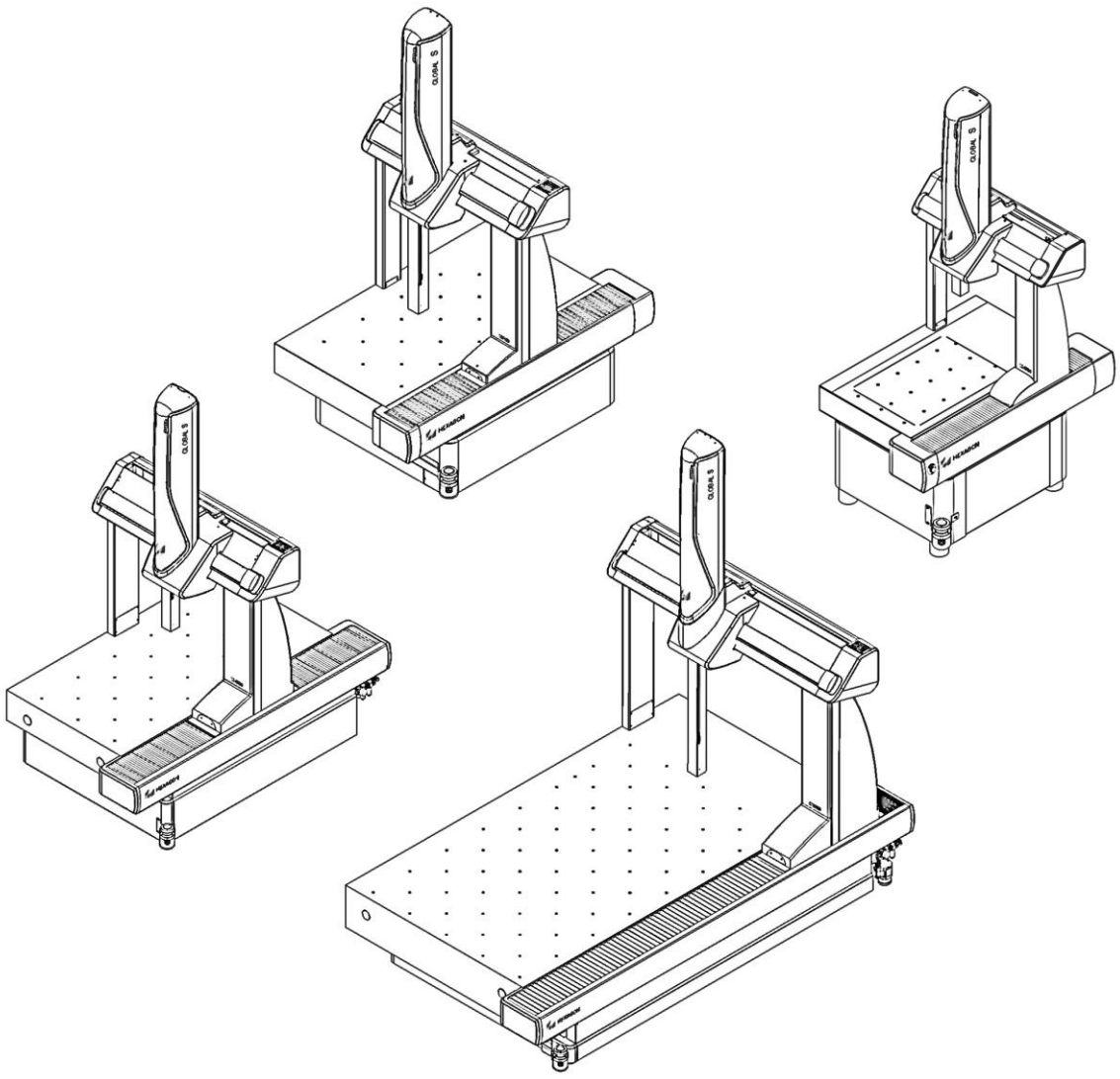
HEXAGON
MANUFACTURING INTELLIGENCE

GLOBAL S

05.YY.05, 07.YY.07, 09.YY.08, 12.YY.10 AND 15.YY.10

USER MANUAL

H00007842



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Intelligent Manufacturing at your finger tips

Contents

Preface

This manual was written for users of the Hexagon Manufacturing Intelligence (Hexagon in the rest of this manual) GLOBAL S measuring machines.
The document provides a general description of the measuring machine and its main technical and design features. The manual also contains instructions on how to use and maintain the measuring machine safely. In addition to the measuring machine with its accessories (for example, heads and tools), a measuring system consists of a control system and measuring software. For information about these components, consult the user manuals of the products used.

You may print as many copies of this copyrighted manual as desired for personal use.

Due to continuous product development, the images included in this manual may not resemble the customer's configuration.

Documentation Provided with the Measuring Machine

The information provided with the measuring machine offers a wide range of solutions for getting to know and using its functions. The measuring machine comes with a compact disc or thumb drive containing the following documentation.

Site Preparation Manual

Provides the Customer with all the necessary information for identifying the requirements to be met on the installation site of the measuring machine. This document specifies the environmental, electrical and pneumatic requirements for the installation of the machine, and contains instructions on how to receive, handle and store the shipping crates. It also indicates the tools and accessories that the Customer is to provide to the Hexagon staff responsible for installing the machine.

User Manual

Contains essential information on how to use the measuring machine safely and efficiently. The manual includes a detailed description of the measuring machine, the instructions for use, and the routine maintenance procedures recommended by Hexagon.

Use and Maintenance of the Measuring System – General Safety Regulations

This document was written for owners of a Hexagon measuring system; it contains the general safety regulations that users and preventive maintenance engineers must know and follow in order to use and maintain the measuring system safely.

Reading the PDF Files

The PDF (Portable Document Format) documents can be read using Adobe Acrobat Reader (Acrobat Reader can be started directly from the compact disc, thumb drive or by copying it onto a Personal Computer and then starting it). Acrobat Reader can even be downloaded to your Personal Computer from the Adobe web site at the Internet address http://www.adobe.com.

Conventions

The following conventions are used in this manual to distinguish between various kinds of information.

Danger

Indicates a hazardous situation that, if not avoided, will result in death or serious injury.

Warning

Indicates a hazardous situation that, if not avoided, could result in death or serious injury.

Caution

Indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.

Notice

Is used to address practices not related to physical injury.

Note: Tip to make your work easier or reference to further information.

Safety Information – the Customer's Responsibilities

All the operations described in this document that are the Customer's responsibility must be performed in respect of national, local and company safety regulations.
The customer must fit the measuring machine with an appropriate protective system capable of meeting the specific application and safety requirements and, in particular, those that emerge from the risk analysis for the specific installation: consult the **Site Preparation Manual**. In particular, the Customer must:

- Adequately instruct the staff responsible for operating the machine on the contents of this manual, so that they learn how to use the machine safely in consideration of the risks declared in the Site Preparation Manual and the User Manual.
- Take measures to prevent inadequately instructed staff from inadvertently gaining access to the machine while it is powered and potentially a source of risks declared in the Site Preparation Manual and the User Manual.
- Allow access to the machine to personnel to be trained only under the supervision of expert personnel.
- Guarantee use of the machine for the expected use only.
- Make sure that scheduled maintenance operations are respected and performed.

Overview

This chapter provides a brief description of the GLOBAL S measuring machine and its main components and its versions.

The GLOBAL S Measuring Machine

GLOBAL S is a family of measuring machines with Cartesian axes, a gantry architecture and a vertical Z-rail. The machine is available in several versions that differ from one another in precision and performance. The accuracy and performance features increase from the GREEN to BLUE to CHROME version.
Models characterized by different working volumes are available for each version.
The GLOBAL S measuring machine is characterized by the speed and precision best suited for the type of use for which it was designed: point-to-point measurement and continuous measurement of small and medium sized parts. The part to be measured is placed on the granite work table, where special threaded inserts enable the tools required to secure the part in position during measurement.
The GLOBAL *S* may be characterized by standard or high working speed.

The bridge structure ensures optimum rigidity so that, under normal environmental conditions, the GLOBAL *S* machine can be installed directly on the floor.
All the measuring axes are equipped with a motor; the movement of the axes is always supervised by the control system and can be controlled by the measuring software or the user using the Jogbox (NJB) portable terminal.
Various types of probe heads and probes may be assembled on the flange of the column. There is also a wide range of accessories and options.
According to its version and model, the GLOBAL S measuring machine interfaces with and is controlled by a DC241, DC800C, or by a DC800 I/O-Ready control system.
The machine family has particular features which provide high performance in terms of speed and accuracy combined with machine management functions aimed at saving energy consumption.

scan PILOT	SCAN PILOT technology optimizes complex profile scanning.
fly2 MODE	FLY2 MODE technology optimizes trajectories, making machine movements more streamline and reducing the time needed to run measurement programmes.
eco MODE	The machine switches off when it is not active and remains ready to resume operations when needed to reduce running costs and decrease mechanical stress on the machine without negatively influencing use times, speed or performance.
eco MODE+	Eco Mode + technology (optional) is used to interrupt the compressed air flow during periods of inactivity.
compass	Compass is an advanced and innovative system which uses physical hardware components and enhanced firmware algorithms to reduce and compensate for the machine's intrinsic vibrations and any impact on results. Available on the CHROME version only.

According to version and model, a workstation integrating the Personal Computer, a monitor and a work top for keyboard and mouse may be available (see Workstation on page 23).

GLOBAL *S* Measuring Machine models

Table 1 shows the models of the GLOBAL S measuring machine.

Version	Model
GREEN	05.yy.05
	07.yy.07
	09.yy.08
	12.yy.10
BLUE	05.yy.05
	07.yy.07
	09.yy.08
	12.yy.10
	15.yy.10
CHROME	05.yy.05
	07.yy.07
	09.yy.08
	12.yy.10
	15.yy.10

Table 1 GLOBAL *S* Measuring Machine models

Messaging Lights

The Messaging Lights LED indicator kit (optional) can be used to monitor machine state at a distance from the measuring station.

Thermal Compensation System

The thermal compensation system is of the multisensor type.
The temperature sensors are positioned inside the measuring machine on the axes, table and beam. In addition, the user is provided with an external sensor that is to be applied to the workpiece to be measured when the thermal compensation system is active.
Due to its intrinsic characteristics and the number of sensors applied to the machine, the thermal compensation system ensures maximum measuring performance in a broad temperature range.
When the thermal compensation system is active, the control system corrects the measurements made by the measuring machine on the basis of the temperature values measured by the sensors.

PULSE

The PULSE system (optional) is used to monitor and record ambient conditions by detecting events occurring during machine use (crashes, vibrations, exceeding of temperature and humidity limits, and air supply pressure, etc.).

It consists of vibration, temperature, humidity, air supply pressure and crash sensors connected to the PC via a USB port and a dedicated module network.

The data collected by the sensors in the kit are made available for later event analysis and immediately indicate the occurrence of operating irregularities to the operator.

Intended Use and Unauthorized Use

GLOBAL S is a low-power machine designed and built to measure small to medium-sized parts used in the mechanical industry. It automatically moves a lightweight, contact or non-contact measuring tool, according to the programmed cycle executed to measure a part placed on its work table.
The measuring machine is not to be used for any machining processes other than measurements and is not to be fitted with any tools other than those designed for use with it without prior authorization from Hexagon. It is not to be used, for example, to move or lift parts, to mill or to measure parts of the human body.
The measuring machine may only be used in an industrial environment that has been suitably prepared and protected.

Warning

Any changes to the measuring machine and, more in general, to the measuring system not authorized by Hexagon, may make the machine dangerous, will make the guarantee offered by Hexagon null and void and result in the company declining all liability for any damage caused by it.

Main Components

Fixed Parts

The fixed part of the measuring machine is made up of the granite.
The guideways of the main carriage are machined into the body of the granite. The top surface of the granite (work table) comprises the threaded inserts for fixing the part to be measured.

Moving Parts

The moving parts of the measuring machine are the main carriage, central carriage and Z-rail:

- The main carriage is made up of a beam and two legs (left and right). The main carriage runs on the work table and represents the Y machine axis.
- The central carriage runs along the beam of the main carriage, and represents the X machine axis.
- The Z-rail (column) is assembled inside the central carriage and moves perpendicular to the floor, thus representing the Z machine axis.

The three machine axes move independently of one another, thus enabling the tip of the tool to move freely in any direction inside the measuring volume. The measuring volume is a cubic space the sides of which are directed in the same way as the axes of the measuring machine and have the same lengths as the strokes of the machine axes.
The measuring machine reference system consists of three Cartesian axes, X, Y and Z whose origin lies at the top front left corner of the measuring volume.

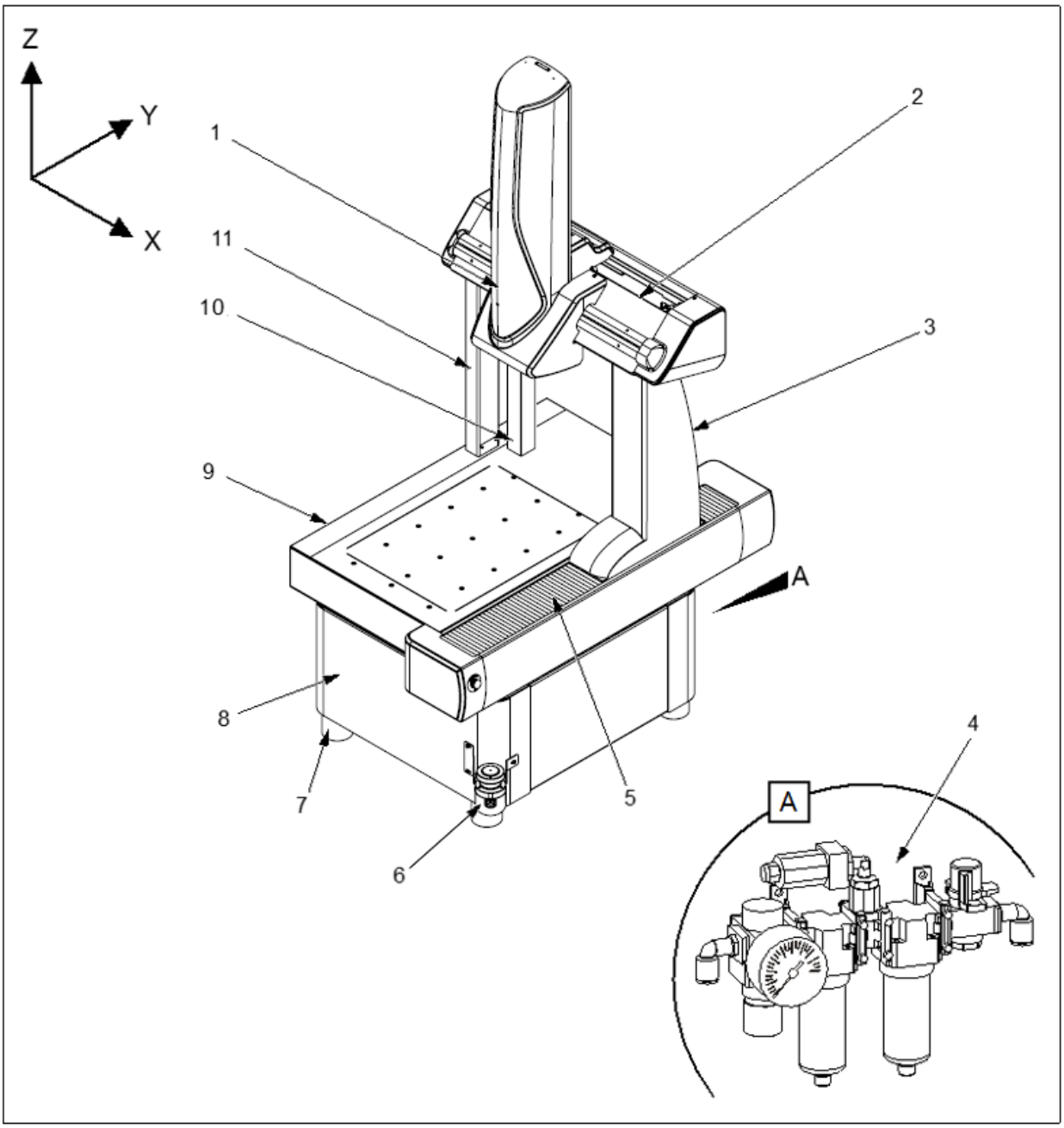


Figure 1 The GLOBAL S Measuring Machine 5.yy.05 and 7.yy.07 Models

1. Central carriage
2. Main carriage (beam)
3. Main carriage (right leg)
4. Pneumatic control unit
5. Y axis bellow
6. Optional Laser scanner
7. Anti-vibration support
8. Machine stand
9. Granite work table
10. Z-rail
11. Main carriage (left leg)

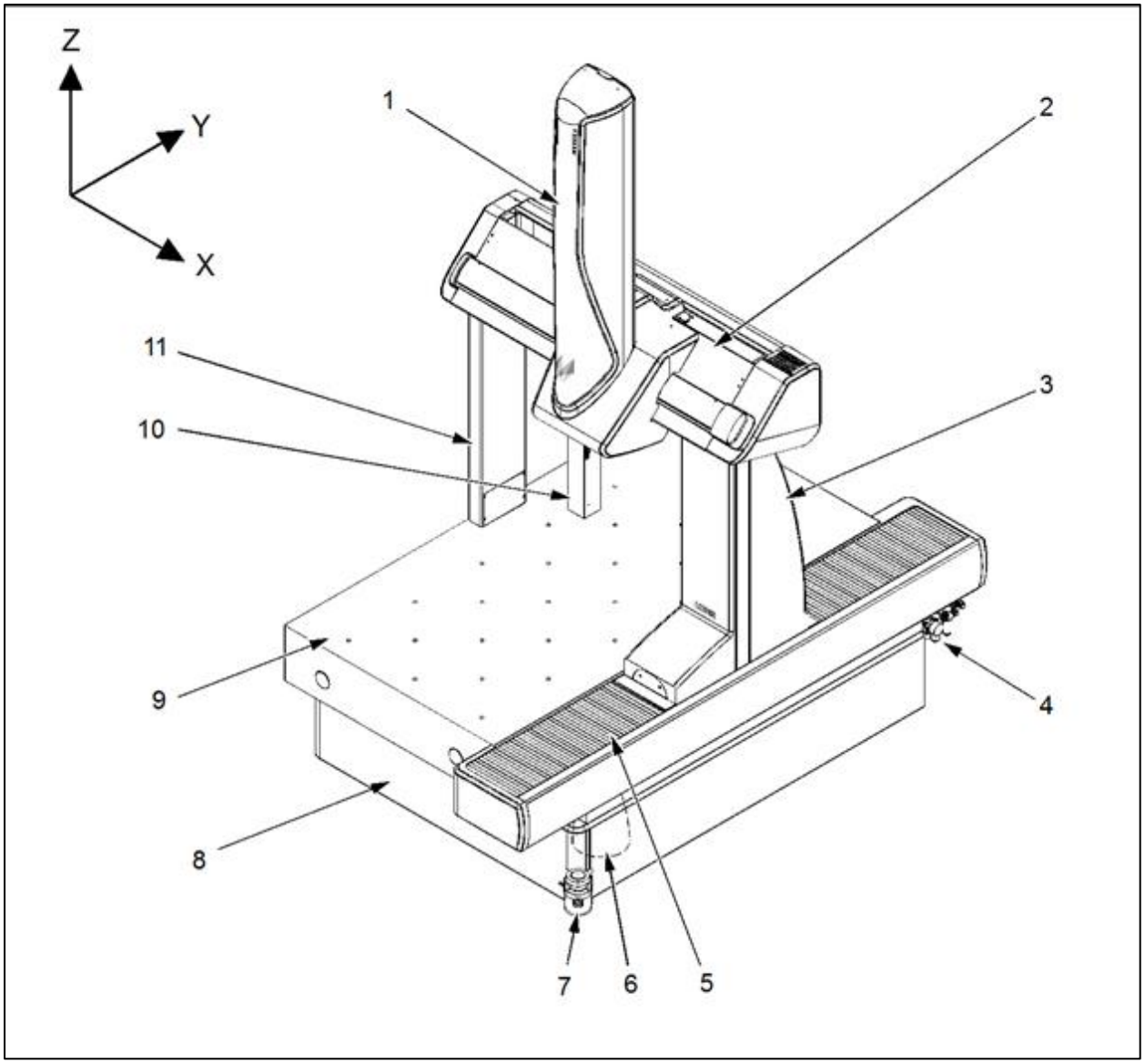


Figure 2 The GLOBAL S Measuring Machine 09.yy.08, 12.yy.10 and 15.yy.10 Models

1. Central carriage
2. Main carriage (beam)
3. Main carriage (right leg)
4. Pneumatic control unit
5. Y axis bellow
6. Anti-vibration support pedestal
7. Optional Laser scanner
8. Optional Machine skirt
9. Granite work table
10. Z-rail (Column)
11. Main carriage (left leg)

Protective Systems Controlling Access to the Danger Zone

Figure 2 shows the measuring system without any guards covering the area in which the measuring machine operates (*danger zone*).
As a reminder, when installing the machine and when using the machine, the Customer must fit the measuring machine with an appropriate protective system capable of meeting the specific application and safety requirements and, in particular, those that emerge from the risk analysis for the specific installation.
For further information refer to the Site Preparation Manual, “Perimeter Protective Systems”.

Optional Laser scanner

During automatic operation of the high-speed version of the machine, the laser scanner system defines two protection areas around the machine (external and internal), having different dimensions.

See the user instruction manual of the DC800 I/O-Ready control system for a description of the operation of the laser scanner system in case of unexpected access to protected areas.

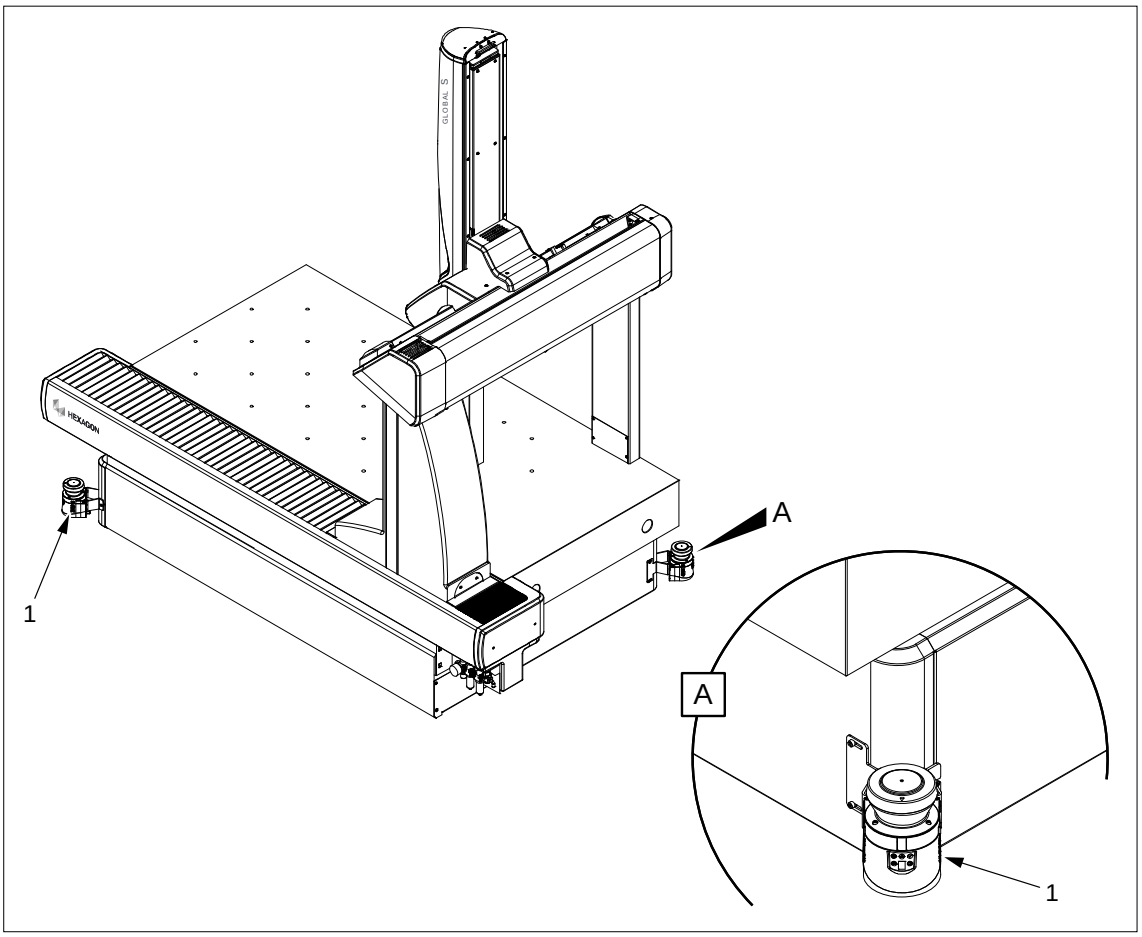


Figure 3 Laser scanner system

1. Laser scanner

The dimensions of the protected areas can be programmed during installation (by Hexagon) and must not be smaller than those shown on the following table.

Model	Front side Df mm(in)		Left side Dl mm(in)		Right side Dr mm(in)		Rear side Db mm(in)	
	External area	Internal area	External area	Internal area	External area	Internal area	External area	Internal area
05.yy.05	935 (36.8)	595 (23.4)	1000 (39.4)	662 (26.1)	870 (34.2)	535 (21.1)	955 (37.6)	620 (24.4)
07.yy.07	840 (33.1)	600 (23.6)	890 (35.0)	650 (25.6)	720 (28.3)	480 (18.9)	900 (35.4)	660 (26.0)
09.yy.08	790 (31.1)	610 (24.0)	900 (35.4)	720 (28.3)	630 (24.8)	460 (18.1)	910 (35.8)	730 (28.7)
12.yy.10	810 (31.9)	600 (23.6)	960 (37.8)	750 (29.5)	700 (27.6)	490 (19.3)	970 (38.2)	760 (29.9)
15.yy.10	890 (35.0)	650 (25.6)	1040 (40.9)	800 (31.4)	780 (30.7)	540 (21.3)	1050 (41.3)	810 (31.9)

Table 2 Minimum depth of the laser scanner protection areas

Warning

Failure to respect the minimum space around the measuring machine may increase the crushing, collision and piercing risks described in the User Manual.

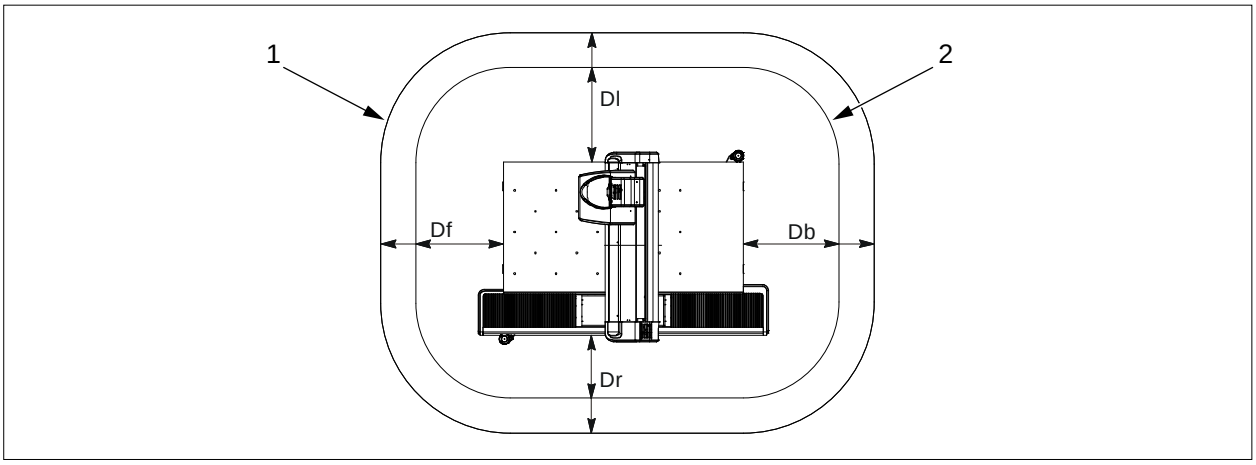


Figure 4 Laser scanner protection areas

1. External perimeter of protected area
2. Internal perimeter of protected area

Notice

The laser scanner protection areas are indicated on the floor to prevent accidental access.

User Controls

See the documentation of the control system in use to use the portable terminal correctly.

NJB Jogbox

The Jogbox is a device connected to the control system by means of which the user can perform operations on the measuring system standing close to the machine.

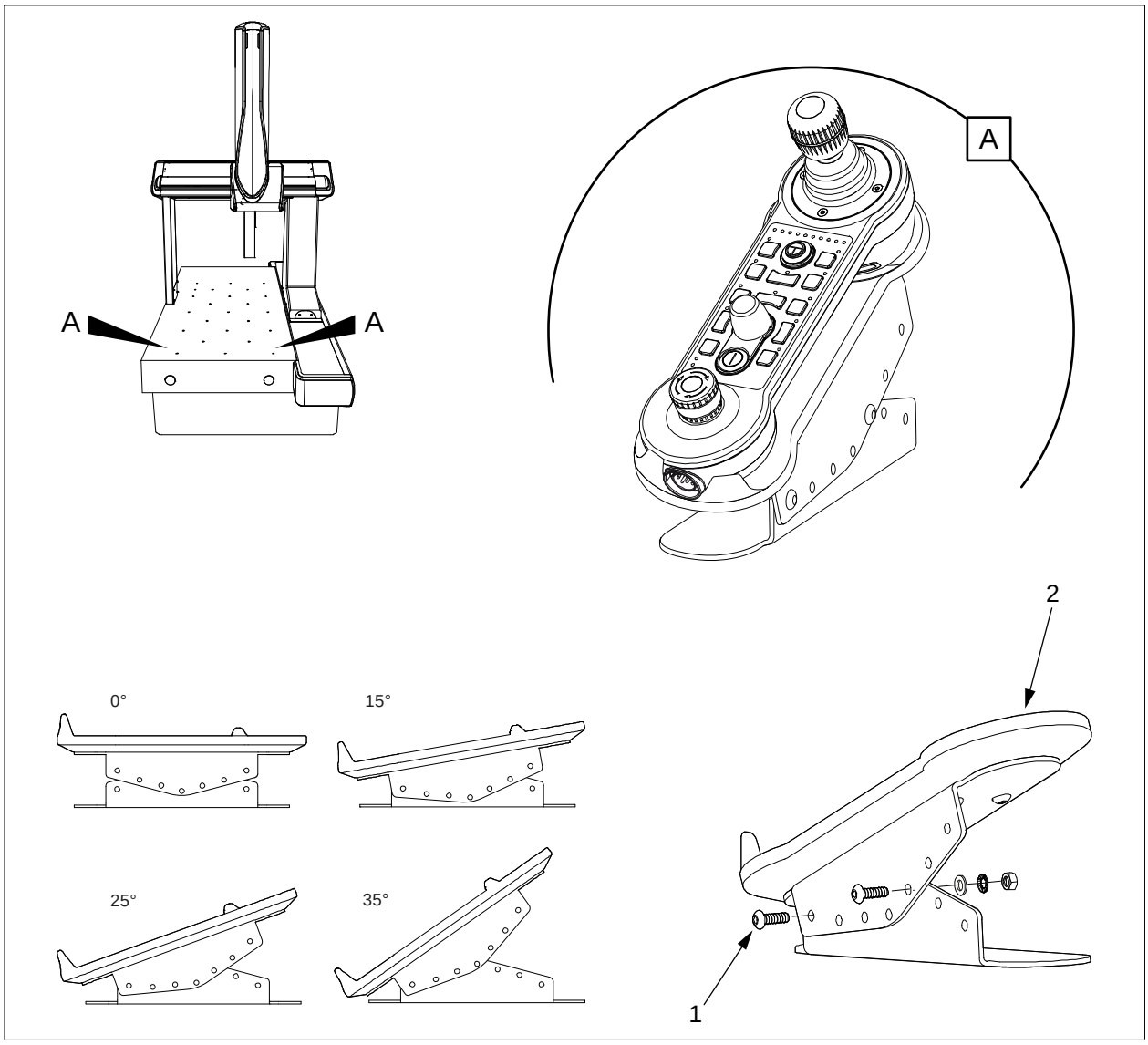


Figure 5 Jogbox NJB stand position

1. Screw
2. Stand

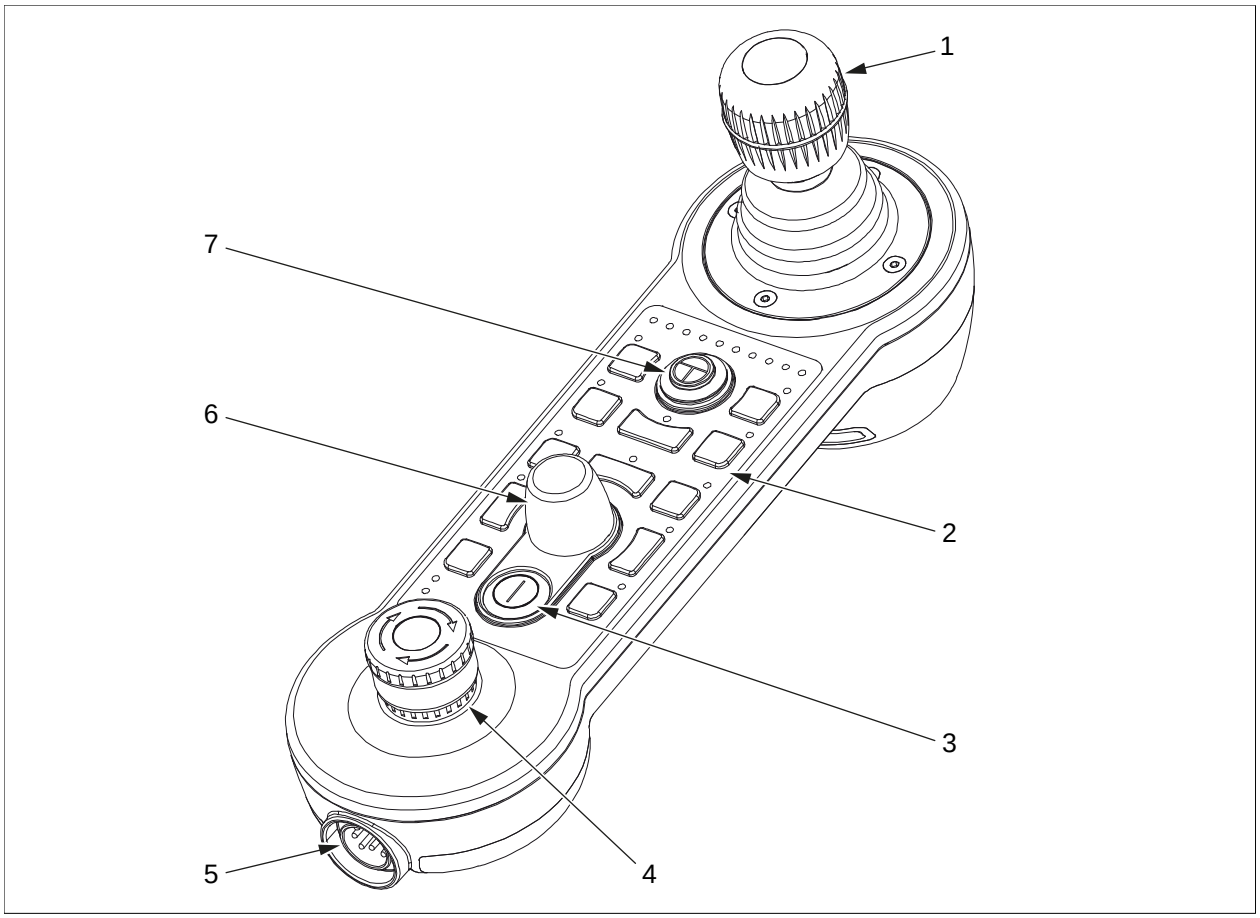


Figure 6 NJB Jogbox keypad

1. Joystick
2. Keypad
3. Machine start
4. Emergency stop
5. Wire connector
6. Speed adjuster
7. Enable button

Move the joystick to move the linear axes X, Y and Z of the measuring machine. The controls on the Jogbox may be used to:

- Adjust the linear axis movement speed when they are controlled by the joystick, and enable or disable manual movement of each axis (a disabled axis cannot be moved using the joystick). The axis movement speed is indicated by the 10 LEDs on the upper part of the Jogbox keypad. Each LED corresponds to a 10% speed increase.
- Carry out the required operations to start the control system and resume after emergencies.
- Carry out software-related functions, such as notifying relevant events which could occur during part program running or teaching.

Joystick reactivity may be modified on the FDC function control panel by selecting the “Quadratic relation jogbox” option. Joystick sensitivity is more adapted to small high-accuracy movements when the function is on and reactivity is more suited to larger movements and faster speeds when it is off (see FDCPanel).

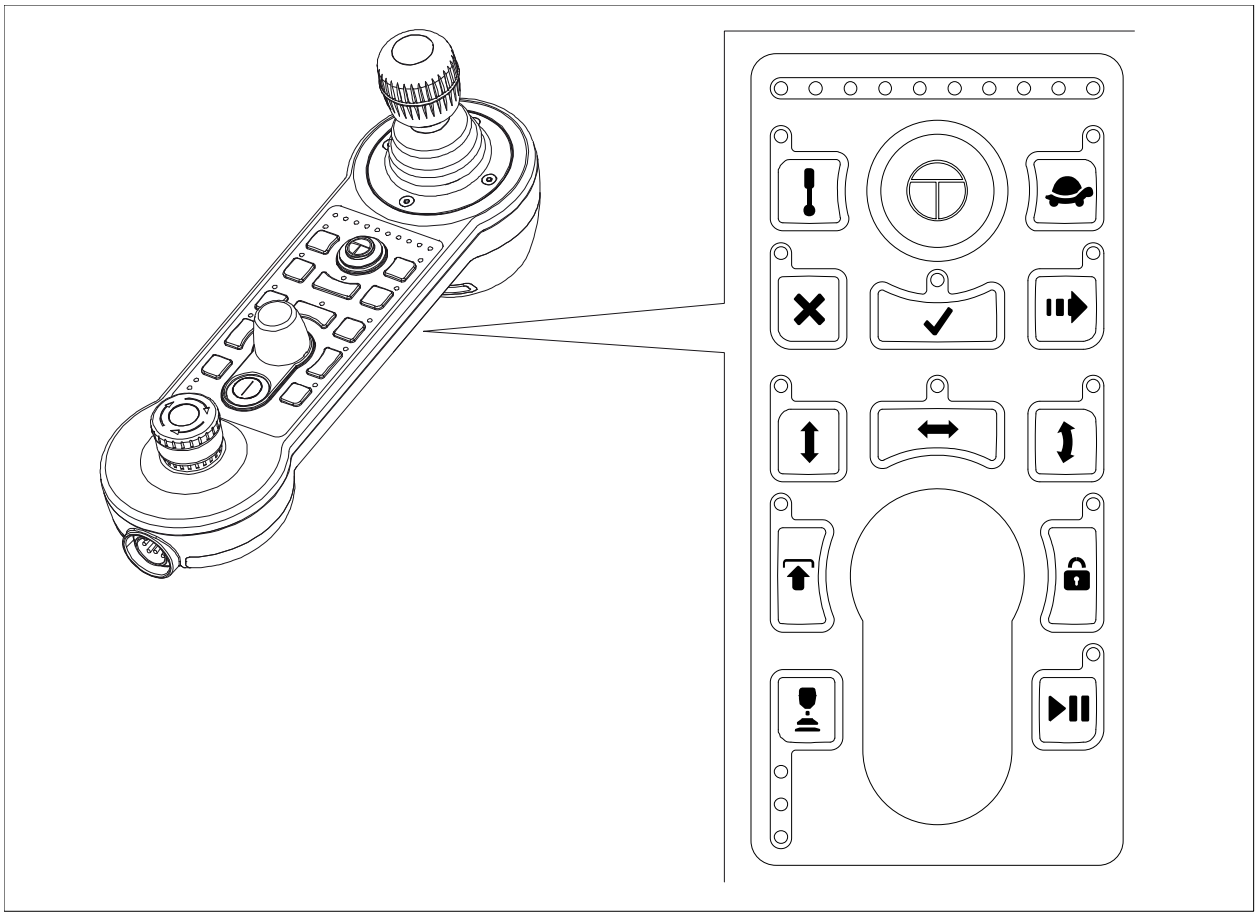


Figure 7 NJB Jogbox keypad

The Jogbox buttons are provided with LEDs which display the state of the associated functions.

Probe enable

This button is only effective when moving the probe using the Jogbox.

The LED shows the current setting:

- LED off. The probe can be moved in this condition but cannot measure. The axis movements will not be stopped if the probe touches an object. Use this condition only to resume probe operation after a collision. It is strongly inadvisable to use it for other functions because it could cause damage to the probe or to the parts placed on the work top.
- LED on. This condition allows the probe to be moved for measuring. The axis movement is stopped if the probe touches an object or at a given point. This is the normal way of using the probe.

Enable

The button must be kept pressed when the JogBox is used to move the axes. If the joystick is moved without holding this button pressed, the axes will not move (this prevents unwanted accidental movement of machine axes).

Slow

The button is used to set the machine axis maximum speed when movement is controlled by Jogbox. Two values can be selected (*fastJogVel* and *slowJogVel,* with *fastJogVel*>*slowJogVel*). These are configured in the control system.

When the control system is in Manual status, the maximum speed of the machine axes is set to the lower of the values between the one set using the SLOW pushbutton and the *manualVel* setup parameter. (The *manualVel* setup parameter specifies the maximum speed at which the linear axes of the measuring machine can be moved using the joystick or the Part Program when the control system is in Manual status).

The LED shows the current setting:

- LED off. The set speed is *fastJogVel.* (or *manualVel* as described above).
- LED on. The set speed is *slowJogVel.* Default setting at control system start-up (or manualVel as described above).

Important Note: The measuring performance and operation of the measuring machine in use is only guaranteed if the maximum speed is set to *slowJogVel* (and the PROBE ENABLE LED is on). When the axes are moved using the joystick with *fastJogVel* (LED off), to prevent problems caused by false triggering, we recommend you select “LED off” status on the PROBE ENABLE button.

Delete point

The button is used to eliminate the last measured point. Press in sequence to eliminate a point of the last measured series.

Done

This button is used to reply to requests from the software

Move point

The button is used to register positioning and release points.

X, Y, Z

Each of these three buttons enables or disables the movement of the corresponding axis using the Jogbox.

The LED shows the current setting:

- LED off. The axis cannot be moved.
- LED on. The corresponding axis can be moved.

Shift

This button is used to select the reference axis triad.

- LED off. The main triad is selected (machine).
- LED on. The secondary triad is selected (e.g. wrist).

Lock/Unlock

Not used.

Jog mode

The JOG MODE control allows selecting the reference system used for the axes movements:

- Probe: the reference system is based on the probe axes
- Part: the reference system is based on the part axes
- Mach: the reference system is based on the machine axes.

The three LEDs indicate the selected reference system.

Run/Hold

The button switches the control system between the Run and Hold states.

The LED shows the current setting:

- LED off. The control system suspends axis movement (hold).
- LED on. The control system allows axis movement (run). Default setting at control system start-up

Workstation

The workstation is a device connected to the control system by means of which the user can perform operations on the measuring system standing close to the machine.

Warning

To prevent the risk of physical injury:
Do not sit or stand on workstation.
Do not lean on workstation.
Lock casters after installing workstation.

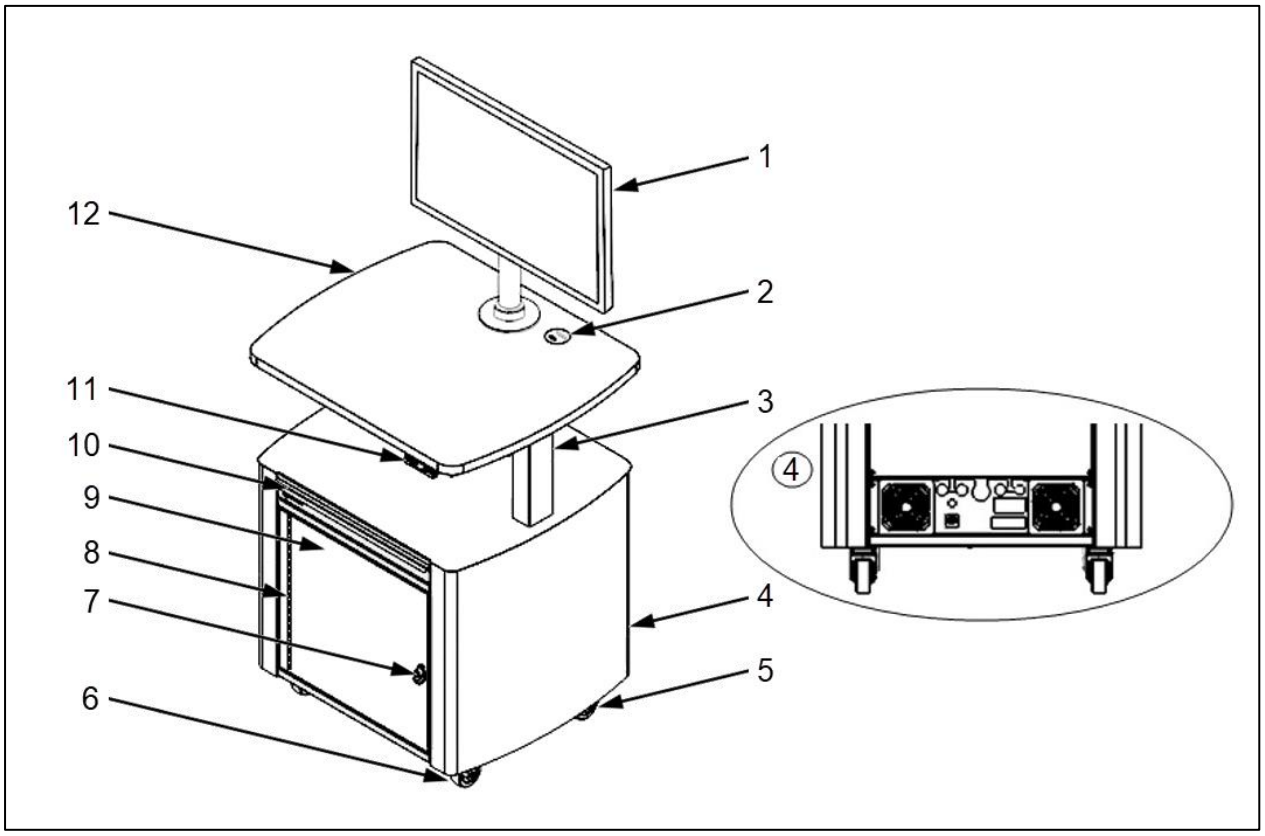


Figure 8 Operator Workstation

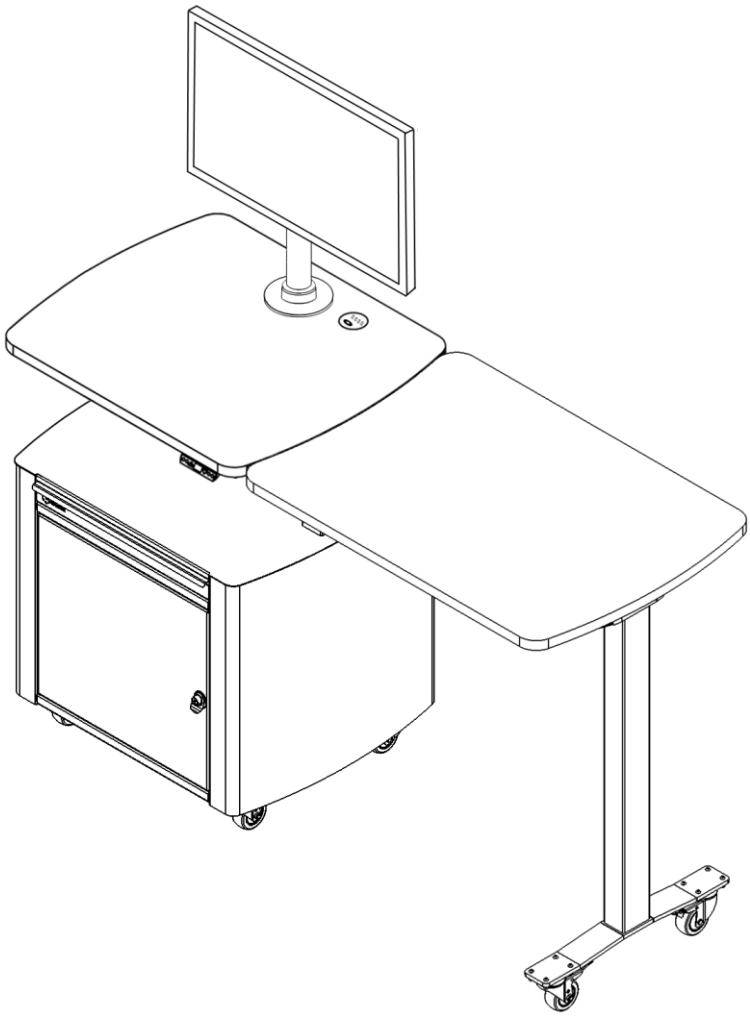
1. Monitor
2. USB Ports
3. Lift Columns
4. Rear Fan/Cable Access Panel
5. Swivel Casters
6. Swivel and Locking Casters
7. Locking Door Latch and Button
8. Cabinet Rack Mount
9. Equipment Cabinet
10. Probe Accessory Drawer
11. Lift Column Keypad
12. Table/Operator Workspace

Warning

Shut down Workstation and CMM prior to accessing rear fan and cable access panel of the workstation.

Figure 8 shows the Operator Workstation configuration:

- Integrated USB ports (powered) for easy data access and charging.
- Lift column maximum load 890N (90kgf, 200 lb).
- Key locking latch and push button cabinet door access.
- Shut down workstation and CMM prior to accessing rear fan and cable access panel
- Swivel and locking casters included on all workstation wheels.
- Equipment Cabinet with Rack Mounts to secure equipment.
- Probe Accessory Drawer for storage.
- Lift column keypad can be used by the Operator to raise and lower the Operator workspace.



An optional extension table is available for use with the workstation.

Program up to four memory positions available on the lift column keypad

Caution
Make sure no obstacles are in the workstations path. Make sure the workstations is not touching any walls or equipment. Make sure all cords are long enough to accommodate the change in height. Once a preset button is pushed, the desk will move to the programmed height.

Use the directions below for your style of lift column keypad.

Minimum (80cm or 31.4in +/-0.1) and maximum (130cm or 51.1in +/-0.1), table height is set at the factory**.**

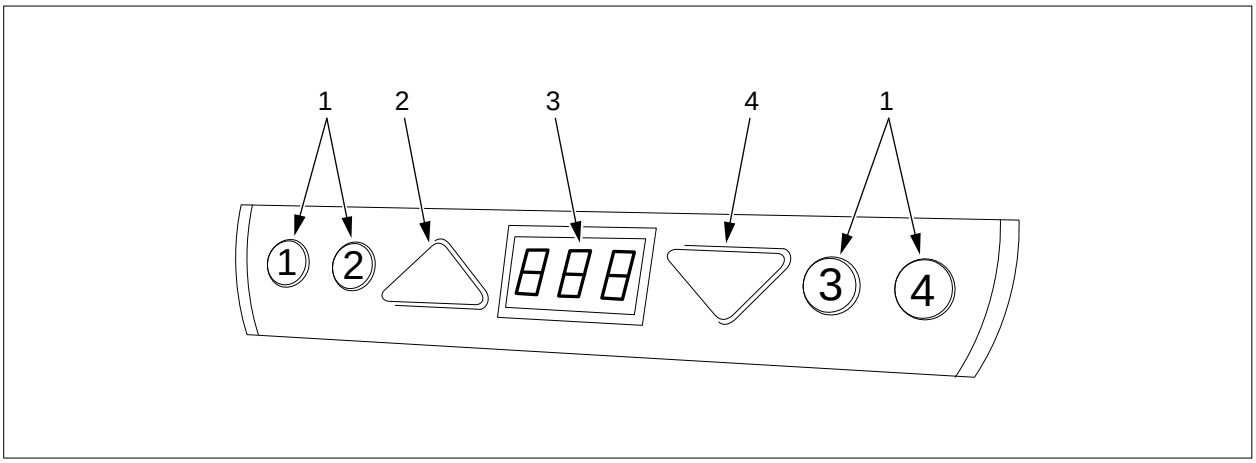


Figure 9 Work top height adjustment control panel

1. Number buttons
2. "Up" button
3. Display
4. "Down" button

Setting the memory positions:

1. Use the up and down buttons to find a desired height.
2. Then press and hold the “up” button and a number button 1 – 4 for 3-5 seconds. The display will flash P and the number set to confirm it has been programed.

To switch between imperial and metric readouts:

1. Hold down buttons 1, 2, and 3 until the readout blinks.
2. Then press 2 for metric or 3 for imperial.

FDCPanel

FDCPanel, which can be accessed from the measuring system PC, is an application which integrates the possibility of editing some measuring machine parameters among its functions.

The application can be accessed by running the file FDCPanelApp.exe file in the C:\FDCPanel\ folder of the PC connected to the measuring machine.

Notice

If the DC800C or DC800 I/O-Ready controller cannot be reached (control off, wire disconnected etc.) all pages appear greyed out and any information they contain will not be significant.

FDCPanel settings

Click on “Settings” on the FDCPanel main page.

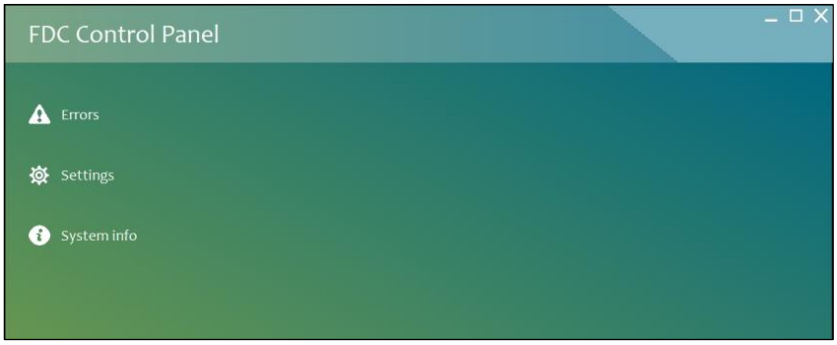


Figure 10 FDCPanel main page

Select the “Settings” options to open the page for enabling/disabling some specific operative functions of the measuring machine.

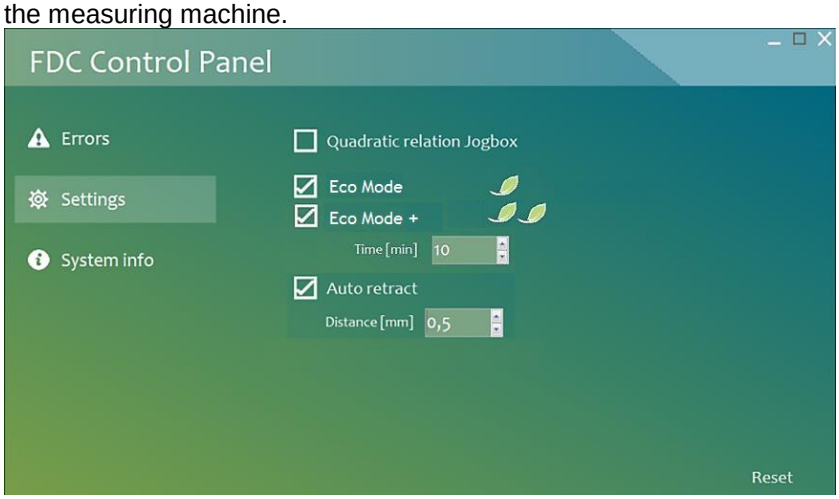


Figure 11 FDCPanel settings page

On this page, click on the selection box to enable/disable the following measuring machine functions:

- Quadratic relation jogbox
- Eco Mode / Eco Mode +
- Auto retract

Quadratic relation jogbox
Enables/disables the quadratic relation between joystick movement and controlled speed.
When enabled, this function modifies the joystick sensitivity to allow a more accurate positioning in low speed movements.
When deactivated, the joystick is more reactive in high speed movements on long distances.
The user can select the required mode according to the most frequency method of use of the joystick (small accurate movements or fast movements on long distances).

ECO mode
Enables/disables energy-saving ECO MODE. The mode allows to reduce electric energy consumption and mechanical stress of motors and transmission parts.
When enabled, this mode automatically cuts off power to the axis motors after two minutes of inactivity of the machine. If necessary, when axis Z supports a high load (e.g. a wrist), its motor remains on to prevent the axis from descending.
The LEDS of the “DONE” **(1)** and “MOVE POINT” **(2)** buttons on the JogBox will blink in alternating manner when the machine is in this mode.

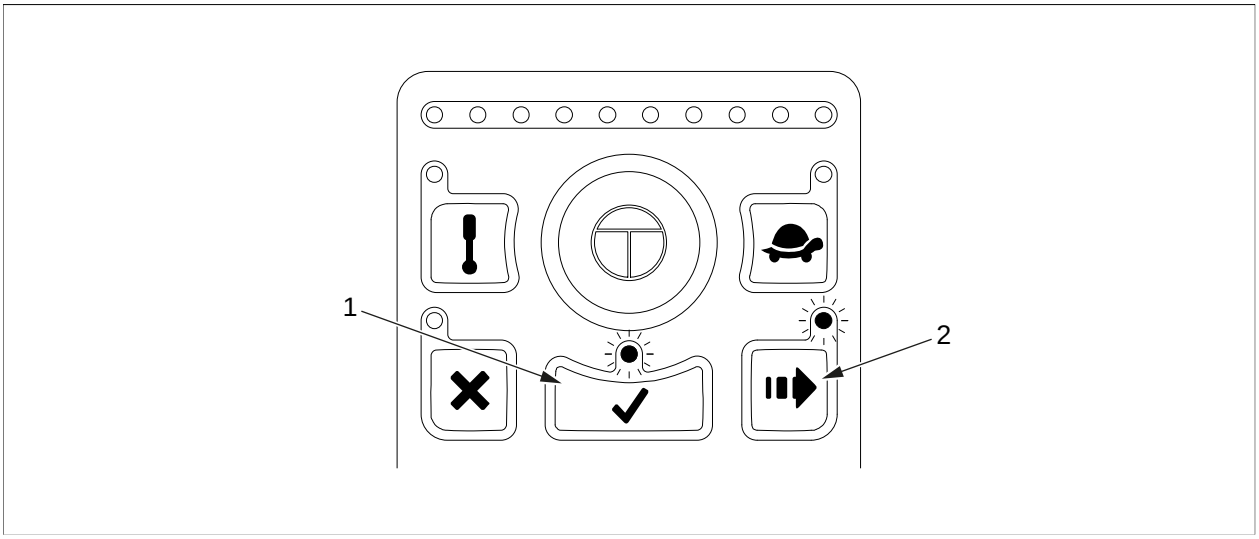


Figure 12 Machine in ECO MODE condition indication on JogBox NJB

Motor power is immediately reactivated without any intervention by the operator as soon as a movement must be performed (by means of the JogBox or part program) or to maintain the nominal position.

Eco Mode +

Enable/disable supplementary Eco Mode + energy saving mode to reduce compressed air consumption. When enabled, this mode automatically cuts off the air flow to the air bearings after a given period of time of non-use of the machine, thus reducing energy consumption and processing costs. The interval of time before the Eco Mode + starts working can be set by the user by means of the “Time” control on the FDCPanel, to a minimum of 10 minutes.

Note on Eco Mode + operation:

- The Eco Mode + function is only available when the Eco Mode function is enabled.
- Start and permanence of the machine in the Eco Mode + condition are indicated by the JogBox by the alternating blinking of the LEDs of the “DONE” **(1)** and “MOVE POINT” **(2)** buttons at a lower frequency than that already used to indicate the Eco Mode condition.
- The air flow to the air bearings is automatically reactivated without any intervention by the operator as soon as a movement must be performed (by means of the JogBox or part program).
- The Eco Mode + function also works when the machine is in emergency stop conditions. In this case, the air flow to the air bearings is reactivated when the machine start button is pressed.
- In all cases, when the air flow is reactivated the machine remains in a waiting state for a given time (1-2 seconds) in order to allow the pressure to stabilise in the pneumatic circuit.

Auto retract

Enables/disables automatic movement performed after taking a point in jog mode. This automatic movement, if enabled, moves the probe away from the part to the distance set in the “Distance” field.

Operating Instructions

This chapter contains the instructions to be followed to ensure proper, safe, and efficient use of the measuring machine.

Safety Regulations and Residual Risks During Use

Warning

We recommend you strictly respect all the safety recommendations made in this section to avoid the risk of injury to persons and damage to the equipment.

Although it is not possible to foresee all hazardous situations that may arise due to the wide variety of operating combinations, the measuring machine is designed to reduce the risk of injury to persons and damage to things to a minimum.

To reduce this risk even further, users of the measuring machine must have:

- An adequate knowledge of the general safety regulations given in the document entitled “Use and Maintenance of the Measuring System – General Safety Regulations”. These regulations must be strictly respected while using the measuring machine.
- An adequate knowledge of the residual risks for users indicated in the table below together with the remedies to be taken in order to reduce them to a minimum or eliminate them altogether.

Residual Risk	Remedies
Crushing or cutting of parts of the body between moving parts of the measuring machine and other parts	During use of the measuring system, keep a safe distance from the moving parts of the measuring machine to avoid the risk of these parts crushing parts of your body such as fingers, hands, arms and the head, or cutting fingers against other parts of the machine or the part (or the part fixture). In particular, avoid standing between the Z-rail and the shoulders of the machine or between the Z-rail and the part (or its equipment). When it is necessary to enter the machine’s working area, keep the emergency mushroom-head button present on the Jogbox close at hand and be ready to use it. This precaution should be taken not only when the measuring system is in Manual mode but also and above all when the measuring system is in Automatic mode and the danger zone has no automatic protective devices Always use Manual operating mode to carry out activities that require close contact between the operator and the measuring machine (for example, when writing and debugging measuring programs or making manual measurements). The operator of the measuring system is responsible for making sure that no unauthorized staff is present in the vicinity and cannot access the measuring machine during its operation.
Knocking parts of the body against moving parts of the machine. In particular, knocking your face against the measuring tool, especially when the tool is driven by a motorized head	While using the measuring system, keep a safe distance from its moving parts. When it is necessary to enter the machine’s working area, keep the emergency mushroom-head button present on the Jogbox close at hand and be ready to use it. This precaution should be taken not only when the measuring system is in Manual mode but also and above all when the measuring system is in Automatic mode and the danger zone has no automatic protective devices Always use Manual operating mode to carry out activities that require close contact between the operator and the measuring machine (for example, when writing and debugging measuring programs or making manual measurements). The operator of the measuring system is responsible for making sure that no unauthorized staff is present in the vicinity and cannot access the measuring machine during its operation.
Piercing of the eyes by a sharp tool.	When sharp tools are present, always wear special protective glasses.

Unexpected movement of the measuring machine due to an error in the measuring program or the execution of an incorrect measuring program, a fault in the control circuits (in the latter case, turning on the motors could cause a brief uncontrolled movement before the machine is automatically turned off by the control system itself).	Only press the button that starts the motors of the measuring machine when there is nobody in the working area of the moving parts of the machine. Always take the precautions indicated for the “Crushing or cutting” risk (see above). Always check that you have selected the desired program before starting it.
Z-rail falling	The Z-rail is hooked to the weight of the counterbalancing system by means of a sturdy, adequately oversized steel wire. Nevertheless, to eliminate the risk of personal injury in the extremely unlikely event of the Z-rail falling, avoid putting any part of your body under it. A potential risk only exists if routine maintenance operations of the steel wire are not performed with the frequencies and methods specified in the “Maintenance” chapter on page 68.
Overturning of the granite	The granite rests on special anti-vibration supports and its stability is only guaranteed if the part to be measured and the fixture are positioned near the centre of the work table and they weigh less than the specified weight. Consequently, to avoid all risk of the granite overturning, never place a part that weighs more than the specified maximum weight on it and do not apply any extra weight to its edges (for example, by leaning or placing heavy tools on them). Check also the anti-tilt feet and anti-vibration supports with the frequency and methods specified in the “Maintenance” chapter on page 68.
Injury to persons and damage to things caused by laser devices	This risk is only present when laser probes are used (class 2 laser devices). When using or maintaining a laser probe, strictly follow the instructions given in the manufacturers’ manual to avoid the risk of personal injury and damage to things. Avoid looking at the laser beam at all times.
Electric shock	Do not use power cables with a damaged sheath or plug or without the necessary equipotential earth connection. The cases of the switchboards in general, the electronic control and the computer in particular are only to be opened by authorized staff and only when unplugged from the mains power supply, having waited for the time indicated on the warning signs (risk of residual voltage).
Deterioration in the machine’s safety	In order to maintain the optimum degree of safety: • Make all the necessary checks during preventive maintenance: see the “Maintenance” chapter. • Contact the Hexagon Customer Service immediately if any errors appear, signalling faults in the mode selector, power circuit, reductions in speed or safety functions in general. • Take care not to damage the cable of the Jogbox by pulling or twisting it excessively or squashing it with heavy objects such as vehicles or other handling equipment. • Only use the emergency stop devices under emergency conditions or when the motors have to be turned off, stopping the machine using the Hold buttons in all other cases. • To stop the machine with the motors on, press the Hold buttons rather than turn the FEED speed regulator on the Jogbox to zero.

Technical and Functional Characteristics

Noise of the Measuring System

The weighted equivalent continuous sound pressure generated by the measuring machine is less than 70 dB (A).

Operating Conditions

Parameter	Required Values
Minimum Supply Pressure	5 bar (72.6 psi)
Minimum Input Flow Rate (ANR) UNI ISO 8778	450 Nl/min (16 scfm)
	600 Nl/min (21 scfm) (*)
Air consumption (ANR) UNI ISO 8778	90 Nl/min (3.2 scfm)
	250 Nl/min (8.8 scfm) (*)
Instantaneous maximum air consumption of the active pneumatic anti-vibration supports (**)	250 Nl/min (8.8 scfm) 5.yy.05 Models
	200 Nl/min (7 scfm) 07.yy.07 Models
	250 Nl/min (8.8 scfm) 09.yy.08, 12.yy.10, 15.yy.10 Models
Average air consumption of the active pneumatic anti-vibration supports (**)	73.5 NI/min (2.5 scfm) 05.yy.05 Models
	80 Nl/min (2.8 scfm) 07.yy.07 Models
	100 Nl/min (3.5 scfm) 09.yy.08, 12.yy.10, 15.yy.10 Models
Working temperature range	+10° (50° F) - +40°C (104° F)
Relative humidity	>20% <90% non-condensing

(*)15.yy.10 Models

(**) Optional

Table 3 Operating Conditions

Notice

With machine in standstill the air consumption of the active pneumatic anti-vibration supports (optional) is negligible.

Temperature and Humidity Requirements

The best possible performance of the measuring machine is ensured during operation if the environmental requirements specified in the table below and, more generally, in the relevant Hexagon procedure are strictly respected.
See the Technical Data bulletin for the model of the GLOBAL S measuring machine in use to find out the measuring performance that may be obtained when specific conditions for maximum measuring precision and the experimental conditions are satisfied.

Parameter	Required Values
Standard temperature range	Ambient temperature: 18° C (64° F) - 22°C (72° F) Max. air temperature variation (per day): 2°C/24h (3.6°F/24h) Max. air temperature variation (per hour): 1°C/h (1.8°F/h) Max. linear temperature gradient in space: 1°C/m (1.8°F/3.3 ft) (vertical), 1°C/m (1.8°F/3.3 ft) (horizontal)
Extended temperature range	Ambient temperature: 16°C (61° F) - 26°C (79° F) Max. air temperature variation (per day): 5°C/24h (9°F/24h) Max. air temperature variation (per hour): 1°C/h(1.8°F/h) Max. linear temperature gradient in space: 1°C/m (1.8°F/3.3 ft) (vertical), 1°C/m (1.8°F/3.3 ft) (horizontal)
Vibrations on the installation site	Within the limits specified in the “Site Preparation Guide”.
Relative humidity	>20% <75% non-condensing

Table 4 Conditions for Maximum Precision

Electrical Power Supply

The measuring machine is powered by the control system. For detailed information on the electrical characteristics, see the documentation provided with the control system in use.
Machines and devices manufactured by Hexagon work correctly within the limits laid down by the EN60204-1 and EN 61000-6-2 standards.

Z-rail Counterbalancing System

Type	Pneumatic and adjustable.
Maximum weight applicable to the Z-rail	4 kg (9 lb)
Maximum weight that can be added to or removed from the counterbalanced Z-rail without having to rebalance the weight of the Z-rail itself and without altering the machine’s measuring precision	1 kg (2 lb)

Table 5 Z-rail Counterbalancing System

Starting the Measuring Machine

Starting the measuring machine is one of the operations necessary to start the entire measuring system (measuring machine, control system and measuring software).

Starting the Measuring Machine

1. Read carefully the section entitled “Safety Regulations and Residual Risks During Use” on page 30.
2. Open the shut-off valve of the pneumatic control unit and check that the pressure indicated on the pressure gauge is the correct value.
3. Complete the measuring system startup procedure by following the instructions given in the user manuals of the control system and measuring software.

Caution

The thermal compensation system only starts when the user activates it using the appropriate functions of the software in use. The thermal compensation systems compensates for the temperature of the machine axes and the temperature of the part.

Stopping the Measuring Machine

Before stopping the measuring machine, check that the machine is not moving so as to avoid damage to the machine, the parts being measured and the tools used.

Stopping the Measuring Machine

1. If possible, move the central carriage to the −Z position (at the bottom of its stroke).
2. Complete the measuring system shutdown procedure by following the instructions given in the user manuals of the control system and the measuring software.
3. Close the shut-off valve of the pneumatic control unit to avoid wasting air and ensure optimum safety conditions.

Moving the Machine Axes

The machine axes are to be moved by running a part program or using the joystick of the NJB terminal.

Caution
Avoid moving the machine axes by pushing on their moving parts.

Caution
Run the AUTOZERO procedure to restore correct Jogbox operation if the NJB terminal is knocked or dropped or if axis position holding instability is found after pressing the ‘’enable’’ button.

NJB Jogbox AUTOZERO procedure

AUTOZERO is not a procedure for ordinary use but must only be carried out if axis position holding instability is found.
Press the four Jogbox keys at the same time to start the AUTOZERO procedure Figure 13.

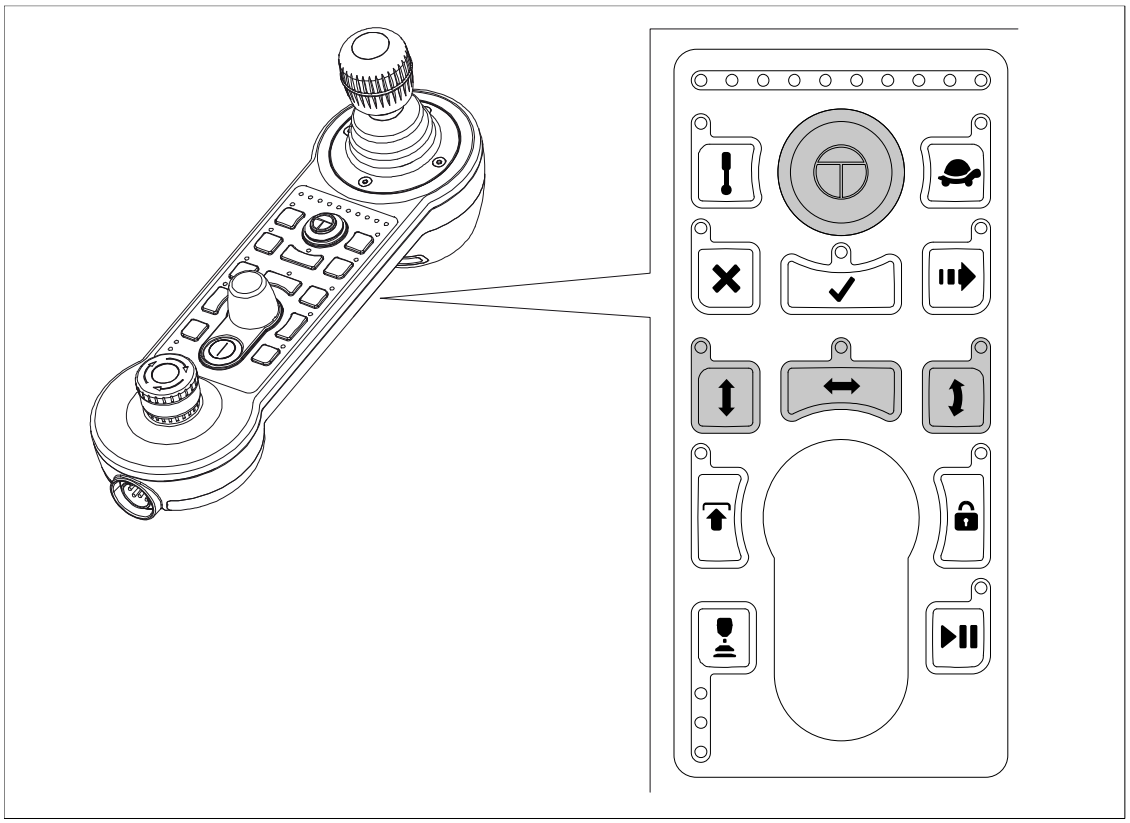


Figure 13 Starting the AUTOZERO procedure

Some speed indicator LEDs will light up as shown in Figure 14 during the procedure.

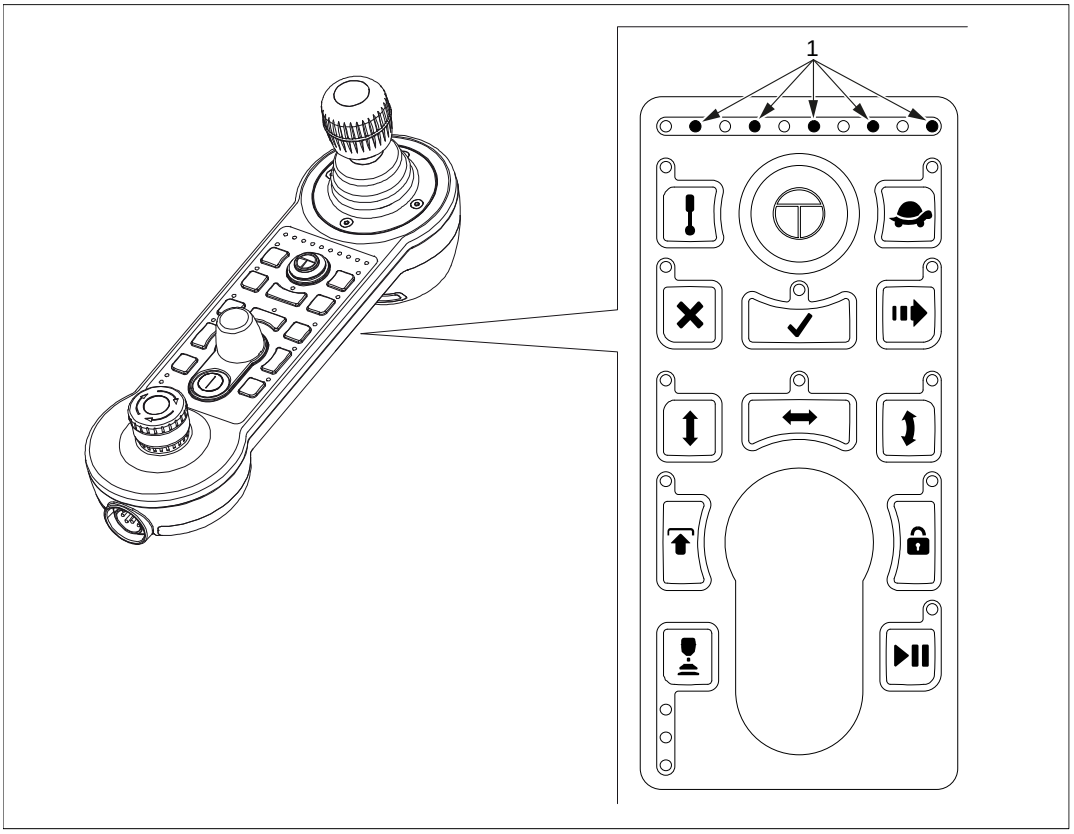


Figure 14 AUTOZERO process in progress

1. LEDs on during the procedure

Caution
For the procedure to be performed correctly:

- do not touch the joystick of the terminal during the procedure
- place the terminal on a stable surface in horizontal position
- the terminal must NOT be held by the operator

The AUTOZERO procedure lasts for approximately three seconds.
The speed indicator LEDs will resume the condition prior to starting when the procedure is finished.

Caution
If the observed “drift” when the joystick is not deflected is not:

- Stable
- Repeatable
- Small

or if repeated AUTOZEROs are required, it is a sign of a defective joystick or of a NJB damaged by a strong impact, drop or abusive operation and the NJB should be replaced.

Loading and Fixing the Part

Section “Overall Dimensions and Mechanical Characteristics of the Measuring Machine” on page 39 indicates the maximum weight of a part that can be placed on the granite. Heavy parts should be positioned towards the center of the granite to guarantee optimum stability of the machine.

The part and the fixtures may be fixed to the granite using the threaded inserts machined into the granite.

Characteristics of threaded inserts	M8 x 1.25. Length of thread 20 mm (0.8 in).
Drill pattern	See the overall view drawings for the specific model in section “Overall Dimensions and Mechanical Characteristics of the Measuring Machine”.

Caution

Never apply a tightening torque of more than 20 Nm (180 in/lbs). Excessive tightening of the bolts may cause the inserts to come unstuck or cracks to appear in the granite work table.

Part weight compensation

The GLOBAL S measuring machine applies automatic corrections to the performed measurements to compensate for geometric changes induced by the loads of parts onto the table.
To allow part weight compensation to work properly, the user is required to define some information relevant to the specific measurement setup:

- In the default case, assuming that the workpiece is placed centrally and symmetrically in the measuring volume, only the weight of the workpiece is required.
- In other cases, the layout of the support points of the workpiece on the granite table can be specified in addition to the workpiece weight.

PC-DMIS and QUINDOS measuring programs are equipped with a specific interactive user interface to enable/disable weight compensation and to enter the required data according to different options. Description of the user interface options and relevant instructions for use are included in the online help of both PC-DMIS and QUINDOS.

Overall Dimensions and Mechanical Characteristics

For each model of measuring machine, this chapter indicates:

- Lengths of the machine axis strokes
- Overall dimensions
- Weight of the measuring machine
- Maximum weight of the part
- Dimensions and drilling pattern of the work table

Overall Dimensions and Mechanical Characteristics of the Measuring Machine

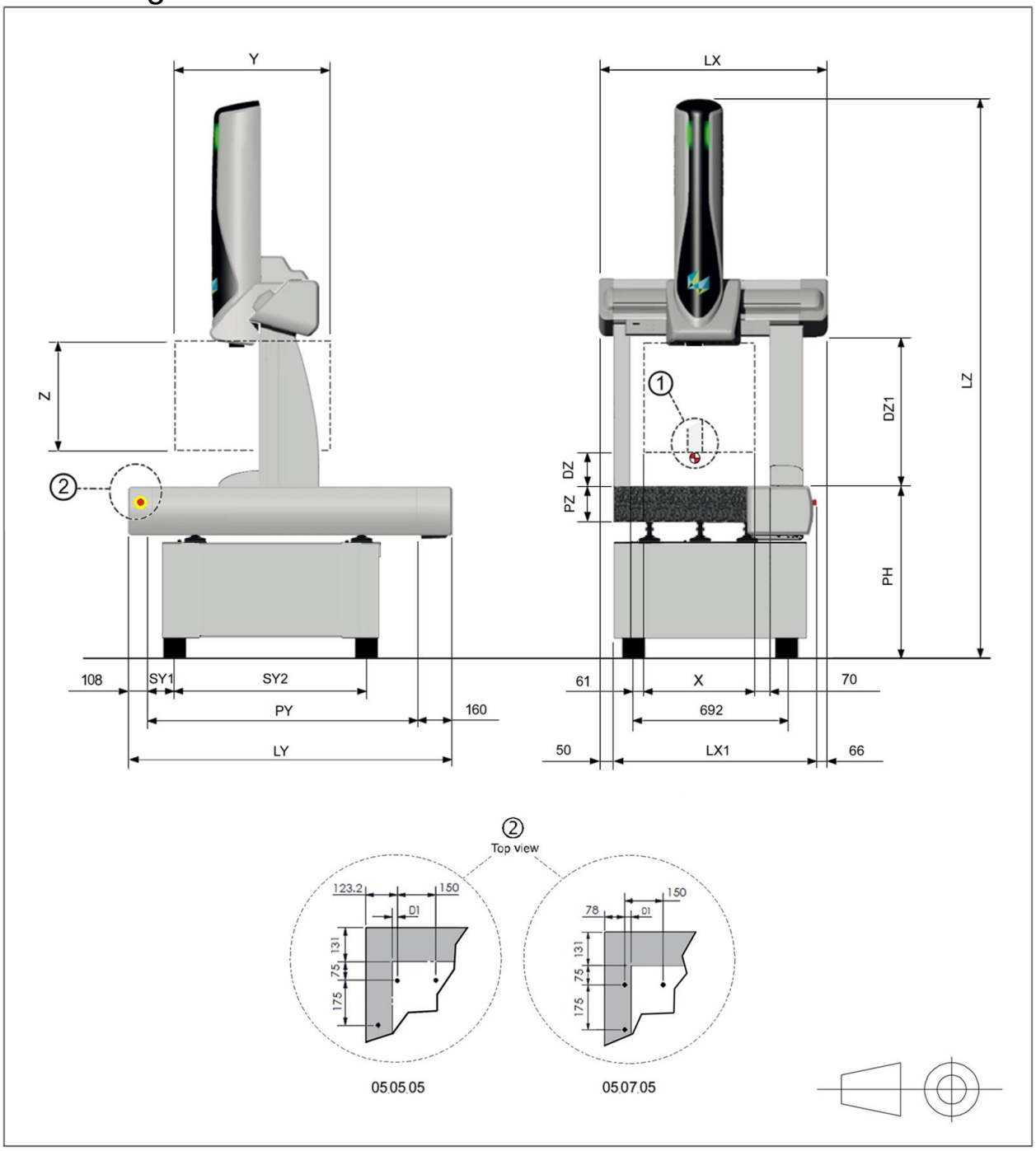
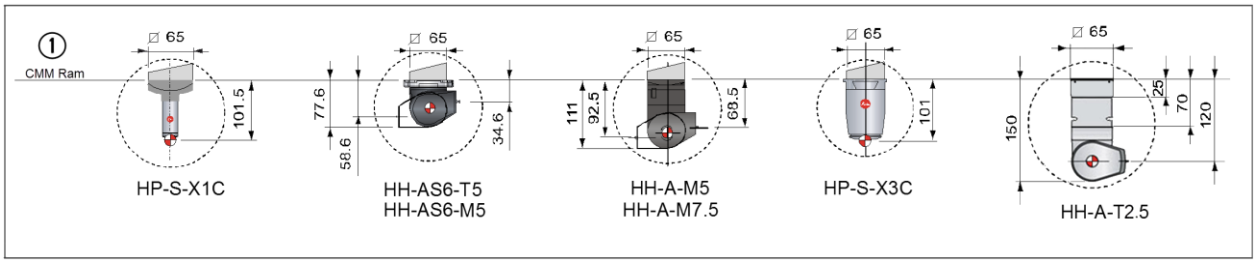


Figure 15 Overall Dimensions of the Machine - 05.yy.05 Models

Notice
Figure 15 measurements shown in mm only.



Notice

Not all probe heads are offered on all machines.

Model	Strokes mm (in)			Overall Dimensions mm (in)				Daylights mm (in)	
	X	Y	Z	Lx	Lx1	Ly	Lz	Dz	Dz1
05.05.05	500 (19.7)	500 (19.7)	500 (19.7)	1024 (40.3)	928 (36.5)	1255 (49.4)	2540 (100.0)	130 (5.1)	775 (30.5)
05.07.05	500 (19.7)	700 (27.6)	500 (19.7)	1024 (40.3)	928 (36.5)	1455 (57.3)	2540 (100.0)	130 (5.1)	775 (30.5)

Table 6 Strokes, Dimensions and Daylights - 05.yy.05 Models

Model	Dimensions of Work Table mm (in)			Distances between Supporting Points mm (in)			Position of Inserts mm (in)	Max. Weight of Part kg (lb)	Weight kg (lb)
	Ph	Py	Pz	Sy	Sy1	Sx	D1		
05.05.05	800 (31.5)	990 (39.0)	158 (6.2)	140 (5.5)	701 (27.6)	692 (27.2)	20 (0.8)	227 (500)	510 (1124)
05.07.05	800 (31.5)	1190 (46.9)	158 (6.2)	133 (5.2)	866 (34.1)	692 (27.2)	25 (1.0)	227 (500)	625 (1378)

Table 7 Dimensions of Work Table, Distances between Supporting Points, Position of Inserts and Weights - 05.yy.05 Models

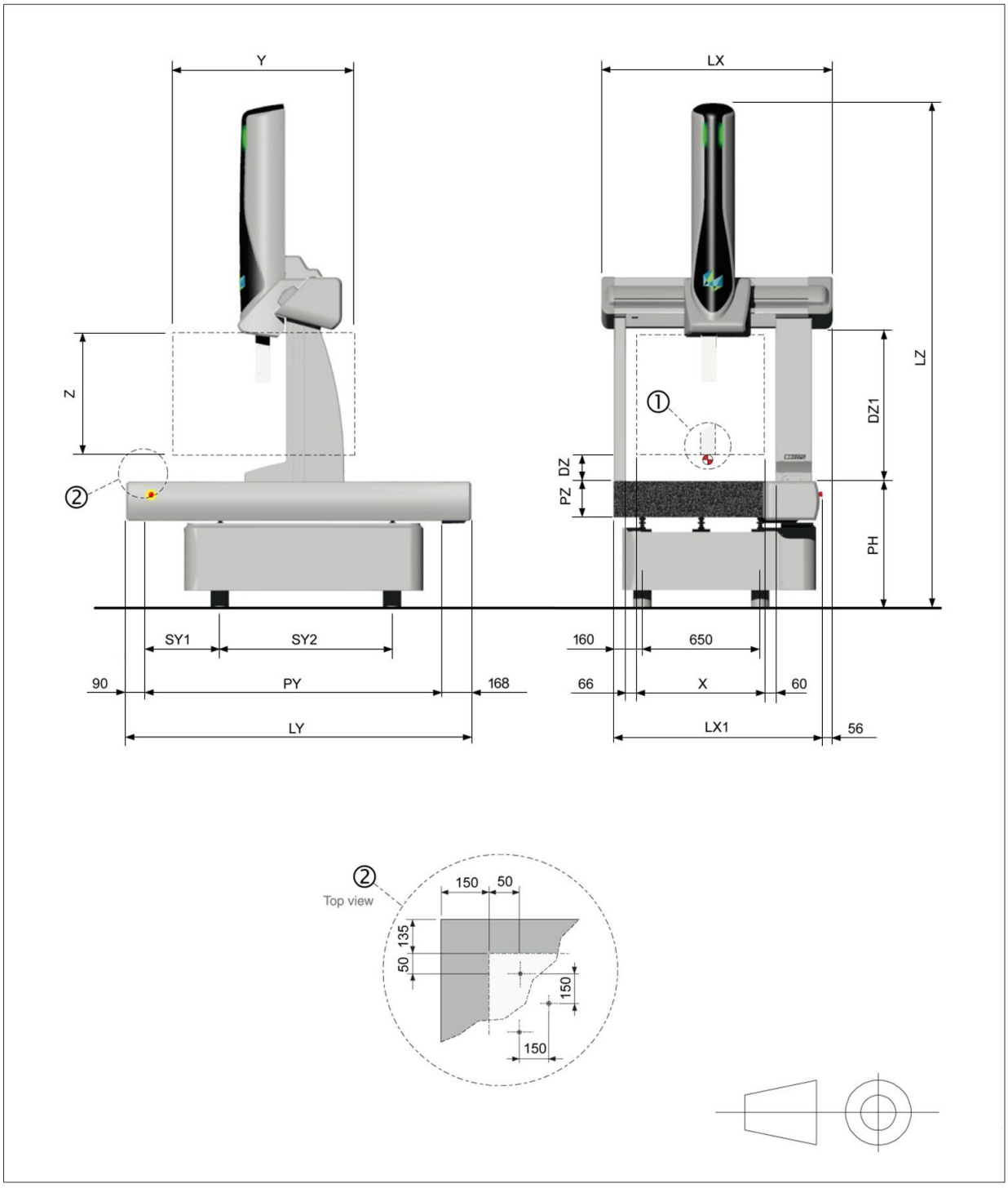
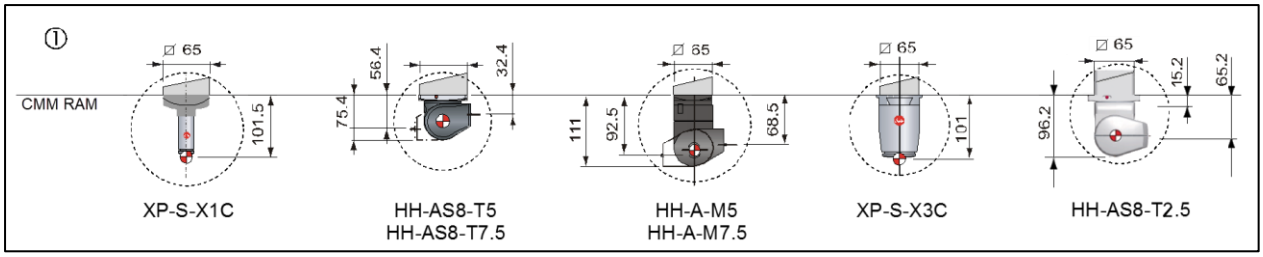


Figure 16 Overall Dimensions of the Machine - 07.yy.07 Models

Notice

Figure 16 measurements shown in mm only.



Notice

Not all probe heads are offered on all machines.

Model	Strokes mm (in)			Overall Dimensions mm (in)				Daylights mm (in)	
	X	Y	Z	Lx	Lx1	Ly	Lz	Dz	Dz1
07.10.07	700 (27.6)	1000 (39.4)	660 (26.0)	1289 (50.7)	1154 (45.4)	1908 (75.1)	2777 (109.3)	140 (5.5)	839 (33.0)

Table 8 Strokes, Dimensions and Daylights - 07.yy.07 Models

Model	Dimensions of Work Table mm (in)			Distances between Supporting Points mm (in)		Position of Inserts mm (in)	Max. Weight of Part kg (lb)	Weigh kg (lb)
	Ph	Py	Pz	Sy1	Sy2	D1		
07.10.07	700 (27.6)	1650 (65.0)	200 (7.9)	430 (16.9)	950 (37.4)	50 (2.0)	900 (1984)	1255 (2767)

Table 9 Dimensions of Work Table, Distances between Supporting Points, Position of Inserts and Weights - 07.yy.07 Models

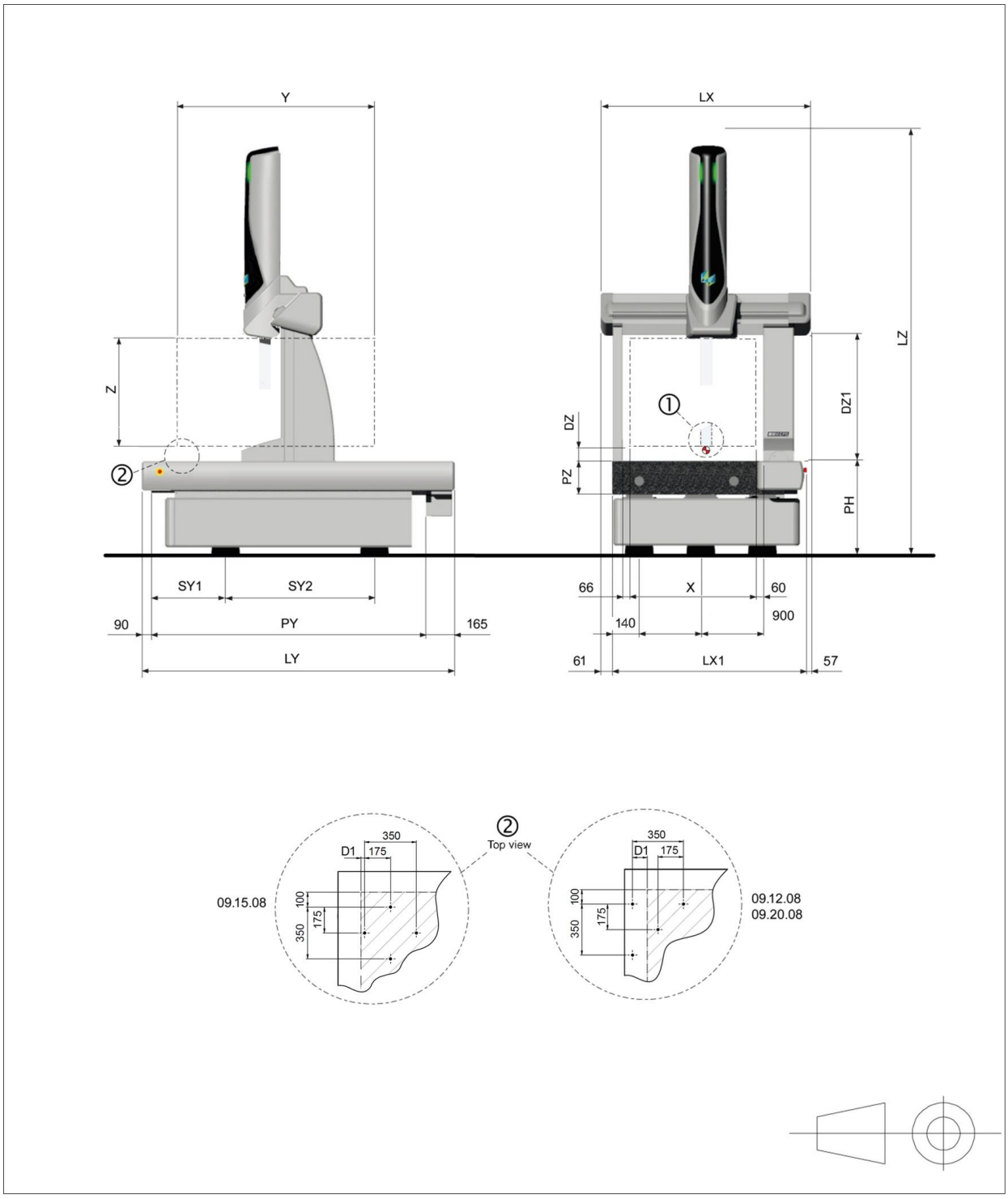
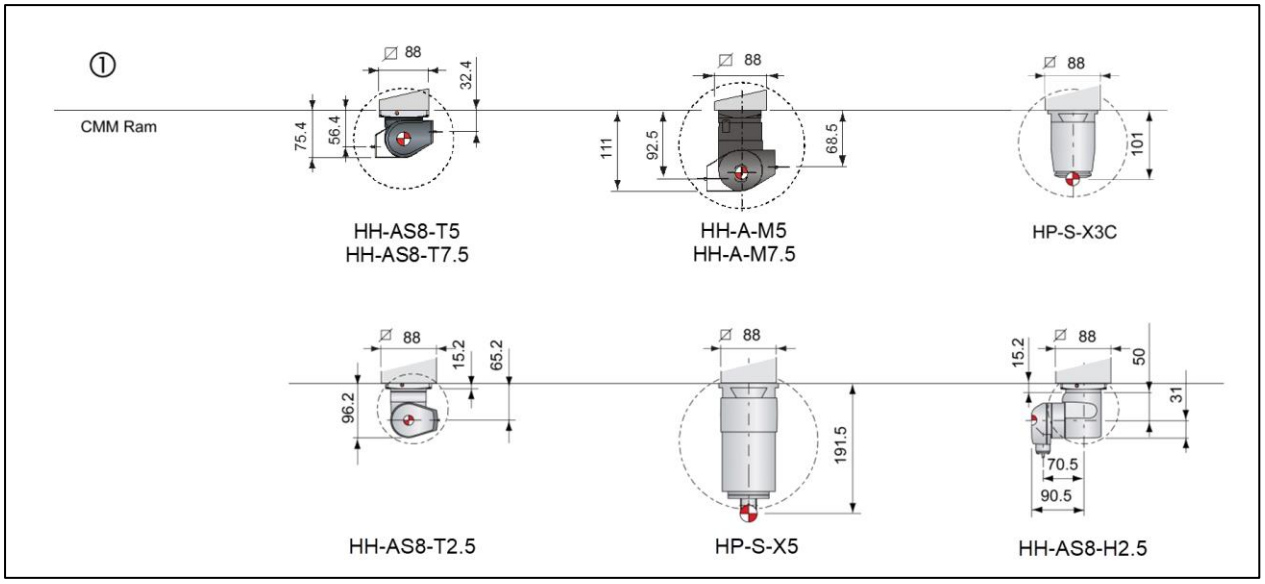


Figure 17 Overall Dimensions of the Machine - 09.yy.08 Models (with DC241 Controller)

Notice
Figure 17 measurements shown in mm only.



Notice

Not all probe heads are offered on all machines.

Model	Strokes mm (in)			Overall Dimensions mm (in)				Daylights mm (in)	
	X	Y	Z (1)	Lx	Lx1	Ly	Lz	Dz	Dz1
09.12.08	900 (35.4)	1200 (47.2)	800 (31.5)	1477 (58.1)	1359 (53.5)	2165 (85.2)	3027 (119.2)	117 (4.6)	945 (37.2)
09.15.08	900 (35.4)	1500 (59.1)	800 (31.5)	1477 (58.1)	1359 (53.5)	2465 (97.0)	3027 (119.2)	117 (4.6)	945 (37.2)
09.20.08	900 (35.4)	2000 (78.7)	800 (31.5)	1477 (58.1)	1359 (53.5)	2965 (116.7)	3027 (119.2)	117 (4.6)	945 (37.2)

(1) With HP-S-X5 probe head, Z stroke = 665 mm (26.2in).

Table 10 Strokes, Dimensions and Daylights - 09.yy.08 Models (with DC241 Controller)

Model	Dimensions of Work Table mm (in)			Distances between Supporting Points mm (in)		Position of Inserts mm (in)	Max. Weight of Part kg (lb)	Weight kg (lb)
	Ph	Py	Pz	Sy1	Sy2	D1		
09.12.08	700 (27.6)	1910 (75.1)	230 (9.1)	455 (17.9)	1000 (39.4)	76 (3.0)	1300 (2886)	1670 (3682)
09.15.08	700 (27.6)	2210 (87.0)	230 (9.1)	540 (21.3)	1130 (44.5)	51 (2.0)	1500 (3307)	1870 (4123)
09.20.08	700 (27.6)	2710 (106.7)	230 (9.1)	680 (26.7)	1350 (53.1)	126 (5.0)	1800 (3968)	2270 (5004)

Table 11 Dimensions of Work Table, Distances between Supporting Points, Position of Inserts and Weights - 09.yy.08 Models (with DC241 Controller)

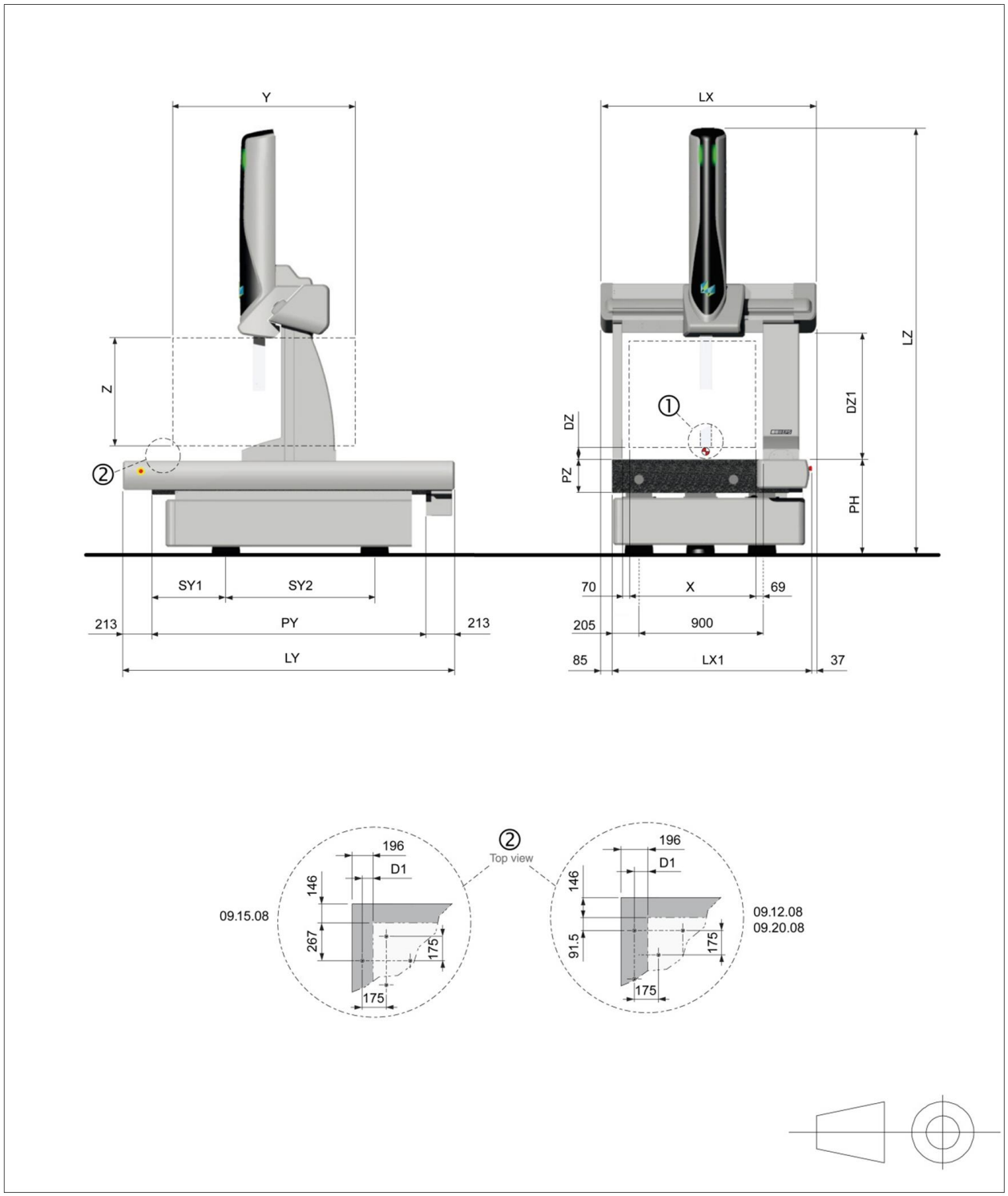
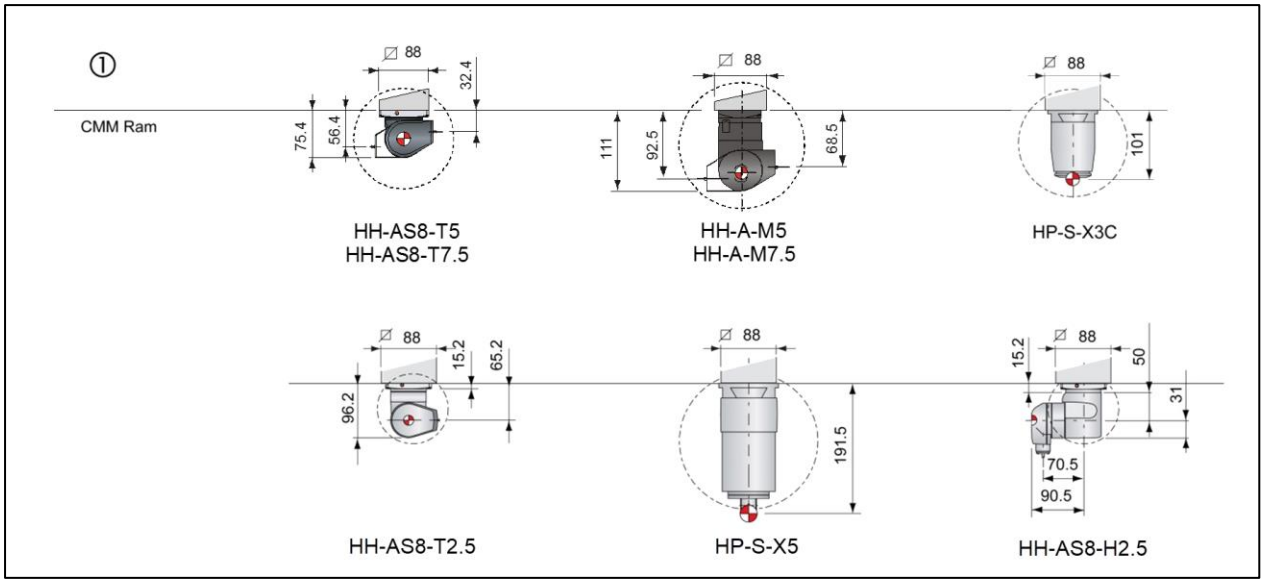


Figure 18 Overall Dimensions of the Machine - 09.yy.08 Models (with DC800C or DC800 I/O-Ready Controller)

Notice

Figure 18 measurements shown in mm only.



Notice

Not all probe heads are offered on all machines.

Model	Strokes mm (in)			Overall Dimensions mm (in)				Daylights mm (in)	
	X	Y	Z (1)	Lx	Lx1	Ly	Lz	Dz	Dz1
09.12.08	900 (35.4)	1200 (47.2)	800 (31.5)	1598 (62.9)	1475 (58.1)	2455 (96.7)	3160 (124.4)	117 (4.6)	936 (36.9)
09.15.08	900 (35.4)	1500 (59.1)	800 (31.5)	1598 (62.9)	1475 (58.1)	2755 (108.5)	3160 (124.4)	117 (4.6)	936 (36.9)
09.20.08	900 (35.4)	2000 (78.7)	800 (31.5)	1598 (62.9)	1475 (58.1)	3255 (128.1)	3185 (125.4)	117 (4.6)	936 (36.9)

(1) With HP-S-X5 probe head, Z stroke = 665 mm (26.2in).

Table 12 Strokes, Dimensions and Daylights - 09.yy.08 Models (with DC800C or DC800 I/O-Ready Controller)

Model	Dimensions of Work Table mm (in)			Distances between Supporting Points mm (in)		Position of Inserts mm (in)	Max. Weight of Part kg (lb)	Weight kg (lb)
	Ph	Py	Pz	Sy1	Sy2	D1		
09.12.08	700 (27.6)	2030 (79.9)	250 (9.8)	550 (21.7)	1100 (43.3)	76 (3.0)	1300 (2886)	2300 (5071)
09.15.08	700 (27.6)	2330 (91.7)	250 (9.8)	600 (23.6)	1200 (47.2)	51 (2.0)	1500 (3307)	2600 (5732)
09.20.08	725 (28.5)	2830 (111.4)	275 (10.8)	700 (27.6)	1450 (57.1)	126 (5.0)	1800 (3968)	3300 (7275)

Table 13 Dimensions of Work Table, Distances between Supporting Points, Position of Inserts and Weights - 09.yy.08 Models (with DC800C or DC800 I/O-Ready Controller)

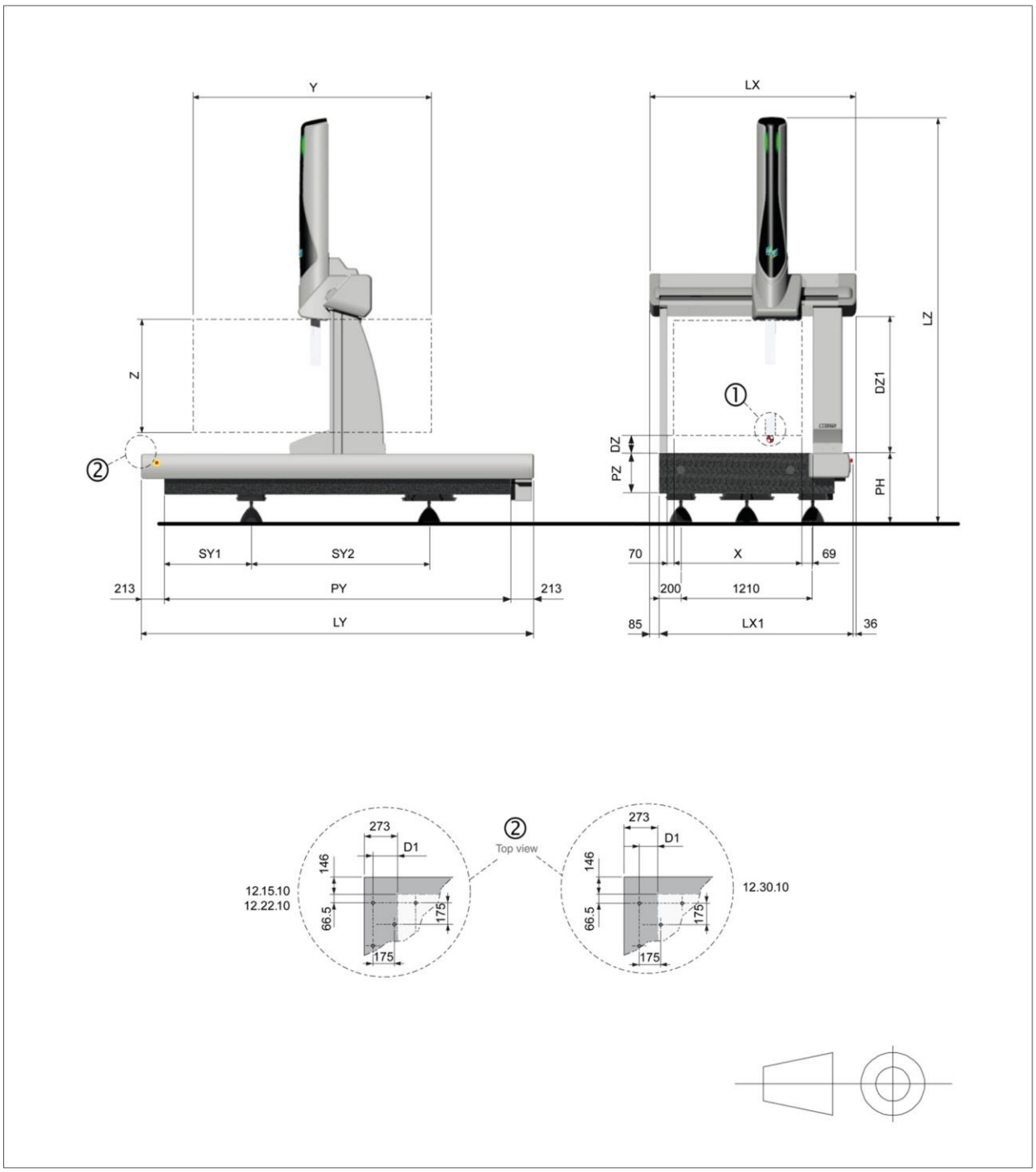
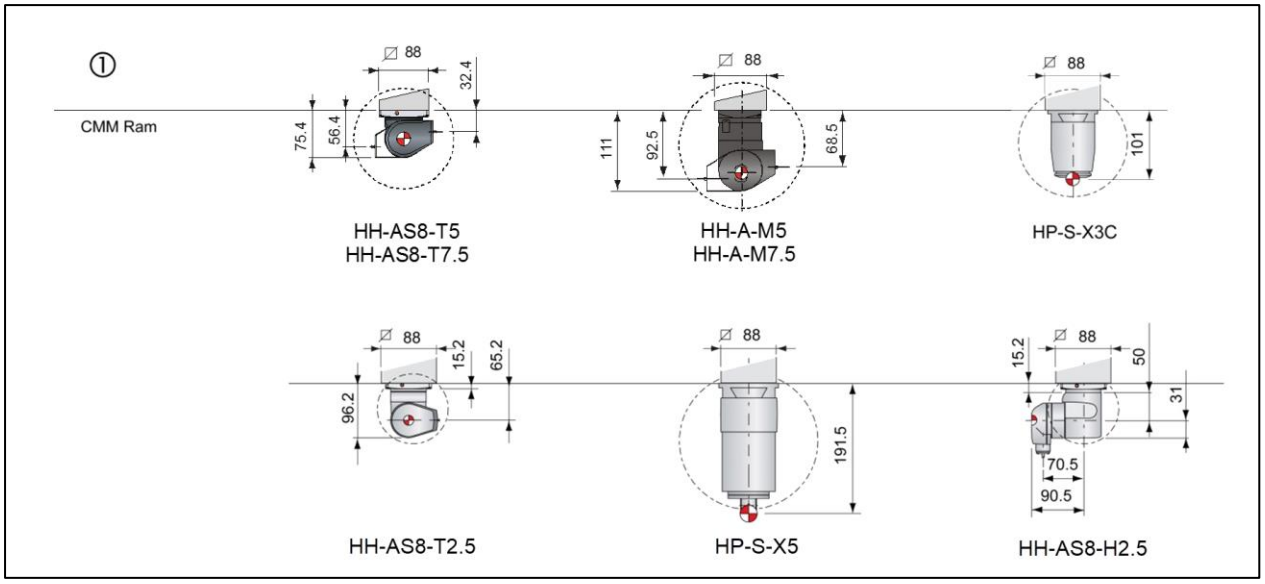


Figure 19 Overall Dimensions of the Machine - 12.yy.10 Models

Notice

Figure 19 measurements shown in mm only.



Notice

Not all probe heads are offered on all machines.

Model	Strokes mm (in)			Overall Dimensions mm (in)				Daylights mm (in)	
	X	Y	Z (1)	Lx	Lx1	Ly	Lz	Dz	Dz1
12.15.10	1200 (47.2)	1500 (59.1)	1000 (39.4)	1838 (72.4)	1757 (69.2)	2905 (114.4)	3513 (138.3)	150 (5.9)	1180 (46.5)
12.22.10	1200 (47.2)	2200 (86.6)	1000 (39.4)	1898 (74.7)	1757 (69.2)	3605 (141.9)	3488 (137.3)	150 (5.9)	1180 (46.5)
12.30.10	1200 (47.2)	3000 (118.1)	1000 (39.4)	1898 (74.7)	1757 (69.2)	4405 (173.4)	3513 (138.3)	150 (5.9)	1180 (46.5)

(1) With HP-S-X5 probe head, Z stroke = 665 mm (26.2in).

Table 14 Strokes, Dimensions and Daylights - 12.yy.10 Models

Model	Dimensions of Work Table mm (in)			Distances between Supporting Points mm (in)		Position of Inserts mm (in)	Max. Weight of Part kg (lb)	Weight kg (lb)
	Ph	Py	Pz	Sy1	Sy2	D1		
12.15.10	625 (24.6)	2480 (97.6)	290 (11.4)	650 (25.6)	1300 (51.2)	149 (5.9)	1800 (3968)	3800 (8378)
12.22.10	600 (23.6)	3180 (125.2)	350 (13.8)	800 (31.5)	1630 (64.2)	149 (5.9)	2250 (4960)	5700 (12566)
12.30.10	625 (24.6)	3980 (156.7)	380 (15.0)	1000 (39.4)	1980 (78.0)	24 (0.9)	2250 (4960)	7600 (16755)

Table 15 Dimensions of Work Table, Distances between Supporting Points, Position of Inserts and Weights - 12.yy.10 Models

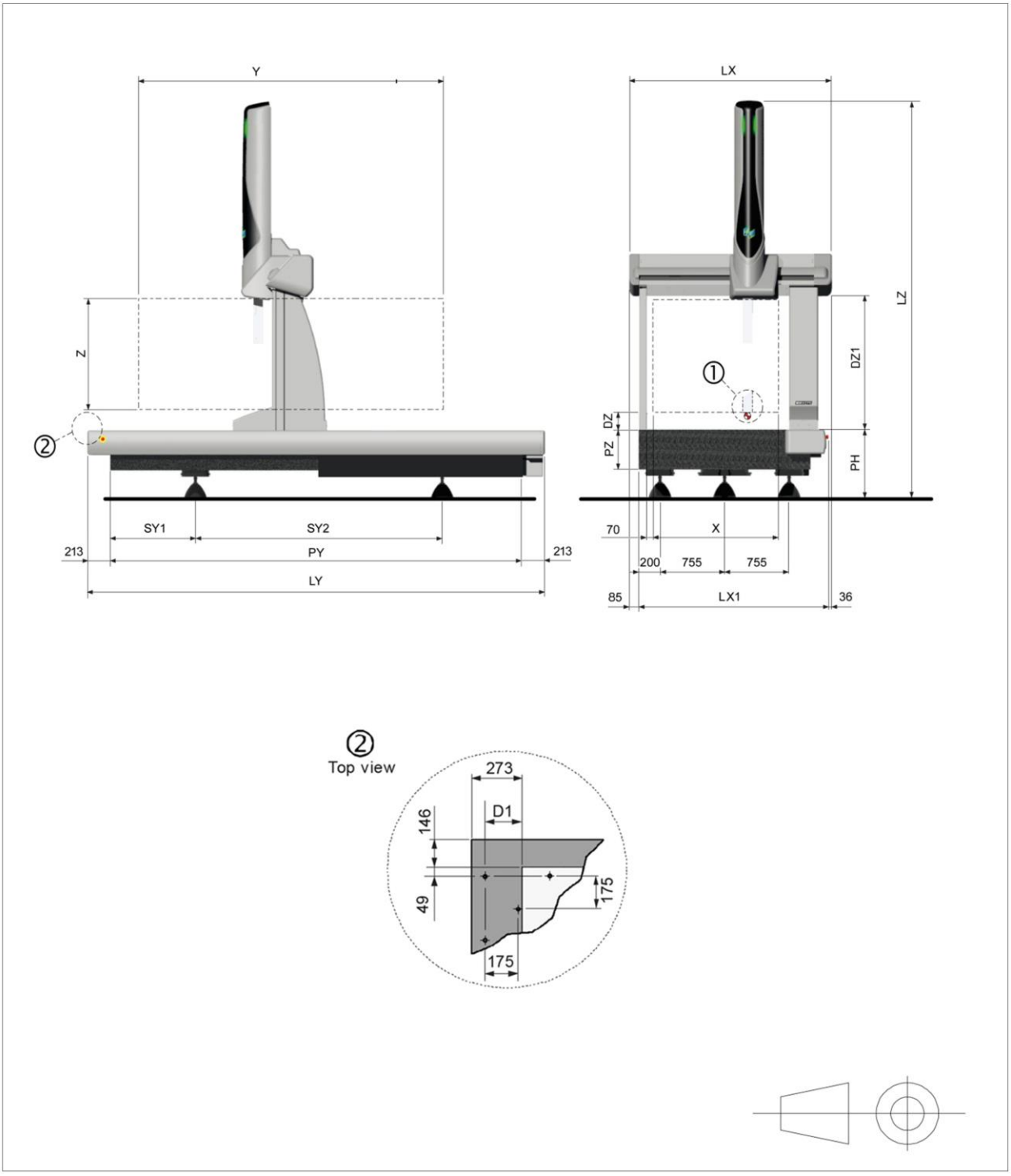
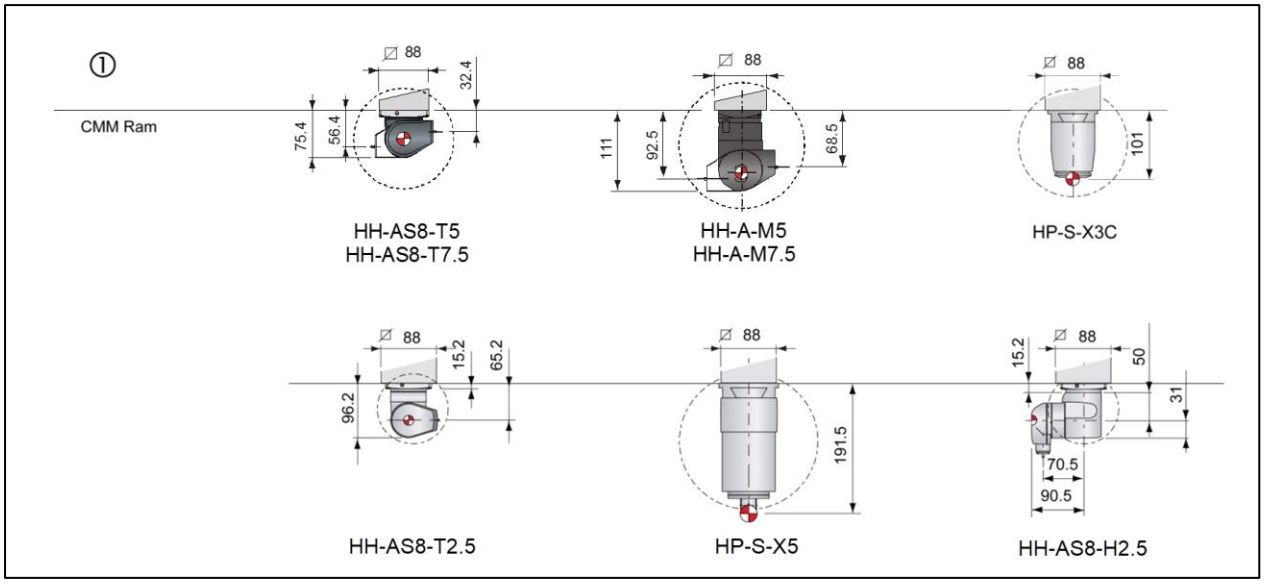


Figure 20 Overall Dimensions of the Machine – 15.yy.10 Models

Notice
Figure 20 measurements shown in mm only.



Notice

Not all probe heads are offered on all machines.

Model	Strokes mm (in)			Overall Dimensions mm (in)				Daylights mm (in)	
	X	Y	Z	Lx	Lx1	Ly	Lz	Dz	Dz1
15.22.10	1500 (59.1)	2200 (86.6)	1000 (39.4)	2138 (84.2)	2057 (81.0)	3605 (141.9)	3488 (137.3)	80 (3.1)	1080 (42.5)
15.30.10	1500 (59.1)	3000 (118.1)	1000 (39.4)	2138 (84.2)	2057 (81.0)	4405 (173.4)	3513 (138.3)	80 (3.1)	1080 (42.5)

(1) With HP-S-X5 probe head, Z stroke = 665 mm (26.2in).

Table 16 Strokes, Dimensions and Daylights – 15.yy.10 Models

Model	Dimensions of Work Table mm (in)			Distances between Supporting Points mm (in)		Position of Inserts mm (in)	Max. Weight of Part kg (lb)	Weight kg (lb)
	Ph	Py	Pz	Sy1	Sy2	D1		
15.22.10	600 (23.6)	3180 (125.2)	290 (11.4)	800 (31.5)	1630 (64.2)	149 (5.9)	2250 (4960)	6630 (14617)
15.30.10	625 (24.6)	3980 (156.7)	350 (13.8)	1000 (39.4)	1980 (78.0)	24 (0.9)	2250 (4960)	8865 (19544)

Table 17 Dimensions of Work Table, Distances between Supporting Points, Positions of Inserts and Weights – 15.yy.10 Models

Work Table

Material	Granite
Flatness	Compliant to DIN 876/III
Part fixing	M8 x 1.25 threaded inserts. Thread length 20 mm (0.8 in). Drilling pattern, see the overall view drawings for the specific model in this chapter.

Column Counterbalancing System

Type	Pneumatic and adjustable.
Max. weight applicable to the column	4 kg (9 lb)
Maximum weight that can be added to, or removed from, the counterbalanced column without having to rebalance the weight of the column itself and without altering the machine's measuring precision	1 kg (2 lb)

Operator Workstation Dimensions

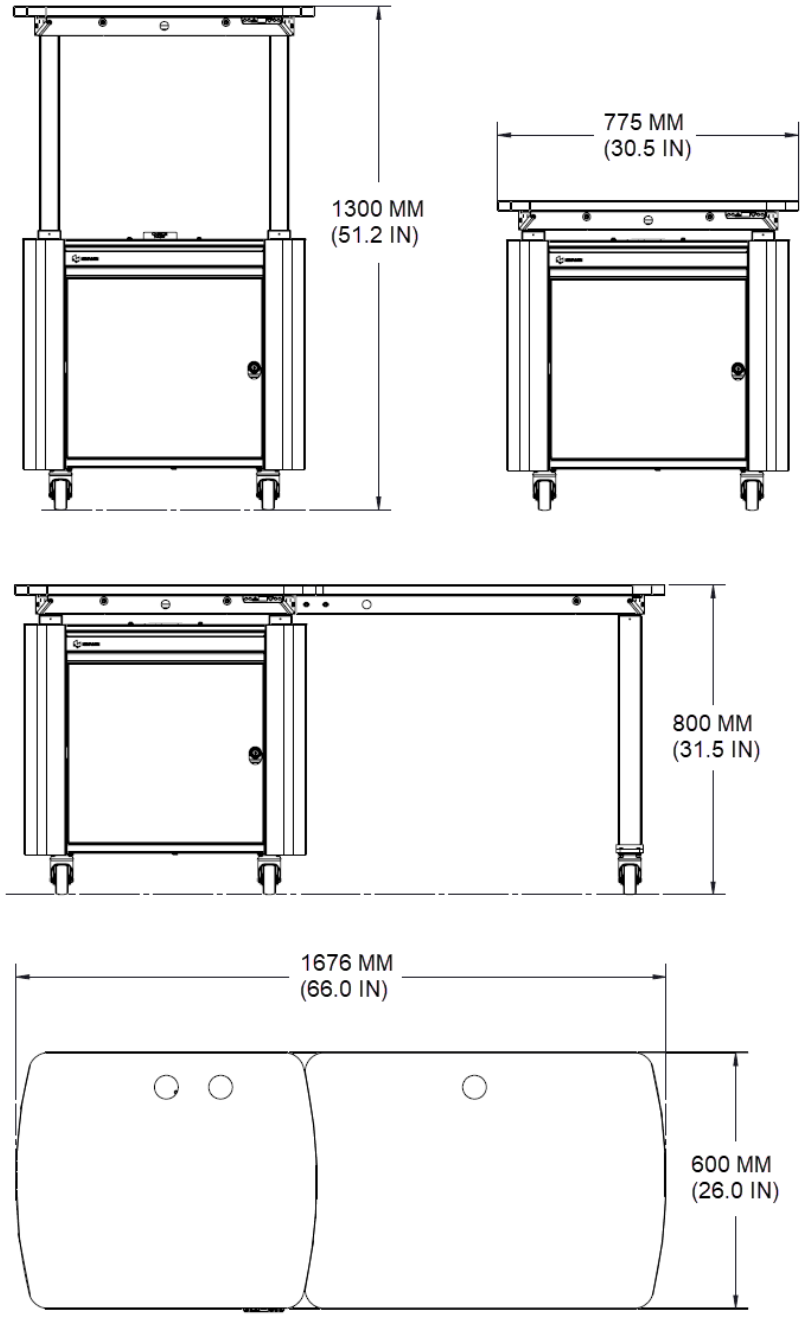


Figure 21 Overall Dimensions of the Operator Workstation

Operator Workstation weight	113 kg (250 lb)
Desk Extension weight	32 kg (70 lb)
Max. workstation load limit	890N (90kgf, 200 lb)

Description

This chapter provides a general description of the measuring machine and its components, and was written to help the operator to perform the operating and maintenance operations.

The chapter discusses the following topics:

- Structure and main components of the machine
- Axis position transduction system
- Axis drive system
- Axis sliding system
- Air supply system and pneumatic appliances

Structure and Components

Figure 22 shows the measuring machine without guards and bellows to facilitate the identification of its main components.

Granite Work Table

The Granite Work Table is a single granite block, which acts both as a work table, and a support for the machine's moving parts. The workpiece to be measured and any clamping equipment required are placed on the work table. The workpiece can be fixed to the work table using the threaded inserts embedded in the body of the granite.
The guideways for the main carriage are machined into the granite.
The granite rests on three anti-vibration supports whose function is to support the weight of the measuring machine and eliminate any vibrations coming from the outside. Two anti-tilt feet perform the dual function of supporting the measuring machine during installation and preventing it from overturning once it has been placed on the anti-vibration supports. The anti-tilt feet are not to touch the granite; in particular, when the maximum load is placed on the work table, the top end of the two feet must be about 2-3 millimetres from the bottom surface of the granite. On models 05.yy.05 and 07.yy.07 the anti-vibration supports rest on the bench, while on models 09.yy.08, 12.yy.10 and 15.yy.10 the vibration supports rest directly on the floor.
As an option, the machine can be fitted with active pneumatic anti-vibration supports if required by operating conditions.

Main Carriage

The main carriage represents the Y axis and is made up of a beam with a triangular cross section and two legs (right leg and left leg). The main carriage runs along the work table on air bearings applied to the bottom ends of the legs. The guideway for the left leg is machined directly into the top surface of the work table, while the three guideways for the right leg are on the surfaces of the guide machined into the body of the granite.
On the front of the beam there is the belt for driving the X axis, while along its bottom surface there is the optical scale.
At the right end of the beam are fixed the X axis drive and the pressure regulator of the Z-rail counterbalancing system. Two elastic X axis stroke end pads are also secured at the two ends of the beam.

Central Carriage

The central carriage represents the X axis and is assembled on the beam of the main carriage. It runs along the guideways machined to the surfaces of the beam.
The air bearings and optical readers of the X and Z axes and the reduction unit of the Z axis are fixed to the central carriage. The cable of the Z-rail counterbalancing cylinder and the stroke end stop are fixed to the top of the frame.

Z-rail

The Z-rail runs vertically inside the central carriage. The weight of the assembly made up of the Z-rail, head and tool is balanced by an air supply system. This system is used to reduce the load on the elements of the drive system to a minimum.
The optical scale of the Z axis is applied to the Z-rail. At the bottom end of the Z-rail there is the flange for attaching the measuring head.

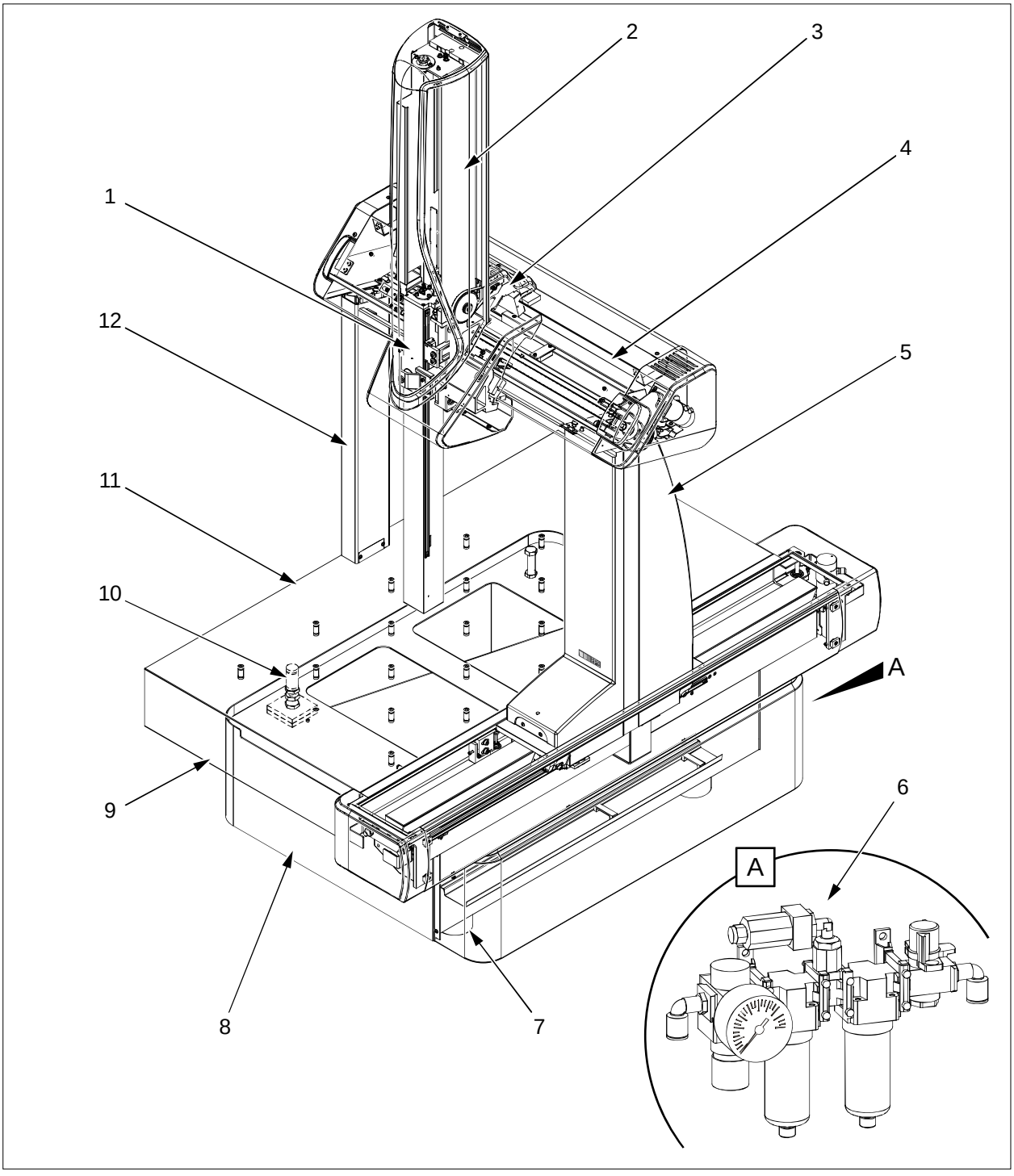


Figure 22 Components of the Measuring Machine 5.yy.05 and 7.yy.07 Models

1. Z-rail
2. Z-tower
3. Central carriage
4. Main carriage (beam)
5. Main carriage (right leg)
6. Pneumatic control unit
7. Anti-vibration support
8. Machine stand
9. Granite
10. Anti-vibration support
11. Work table
12. Main carriage (left leg)

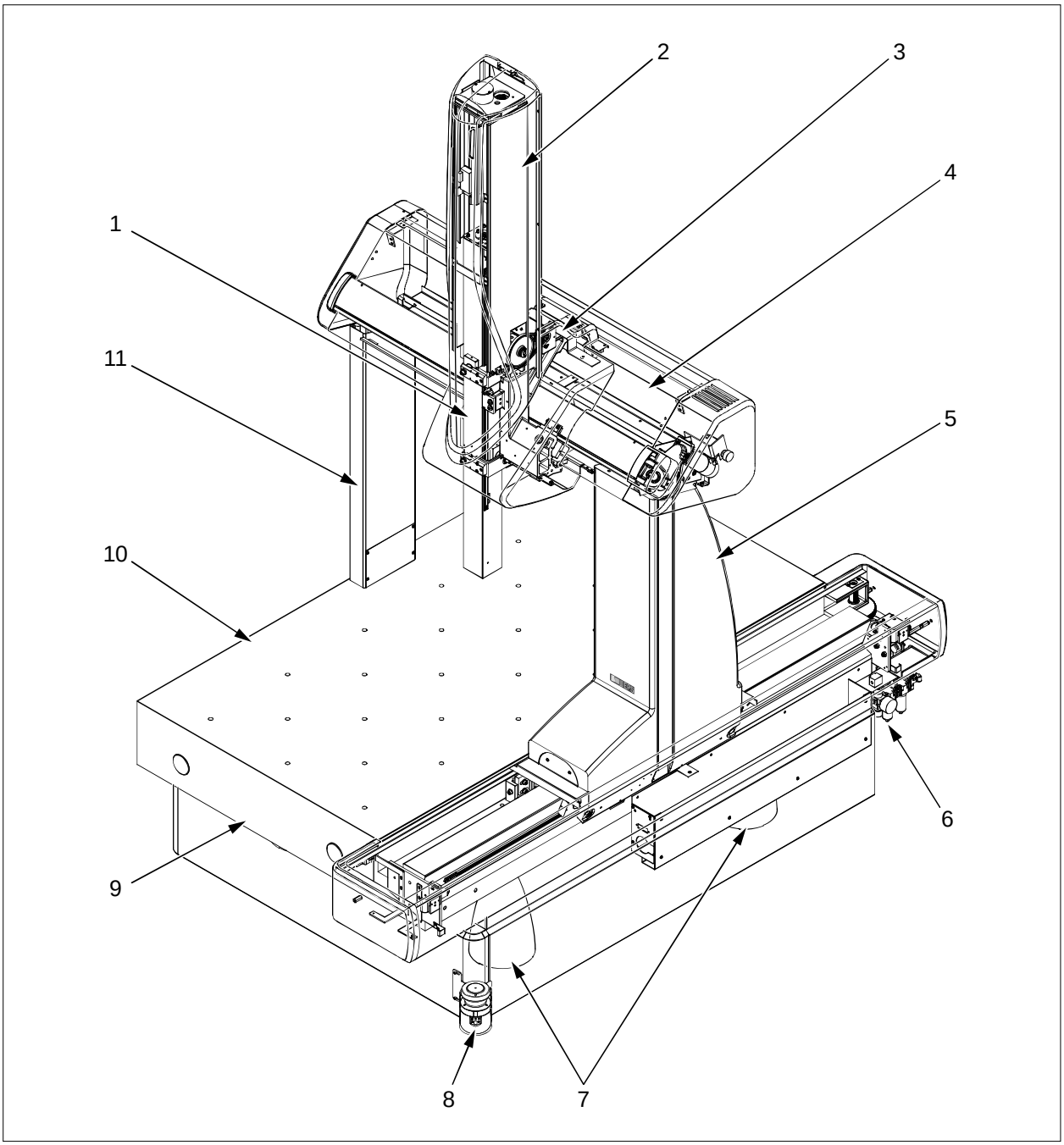


Figure 23 Components of the Measuring Machine 09.yy.08, 12.yy.10 and 15.yy.10 Models

1. Z-rail
2. Z-tower
3. Central carriage
4. Main carriage (beam)
5. Main carriage (right leg)
6. Pneumatic control unit
7. Anti-vibration support pedestal
8. Optional Laser scanner
9. Granite
10. Work table
11. Main carriage (left leg)

Axis Position Transduction System

Each axis is equipped with a linear optical transducer consisting of an optical scale and a position reader, which micrometrically detects the position of the axis and reads the movement.
When an axis moves, the position reader generates electrical pulses which it sends to the control system. The control system counts the pulses and converts them into the corresponding axis movement.
The movement of an axis is always calculated with respect to a reference point, called “zero”, which corresponds more or less to the axis stroke end position (main carriage back, central carriage to the left and Z-rail at the top).

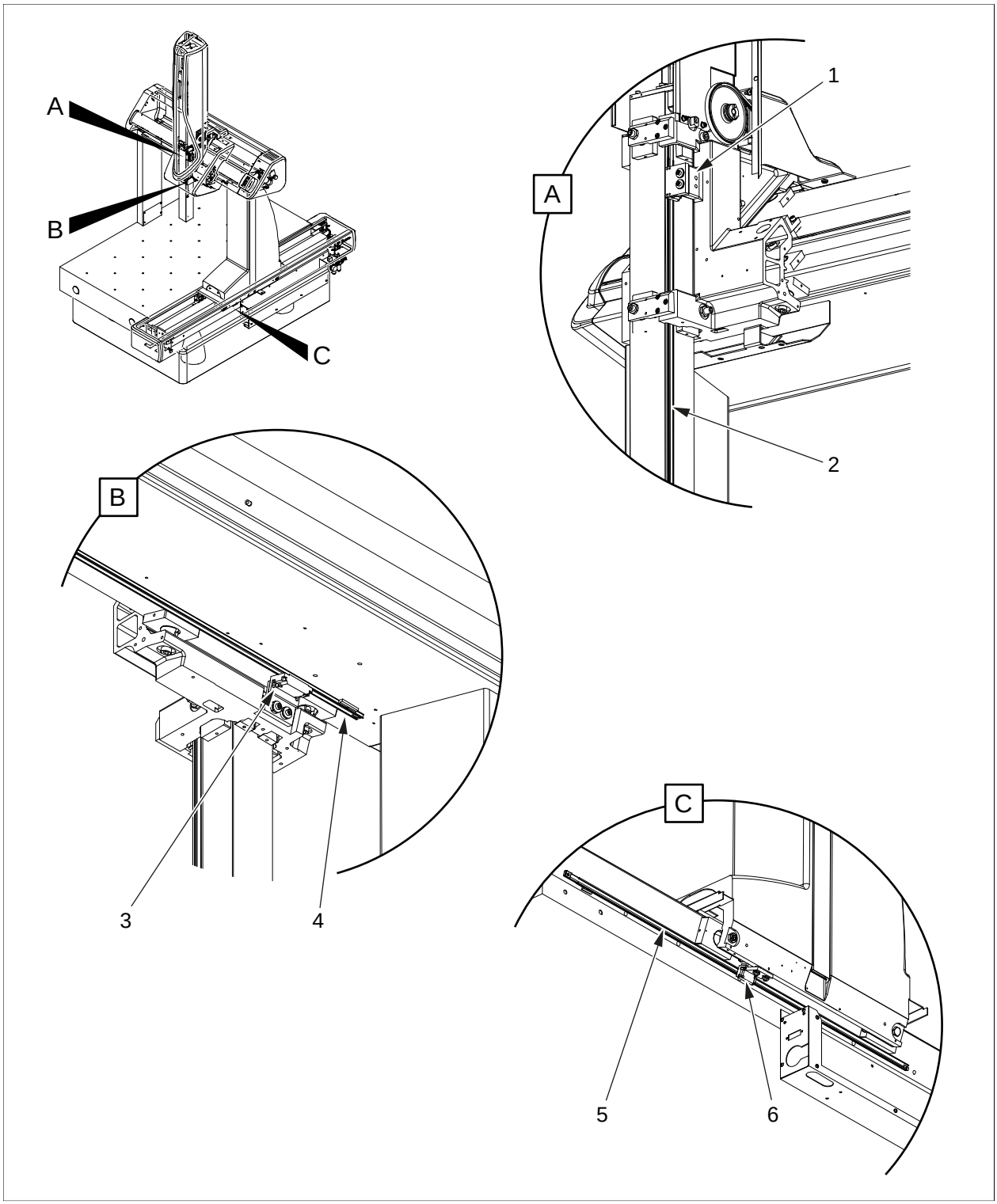


Figure 24 Axis Position Transduction System

1. Optical reader (Z axis)
2. Optical scale (Z axis)
3. Optical reader (X axis)
4. Optical scale (X axis)
5. Optical scale (Y axis)
6. Optical reader (Y axis)

Axis Driving System

The movements of each axis are executed by a cog belt system driven by a direct current motor.
The moving part of the axis is fixed, by means of a drive unit, to the closed-loop cog belt attached to two pulleys (one drive and one return pulley). The drive pulley is driven by a belt reduction unit.

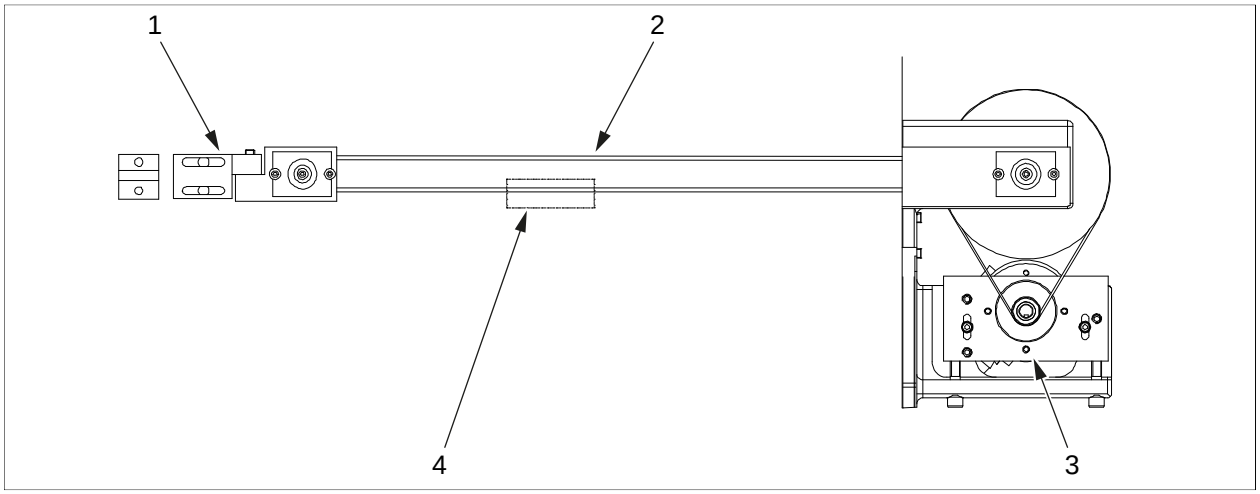


Figure 25 Axis Driving System

1. Belt tightener
2. Cog belt
3. Driving unit
4. Reduction unit

The reduction unit of the Y axis is fixed to the rear edge of the work table, while that of the X axis is fixed to the right end of the beam and that of the Z axis is fixed to the central carriage.
The axis movement system is provided with elastic joints which prevent transmission of intrinsic machine vibrations to the measuring device.

This solution, associated to appropriate firmware algorithms aimed at reducing any effects of machine movements, allows to perform measurements at high speed without penalising accuracy and improving performance for all other measurement types.

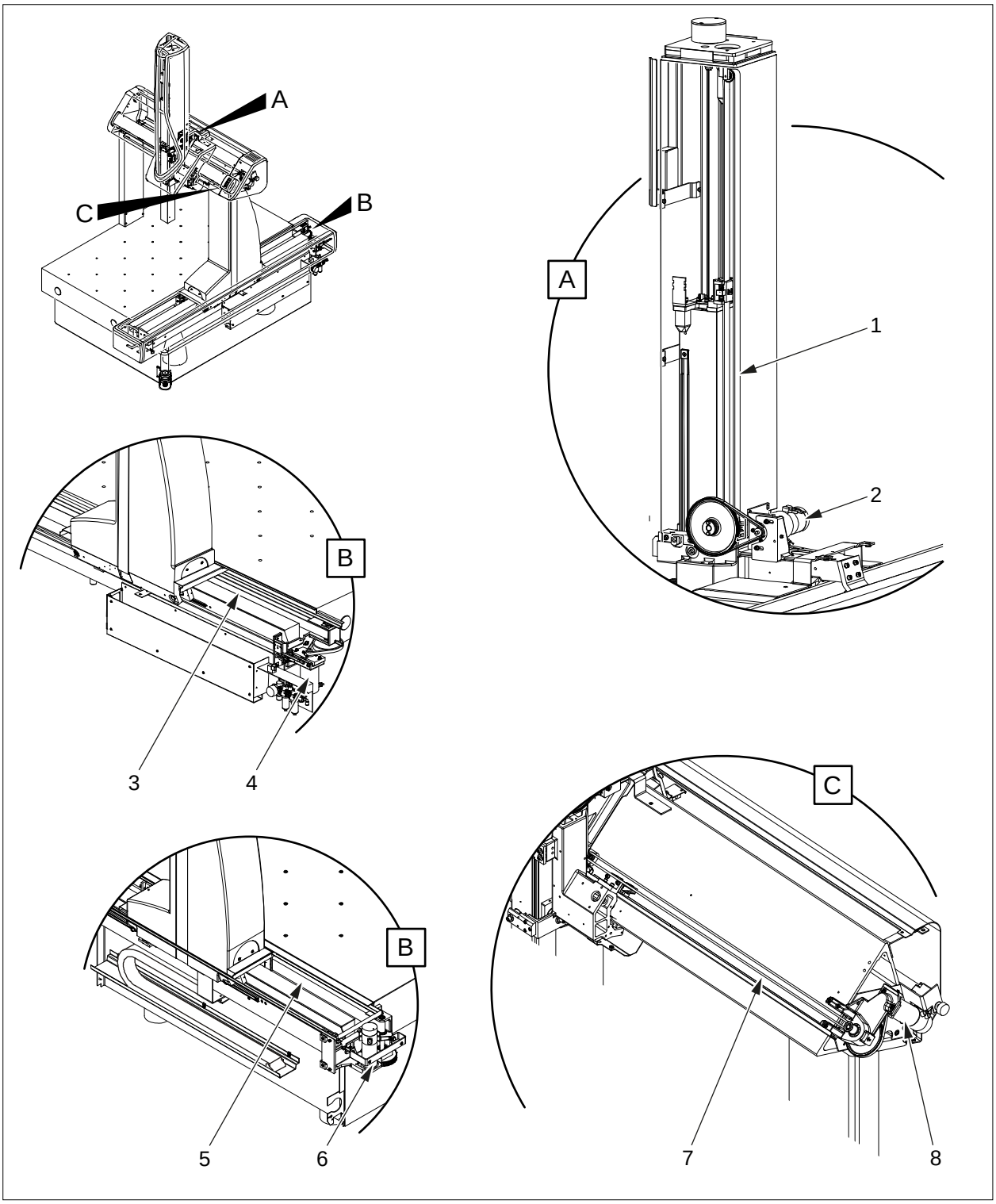


Figure 26 Axis Driving System

1. Driving belt (Z axis)
2. Reduction unit (Z axis)
3. Driving belt (Y axis) – 09.yy.08, 12.yy.10, 15.yy.10 Models
4. Reduction unit (Y axis) – 09.yy.08, 12.yy.10,15.yy.10 Models
5. Driving belt (Y axis) – 05.yy.05, 07.yy.07 Models
6. Reduction unit (Y axis) – 05.yy.05, 07.yy.07 Models
7. Driving belt (X axis)
8. Reduction unit (X axis)

Axis Sliding System

The axis sliding system consists of air bearings that ensure the support and friction–free movement of the moving parts of the axes (main carriage, central carriage and Z-rail).

The moving parts are supported by a flow of compressed air, which comes from the pneumatic control unit. The flow supplies the bearings so as to form an air cushion between the bearings and the guideways.

Caution

Do not perform any operation on the components of the drive system apart from those specified in “Maintenance” on page 68. Operations performed incorrectly may cause operating problems (for example, blocking), and deterioration in the machine’s precision.

Central Carriage (X Axis)

The central carriage (X axis) is guided by six air bearings that run along four guideways machined into the surfaces of the beam. Three bearings run along the two guideways positioned on the front surface of the beam, another two run on the lower flat guideway, while the last bearing runs in the tilting guideway machined into the rear edge of the beam.

Main Carriage (Y Axis)

The main carriage (Y axis) is guided by seven air bearings that run along guideways machined into the granite work table.
The bearing of the left leg runs on the flat guideway machined directly into the surface of the work table, while the three pairs of bearings applied to the bottom end of the right leg run on the three surfaces of the swallow (dove) guideway machined into the right side of the work table.

Z-rail (Z Axis)

The Z-rail (Z axis) is guided by nine air bearings fixed to the central carriage. There are no dedicated guideways in that the surfaces of the Z-rail are used as guideways.
The rear surface of the Z-rail runs along three air bearings, while each of the remaining surfaces runs on two air bearings.

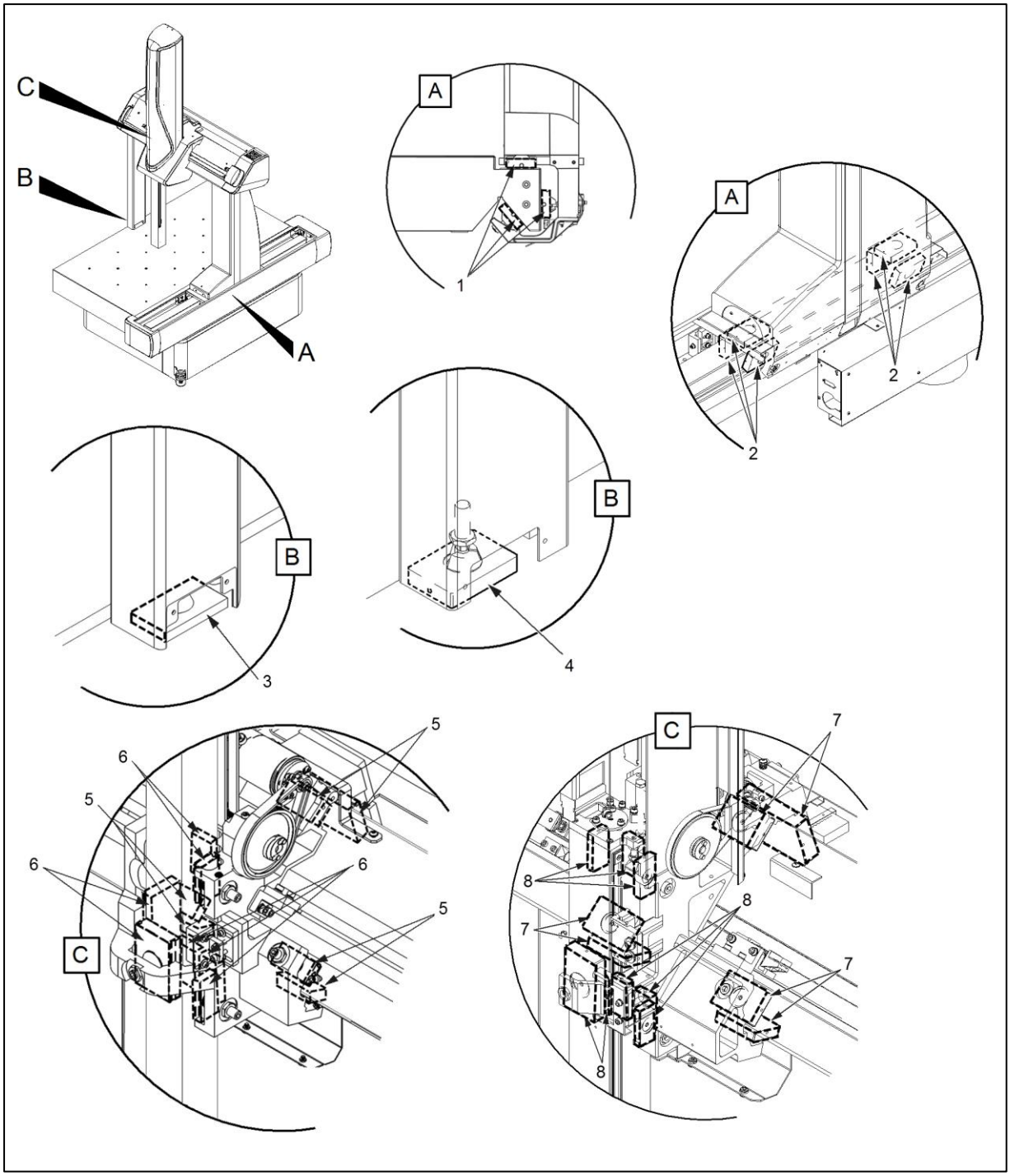


Figure 27 Axis Sliding System 05.yy.05 07.yy.07 Models

1. Air bearing on right leg (Y axis) – 05.yy.05 Models
2. Air bearing on right leg (Y axis) – 07.yy.07 Models
3. Air bearing on left leg (Y axis) – 05.yy.05 Models
4. Air bearing on left leg (Y axis) – 07.yy.07 Models
5. Air bearing (X axis) – 05.yy.05 Models
6. Air bearing (Z axis) – 05.yy.05 Models
7. Air bearing (X axis) – 07.yy.07 Models
8. Air bearing (Z axis) – 07.yy.07 Models

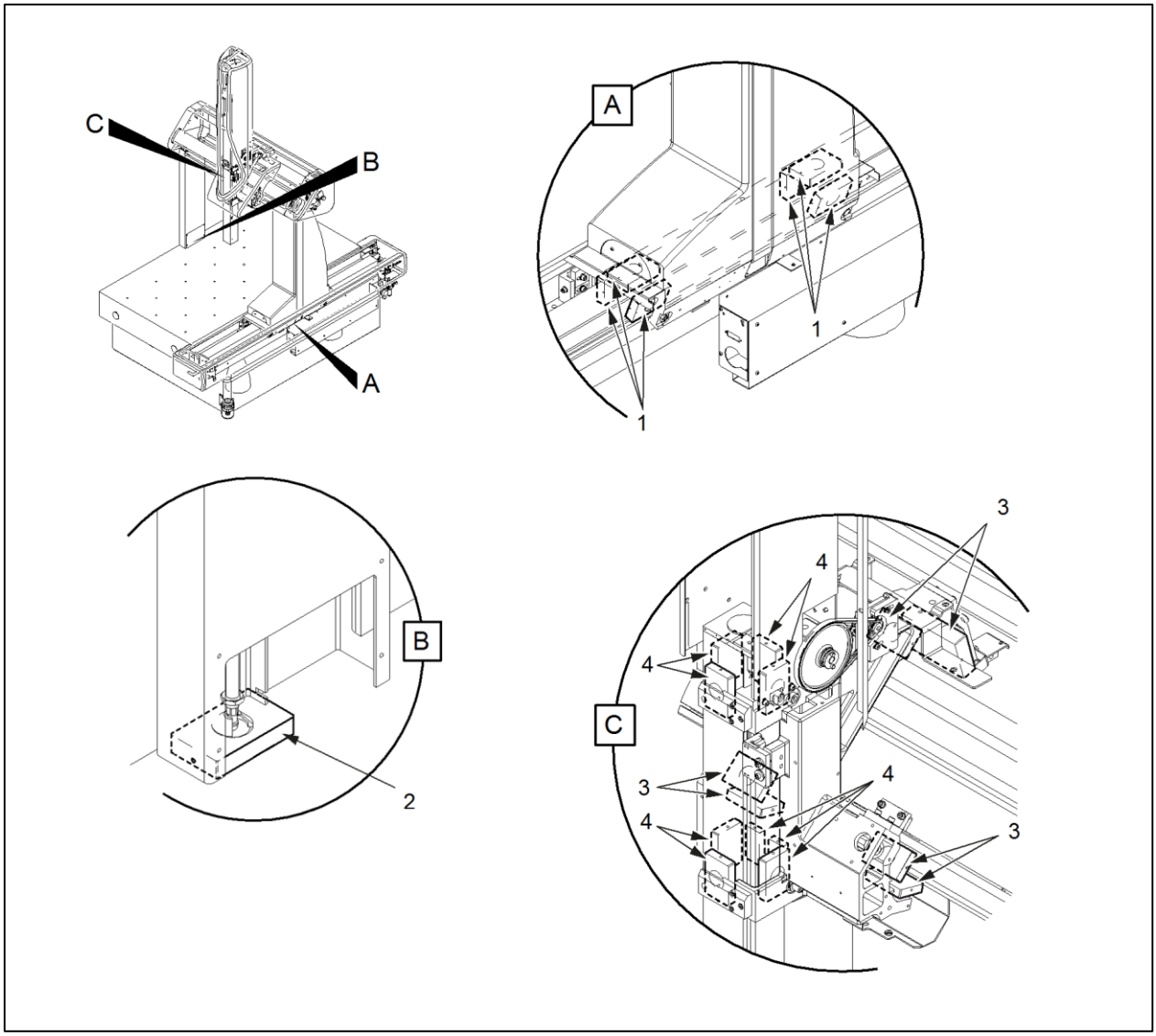


Figure 28 Axis Sliding System 09.yy.08, 12.yy.10, 15.yy.10 Models

1. Air bearing on right leg (Y axis) – 09.yy.08, 12.yy.10, 15.yy.10 Models
2. Air bearing on left leg (Y axis) – 09.yy.08, 12.yy.10, 15.yy.10 Models
3. Air bearing (X axis) – 09.yy.08, 12.yy.10, 15.yy.10 Models
4. Air bearing (Z axis) – 09.yy.08, 12.yy.10, 15.yy.10 Models

Air Supply System

The air supply system consists of the pneumatic control unit and the supply circuits and its function is to:

- supply the machine axis air bearing system.
- supply the pneumatic cylinder for counterbalancing the weight of the Z-rail.

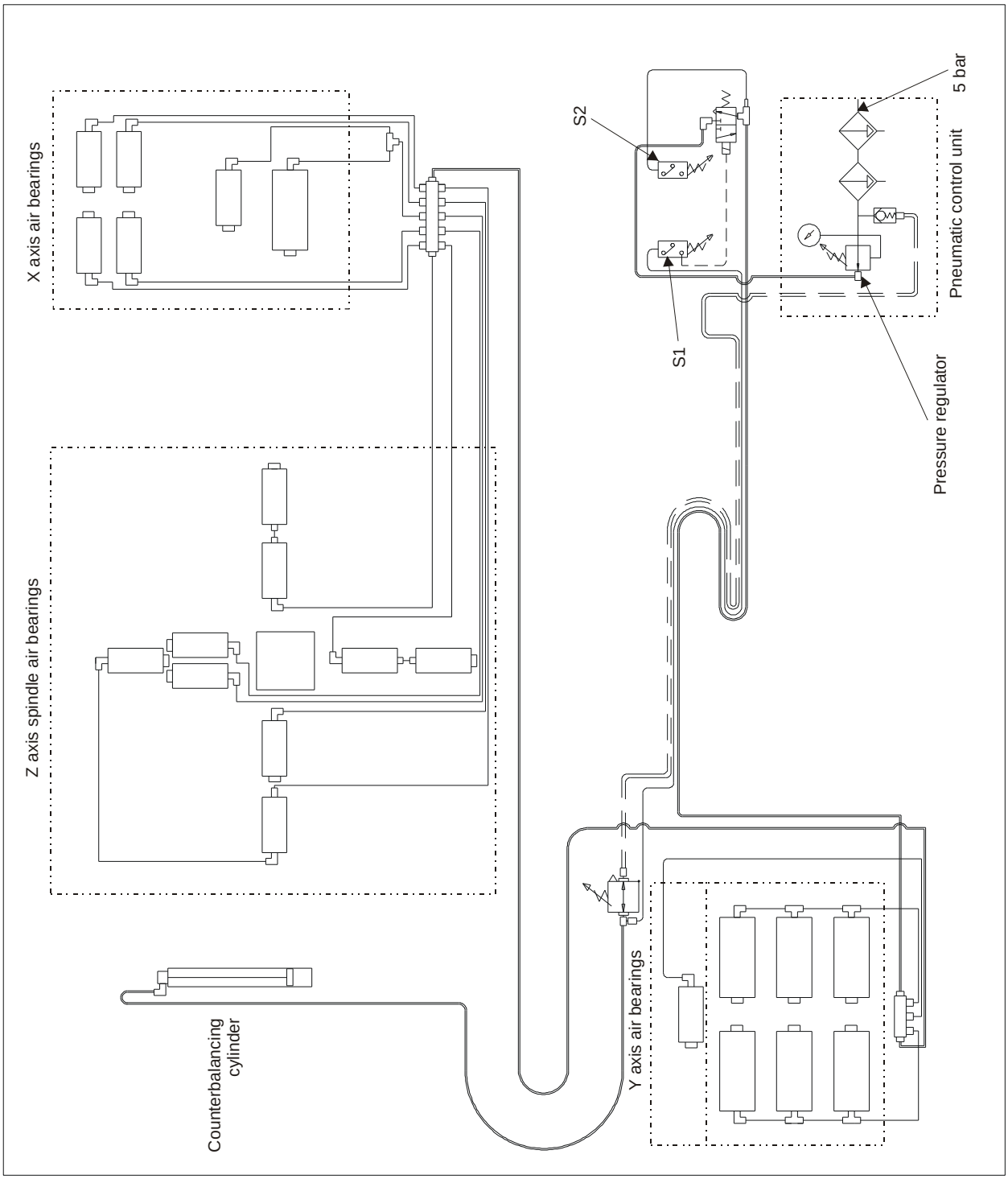


Figure 29 Air Supply System Diagram

Pneumatic Control Unit

The pneumatic control unit filters, regulates and distributes compressed air to the circuits supplying the various appliances. The control unit is situated at the rear of the supporting bench.
The filtering unit consists of a pair of self-cleaning filters (primary and secondary filter).
There is also a pressure gauge and a manual pressure regulator for measuring and regulating the air pressure at the input of the air bearing supply circuit, respectively.

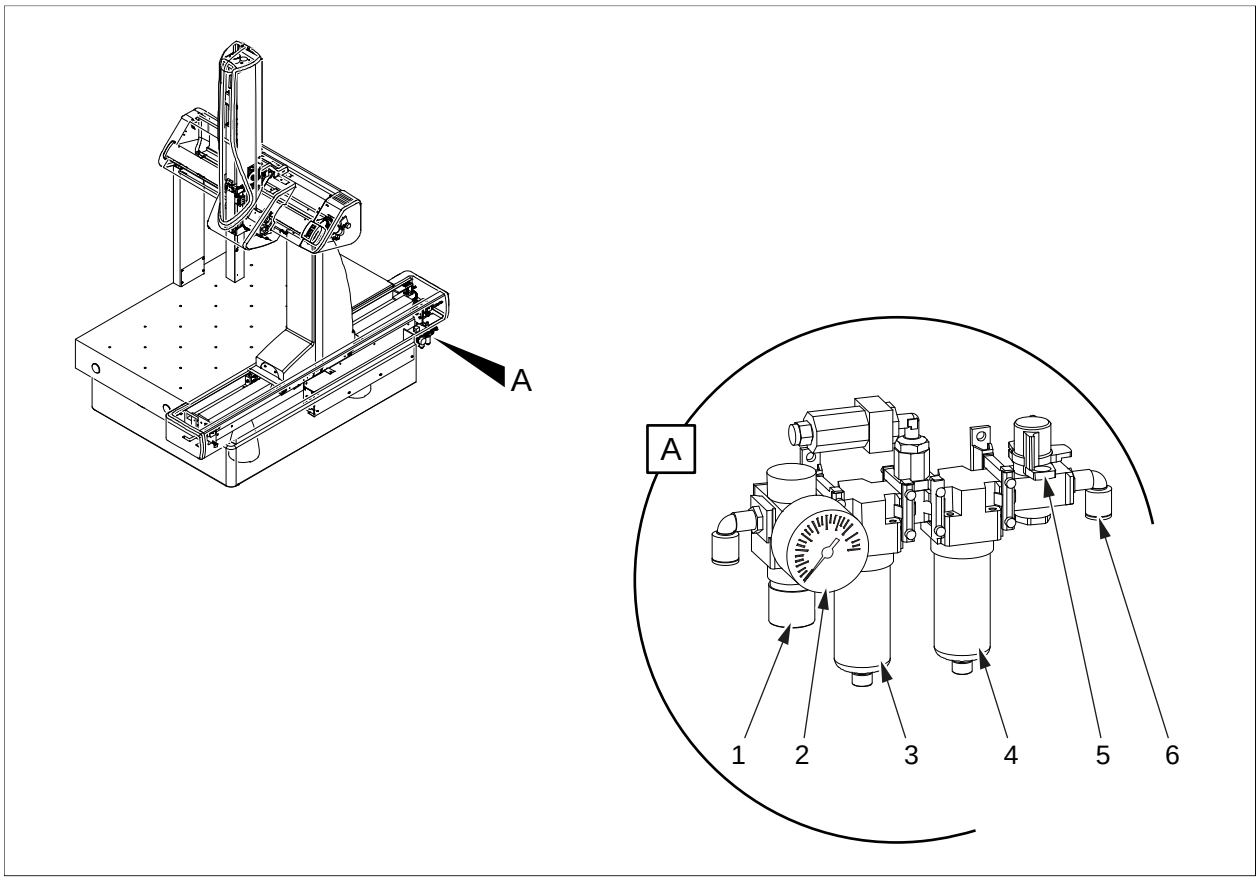


Figure 30 Pneumatic Control Unit

1. Pressure regulator
2. Air pressure gauge
3. Secondary filter
4. Primary filter
5. On-off valve
6. Air inlet

Axis Air Bearings

The machine axis sliding system is made up of air bearings that run on guideways and ensure the bearing and friction-free movement of the moving parts.
The parts are borne by a flow of compressed air supplied by the pneumatic control unit to the air bearings so as to form a thin air cushion between the bearings and their corresponding guideways.
The pressure switch S2, situated below the pneumatic control unit and the main solenoid valve, measures the minimum pressure required at the input of the air bearing supply circuit and consequently only gives its consent to the axis driving motors if there is sufficient pressure.

Counterbalancing the Weight of the Z-rail

A special pneumatic cylinder counterbalances the weight of the Z-rail and the elements connected to it (for example, the head and tool). This cylinder is housed inside the Z-rail and is fixed to the top end of the frame by means of a steel wire.
The cylinder generates a constant force capable of counterbalancing the weight of the Z-rail, irrespective of the position reached by the Z-rail during its movement. The force that the counterbalancing cylinder applies to the Z-rail is directly proportional to the pressure of the air inside it. For this reason, an automatic pressure regulator maintains the pressure inside the cylinder at a constant value equal to that set on the drive regulator.
The drive pressure can be regulated as a function of the weight of the Z-rail and the load applied to it, using the regulating knob. The knob can be accessed by removing the right side guard of the secondary carriage (Figure 31).

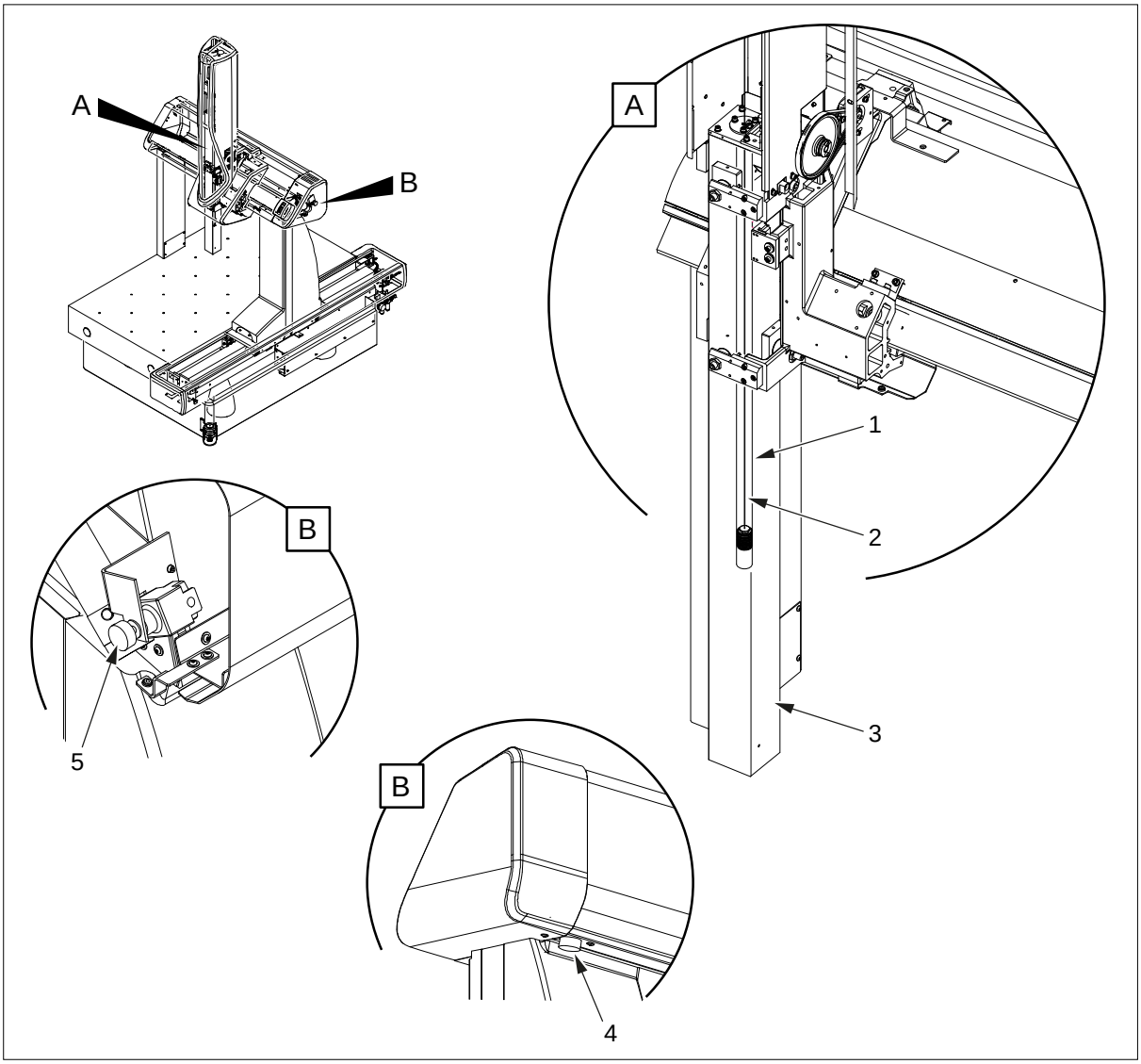


Figure 31 Z-rail Weight Counterbalancing System

1. Cylinder
2. Steel wire
3. Z-rail
4. Regulating knob – 05.yy.05, 07.yy.07 Models
5. Regulating knob - 09.yy.08, 12.yy.10, 15.yy.10 Models

The pneumatic circuit for counterbalancing the Z-rail is completed by the pressure switch S1, which is situated below the pressure regulator and measures the pressure at the input of the counterbalancing cylinder. The pressure switch S1 gives its consent to open the solenoid valve that controls the inlet of air to the air bearing supply circuit, only if the precision value inside the counterbalancing cylinder lies within the range set. If it is not sufficient, the machine does not receive consent to move the axes.

Caution
The drive pressure is regulated during the installation phase and is not to be modified.

Maintenance

This chapter provides a description of the preventive maintenance procedures indicated by Hexagon to ensure the measuring machine works in a safe and continuous fashion.
Before proceeding to carry out any maintenance work, the maintenance staff must be familiar with all the contents of this chapter.

General Maintenance Information

The GLOBAL S measuring machines were designed and built in such a way as to ensure reliable operation and minimum maintenance requirements.
The maintenance operations must in any case be performed by trained engineers, i.e. by persons with technical know-how or experience, or who have received specific instructions about the maintenance operations to be performed.

Preventive Maintenance

The preventive maintenance operations described in this chapter are to be carried out by the Customer.
All preventive maintenance operations must be performed with great care so as not to cause a deterioration in the functioning and performance of the measuring machine.
These operations are to be performed at the frequency suggested in the preventive maintenance schedule. However, the specified frequency may be adapted to the environmental conditions of the installation site and the number of hours the measuring machine is operated.

Extraordinary Maintenance

Extraordinary maintenance operations are not described in this chapter. They must be performed by specially trained engineers. We recommend that you contact the Hexagon customer service.

Hexagon Customer Service

In order to ensure that the machine is kept in optimum operating conditions, we suggest you stipulate a maintenance contract with the Hexagon customer service.

Preventive Maintenance Intervals

The recommended intervals for preventive maintenance are Daily, Monthly and Quarterly. These intervals are based on eight hours per day and forty hours per week of machine operation.
If the machine operates for more than eight hours a day or five days a week, the maintenance schedule should be adjusted as follows:

- Daily or every 8 hours of operation
- Monthly or every 165 hours of operation
- Quarterly or every 500 hours of operation
- Every five months or every 850 hours.

For example, if a machine is operated for two eight-hour shifts per day, monthly maintenance should be carried out every two weeks. If the machine is used less than eight hours per day or less than five days per week, the regular Daily, Monthly, and Quarterly schedules should be changed accordingly.

Safety Regulations and Residual Risks During Maintenance

Warning

Failure to respect the regulations listed here below may cause injury to persons and damage to the equipment.

To reduce the risk of injury and damage, maintenance engineers of the measuring machine must have:

- An adequate knowledge of the general specifications given in the document entitled “Use and Maintenance of the Measuring System – General Safety Regulations”. These regulations must be strictly respected during maintenance of the measuring machine.
- An adequate knowledge of the residual risks for maintenance engineers indicated in the table below together with the remedies to be taken to reduce them to a minimum or eliminate them altogether.

Residual risk	Remedies
Z-rail moving upwards (or downwards) unexpectedly or suddenly	The removal or assembly of parts on the Z-rail (for example, when the measuring head or a tool is changed) may cause the Z-rail and, consequently, the elements applied to its flange to move upwards or downwards rapidly. This may create hazardous situations for the user in the presence of particular measuring probe configurations. To minimize this risk, before performing any maintenance operation, set the Z-rail in position −Z (at bottom end position).
Unexpected movement of moving parts of the measuring machine axes	Shut off the power supply to the measuring system before performing any maintenance operations, removing or reassembling covers, guards, other protective devices, components or making inspections requiring physical contact with the measuring machine. Also turn off the air supply, except for short periods in which it must be possible to move the moving parts of the machine.
Slight cut or abrasion during periodic maintenance (with guards open)	Wear protective gloves.

Warning

Turn the Main Switch OFF before performing maintenance operations, removing or replacing covers, guards and components or making inspections requiring physical contact with the measuring machine.
Also turn off the air supply except when it must be possible to move the moving parts of the machine, so as to avoid unexpected movements.

Accessing Components Covered by Guards

Where necessary, before carrying out maintenance operations with the machine open, remove the guards covering the components that are to be repaired so that the work can be done comfortably and safely.

Warning

The machine must be turned off and the air supply must also be turned off before guards may be removed and maintenance work may be carried out.

During maintenance operations, only remove the guards covering the components subjected to maintenance. At the end of the maintenance operations, reassemble the guards removed previously before starting the measuring machine.

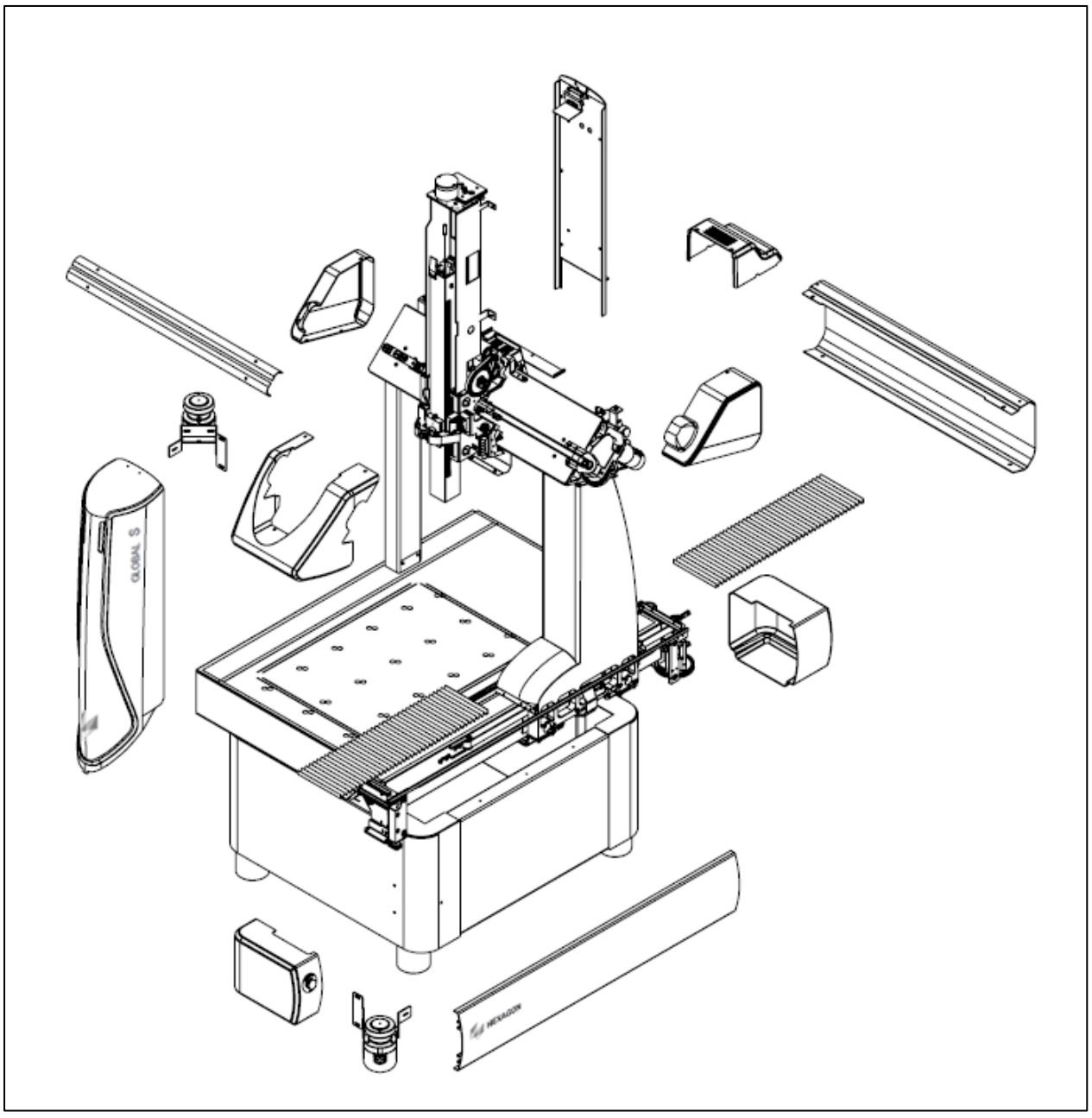


Figure 32 Fixed Guards – 05.yy.05 Models

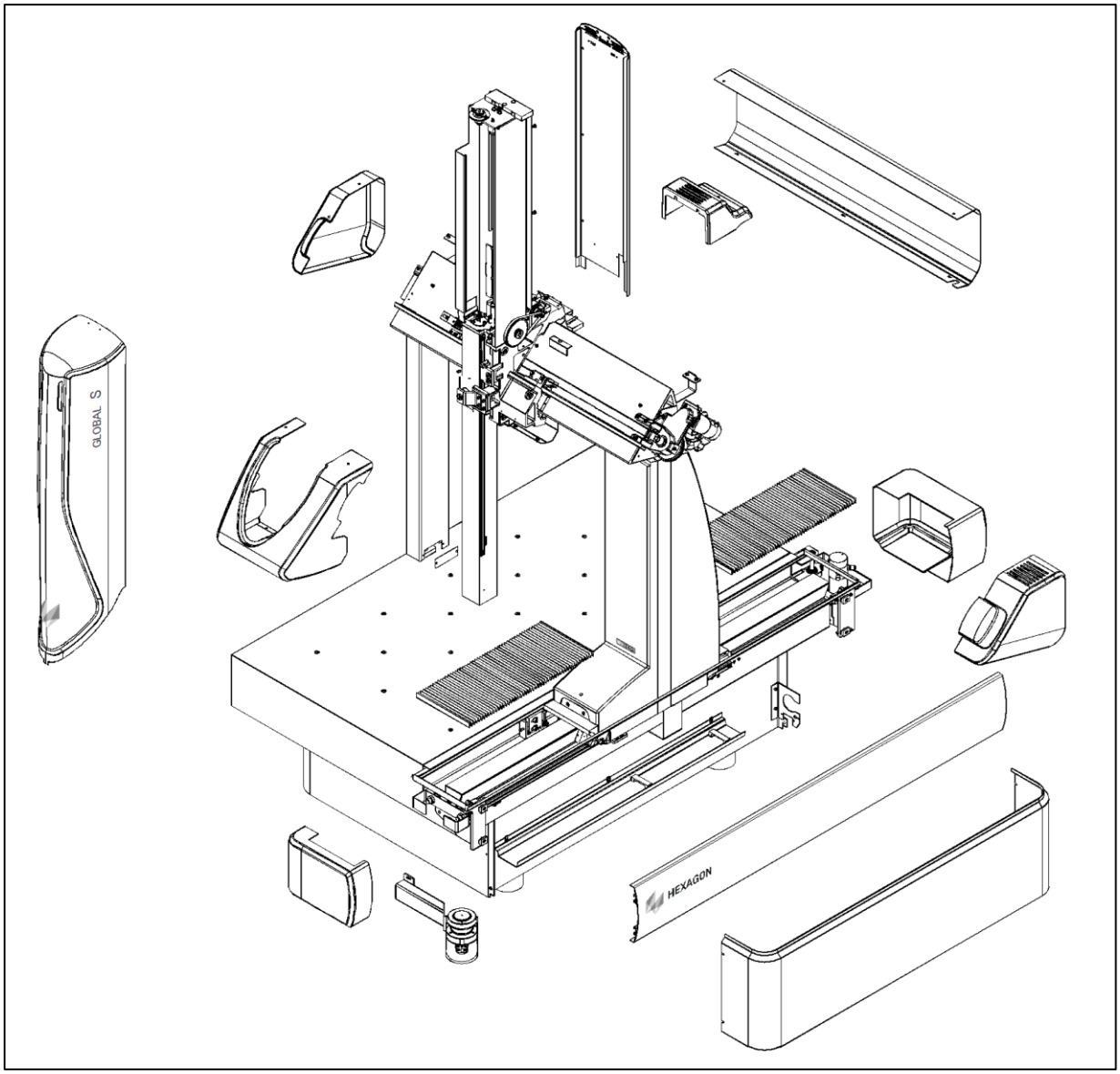


Figure 33 Fixed Guards – 07.yy.07 Models

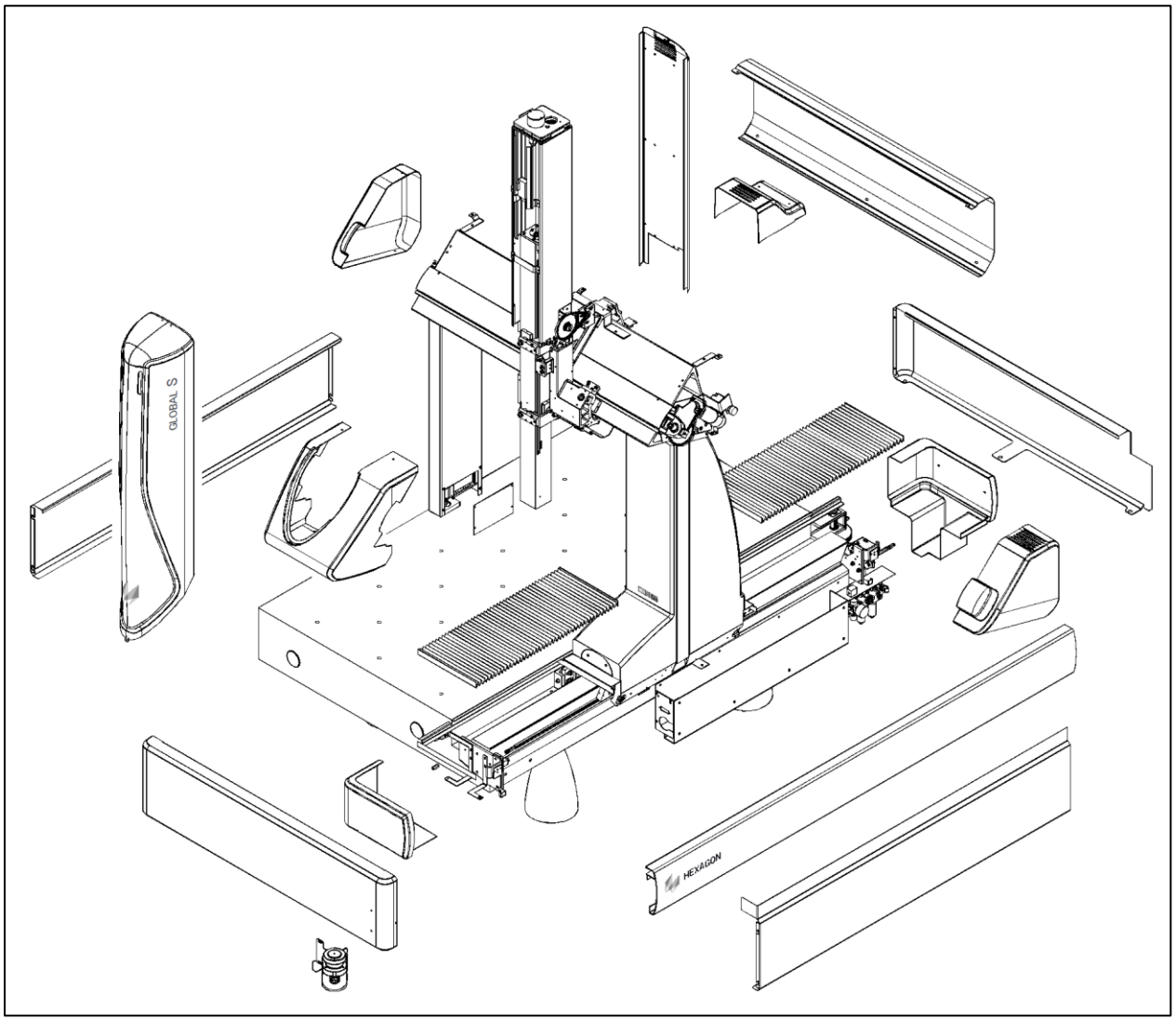


Figure 34 Fixed Guards – 09.yy.08 Models

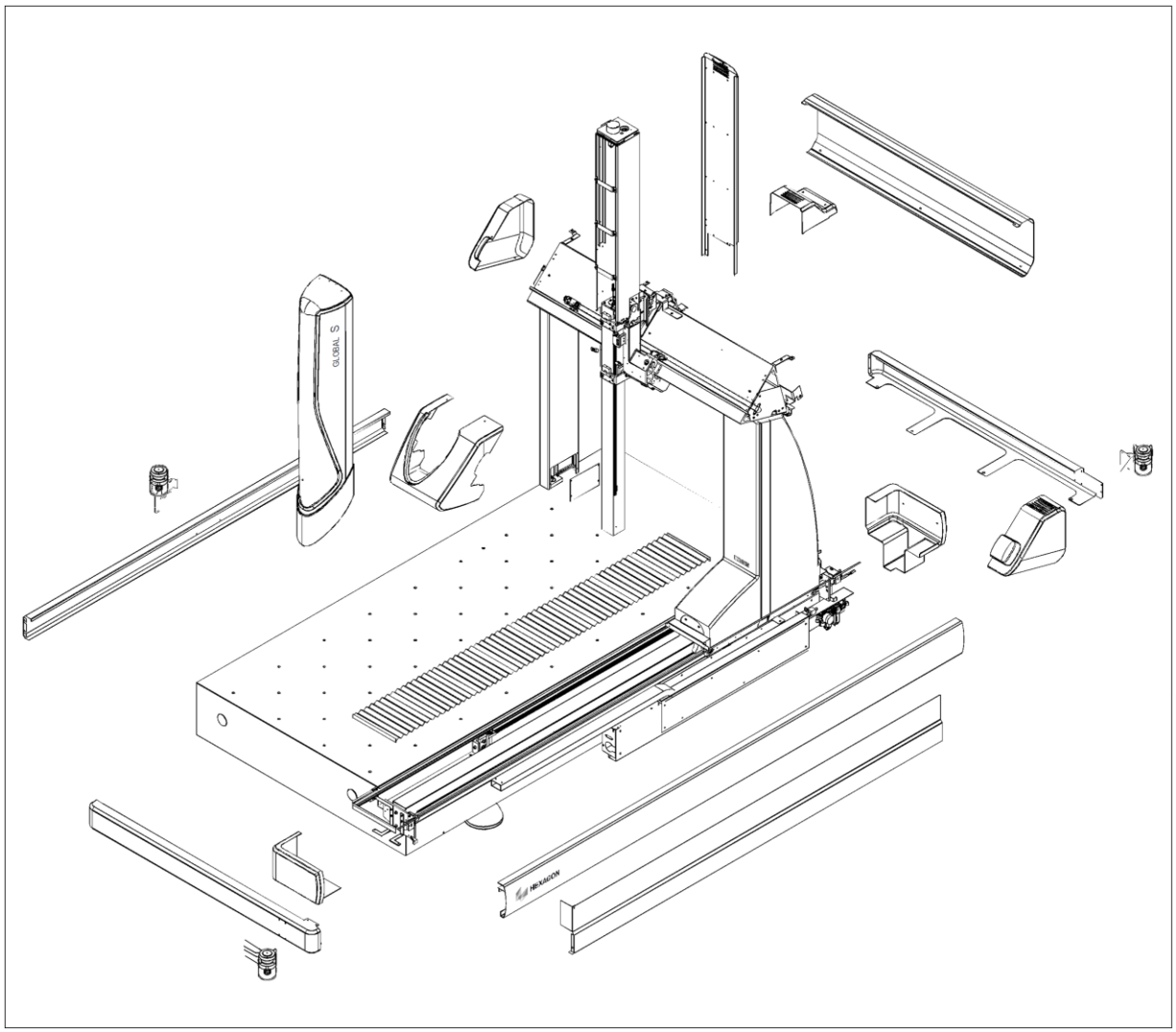


Figure 35 Fixed Guards – 12.yy.10 Models

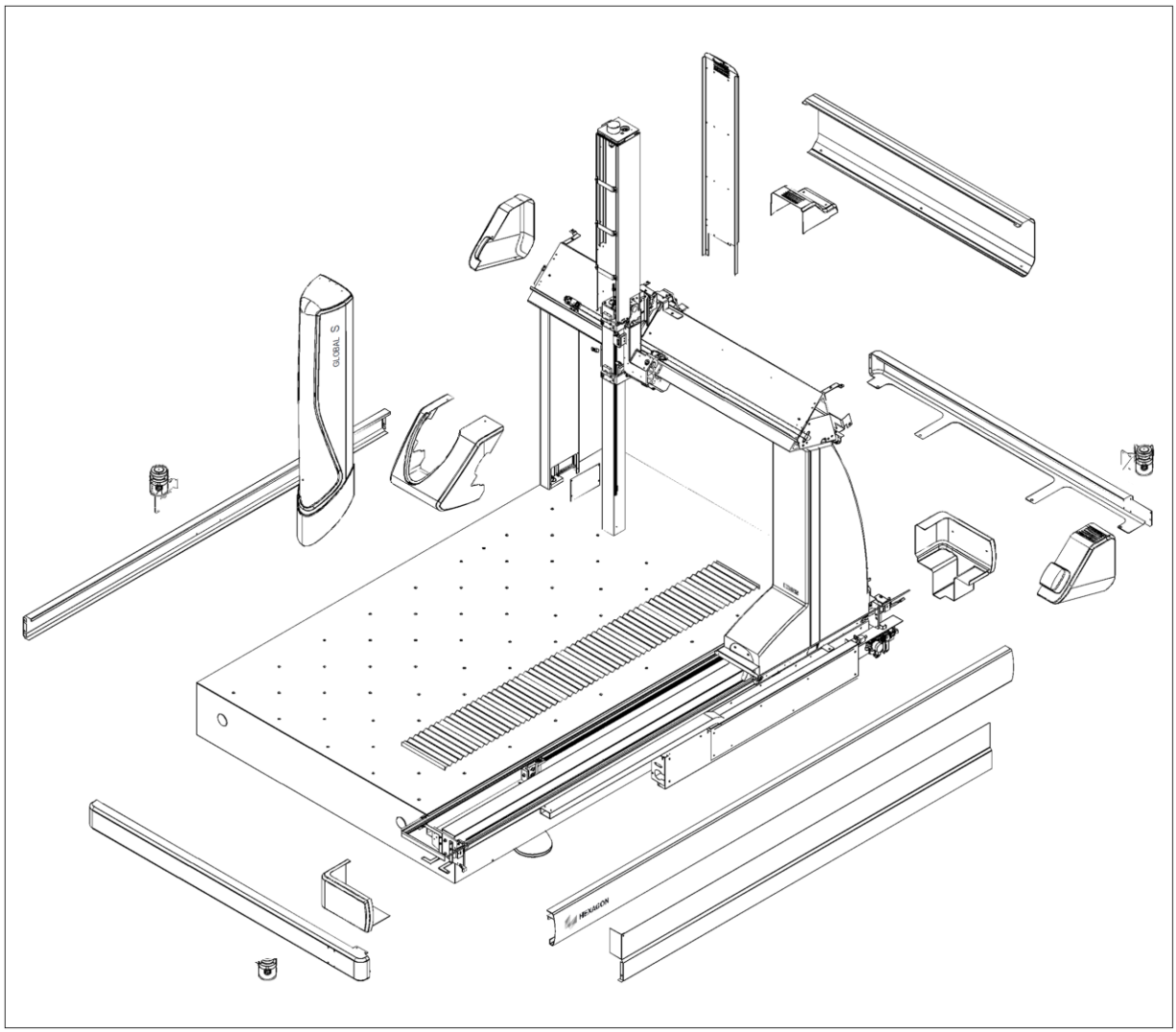


Figure 36 Fixed Guards – 15.yy.10 Models

Removing Fixed Guards

To remove the fixed guards of the machine, simply remove the screws that secure these components to the machine structure.
According to version and model, the GLOBAL *S* measuring machine may be provided with side skirts.

Having completed the maintenance work, reassemble the guards using all the screws and washers removed during disassembly.
Pay attention to the respective connection wiring if the laser scanners (if present) need to be removed.

Removing Bellows

Polyethylene bellows with Velcro closures protect the Y axis, and the X axis (optional).
To remove bellows:

1. Detach the ends of the bellows from the attachment flanges. The closures are made of Velcro so all you have to do is pull.

2. Slide off the bellows.

Having completed the maintenance work, carry out the inverse procedure to reassemble the bellows.

Preventive Maintenance Schedule

This program lists the necessary preventive maintenance operations and specifies the frequency with which these operations are to be performed.

Daily or Every 8 Hours

- Make a visual inspection of the machine. Check that there are no missing or damaged parts, or abnormal vibrations.
- Check the guards and covers. Repair any damaged ones and replace any missing ones.
- Check the pressure in the air supply system on the pressure gauge of the pneumatic control unit. This is also the pressure of the air on the air bearings.
- Check the devices for automatically cleaning the filters of the pneumatic control unit.
- If necessary, clean the work table with heptane or isopropyl alcohol. Use a clean, soft and lint-free cloth (such as medical gauze or equivalent material).
- If necessary, clean the optical scales and the guideways (only those without protection and therefore readily accessible).
- Check that the Z-rail is correctly counterbalanced, after starting the machine and assembling the head and tools.

Monthly or Every 165 Hours

- Check that the emergency buttons and safety devices (optional laser scanner) are working properly.
- Make a visual inspection of the machine. Check that there are no missing or damaged parts, or abnormal vibrations. Tighten any loose screws and nuts. Replace any missing screws or nuts.
- Check the cable of the portable Jogbox programming unit: its outer sheath must be undamaged and the single wires inside it must not be visible, especially near the connector and the connection with the portable unit. In case of damage, it is to be replaced immediately to avoid the risk of the emergency stop device of the Jogbox or the Jogbox itself malfunctioning.
- Clean the optical scales and the guideways of all the axes (where necessary, remove the guards covering them).
- Check the devices for automatically cleaning the filters of the pneumatic control unit.
- Clean the structure and painted guards of the measuring machine; use industrial detergents soluble in water (the use of other products may cause damage to the paintwork). Prevent the detergent liquid from coming into contact with the other components of the measuring machine (for example, guideways, optical scales and racks).

Quarterly or Every 500 Hours

- Check that the emergency stop buttons are working correctly.
- Check that the buttons and switches are not broken or damaged, and that they work properly.
- Check the condition of the air hoses for air leaks.
- Check that the cables show no signs of abrasion or wear. In particular, the electric wires must be replaced immediately if damaged.
- Access the pneumatic control unit to:
  - Clean the primary filter. Replace it if necessary.
  - Check the state of the secondary filter. Replace the filter if necessary.
- Check the anti-tilt feet and the anti-vibration supports.

Every five months or every 850 hours

- Carefully inspect and grease the steel wire of the counterbalancing cylinder. Call the Hexagon customer service if there evident signs of wear are found.
- Check the axis reduction and driving belts. Call the Hexagon customer service if there are evident signs of wear.

Caution
Never attempt to service components of the drive system. Maintenance carried out incorrectly may cause functional problems or a deterioration in the precision of the machine.

Preventive Maintenance Instructions

This section contains information and the instructions required to carry out the maintenance operations specified by the preventive maintenance schedule.

Caution

Do not use the following solvents on the machine under any circumstances: acetone (dimethylketone), chlorinated solvents (for example, trichloroethylene and chlorothen), benzene, methyl alcohol and, in general, branched-chain solvents.

Air Bearing Guideways

The guideway must be kept clean and must never be greased or treated with any substance.
To clean the guideway use a soft, clean, lint-free cloth (e.g. medical gauze or equivalent), moistened with heptane. Move the moving parts of the machine to clean the entire length of the guideway.
If, during maintenance operations, signs of abrasion or scraping are found on the guideway, do not use the machine but contact the Hexagon customer service.

Optical Scales

The optical scales must be kept clean and must never be lubricated or treated with any substance.
To clean the optical scales use a soft, clean, lint-free cloth (e.g. medical gauze or equivalent), moistened with isopropyl alcohol or heptane. Move the moving parts of the machine to clean the entire length of the optical scale.
After cleaning, let the optical scales dry before using the measuring machine.

Caution

Do not perform any operations on the sliding system components other than those specified in this section. Operations performed incorrectly may cause functional problems or a deterioration in the precision of the machine.

If after maintenance operations (or while using the measuring machine) counting errors are found, contact the Hexagon customer service.

Anti-Tilt Feet and Anti-Vibration Supports

With the frequency indicated in the maintenance plan, check that the two anti-tilt feet are present and that, when the maximum load is applied to the work table, their top ends are about 2-3 millimetres from the bottom surface of the granite.
Check also the position of the anti-vibration supports with reference to positions Sy1 and Sy2 shown in the figure of the model in use (see “Overall Dimensions and Mechanical Characteristics of the Measuring Machine” on page 39).
If any faults are found, stop the measuring system and call the Hexagon customer service immediately.

Caution

If any faults in the adjustable feet or the anti-vibration supports that could jeopardize the stability of the machine are found, stop the measuring system immediately. Do not resume operation until the faults found have been eliminated.

Steel Wire of the Counterbalancing Cylinder

With the frequency recommended in the maintenance schedule, inspect carefully and spread a thin layer of grease on the steel wire of the pneumatic cylinder. Use KLÜBER MICROLUBE GL 261 grease or an equivalent class NGLI 1 grease (ISO 3448).

Warning

If the steel wire shows signs of wear, call the Hexagon customer service immediately to have it replaced. Do not use the measuring machine until the wire has been replaced.

Emergency Buttons and Safety Devices

With the frequency indicated on the preventive maintenance plan, check that the emergency buttons present on the measuring system are working properly: the emergency button on the Jogbox, on the machine and on the control system.
Check also that any peripheral protective devices enabled are working properly (for example, optical barriers, interlocked gates or laser scanner systems).
In case of laser scanner, check that it is working, as indicated in the control system user instruction manual, and check the extension of the protected areas (shown in the “Optional Laser scanner” section on page 16).

Check the stop function of the machine and, more in general, of the measuring system while the machine is moving at maximum speed in a safe area. Check, during these tests, that the machine’s stopping spaces are not excessive: the machine should stop within the space of a few centimeters.
One of the symptoms of a fault is when the control system has to be turned off and then on again in order to restart the measuring system after it has been stopped by pressing an emergency button.

Warning

Contact the Hexagon customer service immediately if any fault is found in the operation of the emergency pushbuttons or of the active protection system, if present.

Air Supply System

This section contains the instructions for the preventive maintenance of the air supply system of the measuring machine.

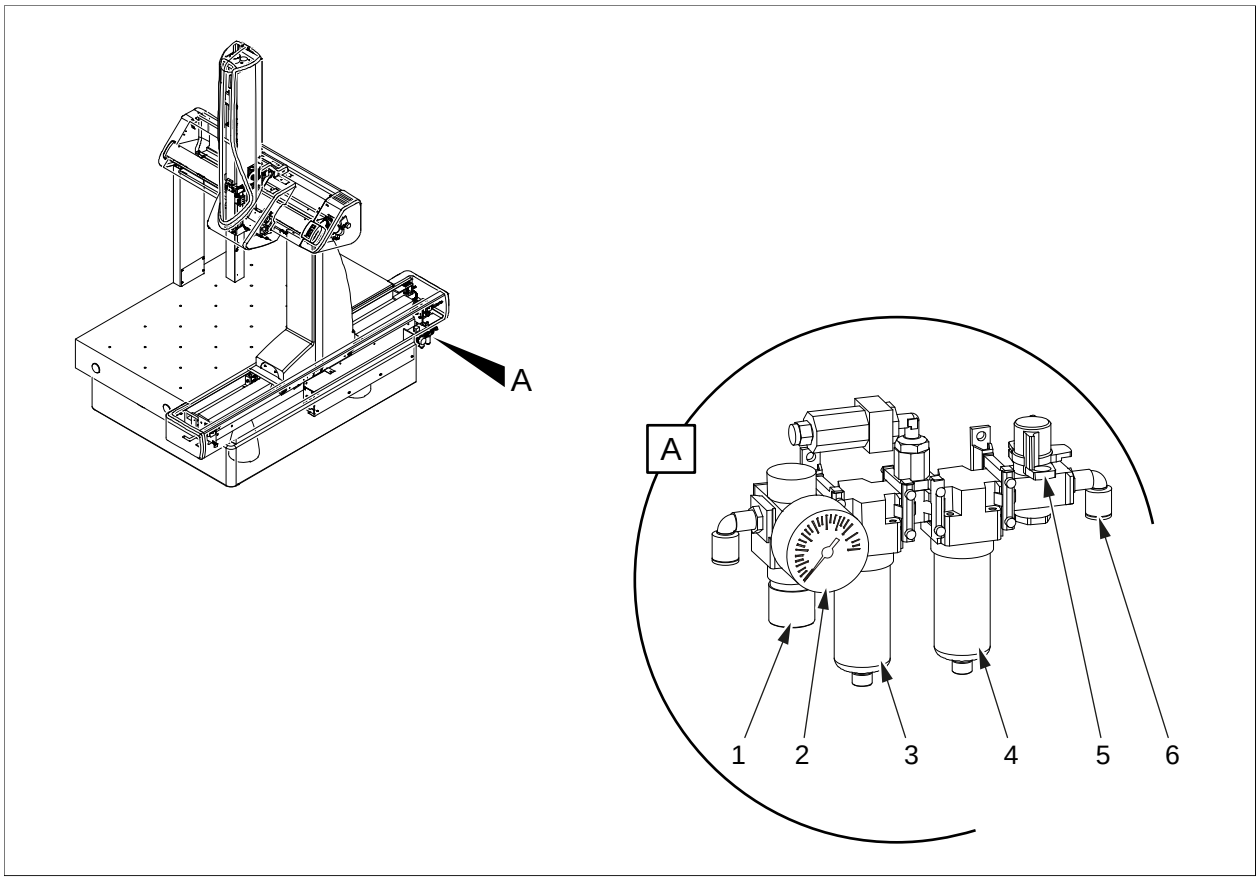


Figure 37 Pneumatic central unit

1. Pressure regulator
2. Air pressure gauge
3. Secondary filter
4. Primary filter
5. On-off valve
6. Air inlet

Checking and Regulating the Pressure of the Air Supply System (Air Pressure on Air Bearings)

With the frequency indicated in the maintenance schedule and after carrying out maintenance work on the pneumatic control unit filters, check and, if necessary, regulate the working pressure rating (0,45 MPa) using the pneumatic control unit pressure regulator.

If the pressure switch situated below the pneumatic control unit sets the measuring machine in emergency status, check the state of the filters. If either or both filters are clogged, the air supplied to the pressure switch will not reach the pressure necessary to load it; in this condition, the pressure switch sets the measuring machine in emergency status. If this happens, one or both filters must be replaced.

Cleaning and Replacing the Filters

The pneumatic control unit is fitted with a pair of self-cleaning type filters; the impurities are automatically removed when the air supply is switched off.

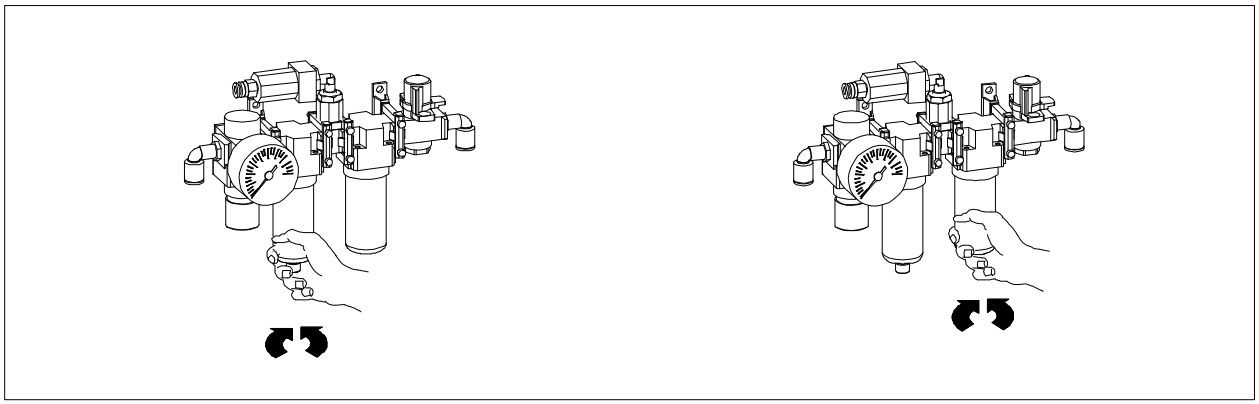


Figure 38 Replacing the Filters

To clean a filter:

1. Close the on/off valve.
2. Remove the transparent polycarbonate cup.
3. Remove the filter and then, with a compressed air jet, remove any solid residue from it. If the air jet is not enough to clean the filter completely, wash it with a neutral detergent (soap and water) and use the air jet again.
4. Wash the cup with neutral detergent.
5. Insert the filter in its compartment and reassemble the cup.
6. Measure and, if necessary, regulate the working pressure.

To replace a filter:

1. Close the on/off valve.
2. Remove the transparent polycarbonate cup.
3. Wash the cup with neutral detergent.
4. Insert the new filter and reassemble the cup.
5. Measure and, if necessary, regulate the working pressure.

Consumables and Spare Parts

The consumables for the maintenance operations are specified in the table below.

Material	Supplier Code or Specification	Hexagon Code
Lubricating grease	KLÜBER MICROLUBE GL261 grease or an equivalent class NGLI 1 grease (ISO 3448)	
Isopropyl alcohol		
Heptane		
Primary filter (complete)	SMC AF 20-F02C	D61340004
Primary filter (cartridge only)	SMC AF 20P-060S	D61400029
Secondary filter (complete)	SMC AFD20-F02C	D61340005
Secondary filter (cartridge only)	SMC AFD 20P-060S	D61400030

Table 18 Consumables

Warning

Isopropyl alcohol and heptanes are products subject to safety regulations. They are to be used in strict respect of the applicable laws in force and the manufacturer's safety regulations.

Declaration of Conformity

Declaration of Conformity – Applies to European Union

The Global CMM has been designed and manufactured in compliance with the essential safety requirements stated in:

Directive 2006/42/EC Machinery (MD)

Directive 2014/30/EU Electromagnetic Compatibility (EMC)

Directive 2014/35/EU Low Voltage Directive

References to the relevant harmonised standards used, or references to the specifications in relation to which conformity is declared:

EN ISO 12100:2010	Safety of Machinery - General Principles for Design – Risk assessment and risk reduction
EN 60204-1:2006+A1:2009	Safety of Machinery – Electrical Equipment of Machines – Part 1: General Requirements
EN 61000-6-4:2011	Electromagnetic compatibility (EMC). Generic standards. Emission standard for industrial environments
EN 61000-6-2:2006	Electromagnetic compatibility (EMC). Generic standards. Immunity for industrial environments

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