring accessory boxes.
- Assemble the measuring probe or the scanning probe, as shown in [Figure 17](#) using a 3 mm hexagon wrench to tighten the pin in the accessory holder device body.

- Make the electrical connection between the plug that protrudes from the probe and the socket on the accessory holder device.

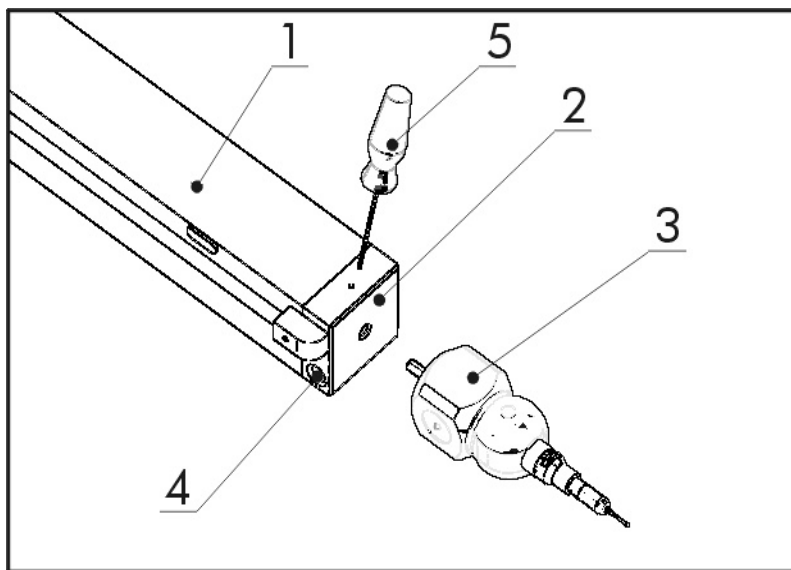
**WARNING:**

Tighten appropriately to prevent the probe unit from falling and damage to it. At routine intervals check that the probe is firmly in place in its housing.

**WARNING:**

Handle the measuring accessories with the utmost care. Measuring and scanning probes are extremely accurate devices, but very delicate; they may be damaged easily even after light shocks.

Figure 17 – Assembly on accessory holder device



Ref.	Description
1	Spindle body
2	Accessory holder device
3	Measuring or scanning accessory
4	Connectors for the electrical connection of measuring accessories
5	3.0 mm hexagon wrench

**Probe assembly on accessory holder cube**

- Prepare a suitable working surface on which to carry out the assembly operations of the measuring accessories.
- Remove the measuring accessories from their packing and assemble them following the instructions of the Manufacturer provided in the measuring accessory boxes.
- Fit the cylindrical adapter in one of the three holes of the accessory holder cube using a 3 mm hexagon wrench to tighten the pin in the accessory holder cube body.
- Assemble the measuring probe or the scanning probe, as shown in [Figure 18](#) using a 2.5 mm hexagon wrench to tighten the pin in the cylindrical adapter body.
- Make the electrical connection between the plug that protrudes from the probe and the socket on the accessory holder device.

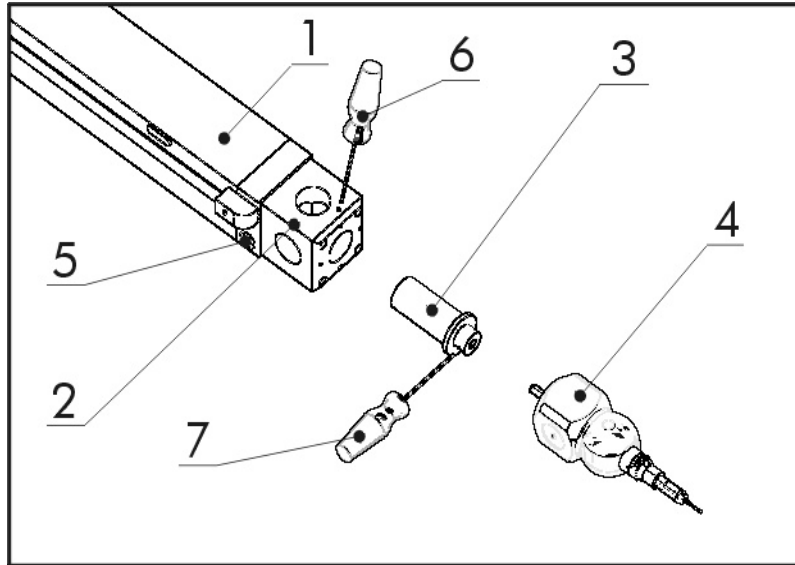
**WARNING:**

Tighten appropriately to prevent the probe unit from falling and damage to it. At routine intervals check that the probe is firmly in place in its housing.

**WARNING:**

Handle the measuring accessories with the utmost care. Measuring and scanning probes are extremely accurate devices, but very delicate; they may be damaged easily even after light shocks.

Figure 18 – Assembly of accessories on accessory holder cube



Ref.	Description
1	Spindle body
2	Accessory holder cube
3	Cylindrical adapter
4	Measuring or scanning accessory
5	Connectors for the electrical connection of measuring accessories
6	3.0 mm hexagon wrench
7	2.5 mm hexagon wrench



# 11. Instructions for maintenance and repair

This chapter describes the cleaning and maintenance operations required to keep the machine in efficient conditions. The criteria are provided for establishing the metrological efficiency of the system and lastly a guide is given to solving the more likely problems.

## Routine cleaning and maintenance

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As already mentioned several times in the previous chapters, the machine is a high precision measuring instrument, as such, the main maintenance operations involve keeping the machine and its parts the cleanest possible.

### Daily checks

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#### Supply filter unit

Check on the pressure gauge of the filter unit that the inlet pressure is adjusted to the rating specified in the [Technical details](#) chapter.

#### Runner tracks

Check that all the air bearing runner tracks are free of dust or foreign matter and reveal no traces of oil or grease. If necessary, clean the tracks using a soft cloth lightly moistened with ethyl alcohol. Do not use compressed air to clean the tracks to avoid foreign matter getting into the delicate parts of the machine.

#### Computer monitor

Every day check that the monitor screen is clean. If necessary clean following the instructions provided by the Manufacturer.

### Weekly checks

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#### Supply filter unit

Check that the filtering elements of the filter unit are in good working condition and that there is no condensation or oil sludge inside. If the filtering elements are depleted, replace them immediately using genuine spares.

#### CAUTION:

Always shut off the compressed air supply before replacement.

**Optical rules**

Check that the optical rules are free of dust or foreign matter and reveal no traces of oil or grease. If necessary, and only if necessary, clean the rules using a soft cloth lightly moistened with ethyl alcohol.

Only carry out this operation if truly necessary and do it as delicately as possible. Refer to the position reading optical transducer installation manual for further information about cleaning the rules.

**Surface plate**

Check that the surface plate has no oil or grease stains. If necessary degrease using regulation solvents.

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**Monthly checks****Electric wiring**

Sight check the electric cables and their connectors. In particular check that the cables have no signs of wear due to scraping on fixed parts, that the floating cables have not been damaged and that the connectors are firmly fastened in their sockets.

**CAUTION:**

These operations must absolutely be carried out with the machine off and disconnected from the electrical supply.

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**Six-monthly checks****Painted parts**

As time passes, stains and dust may appear on the painted parts. In this case, they can be cleaned using detergents based on soap and water. Do not use solvents that might spoil the paint.

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**Extraordinary maintenance**

Below we are listing some types of maintenance operations which require the services of a Coord3 technician.

**Checking and adjusting axes geometry**

If a measuring check reveals axis squareness problems (the length of a gauge block is different if measured in the same conditions in different positions of the machine), it is necessary to ask for the intervention of Coord3's Service Dept. to check the geometry of the axes.

**Surface plate**

If the machine surface plate has undergone violent shock due for example to incorrect or approximate loading or unloading of the parts to be measured, contact Coord3's Service Dept. to check for the need for adjustment.

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## Periodical tests and checks

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Below is a description of the test procedures that make it possible to establish that the machine complies with the accuracy levels declared by the Manufacturer. The acceptance test carried out by the Manufacturer's Technician, periodical checks and random checks are taken into consideration. The latter two may be carried out either by the Manufacturer's Technician or by the Customer according to preference.

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### Acceptance test

Measuring machine testing is a stage of fundamental importance so that it can be inserted in the Customer's Quality System. After the test the Manufacturer's Technician issues the test certificate, which is a form called "CMM performance check".

With regard to the test procedures, Coord3 follows the latest regulations on the subject: UNI EN ISO Std. 10360-2 "Coordinate metrology – Evaluation of the performance levels of coordinate measuring machines".

### Checking the machine

The procedure substantially consists in performing 105 length measurements: 5 samples of different length are measured 3 times each in 7 different positions ( $5 \cdot 3 \cdot 7 = 105$ ). For each of the 105 measurements the measuring error is given for the length measurement  $\Delta L$  of the CMM, i.e. the absolute value of the difference between the length proposed by the CMM and the known value of the length sample used in the test.

Performance of the CMM is verified if none of the 105 length measuring errors (expressed in micrometers) obtained is higher than the E value stated by the Manufacturer.

Of the 105 different length measurements carried out in the test in no more than 5 cases and in no more than 1 of the 3 repetitions shall the error exceed E. Each test in which this situation has arisen shall be repeated 10 times in the position and direction adopted initially.

If all the errors calculated for these repeated measurements are within E, the performance levels of the CMM are verified. The data obtained are noted on the "CMM Performance Check" form which, in addition to the characteristic details of the machine, probe system and any measuring error thermal compensation device, also contains the data of the set measuring samples used for the test.

### Probe check

Then the probe system is verified that has the purpose of verifying whether the CMM is capable of measuring, within the R value established by the Manufacturer. This takes place by determining the dispersion of the radial distance r reference sphere.

For this check the probe configuration and stylus are chosen within the limits specified by the Manufacturer, provided that the probe is not directed on parallel with any machine axis. A calibrated sphere is used with a diameter of between 10 and 50 mm and a certified shape error of no more than  $R/5$ . The sphere specifications are given on the test certificate. After choosing the configuration of the probe and stylus, and once the probe has been qualified following the procedures suggested by the Manufacturer (see WinMeil Plus Instructions for Use), the

coordinates of 25 points measured on the sphere, in random sequence are measured and recorded. Using all 25 measurements the centre of the substitute element is calculated using the least square method. The radial distance  $r$  is calculated for each of the 25 measurements. Performance of the probe system is verified if the dispersion ( $r_{max}-r_{min}$ ) of the 25 radial distances obtained is no higher than the  $R$  value stated by the Manufacturer.

### Periodical checking procedure

This is carried out following the same procedure as described previously. It allows the Customer to check, at a later stage, the performance levels of the CMM and of the CMM probe system. The maximum error revealed in this test is shown with  $V$ . The interval between these types of checks, carried out according to preference either by the Manufacturer’s Technician or by the Customer, shall be defined depending on the environmental characteristics of the place in which the machine is installed, the working load and the type of pieces measured.

The periodical check is also advisable in cases in which the occasional checks (described later) reveal faults or if accidental or unforeseen events have occurred on the machine (shocks, exposure to sources of heat, vibrations, ...).

In order to insert the CMM in the company Quality System, the customer shall draw up the suitable procedures concerning the checks to be inserted in the Firm’s Quality Manual. In any case Coord3 recommends the periodical check at least once a year.

### Occasional check

This allows the Customer to check the CMM and the CMM probe system during the interval between the regular periodical checks. A limited number of tests is carried out but in any position within the measuring volume of the CMM.

It is advisable to carry out these checks preferably before starting daily work on the machine.

## Problem solving

This chapter helps the user to diagnose and solve certain simple inconveniences that may occur during use of the machine.

### General problems

<b>Problem:</b>	<b>The machine fails to turn on</b>
<b>Cause:</b>	Electricity failure. Power connector disconnected. Magnetothermal switched disarmed.
<b>Solution:</b>	Check the presence of electricity. Check the power connector. Re-arm the magnetothermal switch.
<b>Problem:</b>	<b>Some or all the air bearings are hissing and seem to vibrate.</b>
<b>Cause:</b>	Compressed air supply pressure too high.
<b>Solution:</b>	Adjust the pressure gauge of the filter unit to the correct rating (see <a href="#">Technical details</a> chapter)

**Motion problems**

<b>Problem:</b>	<b>It is not possible to move the axes with the joystick</b>
<b>Cause:</b>	The WinKey connector is not connected properly.
<b>Solution:</b>	Check the WinKey connector.
<b>Problem:</b>	<b>Suddenly, it is no longer possible to move the axes with the joystick</b>
<b>Cause:</b>	The <b>MICRO CNC</b> key on the WinKey has been enabled by accident.
<b>Solution:</b>	Disable the <b>MICRO CNC</b> key on the WinKey.
<b>Problem:</b>	<b>The machine axes suddenly run away</b>
<b>Cause:</b>	Loose electric connectors. Motor or drive failure. Position reading system problems.
<b>Solution:</b>	Check the connectors of the motors, tachometric generators and optical transducers. Contact the Service dept.

**Measuring problems**

<b>Problem:</b>	<b>During movement, the probe acquires unwanted points.</b>
<b>Cause:</b>	The probe system is ill-adjusted.
<b>Solution:</b>	Adjust the probe closing force referring to the instructions for use of the probe.
<b>Problem:</b>	<b>Much higher than expected measuring errors are obtained.</b>
<b>Cause:</b>	The stylus has loosened in its housing. The probe system is ill-adjusted. The piece moved during measuring.
<b>Solution:</b>	Check that the stylus is firmly tightened in place. Check that the probe opening force is not too high for the stylus used. Check that the piece is well clamped.
<b>Problem:</b>	<b>All the measurements made differ by a value amounting to the radius or diameter of the stylus used compared with the expected value.</b>
<b>Cause:</b>	The stylus is not qualified
<b>Solution:</b>	Qualify the stylus

## 12. Instructions for training

This chapter offers an overview about the control software with which the machine may be fitted and informs about the procedures to be followed for access to the associated training courses which are indispensable for qualification to use the machine.

### Coord3's training programme

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#### **CAUTION:**

The only professional figure authorised by the Manufacturer to work on the machine is the coordinate measuring machine Operator. This qualification is granted after attending the measuring software course held by the Manufacturer's Technician. In no case may the Instructions for Use and Maintenance substitute the training course.

The machine can be fitted with WinMeil Plus measuring software or ArcoCad Plus measuring software or with Digitrek scanning software. In all cases the user is obliged to follow the training course for qualification to use the machine.

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#### **WinMeil Plus course**

The following is a list of the characteristics a would-be coordinate measuring machine operator ought to possess.

##### **Informatic knowledge**

The professional figure appointed to work on the WinMeil Plus measuring software is required to have some basic elementary computer knowledge. This is absolutely necessary to act in safety, and with a certain mastery on the computer system he is in charge of.

Please remember that the WinMeil Plus measuring software is a professional computer application devoted to the dimensional control of objects and processing the measuring results. By nature WinMeil Plus is bound to converse with a coordinate measuring machine. If this is motorised, WinMeil Plus also governs its axis motion operation. In this case the utmost attention must be paid during motion programming to avoid accidents or damage to things.

##### **Personal computer knowledge**

Below is a list of the computer knowledge that the Manufacturer considers helpful for profitable use of the WinMeil Plus software.

- Notions about the general use of the personal computer.
- Knowledge of the nature of peripheral units such as mouse, screen, keyboard, printer, etc... and how they work.
- Knowledge of the general precautions and warnings concerning use of the personal computer.

- Knowledge of the legal standards concerning work in front of a video terminal.
- Knowledge of the operating system
- Knowledge of the type of interface being used.
- Mastery in the use of the informatic tools offered by the operating system and capability to customise the system.
- Knowledge and mastery of the use of the file system.
- Capability to work with files and directories on the disk units.
- Knowledge of the text editors in the operating system.
- Capability of carrying out routine maintenance operations using the tools offered by the operating system.

### **Mechanical knowledge**

If it is true that knowledge of the computer devices is an important requirement for working with measuring software, it is equally true that solid mechanical training constitutes a fundamental basis for interpreting the results of measurement and for effective integration of dimensional control within the quality production process.

Below is the list of the requisites that are presumed to be included in the skills of the professional figure of the coordinate measuring machine operator.

- Knowledge of trigonometry and elementary geometry.
- Knowledge and interpreting capability of technical drawings.
- Capability to locate elementary geometric elements on a technical drawing.
- Knowledge of the dimensional and geometric tolerance system

### **Advanced knowledge**

The WinMeil Plus software offers two levels of use: The *base level* that allows quick and simple use of all the dimensional and geometric control operations, and the *advanced level* that makes it possible to apply automated control procedures and “intelligent” data analysis systems to the inspection process. To help the best use to be made of the services offered by WinMeil Plus in this direction, Coord3 believes it helpful for the operator to possess minimum notions about programming, which can considerably benefit the development of special applications connected with the field of dimensional control. If the WinMeil Plus measuring software is inserted in a production process that includes statistical analysis of the measuring results, then the persons involved in the result analysis process should also be able to interpret the statistical data generated.

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### **Digitrek course**

What has been said for the WinMeil measuring software also goes for the Digitrek scanning software. With the addition that, as this is surface acquisition software, the user would gain advantage by knowledge of the elementary concepts that govern the geometry of surfaces.

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### **Other courses**

Coord3 also offers training courses in the use of accessory software possibly installed in the system, such as reverse-engineering, graphic analysis or statistical analysis.

## 13. Characteristics of the tools to be fitted

This chapter lists the measuring and scanning accessories recommended by the Manufacturer with their main characteristics.

### Measuring accessories

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On each machine model it is possible to install both electromechanical and optical measuring accessories. The former utilise a probe called *touch-trigger* which sends a point acquisition signal to the control software the moment the probe touches the area of the part to be measured; the latter exploit the refraction properties of a laser beam to obtain the measurements required.

In both cases the accessory is installed at the end of the spindle, which is fitted with a suitable fastening system and connectors for the necessary electrical connections.

As the motorised machine has very high metrological performance levels, in choosing the measuring accessories it is advisable to give preference to models with motorised rotation with the best metrological features in order to better exploit the top-flight metrological features that characterise the system.

#### Mechanical probes

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The measuring accessory may be an integrated device or composed of a toolstock head and the actual probe; in addition, the measuring devices may be directed by hand or motorised. For some models the possibility also exists of coupling them with an automatic tool changeover system. Coord3 advises the use of measuring accessories supplied by the English firm Renishaw. Attached to the machine documents is a list drawn from the Renishaw catalogue which contains the main models recommended by the Manufacturer. Updated news about measuring accessories can be obtained consulting Renishaw's web site (<http://www.renishaw.com/>). In any case the Manufacturer advises you to contact Coord3's Service Dept. before replacing the present measuring accessory.

#### Laser probes

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Also for laser acquisition devices Coord3 advises the use of measuring accessories supplied by the English firm Renishaw. Attached to the machine documents is a list drawn from the Renishaw catalogue which contains the main models recommended by the Manufacturer. In any case the Manufacturer advises you to contact Coord3's Service Dept. before replacing the present measuring accessory.

On the Customer's request Coord3 can also provide customised solutions for specific requirements.



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## Scanning accessories

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On each machine model it is possible to install both electromechanical and optical scanning accessories. The former utilise a proportional probe, which, running in contact with the surface of the object, sends the point acquisition signals to the control software; the latter exploit the refraction properties of a laser beam to detect the surface.

In both cases the accessory is installed at the end of the spindle, which is fitted with a suitable fastening system and connectors for the necessary electrical connections.

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### Proportional probes

The scanning may be an integrated device or composed of a tool holder head and the actual probe; in addition, the measuring devices may be directed by hand or motorised. Scanning probes can also treat the signal deriving from the measurements in the digital or analogue mode. Coord3 advises the use of measuring accessories supplied by the English firm Renishaw. Attached to the machine documents is a list drawn from the Renishaw catalogue which contains the main models recommended by the Manufacturer. Updated news about measuring accessories can be obtained consulting Renishaw's web site (<http://www.renishaw.com/>). In any case the Manufacturer advises you to contact Coord3's Service Dept. before replacing the present measuring accessory.

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### Laser probes

Laser scanning devices may be of different kinds and are rapidly evolving to meet the most varied market requirements. Coord3 advises you to contact Coord3's Service Dept. before replacing the present scanning accessory to find out the best offer available from Coord3.

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## Tracing Accessories

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On machines with manual motion it is possible to perform tracing operations. Tracing operations consist in scoring the surface of objects, obtained using pointed tools (tracer points). The accessory is always fitted to the end of the spindle fitted with accessory holder cube.

Consult Coord3's Service Dept. for an updated list of the tracing accessories recommended by the Manufacturer.

# 14. Technical details

This chapter contains the technical specifications of the machine and the environmental and operating conditions required to guarantee the accuracy levels declared by the Manufacturer.

## Dimensions

This paragraph contains the dimension data of the machine and of the whole supply needed by the user.

### Range of measure

This is the actual maximum travels that the coordinate axes of the machine can accomplish when working. The volume identified by these strokes is known as the machine working volume. The X stroke is available with 500 mm increments. X strokes above 6000 mm are available on request.

Table 1 –SWAN L Range of measure

Model	X mm	Y mm	Z mm
SWAN L XX-10-12	2000 ÷ 6000	1000	1200
SWAN L XX-10-15	2000 ÷ 6000	1000	1500
SWAN L XX-10-18	2000 ÷ 6000	1000	1800
SWAN L XX-10-20	2000 ÷ 6000	1000	2000
SWAN L XX-12-15	2000 ÷ 6000	1200	1500
SWAN L XX-12-18	2000 ÷ 6000	1200	1800
SWAN L XX-12-20	2000 ÷ 6000	1200	2000
SWAN L XX-15-15	2000 ÷ 6000	1500	1500
SWAN L XX-15-18	2000 ÷ 6000	1500	1800
SWAN L XX-15-20	2000 ÷ 6000	1500	2000

Table 2 –SWAN SI Range of measure

Model	X mm	Y mm	Z mm
SWAN SI XX-10-12	3000 ÷ 6000	1000	1200
SWAN SI XX-10-15	3000 ÷ 6000	1000	1500
SWAN SI XX-10-18	3000 ÷ 6000	1000	1800
SWAN SI XX-10-20	3000 ÷ 6000	1000	2000
SWAN SI XX-12-15	3000 ÷ 6000	1200	1500
SWAN SI XX-12-18	3000 ÷ 6000	1200	1800
SWAN SI XX-12-20	3000 ÷ 6000	1200	2000
SWAN SI XX-15-15	3000 ÷ 6000	1500	1500
SWAN SI XX-15-18	3000 ÷ 6000	1500	1800
SWAN SI XX-15-20	3000 ÷ 6000	1500	2000

### Machine only sizes

These are the sizes of the machine structure alone, excluding the control rack, table and any external accessories not included in the standard supply. The values of the upright (**Length**) are obtained adding the numerical value indicated to the value of the machine X stroke.

Table 3 – Machine only sizes for SWAN L

Model	Length mm	Width mm	Height mm
SWAN L XX-10-12	X + 780	2710	2655
SWAN L XX-10-15	X + 780	2710	2955
SWAN L XX-10-18	X + 780	2710	3255
SWAN L XX-10-20	X + 780	2710	3455
SWAN L XX-12-15	X + 780	3110	2955
SWAN L XX-12-18	X + 780	3110	3255
SWAN L XX-12-20	X + 780	3110	3455
SWAN L XX-15-15	X + 780	3710	2955
SWAN L XX-15-18	X + 780	3710	3255
SWAN L XX-15-20	X + 780	3710	3455

Table 4 – Machine only sizes for SWAN SI

Model	Length mm	Width mm	Height mm
SWAN SI XX-10-12	X + 1000	1860	2155
SWAN SI XX-10-15	X + 1000	1860	2455
SWAN SI XX-10-18	X + 1000	1860	2755
SWAN SI XX-10-20	X + 1000	1860	2955
SWAN SI XX-12-15	X + 1000	2060	2455
SWAN SI XX-12-18	X + 1000	2060	2755
SWAN SI XX-12-20	X + 1000	2060	2955
SWAN SI XX-15-15	X + 1000	2360	2455
SWAN SI XX-15-18	X + 1000	2360	2755
SWAN SI XX-15-20	X + 1000	2360	2955

### Sizes of supply with closed crate

These are the sizes of the crate used for transporting the machine. The supply includes the machine, control rack, table, measuring accessories and components included in the standard supply.

Table 5 – Sizes of supply with closed crate for SWAN L and SI

Model	Length mm	Width mm	Height mm
SWAN XX-10-12	X + 1310	1100	1450
SWAN XX-10-15	X + 1310	1100	1450
SWAN XX-10-18	X + 1310	1100	1450
SWAN XX-10-20	X + 1310	1100	1450
SWAN XX-12-15	X + 1310	1100	1450
SWAN XX-12-18	X + 1310	1100	1450
SWAN XX-12-20	X + 1310	1100	1450
SWAN XX-15-15	X + 1310	1100	1450
SWAN XX-15-18	X + 1310	1100	1450
SWAN XX-15-20	X + 1310	1100	1450

**Minimum space for installation**

This is the actual minimum space needed to install the whole system ensuring user friendly conditions of use and safe maintenance operations.

Table 6 – Minimum space for installation of SWAN L

Model	Length mm	Width mm	Height mm
SWAN L XX-10-12	X + 2780	4710	2755
SWAN L XX-10-15	X + 2780	4710	3055
SWAN L XX-10-18	X + 2780	4710	3355
SWAN L XX-10-20	X + 2780	4710	3555
SWAN L XX-12-15	X + 2780	5110	3055
SWAN L XX-12-18	X + 2780	5110	3355
SWAN L XX-12-20	X + 2780	5110	3555
SWAN L XX-15-15	X + 2780	5710	3055
SWAN L XX-15-18	X + 2780	5710	3355
SWAN L XX-15-20	X + 2780	5710	3555

Table 7 – Minimum space for installation of SWAN SI

Model	Length mm	Width mm	Height mm
SWAN SI XX-10-12	X + 3000	3860	2255
SWAN SI XX-10-15	X + 3000	3860	2555
SWAN SI XX-10-18	X + 3000	3860	2855
SWAN SI XX-10-20	X + 3000	3860	3055
SWAN SI XX-12-15	X + 3000	4060	2555
SWAN SI XX-12-18	X + 3000	4060	2855
SWAN SI XX-12-20	X + 3000	4060	3055
SWAN SI XX-15-15	X + 3000	4360	2555
SWAN SI XX-15-18	X + 3000	4360	2855
SWAN SI XX-15-20	X + 3000	4360	3055

**Masses**

This paragraph contains all the masses of the supply, including the maximum permissible ones for measuring accessories and pieces.

**Supply**

The following table contains the mass of the measuring machine (CMM), control rack (Rack), accessories provided (monitor, printer, etc.) and the total mass of the whole supply. To avoid including data tables that would take up a considerable number of pages, the CMM mass and the total are indicated according to the X stroke of the machine expressed in millimeters.

**EXAMPLE:**

SWAN L 40-15-18

Total mass of CMM = 500 + 4000 \* 0.262 = 1548 kg

Total mass of supply = 620 + 4000 \* 0.262 = 1668 kg

Table 8 – Supply masses for SWAN L

Model	CMM kg	Rack kg	Accessories kg	Total kg
SWAN L XX-10-12	$475 + X \cdot 0.262$	75	45	$595 + X \cdot 0.262$
SWAN L XX-10-15	$480 + X \cdot 0.262$	75	45	$600 + X \cdot 0.262$
SWAN L XX-10-18	$490 + X \cdot 0.262$	75	45	$610 + X \cdot 0.262$
SWAN L XX-10-20	$495 + X \cdot 0.262$	75	45	$615 + X \cdot 0.262$
SWAN L XX-12-15	$485 + X \cdot 0.262$	75	45	$605 + X \cdot 0.262$
SWAN L XX-12-18	$495 + X \cdot 0.262$	75	45	$615 + X \cdot 0.262$
SWAN L XX-12-20	$500 + X \cdot 0.262$	75	45	$620 + X \cdot 0.262$
SWAN L XX-15-15	$490 + X \cdot 0.262$	75	45	$610 + X \cdot 0.262$
SWAN L XX-15-18	$500 + X \cdot 0.262$	75	45	$620 + X \cdot 0.262$
SWAN L XX-15-20	$505 + X \cdot 0.262$	75	45	$625 + X \cdot 0.262$

Table 9 – Supply masses for SWAN SI

Model	CMM kg	Rack kg	Accessories kg	Total kg
SWAN SI XX-10-12	$695 + X \cdot 0.479$	75	45	$815 + X \cdot 0.479$
SWAN SI XX-10-15	$700 + X \cdot 0.479$	75	45	$820 + X \cdot 0.479$
SWAN SI XX-10-18	$710 + X \cdot 0.479$	75	45	$830 + X \cdot 0.479$
SWAN SI XX-10-20	$715 + X \cdot 0.479$	75	45	$835 + X \cdot 0.479$
SWAN SI XX-12-15	$705 + X \cdot 0.479$	75	45	$825 + X \cdot 0.479$
SWAN SI XX-12-18	$715 + X \cdot 0.479$	75	45	$835 + X \cdot 0.479$
SWAN SI XX-12-20	$720 + X \cdot 0.479$	75	45	$840 + X \cdot 0.479$
SWAN SI XX-15-15	$710 + X \cdot 0.479$	75	45	$830 + X \cdot 0.479$
SWAN SI XX-15-18	$720 + X \cdot 0.479$	75	45	$840 + X \cdot 0.479$
SWAN SI XX-15-20	$725 + X \cdot 0.479$	75	45	$845 + X \cdot 0.479$

### Closed crate

The table below contains the masses of the crate alone, its contents and the total mass.

Table 10 – Crate mass for SWAN L

Model	Crate kg	Contents kg	Total kg
SWAN L XX-10-12	$450 + X \cdot 0.1$	$595 + X \cdot 0.262$	$1045 + X \cdot 0.362$
SWAN L XX-10-15	$450 + X \cdot 0.1$	$600 + X \cdot 0.262$	$1050 + X \cdot 0.362$
SWAN L XX-10-18	$450 + X \cdot 0.1$	$610 + X \cdot 0.262$	$1060 + X \cdot 0.362$
SWAN L XX-10-20	$450 + X \cdot 0.1$	$615 + X \cdot 0.262$	$1065 + X \cdot 0.362$
SWAN L XX-12-15	$450 + X \cdot 0.1$	$605 + X \cdot 0.262$	$1055 + X \cdot 0.362$
SWAN L XX-12-18	$450 + X \cdot 0.1$	$615 + X \cdot 0.262$	$1065 + X \cdot 0.362$
SWAN L XX-12-20	$450 + X \cdot 0.1$	$620 + X \cdot 0.262$	$1070 + X \cdot 0.362$
SWAN L XX-15-15	$450 + X \cdot 0.1$	$610 + X \cdot 0.262$	$1060 + X \cdot 0.362$
SWAN L XX-15-18	$450 + X \cdot 0.1$	$620 + X \cdot 0.262$	$1070 + X \cdot 0.362$
SWAN L XX-15-20	$450 + X \cdot 0.1$	$625 + X \cdot 0.262$	$1075 + X \cdot 0.362$

Table 11 – Crate mass for SWAN SI

<b>Model</b>	<b>Crate</b> kg	<b>Contents</b> kg	<b>Total</b> kg
SWAN L XX-10-12	450 + X*0.1	815 + X*0.479	<b>1265 + X*0.579</b>
SWAN L XX-10-15	450 + X*0.1	820 + X*0.479	<b>1270 + X*0.579</b>
SWAN L XX-10-18	450 + X*0.1	830 + X*0.479	<b>1280 + X*0.579</b>
SWAN L XX-10-20	450 + X*0.1	835 + X*0.479	<b>1285 + X*0.579</b>
SWAN L XX-12-15	450 + X*0.1	825 + X*0.479	<b>1275 + X*0.579</b>
SWAN L XX-12-18	450 + X*0.1	835 + X*0.479	<b>1285 + X*0.579</b>
SWAN L XX-12-20	450 + X*0.1	840 + X*0.479	<b>1290 + X*0.579</b>
SWAN L XX-15-15	450 + X*0.1	830 + X*0.479	<b>1280 + X*0.579</b>
SWAN L XX-15-18	450 + X*0.1	840 + X*0.479	<b>1290 + X*0.579</b>
SWAN L XX-15-20	450 + X*0.1	845 + X*0.479	<b>1295 + X*0.579</b>

**Measuring accessories**

The following table shows the maximum permissible mass for measuring accessories. The figure given is valid for all machine models.

Table 12 – Permissible mass for measuring accessories

<b>Model</b>	<b>Mass</b> kg
All models	2.0

**Machine surface plate masses**

The machine surface plate is not usually part of the machine supply and in any case it is always supplied separately. However, in order to give an idea of the offers possible, Table 13 contains the data related with the most frequently requested machine surface plates. Of course, depending on the load requirements of our Customers, machine surface plates are available capable of withstanding loads of 5 tons per square meter up to over 150 tons per square meter.

Table 13 – Masses of some machine surface plates

<b>Plate thickness</b>	<b>Plate weight</b>	<b>Limit load</b>
250mm	750kg/m <sup>2</sup>	5000 kg/m <sup>2</sup>
300mm	840 kg/m <sup>2</sup>	15000 kg/m <sup>2</sup>
350mm	930 kg/m <sup>2</sup>	35000 kg/m <sup>2</sup>

**Performance rates**

This paragraph contains the machine performance rates in the environmental and operating conditions indicated by the Manufacturer.

**3D speed and maximum acceleration**

The following table contains the maximum speeds and accelerations in the volume (3D) allowed by the Manufacturer.

Table 14 – Maximum 3D speed and acceleration

<b>Model</b>	<b>3D Speed</b> m/s	<b>3D Acceleration</b> m/s <sup>2</sup>
All models	0.520	0.850

### Maximum errors ISO 10360-2

The following table contains the maximum machine errors stated by the Manufacturer in accordance with UNI EN ISO Std. 10360-2, in the foreseen environmental and operating conditions. The maximum error  $E$  for length measures is given by the formula  $E=A+KL$  in which  $L$  represents the length expressed in meters.  $R$  is the measure error of the probing system.

Table 15 – Accuracy according to UNI EN ISO 10360-2

Model	A $\mu\text{m}$	K $\mu\text{m}$	R $\mu\text{m}$	$E_{\text{max}}$ $\mu\text{m}$
SWAN XX-10-12	10.0	15.0	10.0	40.0
SWAN XX-10-15	10.0	15.0	10.0	40.0
SWAN XX-10-18	12.0	18.0	12.0	45.0
SWAN XX-10-20	15.0	20.0	15.0	55.0
SWAN XX-12-15	12.0	18.0	12.0	45.0
SWAN XX-12-18	15.0	20.0	15.0	50.0
SWAN XX-12-20	20.0	22.0	20.0	55.0
SWAN XX-15-15	15.0	20.0	15.0	50.0
SWAN XX-15-18	20.0	23.0	20.0	55.0
SWAN XX-15-20	22.0	25.0	22.0	60.0

### NOTICE:

The degrees of accuracy stated in [Table 15](#) are obtainable using a Renishaw TP2 or TP20 probe, without extension, and a Renishaw PS17R stylus. The use of other probes or other styluses will lower the measuring accuracy.

## Pneumatic specifications

This paragraph contains the machine pneumatic specifications which must be strictly adhered to in order to ensure correct system operation.

### Pneumatic supply

The compressed air of the supply line MUST NOT be lubricated, but it MUST be dehumidified. In particular, it is absolutely necessary to supply the air to the machine using a drying unit with a dew point of at least 3 °C and with deoiling filter with 0.01 ppm (parts per million) filtering elements).

The following table summarizes the main specification the pneumatic supply has to meet with regard to the line supply pressure (**Supply P**), the maximum tolerance allowed on the line pressure (**Supply P Tol.**) and the minimum inside diameter of the supply pipe (**Pipe I.D.**).

Table 16 – Pneumatic supply specifications

Model	Supply P MPa	Supply P Tol. MPa	Pipe I.D. mm
All models	0.55	± 0.05	8.0

### Operating figures

The following table contains the pressure rating with which the pressure regulator is to be adjusted on the machine supply filter unit to allow the air bearings to work at the correct operating pressure. It also

contains the air consumption rate expressed in normal liters per minute in the operating conditions indicated by the Manufacturer.

Table 17 – Operating figures

Model	Bearing pressure	Air consumption	Air consumption
	Mpa	NI/min	l/min at 0.55 Mpa
SWAN L	0.45	110	17
SWAN SI	0.45	90	14

## Electrical specifications

This paragraph contains the machine electrical specifications which must be strictly adhered to in order to ensure correct system operation.

### Electrical supply

The two tables below contain the specifications the electrical node to which the machine is connected must meet. In particular there is the supply voltage (**Supply V**) in Volt, the tolerance allowed in relation to the nominal rating (**Supply V Tol.**), the maximum current absorption (**Max. Absorp.**), the installed power (**Installed P**) and the maximum installed power (**Max P**) under normal operating conditions.

### WARNING:

The maximum absorbed power under normal operating conditions means the power absorbed by a system that supplies: - Numerical control and drives (motorized versions only). – Auxiliary electric circuits. – A personal computer, a monitor and an inkjet printer.

### WARNING:

Pay the utmost attention to the installed power and maximum absorbed power ratings. Do not connect to the machine equipment other than as foreseen by the Manufacturer. In any case, the sum of the power ratings absorbed by the equipment connected to the machine supply sockets must not exceed the Installed Power rating indicated.

Table 18 – Electrical supply specifications (1)

Model	Supply V V	Supply V Tol. V	Frequency Hz
All models	230	± 23	50

Table 19 – Electrical supply specifications (2)

Model	Max. Absorp. A	Installed P W	Max P W
Manual models	6	1380	600
Motorized models	10	2300	1400

### Motors (motorized versions only)

The machine uses motors showed in the following table.



Table 20 – Type of motors

Model	Axis X model	Axis Y model	Axis Z model
All models	SANYO L720T	SANYO L406T	

**Limit switch sensors (motorized versions only)**

The machine uses limit switch sensors showed in the following table.

Table 21 – Limit switch sensors

Model	Axes X, Y, Z model
All models	Micro magnetic Selet B8/1PFC-MKLV6

## Position reading system

This paragraph describes the devices used for reading the position of the axes.

**Transducers**

The machine uses an optical transducer for each axis. The type of transducer used is the same for all the axes.

Table 22 – Optical transducers

Model	Axis X model	Axis Y model	Axis Z model
All models	Renishaw RGH 22Z at 0.5 $\mu\text{m}$		

**Optical rules**

The machine uses an optical rule for each axis. The type of rule used is the same for all the axes.

Table 23 – Optical rules

Model	Axis X model	Axis Y model	Axis Z model
All models	Renishaw RGS S		

## Operating conditions

This paragraph describes the environmental conditions required to obtain the accuracy stated by the Manufacturer, simple machine operation and storage of the supply.

### Accurate measuring conditions

The values given below ensure obtaining the metrological performance rates declared by the Manufacturer.

**Temperature**

The following table contains the operating environment temperature (**T**), the tolerance allowed on the environment temperature (**T. Tol.**) and the permissible hourly thermal gradient ( **$\Delta\text{T}$** ).

Table 24 – Environment Temperature

Model	T °C	T Tol. °C	ΔT °C/h
All models	20	± 2	0.5

**Relative humidity**

The following table contains the relative humidity conditions required to ensure the metrological performance rates declared by the Manufacturer.

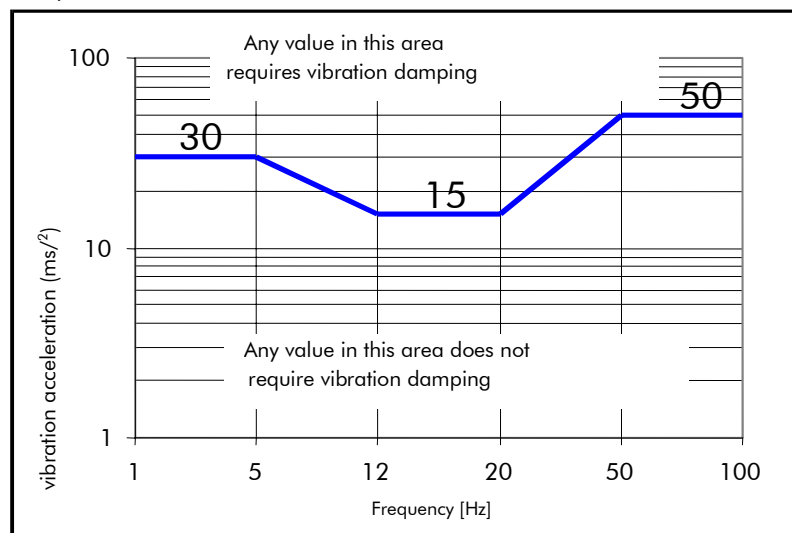
Table 25 – Environment relative humidity

Model	Humidity %	Humidity Tol. %
All models	50	± 5

**Vibrations**

The graph below shows the maximum permissible vibrations in the place of installation to ensure the metrological performance rates declared by the Manufacturer. The graph is valid for all machine models fitted with standard-mounted vibration dampers.

Graph 1 – Permissible vibrations



**Conditions for simple operation**

The values given below ensure simple operation of the machine but do not ensure obtaining the metrological performance rates declared by the Manufacturer.

**Temperature**

The following table contains the minimum (**Min T**) and maximum (**Max T**) environment temperature within which simple operation of the machine is guaranteed.

Table 26 – Environment Temperature

Model	Min T °C	Max T °C
All models	15	35

**Humidity**

The following table contains the minimum (**Min Humidity**) and maximum (**Max humidity**) environment humidity within which simple operation of the machine is guaranteed.

Table 27 – Environmental humidity

<b>Model</b>	<b>Min Humidity</b> %	<b>Max Humidity</b> %
All models	40	80

**Storage conditions**

The values given below ensure preservation of the supply in storage conditions.

**Temperature**

The following table contains the minimum (**Min T**) and maximum (**Max T**) environment temperature allowed for storing the supply.

Table 28 – Environment Temperature

<b>Model</b>	<b>Min T</b> °C	<b>Max T</b> °C
All models	5	45

**Humidity**

The following table contains the minimum (**Min Hu**) and maximum (**Max Hu**) environment humidity, with no condensation, allowed for storage.

Table 29 – Environment humidity

<b>Model</b>	<b>Min Hu</b> %	<b>Max Hu</b> %
All models	15	95

**Air noise produced**

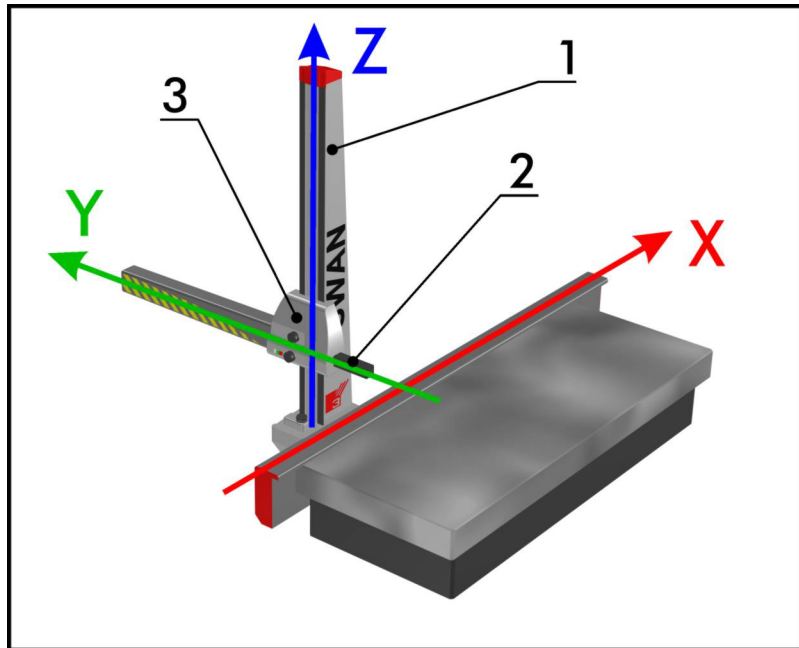
In all machine models the weighted equivalent continuous acoustic pressure A in the workplace does not exceed 70 dB (A), in any operating condition foreseen by the Manufacturer.

## Designation

### Cartesian axes

Figure 19 shows the layout and bearing of the machine Cartesian axes. The arrow shows the positive axis direction.

Figure 19 – Layout of the machine Cartesian axes



Ref	Description
1	Column (or upright)
2	Horizontal arm (or spindle)
3	Head

## 15. Recommended spares

This chapter contains the details necessary to obtain the updated lists of the machine spare parts.

### List of spare parts

---

In view of ongoing research and product improvement, Coord3 continuously updates the components fitted on our machines to adjust them to the state-of-the-art of research and technical skills. This is why Coord3 recommends you to contact Coord3's Service Dept. at one of the addresses given in the chapter entitled [Coord3's service](#) to receive the updated list of the spare parts recommended by the Manufacturer.

**NOTE:**

Before contacting Coord3's Service Dept. it is wise to note the machine serial number.

In addition, depending on the location of the installation of the supply, Coord3's Service Dept. will be able to let you know the most appropriate choice of spare parts in order to minimise machine down times following any failure.

After reading through this manual, you are advised to purchase in advance the parts notified by Coord3's Service Dept., to avoid having to wait for stocks, which is sometimes inevitable, with all our goodwill, in case of urgent requirements.

**WARNING:**

For part replacement, only genuine spares should be used, ordering directly through Coord3 or the authorised area Dealer.