

SLV EDU

CNC MILLING MACHINE

Original user's manual

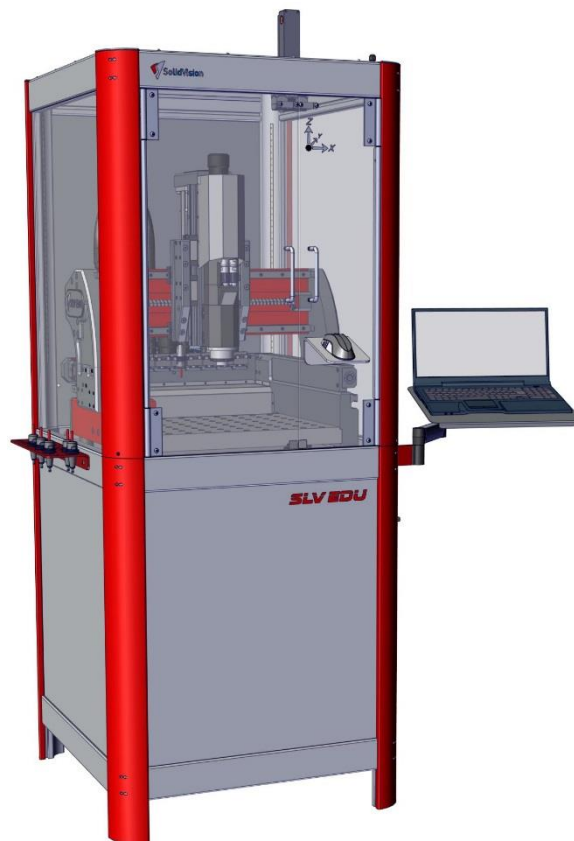


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INTRODUCTION

Dear customer,

Thank you for purchasing a machine from **SolidVision, s.r.o.**

This manual was created with the intention to provide the necessary information about the machine to all persons who may come into contact with the **machine during operation, control or maintenance**. Each of these persons must be properly introduced to the contents of this manual before attempting to use the machine in any way.

► Symbols used in this manual

SYMBOL	MEANING
	These symbols serve as " CAUTIONS " and " WARNINGS " and warn about situations which may damage the machine and/or cause serious injuries to the operator.
	
	This symbol warns about an important instruction, property, procedure or issue which you must pay attention to or must be observed during operation, or be aware of.
	This symbol refers to useful information related to the equipment or to accessories.
	This symbol refers to another chapter in this manual.

► Important notices

Carefully study this manual.

Follow instructions specified herein exactly in order to make operation of the machine easier but also to ensure optimum utilisation and a long service life.

Do not turn the machine On unless you are familiar with all the instructions and aware of the prohibited actions and recommendations specified in this manual, in particular in Chapter 2: Occupational safety and health protection at work.

The pictures shown in this manual may not always correspond with the reality; their purpose is to describe the main principles of the machine.

► Manufacturer contact information

During operation you may experience unexpected situations which are not included or described in this manual. If you are not one hundred percent sure of how to proceed, contact the manufacturer at:

SolidVision, s.r.o.

Josefy Faimonové 2409/11a

628 00 Brno

Phone: +420 533 433 111

E-mail: info@cncstroj.cz

<http://www.solidvision.cz>

<http://www.cncstroj.cz>

View this manual as an inseparable part of the machine which cannot be separated from the machine even if the machine is resold. Keep the manual for future use.

► Machine delivery specifications and machine accessories

A delivery document describing the **SLV EDU** CNC milling machine is a part of separate documentation handed over at the time the machine is delivered.



The delivery also includes installation and commissioning. Other activities (training, etc.) are subject to special agreement.



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1 | TECHNICAL INFORMATION

1.1 PURPOSE OF THE MACHINE

The **SLV EDU** CNC milling machine is a multipurpose machine designed to machine a wide range of materials including wooden and plastic materials, composite materials, aluminium and nonferrous metals. The machine may be used in prototype workshops, by electronics manufacturers requiring clean machining of printed boards, control panels, as well as for cast and modelling equipment machining.

The machine is specially designed to be used for automated cycle production. The machine operator controls the machining process and supervises its operation from the operator observation stand, which is separated from the working area by covers. When the front door is opened, the operator unclamps the finished product from the work table or from the clamping device and places a new semi-finished product on the table or into the clamping device - while the machine is stopped.

The machine may be controlled either manually or automatically. When the manual regime is selected, the machine performs only operations selected on the control panel by pressing the appropriate buttons. When in automatic mode, control and individual actions are carried out in a sequence specified by the given programme. If a particular operation/action is not fully completed, the machine will stop and signal an error.



| Detailed descriptions of individual machine sections are available in Chapter 1.4.

1.2 INCORRECT MACHINE USE

Any use other than specified in the previous chapter will be regarded as unauthorised use not complying with the purpose of the machine. Therefore, it is strictly prohibited to use the machine for purposes other than defined herein.

Only a machine in perfect working order may be operated. Any errors or defects discovered or reported by the system must be immediately reported to the given service department and repaired as soon as possible.



| The manufacturer is not liable for any damage caused by incorrect or improper use. These risks shall be borne by the machine operator.



| Additional details for safe use of the machine are available in Chapter 2.

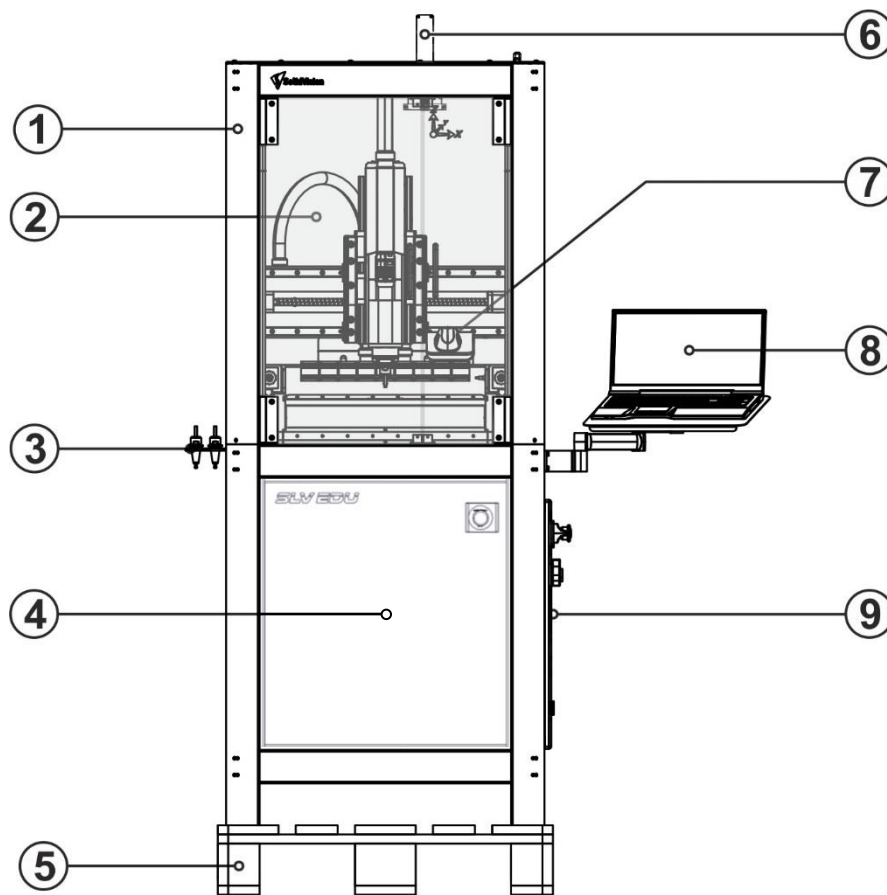
1.3 RESIDUAL RISKS

The machine and its parts are designed to prevent any danger being posed to the operator or to the surrounding environment, **providing that the machine is in perfect working order and used properly.** Nevertheless, situations may occur during operation which may pose a danger to the operator, mainly if the operator is not aware of them and if the operator fails to observe the safety instructions specified herein.

These dangers are called **residual risks** and refer to risks which are present even if all other preventive and safety precautions have been applied. A detailed list of individual risks is available in ■■ 2.6 and 2.7.

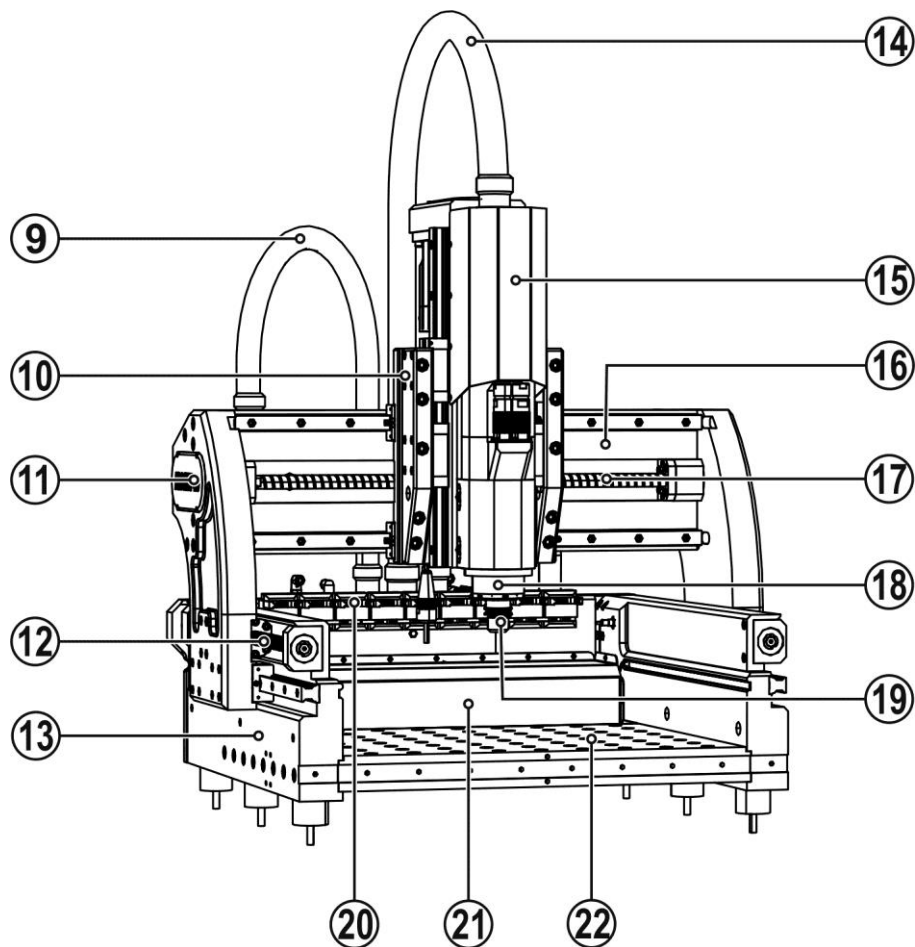
1.4 MAIN MACHINE PARTS

1.4.1 Main parts – View with covers installed



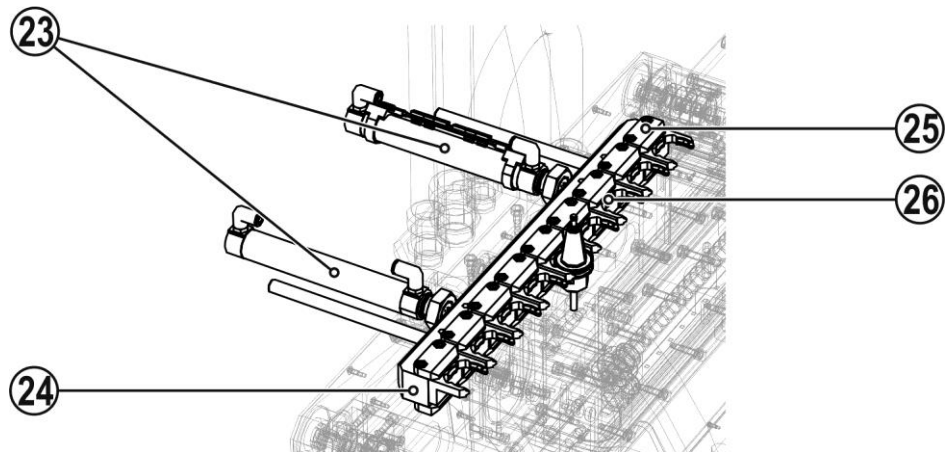
Position	Name
(1)	Frame with covers
(2)	Front door
(3)	Side tool magazine
(4)	Lower covers
(5)	Pallet
(6)	Safety switch
(7)	Mouse
(8)	Control system with holder
(9)	Side plate with control elements

1.4.2 Main parts – View without covers



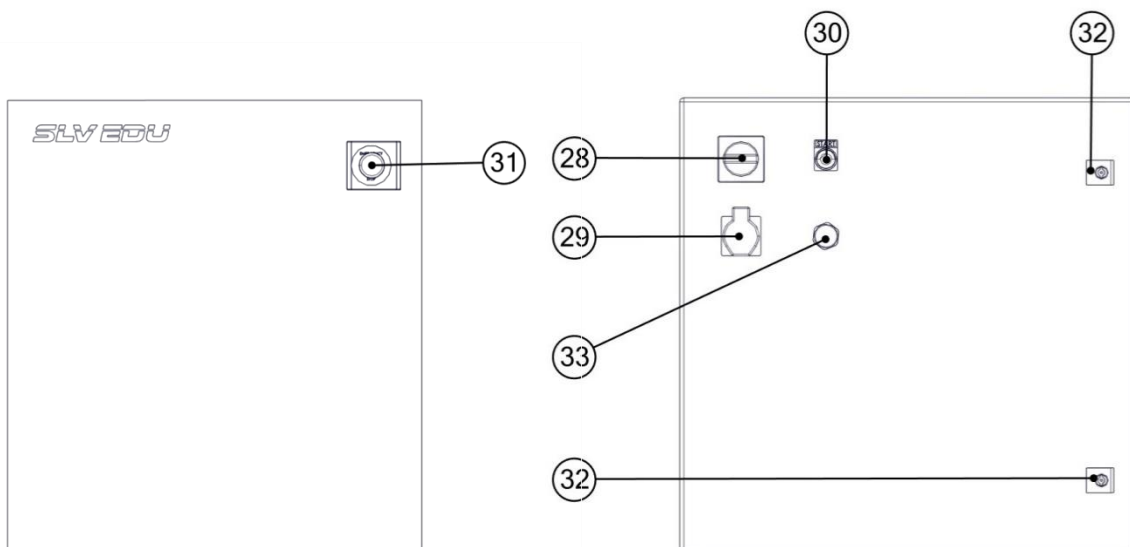
Position	Name	Position	Name
(9)	Power supply, X axis	(16)	Horizontal cross member (Y axis)
(10)	Saddle (X axis)	(17)	Ball screw (X axis)
(11)	Movable sidewalls	(18)	Quill
(12)	Ball screw (Y axis)	(19)	Tool clamping unit
(13)	Fixed sidewalls	(20)	Automatic tool exchanger
(14)	Power supply, Z axis	(21)	Splinter guard
(15)	Spindle cover (Z axis)	(22)	Worktable

1.4.3 Main parts – Automatic tool exchanger



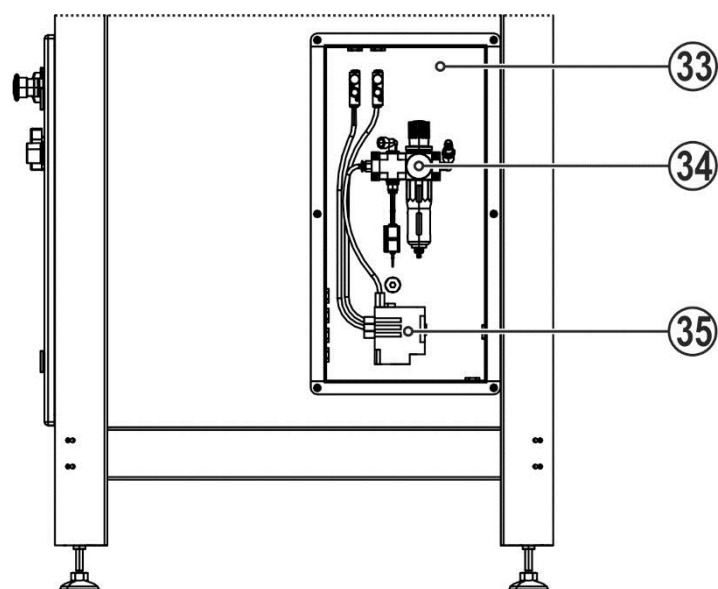
Position	Name
(23)	Pistons
(24)	Ledge
(25)	Tool bed holder
(26)	Tool bed

1.4.4 Main parts – Control elements



Position	Name	Position	Name
(28)	Main switch	(31)	Emergency stop pushbutton
(29)	230 V-16 A socket	(32)	Panel lock
(30)	Start button	(33)	Ethernet cable

1.4.5 Main parts – pneumatic elements



Pozice	Název
(33)	Steel air bed
(34)	Air device
(35)	Pneumatic unit

1.5 MAIN PART DESCRIPTION

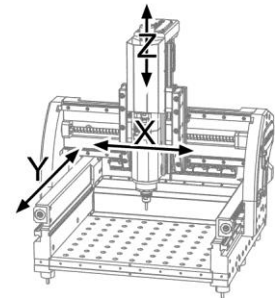
Control system:

Machine functions are controlled by the **CNC control system Arem Pro**, which is based on an industrial PC system and runs the Windows operating system. The system works very well with CAD/CAM software which is used to control manufacturing processes, and with workshop programming software, etc. This allows the system to control machining of complex shapes as the tool follows a trajectory created as 3D output in CAD software.

Main units:

Saddle (X axis) moves in the transversal direction on the cross member. **Cross member (Y axis)** moves in the longitudinal direction on side guides. **Quill (Z axis)** moves in the vertical direction on the guiding saddle

Based on the machine model, the spindle is either equipped with a **high revolution spindle HSD or IMT**. **HSD** spindle allows manual tool replacement using the ER25 collet, allowing the attachment of tools up to 16 mm in diameter. **IMT** spindle is equipped with a pneumatic tool release system and with a cone cavity in line with ISO20/ER16, which allows clamping of tools up to 10 mm in diameter.



The machine is equipped with a **fixed worktable** where workpieces are clamped. The tool is equipped with M8 clamping holes distributed in a 50 x 50 mm spacing pattern and with recesses allowing the attachment of fastening clamps, various product shapes, and various clamping devices.

Tool exchanger:

The machine is equipped with an ATCH-9 automatic tool exchanger, which is installed in the rear section of the work area. Tools are stored in the vertical position in beds mounted on a ledge. Pistons move the exchanger towards the spindle, which moves towards the exchanger and carries out the necessary tool replacement operation. Tools are loaded into the exchanger magazine manually by placing the tools inside the beds. Part of the control system is a very advanced TOOL MANAGER which allows the use of the tools fitted inside the exchanger as well as the use of manual tools in any combinations.

The magazine capacity is 9 tools.

Guides and measuring system:

All X, Y, Z guides are made of **linear guides equipped with roller bearing units**. Work movements of the saddle, cross member and the spindle are ensured by AC motors with digital control by means of **rotating ball screws with ball nuts**.

Position measuring in the X, Y, Z axes depends on the machine design and is done either by reference sensors or by absolute sensors in the motor drives which power individual axes.

Cooling and lubrication:

The tool clamped inside the spindle is cooled and lubricated with an air-drop system. This system delivers a special oil to the cutting edge of the tool in the form of a mist consisting of small droplets 0.5 mm in size dissipated in pressurized air.

Lubrication of individual bearings of linear guides, ball screw nuts and ball screw bearings is done by the operator based on control system messages or as necessary.

Spindle bearings are lubricated with a **permanent grease filling**.

Covers:

The machine is completely protected with covers which prevent hands or any part of the body from entering the work area. These covers also protect the operator from splinters which may fly outside of the work area. The machine may be accessed once the front door, made of Plexiglass, has been opened. The door is fitted with a safety switch.

Splinter management:

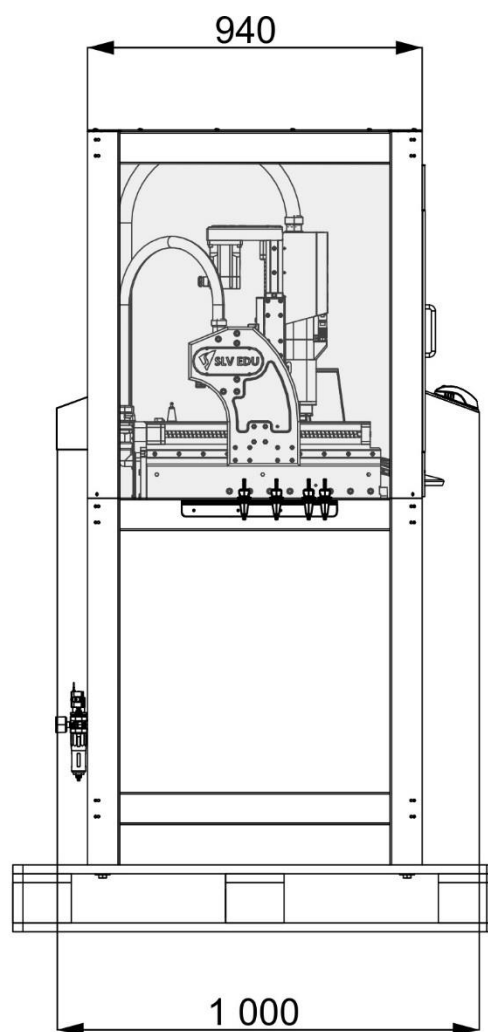
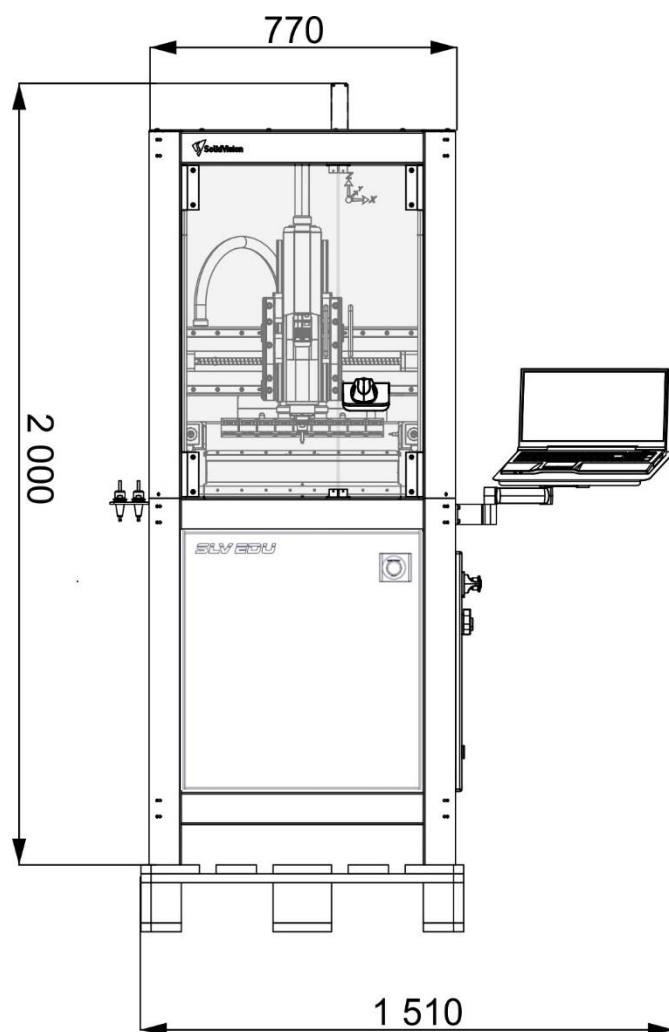
Splinters and other metal particles created during the machining process remain in the work area and must be removed by sweeping, air blowing or by vacuuming.

1.5.1 Optional accessories

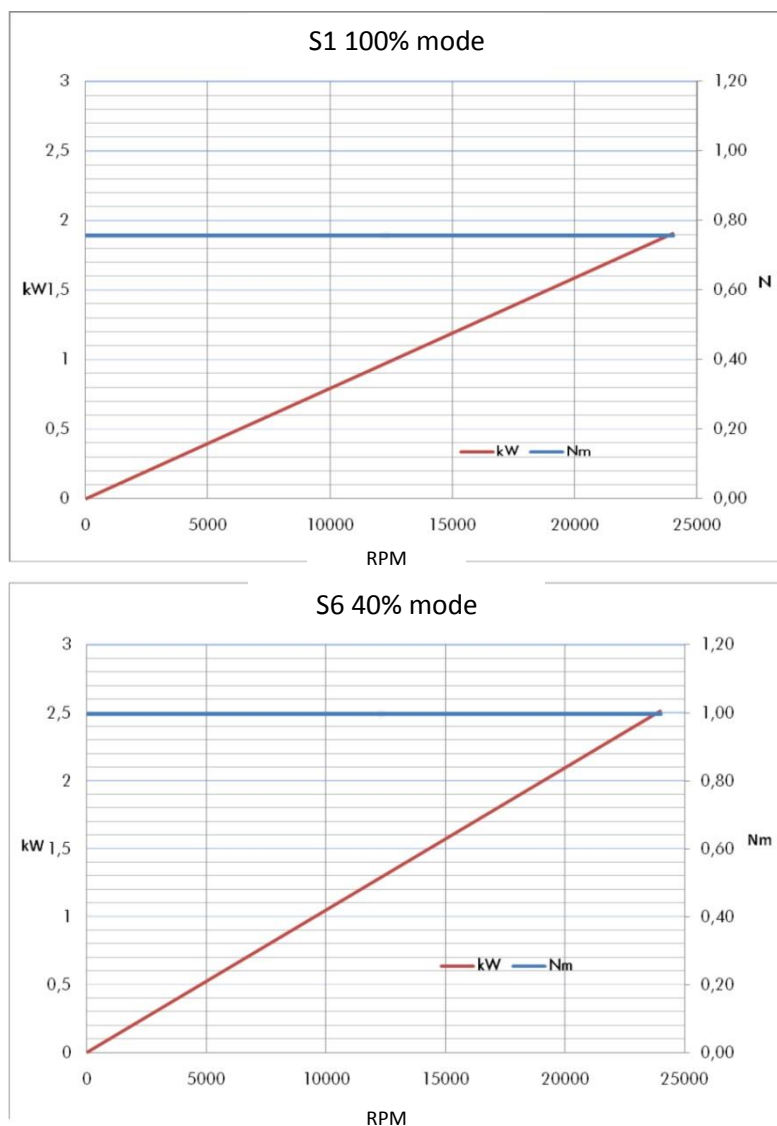
The machine may be equipped with the following accessories:

- Tool cooling system
- Tool exchanger - up to 9 tools
- Spindle with manual tool replacement feature
- Spindle with automatic replacement feature
- Vacuum clamping table
- Collets
- Clamping pallet
- Collet chuck ISO 20
- Compressor
- Industrial vacuum cleaner

1.6 MAIN MACHINE DIMENSIONS

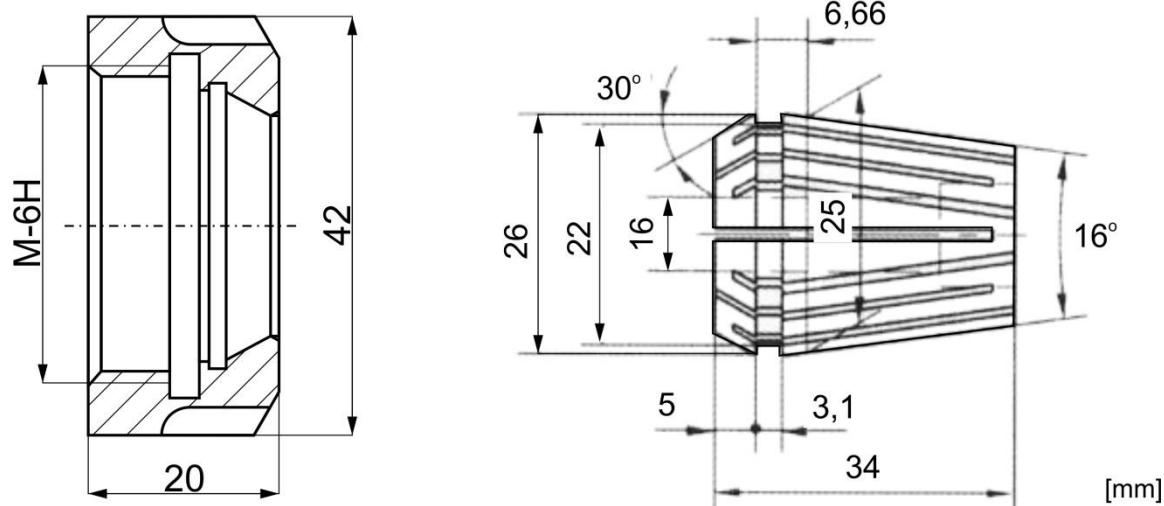


1.7.2 Spindle power characteristics



1.7.3 Clamping nut, collet and spindle specifications

Clamping nut of the ER 25 – T2 collet and clamping collet ER 25 -16:



1.8 TECHNICAL SPECIFICATIONS

Control system		
Type		Arem Pro

Power drives (servo drives)			
TG Drives	X axis	Nm	1.15
	Y axis		1.15
	Z axis		1.15

Travel range		
X axis – saddle	mm	365
Y axis – cross member	mm	400
Z axis – spindle	mm	185

Worktable		
Dimensions	mm	476 x 400
Clamping system	mm	M8 holes following a 50 x 50 distribution pattern

Workpiece - semi-finished product		
Semi-finished product material		AL alloys, nonferrous metals, plastics
Maximum dimensions of semi-finished product	mm	400 x 350 x 160

HSD spindle		
Clamping range	-	Collet ER25 DIN 6499
Power output (S1)	kW	2.1
RPM range	min ⁻¹	100 – 24 000
Torque	Nm	1.1
Min / Max distance of the spindle from the worktable	mm	10 / 210

Spindle IMT Eco 80 VA51		
Clamping range	-	Clamping cone ISO20 / BT20
Power output (S1-100%) / (S6-40%)	kW	1.9 / 2.5
RPM range	min ⁻¹	100 – 24 000
Torque	Nm	0.8
Min. / Max. distance of the spindle from the worktable	mm	65 / 250

Tool exchanger		
Type	-	ATCH-9
Number of tool beds	pc	9

Feeding system		
Operational feed	mm/min	0 - 20,000
Fast feed	mm/min	0 - 20,000

Accuracy	
Measuring system	Absolute

Repeatable accuracy	mm	0.005
Geometrical accuracy	mm	0.05

Dimensions and weights

Basic/transport dimensions (H x W x L)	mm	2,000 x 770 x 940 / 2,050 x 1,510 x 1,200
Machine dimensions with tool holder, control system holder and trackball holder (H x W x L)	mm	2,000 x 1,510 x 1,000
Machine weight	kg	300

Connection to electrical power supply*

Power supply	VAC / Hz	1 x 230 / 50 (60)
Input	kW	3
Circuit breakers	A	1 x 16

** The source of electrical power and connection of electrical power to the machine must be provided by the machine operator!*

Connection to pressurized air (optional accessories)*

Required air pressure at the machine inlet	bar	6 - 10
Pressure fluctuation	%	+/- 10
Pressurized air requirements		dry and filtered
Air consumption	l/min	120
Air coupling		quick coupling 1/8"

** The source of pressurized air and connection of the air to the machine must be arranged by the machine operator!*



Technical specifications not included in this section of the manual may be found in the manufacturer's instruction manuals supplied with individual components which are included in the delivery. If you cannot find any piece of important information, please contact us.

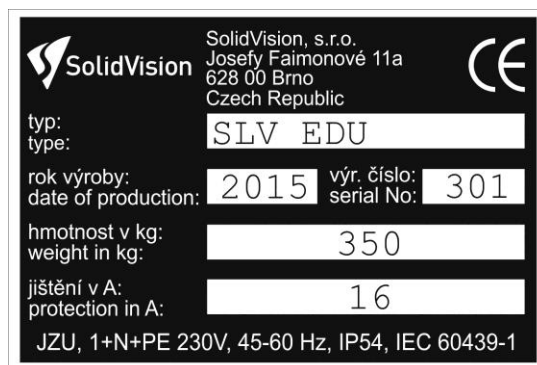
1.9 NOISE EMISSIONS

In automatic mode, the noise level does not exceed 85 dB(A). Therefore, no hearing protection is required when operating the machine.

1.10 MACHINE LABELS

Manufacturer nameplate

Provides basic information about the manufacturer and the machine.



Warning and information plates

Warn about the possible risk of injuries to the operator or to other persons if instructions or correct procedures are not followed. Warn about dangerous locations on the machine and remind of basic safety regulations.

<p>WARNING! POZOR!</p> <p>Don't put your hands close to the work area to avoid injury. Nevkládejte ruce do pracovního prostoru stroje při práci. Nebezpečí úrazu.</p>	<p>WARNING! POZOR!</p> <p>Do not approach rotating parts during operation. Failure to follow the warning can result in severe injury. Nesahajte rukou na točivé časti během pracovního cyklu. Použití předsedu může způsobit poranění obsluhy.</p> <p>WARNING! POZOR!</p> <p>Do not approach moving parts during operation. Failure to follow the warning can result in severe injury. Nesahajte rukou na točivé časti během pracovního cyklu. Použití předsedu může způsobit poranění obsluhy.</p>	<p>SAFETY INSTRUCTIONS</p> <ol style="list-style-type: none"> 1. Read the instruction manual carefully before installation and operation. 2. Only qualified personnel can be responsible for the machine to allow the machine to be used. 3. Do not touch the machine parts during operation. 4. Do not touch the machine parts during operation. 5. Do not touch the machine parts during operation. 6. Do not touch the machine parts during operation. 7. Do not touch the machine parts during operation. 8. Do not touch the machine parts during operation. 9. Do not touch the machine parts during operation. 10. Do not touch the machine parts during operation. <p>BEZPEČNOSTNÍ POKYNY</p> <ol style="list-style-type: none"> 1. Před použitím stroje si pečlivě přečtěte všechny instrukce a varování, která jsou popsána v provozní příručce a v návodu k obsluze. 2. Stroj nesmí být používán osobami, které nejsou kvalifikovány a nejsou v dostatečné vzdálenosti od stroje. 3. Stroj nesmí být používán osobami, které nejsou v dostatečné vzdálenosti od stroje. 4. Stroj nesmí být používán osobami, které nejsou v dostatečné vzdálenosti od stroje. 5. Stroj nesmí být používán osobami, které nejsou v dostatečné vzdálenosti od stroje. 6. Stroj nesmí být používán osobami, které nejsou v dostatečné vzdálenosti od stroje. 7. Stroj nesmí být používán osobami, které nejsou v dostatečné vzdálenosti od stroje. 8. Stroj nesmí být používán osobami, které nejsou v dostatečné vzdálenosti od stroje. 9. Stroj nesmí být používán osobami, které nejsou v dostatečné vzdálenosti od stroje. 10. Stroj nesmí být používán osobami, které nejsou v dostatečné vzdálenosti od stroje. 	<p>WARNING! POZOR!</p> <p>Unexpected object may fly out and cause injury. Keep the splash guard closed during machining. Keep interlocks other safety devices in place and functioning. Nečekané objekty mohou odletnout z pracovního prostoru a zranit obsluhu. Zavřete ochranné desky před spuštěním cyklu obrábění. Obsluhujte stroj z bezpečného místa.</p>	
<p>POZOR NEBEZPEČÍ POREZÁNÍ NÁSTROJEM</p>	<p>POZOR NEBEZPEČÍ STLAČENÍ ČÁSTI KONČETIN</p>	<p>POZOR JINÁ NEBEZPEČÍ</p>	<p>POZOR ELEKTRICKÉ ZARÍZENÍ</p>	<p>POZOR HORKÝ POVRCH</p>
<p>BEZPEČNOSTNÍ PŘEDPISY</p> <ul style="list-style-type: none"> - Tento stroj může být obsluhován pouze kvalifikovanými a náležitě vzdělávanými osobami, které vědí, jak ho bezpečně obsluhovat. - Před uvedením stroje do provozu si pečlivě přečtěte všechny instrukce a varování, která jsou popsána v provozní příručce a v návodu k obsluze. - Stroj neuvádějte do provozu do té doby dokud nebudou na místě a funkční všechny kryty, zámky a další bezpečnostní zařízení. - Tento stroj může být automaticky spuštěn a přemístěn v automatickém režimu. Nikdy se nepřibližujte ke stroji nebo k jeho pohyblivým částem. - Vždy pevně upněte obrobek a řezný nástroj. Vyhněte se nadměrnému přívodu el. proudu a rychlosti otáčení vřetena. - Vždy úplně vypněte vřeteno před tím než sáhnete na obrobek, nástroj nebo vřeteno a nikdy se během strojového cyklu nepokoušejte odstraňovat třísky. - Prostor pro údržbu by měl být bez překážek a mastných nečistot. - Servis a instalace stroje musí být provedena pouze kvalifikovanou osobou, podle následujících postupů popsaných v návodu k obsluze. Před provedením údržby vypněte a vypojte přívod elektřiny v hlavním elektrickém panelu. - Pokud máte nějaké problémy s bezpečným provozem stroje kontaktujte okamžitě našeho zástupce. <p>PROŠIM, NEODSTRAŇUJTE NEBO NEPOŠKOZUJTE TUTO ZNAČKU.</p>				
<p>TOTAL STOP</p>				

WARNING TOOL CUTTING HAZARD	WARNING LIMB CRUSHING HAZARD	WARNING OTHER HAZARD	WARNING ELECTRICAL EQUIPMENT	WARNING HOT SURFACE
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SAFETY REGULATIONS

- This machine may be operated only by qualified and properly trained persons who are aware of all possible risks.
- Before starting the machine, carefully read all the instructions and warnings specified in the user's manual and operating manual.
- Do not start the machine until all protective and functional covers, locks and other safety devices are installed.
- This machine may be automatically initiated and moved when in automatic mode. Never approach the machine or its moving parts.
- Always fasten the workpiece and cutting tool securely and firmly. Avoid excessive electrical power feed and excessive revolutions of the spindle.
- Before reaching for a workpiece or tool, always shut down the spindle completely. Never attempt to remove splinters when the machine is in operation.
- The maintenance area should be free of obstacles and greasy spots or dirt.
- The machine may be installed or serviced only by a qualified person who observes the procedures described in this user's manual. Before performing any maintenance, shut down the electrical power supply in the main electrical panel.
- If you experience any issues or unsafe function of the machine, immediately contact our representative.

PLEASE DO NOT REMOVE OR DAMAGE THIS WARNING PLATE

1.11 DECLARATION OF CONFORMITY

The Declaration of Conformity is delivered together with the machine as an independent technical documentation.

2 | OCCUPATIONAL SAFETY AND HEALTH PROTECTION AT WORK

The purpose of this chapter is to provide basic information about occupational safety and health protection requirements which must be observed by the operator and by any other persons who may come into contact with the machine or its accessories.

2.1 GENERAL INFORMATION

While operating the machine, the operator is responsible for his or her own safety. The machine manufacturer is not liable for personal injuries, machine damage or for environmental damage due to incorrect use of the machine or if the machine is used in conflict with the instructions/maintenance manual or in conflict with applicable and valid safety requirements.



IF THE MACHINE IS NOT USED IN LINE WITH ALL SAFETY REQUIREMENTS AND PROCEDURES OR IF NOT ALL OCCUPATIONAL SAFETY REQUIREMENTS SPECIFIED IN THIS MANUAL OR IN OTHER VALID NATIONAL GUIDELINES ARE OBSERVED, DAMAGE OR TOTAL DESTRUCTION OF THE MACHINE OR ITS PARTS OR ACCESSORIES MAY OCCUR, INCLUDING SERIOUS INJURIES OR DEATH OF THE OPERATOR.

This machine has been designed in line with international standards and regulations applicable to the construction and design of these types of machines. This fact is confirmed by the manufacturer in the Declaration of Conformity which is delivered together with the machine's technical documentation.

Electrical equipment of the machine complies with international regulations describing protection against injuries by electrical current. All areas installed with electrical instruments and motors comply with the required electrical protection/coverage.

In case of any sudden danger, the machine may be stopped by pressing the **emergency stop pushbutton**. The operator must know the location of the emergency pushbutton and must be familiar with its use (■■ 2.5).

2.2 REQUIREMENTS FOR MACHINE OPERATOR

Only **persons who are properly trained and are adequately qualified** in terms of operation, maintenance, inspection and assembly work may operate the machine. These persons **must be familiar with all the contents of this user's manual**, and **must observe the instructions specified in the manual**.

The machine owner must clearly establish responsibilities and competencies of individual employees as well as work inspection procedures. If the employees lack the necessary knowledge, it is necessary to arrange for professional training and provide them with clear instructions and work safety procedures. Proper knowledge and understanding must be verified. We recommend creating a training report. The trained employees must sign the occupational safety book.

Employees who are selected to operate the machine **must memorize the location of the emergency stop pushbutton** on the machine and must make sure **that the machine is used only by authorised persons**.

Operator qualification requirements:

Mechanic:	Completed machinery and engineering education - knowledge of machine units, experience with the repair of similar machines/equipment.
Electrician:	Completed electro-technical education, knowledge of the used control system and power drives.
CNC machine operator:	Knowledgeable and experienced in metal machining procedures, knowledge of CNC machines, knowledge of cutting tools and their adjustment, wear and tear, experienced in the operation of CNC machines.

CNC machine programmer: Knowledgeable and experienced in metal machining procedures, metal machining technology and CNC machine programming. Knowledge of the used control system is a plus.

Air systems and hydraulic repairs: Knowledgeable and experienced in pneumatic and hydraulic systems.

2.2.1 Machine operator work clothing

The machine operator must always wear the following:

- **Suitable close-fitting work clothing or the supplied work clothing**, free of any damage and free of any oil or grease spots.
- **Closed work shoes**, best with steel toe caps.
- **Safety goggles**.
- **Protective gloves and wristbands**.



The work clothing of the operator must comply with requirements valid in the country of operation while taking into account applicable guidelines describing personal protection requirements.

When operating the machine, the **following clothing cannot be worn:**

- Loose jackets
- Open shoes made of cloth or sandals
- Scarves, ties, necklaces, watches, bracelets, keys, rings or other metal objects. Unsuitable bandages are also prohibited.
- Electronic equipment such as pacemakers, wristwatches, credit cards, etc., or other items equipped with magnetic storage media
- Loose long hair **It is recommended to secure long hair with a suitable hat or head cover.**

2.3 OBLIGATIONS OF THE MACHINE OWNER

The owner of the machine is responsible for ensuring the following:

- a) The machine owner must clearly establish the responsibilities and competencies of individual employees as well as work inspection procedures. If the employees lack the necessary knowledge, the machine owner must arrange for **professional training and provide employees with clear instructions and work safety procedures. Proper knowledge and understanding must be verified.**
- b) Before the machine is installed and before commissioning, the machine owner must make sure that **all persons who will come into contact with the machine have had the opportunity to become familiar with:**
 - the contents of the user's manual and are able follow the instructions specified in the manual
 - the complete technical documentation delivered with the machine and its accessories
 - the control elements and communication components of the machine
 - safety and protection elements
 - protective gear and requirements related to operation of the machine
 - all other safety requirements and guidelines applicable to working with similar types of machines
- c) The machine owner must train the operators in possible risks of injuries, about devices installed to enhance the safety of the operating personnel, noise risks and about general and valid preventive measures issued by international and local institutions and valid at the location where the machine/equipment is to be operated

- d) It must establish requirements for the **safe presence and movement** of other persons including **prohibited activities**, using, for example, warning and information plates.
- e) It must ensure and provide **free escape routes** including access to escape routes.
- f) It must maintain free access to all control and communication components
- g) It must equip the place where the machine is installed with the necessary personal protection gear to ensure safety of the operators, including the necessary fire prevention equipment required by local guidelines and regulations.

2.3.1 Responsibilities of machine operators, maintenance and service employees

- a) The machine/equipment may be operated only by a person who has been properly trained by the machine/equipment owner.
- b) An employee may perform adjustment or repairs/replacement of parts only if such person has been properly trained and selected to perform these activities.
- c) **Employees selected to operate the machine/equipment** must make sure that **in addition to these selected employees only authorised and experienced persons may operate the machine**. Employees must always follow the established work procedures.

2.3.1.1 Before beginning

- a) Before using the machine, the operator **must check all functions of the machine and accessories**, focusing on daily maintenance checks. In particular, the operator must make sure that all safety components, protective covers, etc., are installed and fully operational.
- b) The machine operator must make sure that the correct workpieces and materials necessary for the given operations are prepared and ready. Using incorrect or damaged parts may damage the machine or its accessories.
- c) **Before commencing any work**, the operator must make sure that no foreign **objects are in the work area** (tools, measuring instruments, keys, etc.).

2.3.1.2 During operation

- a) The machine operator must follow the safety instructions and guidelines specified in this manual and in the manual supplied with the control system.
- b) **The operator must not bypass or disable any safety devices.**
- c) **Breakdowns occurring during operation of the machine must be reported by the operator immediately** to his or her supervisor. No work may be carried out on the machine until safe working conditions have been reestablished.

2.3.1.3 After finishing your work

- a) **The machine operator must clean the workplace**, remove any remaining materials and clean out dirt, store measuring instruments, tools, etc.
- b) Unless the direct supervisor of the machine operator specifies otherwise, the operator must always turn Off the main switch to shut down the electrical power supply.

2.4 FIRE SAFETY

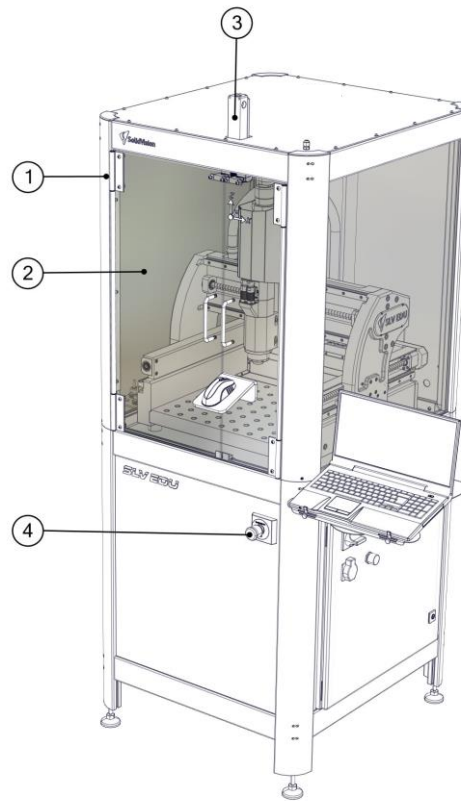
It is recommended to equip the workplace where the machine is installed with suitable fire extinguishers and other fire extinguishing devices as required by valid international and local fire safety regulations. The operator must make sure that all employees are aware of the location of fire extinguishers and know how to use them.

Water fire extinguishers cannot be used to extinguish electrical components on fire. A powder, foam or halon fire extinguisher must be located near the machine and the operator must know how to use this fire extinguisher. If a water or snow fire extinguisher is used, the electrical power must be turned Off in the

main/superior electrical cabinet. In addition to these fire extinguishers it is recommended to equip the workplace with at least two portable fire extinguishers filled with suitable media, of which, one should be a portable powder extinguisher containing at least 5 kg of extinguishing powder.

2.5- MACHINE SAFETY COMPONENTS

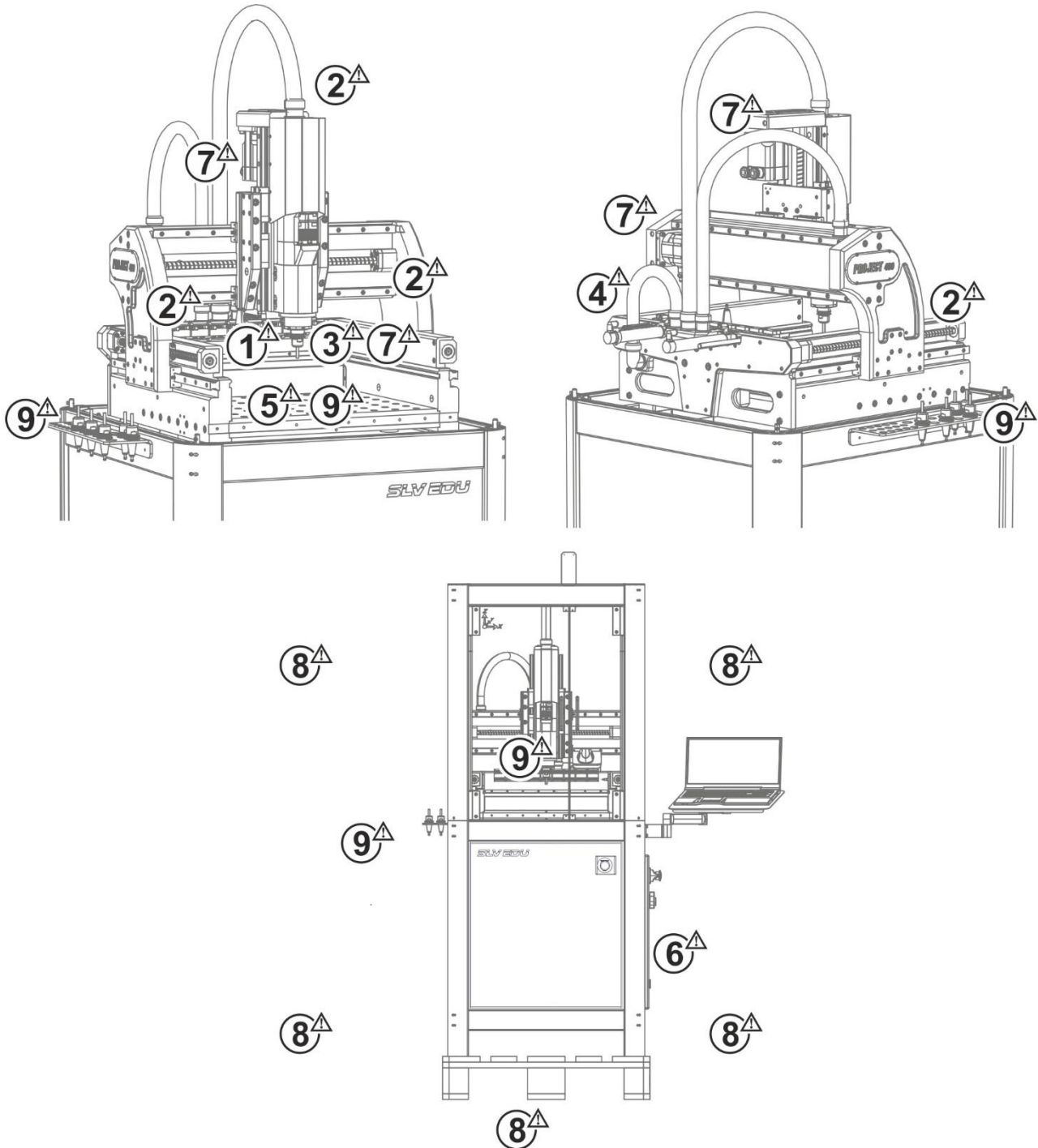
The machine is equipped with safety devices and components which increase the safety of the operator as well as the safety of operations performed on the machine.



Safety element	Function
(1)	Covers: Prevent hands or body parts from entering the work area and protect against flying splinters.
(2)	Polycarbonate: Allows the operator to observe the ongoing work and protects the operator from flying splinters.
(3)	Safety switch: When the machine programme is running (machining) and someone opens the front door, the safety switch will immediately shut down the movement of all axis.
(4)	Emergency stop pushbutton: When pressed, all work movements inside the work area stop and the power supply in the electrical cabinet is turned Off.

2.6 DANGEROUS ZONES







When the machine is operated in regular conditions, which means the door is closed, front locks or covers work properly and all safety requirements are observed, the work area around the machine poses no danger to the operator or to the environment. The only time a danger exists inside the work area is when the machine is being adjusted, modified or serviced, or if any safety component has been compromised, or if any cover has been removed and the machine works under a special control mode. In such situation, dangerous zones are everywhere where uncovered movable parts of the machine can be reached, or any machine parts are under live electric current, or where pressurized air is active.



Number	Zone	Danger
(1)	TOOL EXCHANGE AREA	<p><u>During automatic tool replacement:</u></p> <ul style="list-style-type: none"> - Risk of crushing, shearing, catching or impact hazard by moving units. - Cutting hazards, stabbing or puncturing by tools <p><u>During manual tool exchange and installation/removal of tools:</u></p> <ul style="list-style-type: none"> - Cutting hazard, stabbing or puncturing by tools
(2)	AXES MOVEMENT AREA	Crushing hazards, shearing, catching or impact by moving axis.
(3)	SPINNING TOOL AREA	<p>Cutting hazard by rotating tools.</p> <p>Cutting hazard, stabbing or puncturing by tools.</p>
(4)	GEAR AND TRANSMISSION MECHANISMS AND POWER SUPPLY UNITS	Pulling or catching hazard.
(5)	MACHINE SPLINTER AREA AND SPLINTER REMOVAL AREA	Cutting hazard, stabbing or puncturing by tools or burning hazard during tool cleaning.
(6)	ELECTRICAL COMPONENTS AND CONDUCTIVE ELEMENTS	Risk of electric shock (burn injuries or death).
(7)	HOT MACHINE PARTS	Risk of burns by touching hot machine parts (motors, gearboxes), tools or workpieces.
(8)	AREAS NEAR THE MACHINE AND AROUND THE MACHINE	<p>Hearing damage hazard, stress and noise fatigue.</p> <p>Danger of inhalation of harmful vapours produced by mist cooling system.</p> <p>Danger of contact with dust and gases created during machining processes.</p> <p>Risk of health injuries by contact with contaminated fluids and deposits (oils, coolants, lubricants, etc.).</p> <p>Risk of injury from parts, workpieces and tools ejected by the machine due to failure of the clamping system, collision or due to a failure of the control system.</p>
(9)	LOADING/UNLOADING, ASSEMBLY AREA, TOOL AND WORKPIECE INSTALLATION AND MAINTENANCE AREAS	Risk of injury due to discomfort, fatigue and stress during loading and unloading of workpieces, due to tool changing, or when performing cleaning operations under poor lighting.

2.7 RESIDUAL RISKS – LIST OF DANGERS AND WARNINGS

Increased demands on compliance with safety rules must be observed by the operator not only during machine operation, but also during adjustment, maintenance and repair. People most at risk are persons working with the machine or carrying out maintenance of the machine. These risks include:

<p>1. Electrical power – risk of electric shock</p> <p>Most circuitry and control components of the machine are powered by safe 24 V. However, the machine contains many systems that need to be powered by voltage which is dangerous to human life.</p> <p>Under normal operation these systems do not pose any risk because they are protected by covers. However, certain circuits of the machine installed in the electrical cabinet are still under power and dangerous to human life even if the main switch is Off. Therefore, never leave the door of the electrical cabinet open.</p> <p>Before performing any maintenance, the technician must turn Off the main electrical switch of the machine and turn Off or disconnect the machine main power supply cable. When performing certain servicing or maintenance operations (for example, during diagnostics or adjustment of certain machine components), the machine must be under electrical voltage. In such scenario, the employee performing these operations should work together with an assistant who knows how to disconnect the electrical supply, how to apply CPR and is aware of all corporate regulations describing hazardous/emergency situations.</p>	 
<p>2. Rotating or stationary spindle with tool – cutting or catching hazard</p> <p>The rotating spindle together with a tool poses a serious risk of injuries. For example, there is a cutting and catching risk (fingers may be cut off, work clothing, hair, etc., may be caught by the rotating spindle).</p> <p>During normal operations employees are protected from the rotating spindle and tools by covers installed around the work area, which may be entered only through the door equipped with a locking mechanism. When the door is opened the spindle stops rotating. Under no circumstances may the operator bypass or turn Off this locking mechanism.</p> <p>Cutting tools also pose a serious cutting hazard. When handling cutting tools pay close attention and make sure that you are not touching the cutting edge of the tool. Use protective gloves.</p>	 
<p>3. Splinter removal - risk of cuts and burns</p> <p>Splinters created during machining operations are sharp and hot. Use gloves, hooks with handles and covers, scrapers, or brushes to remove splinters from the machine.</p>	
<p>4. Workpiece or semi-finished product - risk of cuts and burns</p> <p>Workpieces or semi-finished products may have sharp edges and may be very hot after machining. Always use protective gloves when handling workpieces.</p>	

5. Movement of individual axes - risk of crushing of body parts

Under normal operations employees are protected from moving axes by the covers. Danger exists only when any safety door lock is turned Off and the machine is to be configured, modified or serviced, and the technician enters the machine work area. Here the technician works under manual mode (see the Control system instruction manual), which allows him to control individual machine movements. Such movements pose risks to body parts due to cutting hazards (limbs or fingers may be cut off).

Any employee entering the work area must be fully familiar with the movement of individual machine components and should be aware about any past or following movement of the machine components as well as of the movement of the machine as a whole. It is recommended to perform adjustment or repair of the machine in pairs, which allows the second employee to take the necessary action and release or remove the injured technician from the machine if necessary.

It is also recommended to furnish the control panel and the door with a warning plate with the following text:

WARNING. MAINTENANCE IN PROGRESS! DO NOT TOUCH THE CONTROLS!



6. Power supply system - risk of tripping, sliding or fall

Make sure that all power supplies delivering power and media to the machine are protected so they cannot be tripped over or damaged.

The machine and its surroundings must be kept clean. Make sure that the floor around the machine is dry and not slippery or dirty with oils or coolants from other machines, and that no foreign objects that may be tripped over are lying around.



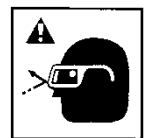
7. Belts, chains or gears - risk of injuries

Rotating gears or V-belt pulleys or chain gears or moving belts uncovered due to maintenance reasons pose a serious risk of injuries. Never come too close to moving or rotating parts.



8. Pressurized air - risk of injuries during maintenance/cleaning




If a technician cleans the machine or its parts using compressed air there is a risk that the operator or operators of other machines may be injured by flying splinters or dirt. The machine operator using compressed air to clean the work area around the machine must always wear protective eye goggles.



9. Risk of hearing damage

When human hearing is exposed to excessively high noise levels or when exposed to noise for a prolonged time, it may sustain permanent hearing damage. The manufacturer requires the operator to wear a hearing protection aid when working with the machine for a long time. However, the level of required protection may vary because the noise levels may also vary.



<p>10. Risk of inhaling harmful substances</p> <p>When machining certain materials, harmful vapours may be produced. When the work area door is open there is a danger that harmful substances may be inhaled. Therefore, the manufacturer recommends using a suitable mask when working with particular materials.</p> <p>If the concentration of harmful substances exceeds the level allowed by hygiene regulations, the machine must be equipped with a vacuum system (optional). It is the responsibility of the machine owner to equip the machine with such system.</p>	
<p>11. Risk of explosion</p> <p>It is not permitted to use the machine to work on materials that may explode during machining (for example, dusty materials).</p>	
<p>11. Burns suffered due to hot parts</p> <p>During the automatic mode, certain parts of the machines get hot. When hot parts are touched immediately after the machine has been stopped, for example, during servicing or maintenance operations, there is a danger of serious burn injuries. Always use protective gloves.</p>	

2.8 AVOIDING HAZARDOUS SITUATIONS - PROHIBITED ACTIVITIES

- a) Never let persons who are not properly skilled and trained for this type of machine/equipment operate the machine or perform servicing or maintenance on the machine.
- b) Situations or circumstances which may worsen safe use of the machine must be immediately reported by the employee who discovers such defects to his or her immediate supervisor.
 - 1) Do not work on the machine if a defect has been discovered!
 - 2) Do not continue working on the machine if the defect has not been removed!
 - 3) Do not work on the machine when under the influence of drugs or alcohol!
 - 4) Do not use the machine if you suffer from dizziness, fainting or if you are otherwise weakened or incapacitated.
- c) The management is obligated to randomly check the activity of the machine operator. The management is obligated to immediately notify the operator if the management discovers noncompliance with safety rules or failure to follow procedures specified in the user's manual, and must apply the necessary corrective measures immediately.
- d) All covers and other safety components of the machine must always be present and installed. The operator may never remove any mechanical locks/blocking systems or interfere with their functions.
- e) It is prohibited to modify or cover any machine control or communication components.
- g) Do not modify or replace any sections of the machine without the prior consent of the manufacturer. Unauthorised changes may create unsafe and hazardous conditions during operation of the machine. Unauthorised modifications and/or changes to safety systems may cause serious personal injuries.
- g) The second operator is prohibited from operating the machine during the following activities:
 - 1) work area cleaning
 - 2) installing/placing semi-finished products in the work area
 - 3) machine maintenance or replacement of defective parts
 - 5) repair of any section of the machine
- h) Never put your hands or your body into an area where machine parts are moving unless the second operator or the technician performing maintenance is aware of your actions.
- i) The machine and its surroundings must be kept clean. Make sure that the floor around the machine/equipment is dry and not slippery or dirty with oils or coolants from other machines, and that no foreign objects that may be tripped over are lying around. Make sure that all power supplies delivering power and media to the machine are protected/covered so they cannot be tripped over or damaged.
- j) It is strictly prohibited to remove or damage warning plates on the machine.
- k) Without the prior consent of the machine supplier it is prohibited to change the parameters of the control system, PLC software, etc.
- l) You may connect electrical cables to terminals or connectors only when the machine is turned Off! When the machine is turned On it is prohibited to change the parameters of the control system, PLC software, etc.
- m) If several persons are working together on the machine, for example, during installation, commissioning, etc., they must inform each other about the progress of their work.
- n) When storing workpieces, make sure that they are stored in a stable position. If workpieces are not stored properly, they may fall and cause injuries. Use a stable and rigid worktable to make sure it will support the weight of the workpieces easily.
- o) To handle heavy objects (workpieces) use suitable lifting equipment. If you intend to handle heavy objects using your own strength only, you may injure yourself. Also, due to the increased physical fatigue, the risk of errors during work increases as well. Never stand underneath an object that is being

lifted and do not expose any part of your body in locations where the lifted object may fall. Never move a lifted object over any bodily parts of other persons.

2.9 INSTRUCTIONS AND TOOLS USED TO RELEASE PERSONS CAUGHT BY THE MACHINE

Should the operator neglect or fail to observe occupational safety requirements, there is a risk that the operator may get caught by the machine or injured by moving machine parts. This risk is particular high when the machine operates under a mode which allows movement of the machine axes while the work area door is open, or when covers are removed during maintenance, for example.

Should the operator be crushed by a moving axis, the operator may be released by moving the axis in the opposite direction using the respective directional button on the control panel.

3 | MACHINE INSTALLATION

3.1 PREPARATION FOR INSTALLATION AND OPERATION



Unpacking, installation, connection and initial commissioning at the location of the user of the machine may only be done by employees of the machine manufacturer and in the presence of technicians of the machine user/operator.

3.1.1 Installation location requirements

► Recommended environment

The machine as well as its individual sections are able to operate correctly under the following conditions:

- ✓ at mean altitudes above sea level up to **2,000 m**
- ✓ at relative **air humidity** in the workplace of between 10 – 80 %, without condensation
- ✓ at ambient temperature of between **+5°C** and **+40 °C**, whereas the temperature average over 24 hours must not exceed +35°C. In order to maintain the long service life of the machine it is recommended to operate the machine in an environment where the temperature will not fall below 15 degrees Celsius and remains constant with a tolerance of $\pm 2^\circ\text{C}$, and at the same time it will not exceed 30°C.



► Unsuitable environments

- ! It is not recommended to install the machine in an environment containing **chemically active substances** (e.g., salty aerosols contained in seawater or brine and used for road winter treatments, sulphur dioxide, hydrogen sulphide, chlorine, hydrogen chloride, ammonia, etc.) or **mechanically active substances** (e.g., sand, dust).
- ! It is not recommended to expose the machine:
 - **to direct sunlight**
 - **to windy environments (air drafts)**
 - **to radiated heat**
- ! It is prohibited to install the machine close to devices producing **vibrations and shocks** with an acceleration value above **1g** (9.81 m/s^2). Frequent sources of vibrations and shocks are hammers, presses, shaping machines, roads, etc.



► Placement at the installation location

The machine must be installed in a location where the machine operator **will not be disturbed by activities** taking place in other neighbouring workplaces and **the back of the operator cannot face a corridor**, providing that there is a corridor close to the workplace.

It is recommended to install the machine in a location where surrounding permanent obstacles (walls, columns, other machines, etc.) will allow the operator to safely operate, maintain, service or replace parts of the machine.

When selecting the installation location, take into account the external dimensions of the machine specified in Chapter 1.7. Do not forget to take into account **the highest machine height**.

► Installation floor requirements

The floor where the machine is to be installed must be in good condition without any cracks, and suitably level. It is recommended to install the machine on a suitable concrete bed wide and rigid enough to support the weight of the machine and to provide easy access.



If a new concrete bed is made for the machine, the machine may be installed only after the concrete has cured properly.

► Fire prevention

Keep suitable fire extinguishers near the machine and make sure that all employees know the locations of fire extinguishers and know how to use them. Additional fire prevention information may be found in ■■ 2.4.

► Workplace lighting

In order to ensure safe work, the machine and the workplace must be properly illuminated in line with the applicable national and local requirements.

Even if the work area is equipped with lights it is recommended to use portable lamps when performing adjustment or servicing in the work area in order to ensure constant and sufficient illumination, for example, when the workplace lighting system is blocked.

3.1.2 Information about connection points

► Connection to power supply

Electrical devices on the machine are supplied with power from the main electrical cabinet, which the workshop or production hall manager must provide. Cables and power supply distribution cables on the machine either run inside trays or pipes.

Power supply specifications	Value
Power grid	TN-S
Voltage	230 V
Workplace lighting	12V DC SELV
Control voltage	24V DC PELV
Electricity	16 A (B)
Frequency	50Hz
Distribution cabinet protection closed/open	IP54/IP20

Information necessary to connect the machine to the power supply is also available on the manufacturer nameplate, which is located on the lower right side of the machine. A nameplate with the necessary information is also located inside the electrical distribution cabinet.



Make sure that the voltage of the electrical supply grid corresponds with the values specified on the machine nameplate. Do not attempt to start up the machine using a different power supply. Serious damage may occur.

Only a properly trained and skilled electrician may repair and service the machine's electrical equipment!

► Connecting a pressurized air supply to the machine

The supplied pressurized air must be dry and clean and must maintain a constant pressure of 6 bar. The air pressure cannot vary by more than $\pm 10\%$.

Connection to pressurized air		
Required air pressure at the machine inlet	bar	6 - 10
Pressure fluctuation	%	+/- 10
Air coupling		quick coupling 1/8"
* The source of pressurized air and connection of the air to the machine must be arranged by the machine operator!		

3.2 TRANSPORTATION, HANDLING AND UNPACKING

3.2.1 Transportation and handling before unpacking

The packed machine may be transported using a forklift or crane and lifting ropes.

The following warning applies to lifting and handling of the packed as well as unpacked parts of the machine.



*Lifting equipment and crane ropes may only be handled by persons who possess the necessary permit. Never **stand underneath an object that is being lifted**. Make sure that no part of your body may come under the lifted object. Do not move the lifted objects over any bodily parts of other persons.*

When handling/lifting individual sections of the machine, bear in mind that the lifting capacity of the crane or hoist must always be greater than the weight of the lifted object!

Before moving individual machine parts, make sure that all movable machine parts are secured against movement.

Inspect lifting and fastening equipment before use. Replace defective equipment with new equipment. Do not use damaged or incomplete lifting ropes or equipment.

*Lifting chains, ropes or slings must not be twisted when used to lift an object and must not have any loops or knots in them. **Never try to repair defective lifting equipment by yourself.***

Do not overload lifting ropes and equipment with dynamic impacts or shocks. Shocks may occur when you try to lift an object too quickly (quick load and tension on loose chain or rope, for example) or when the lifted object tips over or loses stability. Use hooks with safety clamps to prevent the lifted object from slipping out of the hook.

Before lifting any object completely, lift the object just above the ground and make sure that it is well-balanced in the both transversal and longitudinal directions. In the ideal scenario, the hook of the crane is right above the center of gravity of the object. The lifted object must be properly secured against rotating.

The lifting eye must be sufficient in diameter in order to fit the size of the hook. The weight of the object cannot rest on the tip of the hook.

Before moving the machine around on carts, make sure that the floor does not have a dangerous slope!

If the machine cannot be moved to the installation location using lifting equipment (the workshop is not equipped with a crane or a portable crane cannot enter the workshop due to lack of space), use suitable transportation/moving carts to move the machine around. Attach the transportation carts to suitable locations using the machine setting screws. Use a draw bar to hook the machine to a suitable pulling vehicle.

3.2.2 Unpacking and cleaning

- 1) Remove packaging materials from all parts of the machine.



When the machine is unpacked, make sure that packaging materials are recycled or properly disposed of. Follow applicable waste disposal rules valid in the country where the machine will be operated.



- 2) Make sure that parts or components of the machine were not damaged during the transport.

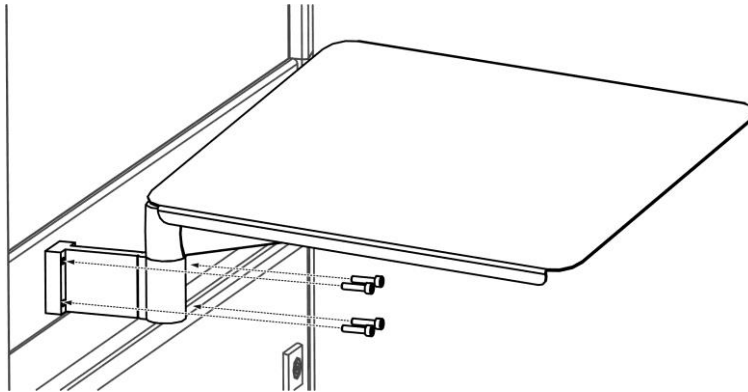
3.2.2 Transportation and handling at the place of installation

- 1) Use suitable lifting or transportation equipment to move the entire machine to the place of installation.
- 2) Remove all fastening and attachment components used during the transport.

3.3 MACHINE INSTALLATION AND STARTUP

3.3.1 Notebook holder installation

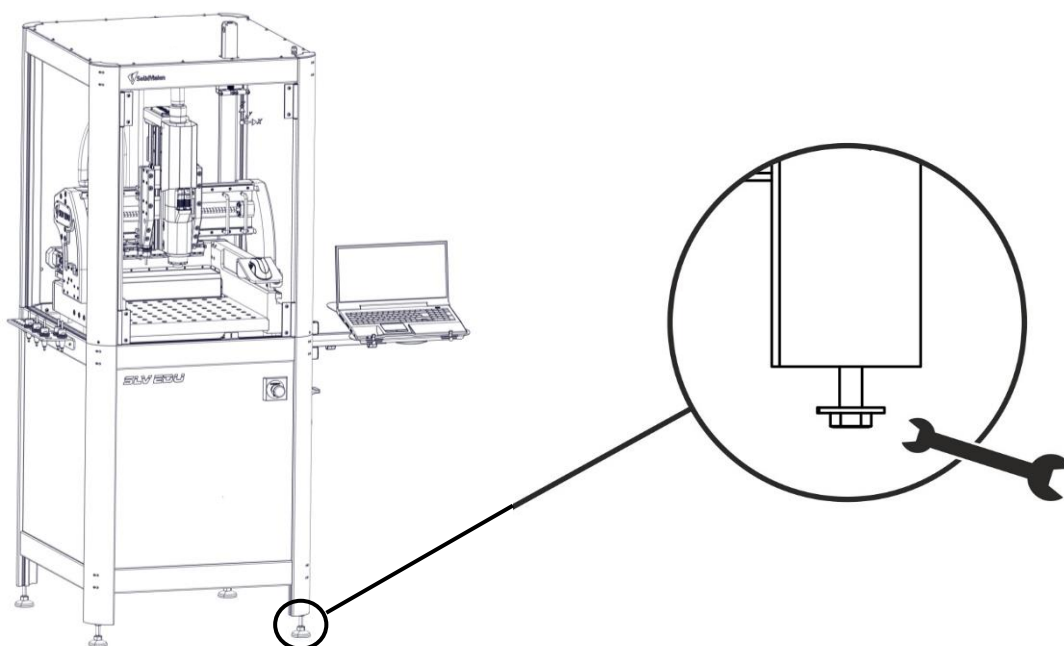
The notebook holder was removed due to transportation and must be attached again using the predrilled holes and screws on the right side of the machine.



3.3.2 Machine alignment and balancing

Align and balance the machine as well as you can.

- ▶ If a pallet remains on the machine, align and balance the pallet using a water level tool in order to align the machine as best as you can.
- ▶ If the machine is delivered without a pallet, use the height adjustable legs at the bottom of the machine to level the machine properly. In order to align and balance the machine properly, put the water level tool on the worktable and turn the screws to adjust the height of the machine as necessary.



3.3.3 Connecting the machine to an electrical power supply

The machine supplier shall connect the machine to the power grid of the user/owner of the machine. The power supply grid must comply with the parameters specified in Chapter 3.1.2. of this manual. For this purpose, the machine is equipped with a 230V/16A supply cable located in the rear section on the lower right side of the machine.



Connection or disconnection of the machine from the power supply may only be done by qualified personnel!

3.3.3 Connection of the machine to the pressurized air supply (optional)

The connection procedure of the machine to the source of pressurized air is specified in the manual supplied with the air equipment.

3.3.4 Inspections before first start-up

- Make sure that the parameters on the machine nameplate correspond with the parameters of the connection point.
- Check and tighten all screws of electrical connections, terminals and make sure that all connectors are properly inserted in sockets.
- Make sure that all devices or equipment that were used to secure the movable parts of the machine in place during transport have been removed.
- Check functionality of safety switch of workplace
- Check functionality of safety STOP button
- Check visually, if electric cables are not damaged by moving with machine

4 | OPERATION AND CONTROL

Exact and detailed procedures of the machine operation and use of the control system are specified in a separate manual which is delivered with the machine. This chapter only briefly describes basic work procedures/steps.



The machine may be operated only by persons who have been properly trained by the manufacturer or the machine operator/owner in use of the machine, including occupational safety issues.

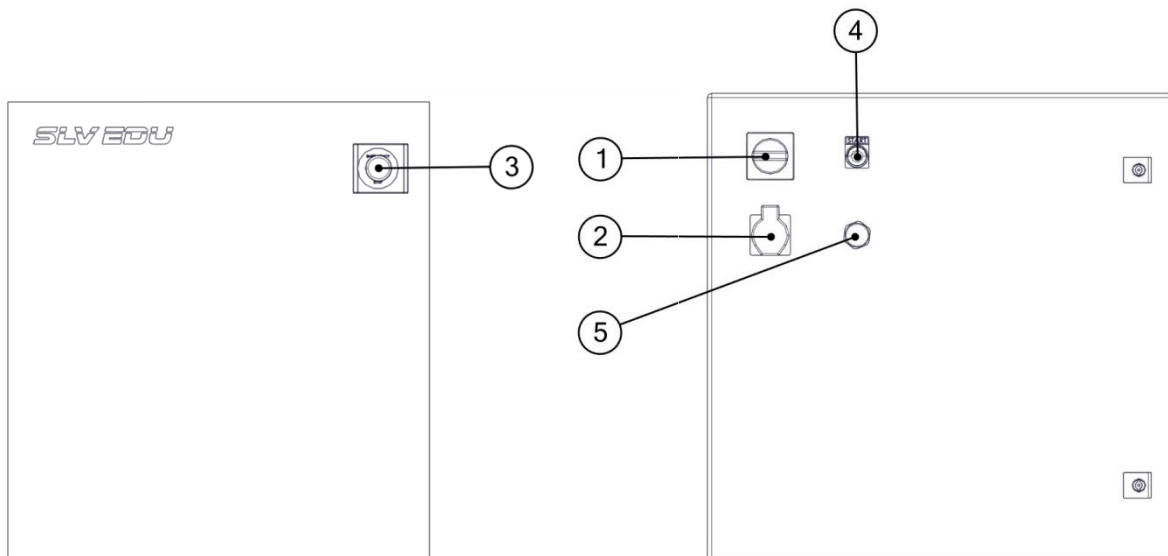
Before using the machine, the operator must check all parts of the machine and must make sure that all parts of the machine work properly in line with the maintenance plan, see Chapter 5: Maintenance.



The PC is just for control system and machine control. It is strictly prohibited to download other files, than actualizations files for control system Arem Pro and use PC for other functions, than machine control.

4.1 MACHINE CONTROL ELEMENTS

All machine control elements are located on the panel of the control cabinet on the lower right side of the machine.



► Main switch (1)

The main switch is used to turn the machine On and Off.

► Socket (2)

It is used to connect a PC to the machine.

► Emergency stop pushbutton (3)

It is used to stop the machine immediately in emergency situations.

► START button (4)

This button is used to initiate/start the control system. Until this button is pressed the command line shows the Off status. This button must also be pressed after the emergency stop button was pressed.

► Ethernet cable (5)

This cable is connected to the PC and is used to transfer data between the machine and the PC.

4.2 CONTROL SYSTEM

The Arem Pro/Win control system runs on the Windows platform with RTX real time extension provided by Ardence. The advantage of this system is its compatibility with other programmes such as CAD/CAM, production control programmes, workshop programming software, etc.



No software, drivers or patches may be installed on the control computer without the knowledge of the supplier of the control system. Otherwise, proper functioning of the control programme cannot be guaranteed.

Once the PC is turned On and the Windows standard user interface has loaded, click on the icon on the desktop to start the Arem Pro system.



Once the Arem Pro is running the computer screen displays a window with the user **graphic interface**. Most operations are initiated using procedures common for the Windows operating system, such as left mouse double-click, etc.



Automatic	Manual	Library	Parameters	Service	Errors	Ready
Axis	In programme	Tool	Off. G53	Offset	InP	Mode
Length					Yes	Normal
Spindle						Step
Travel						Duration

The graphic interface consists of the status window (1), cards with tabs (2) and buttons on the panel (3).

Numbers, file editing and many other operations may be entered using the keyboard or mouse or even via a touchscreen, if available. In such scenario, the mouse and touchscreen work together in parallel. The same action may be achieved either by using the touchscreen or the mouse.



Detailed information about use of the control system is available in a separate documentation provided by the system manufacturer.

4.3 TURNING THE MACHINE ON AND OFF



Before turning the machine On, make sure that no foreign object is present in the work area. Also make sure that the machine is in perfect condition and that no safety devices have been removed or deactivated.

► Turning the machine On



Before turning On the main switch, make sure that the machine's front covers and covers of the control cabinet panel are closed, otherwise, the main switch will not work. The emergency pushbutton on the distribution cabinet must also be released/pulled out.

You can turn the main switch On by moving/rotating it to the **ON** position.

Now you must turn On the PC. Once the operating system is loaded and the control system has been started, you must press the **START** button. The system will switch into the **Initialisation mode** and then into the **Ready**.



When the axes have been referenced the system will not allow manual movement beyond limits set by machine constants. However, if the given axis is not referenced, the system cannot monitor any limit positions. In this scenario the operator may move the axes all the way to the positions of breakdown limit switches, which will produce an error status.

► Turning the machine Off

The system may be shut down in several steps. First, you must end events in the Arem Pro programme, that is, interrupt or terminate the technological programme, editing programme, etc. Then you may terminate the Arem Pro programme by clicking on the cross in the upper right corner of the window. Now, you may shutdown the Windows operating system. Finally, the machine may be turned Off by moving the main switch to the **OFF** position.



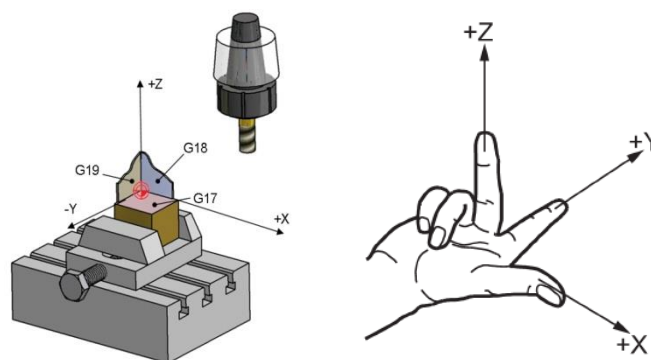
In case of a power outage, the main switch disconnects automatically.



If the machine is executing a working cycle, it is prohibited to use the main switch to turn the machine Off!

4.4 MACHINE COORDINATE SYSTEM

When in manual mode, the pushbuttons or the programme may be used to move the saddle, cross-feed table and the spindle along the three basic axes (X, Y, Z) perpendicular to each other. These machine parts move in the + (plus) or – (minus) directions, in line with general rules applicable to movements of metal turning machine axes, in particular DIN 66217.



5 | MAINTENANCE

Regular and correctly performed maintenance is a necessary condition for safe and trouble-free operation of the machine, long service life and for high quality products.

The machine must be kept clean and in full operating condition. While working, the machine operator shall continuously visually inspect the machine. If any part of the machine demonstrates non-standard behaviour (for example, excessive noise, etc.), the operator must notify the service technician.

Worn or damaged parts of the machine must be replaced in time. A list of replaceable worn parts is shown in ■ 5.5 of this manual.



- ! Before maintenance or before servicing the machine, carefully study the instructions, prohibited activities and recommendations specified in Chapter 2: Occupational safety and health protection at work.*
- ! Maintenance or repairs of mechanical and/or electrical parts of the machine may only be performed by a qualified employee, authorised by the machine supplier to perform such activities.*
- ! **Each time the machine is serviced or when parts of the machine are being handled and direct contact between the operator and rotating machine parts or moving machine parts may occur, the power supply must be shutdown by pressing the "Emergency stop pushbutton", or by turning Off the main switch located on the electrical distribution cabinet.***
- ! Before performing any maintenance or cleaning activities, the machine must be disconnected from the supply voltage by turning Off the main switch.*
- ! Maintenance, inspections or replacement of any machine parts or accessories **may only be carried out when the pressurized air supply is closed and the electrical supply is turned Off!***
- ! If the pressurized air supply is required during machine adjustment or if the assistance of other persons is required, it is necessary to specify which employee is responsible for performing the given activities and when.*
- ! During maintenance and cleaning done on machine parts located higher above the ground using auxiliary steps or devices such as ladders, the machine must always be turned Off and secured and protected against accidental start-up.*



Certain parts of the machine are supplied with separate instruction manuals. When maintaining these parts, follow the instructions specified in these manuals.

5.1 EQUIPMENT MAINTENANCE OVERVIEW

INTERVAL	PART	ACTIVITY	Details
Daily	Work area	Cleaning of the entire work area. Removal of metal splinters and dirt	■ 5.2.1
	Mechanical machine parts	Visual inspection of damage; noise check	
	Control and safety elements	Inspection of status and functionality	
	Pneumatic distribution system	Inspection of the integrity of supply hoses	■ 5.2.2
	Pneumatic unit	Inspection of the correct pressure and fluid level in the reservoir.	
	Work area glass panels	Cleaning	■ 5.2.1
Monthly	Mechanical connections/couplings	Inspection of the tightness of mechanical joints and connections (screws, nuts, etc.)	■ 5.2.1
	Electrical connectors and terminals	Inspection of tightness and correct connections (connectors properly inserted)	■ 5.2.3
	Pneumatic connectors	Tightness and leak inspection	■ 5.2.2
6 months	Air treatment unit	Filter cleaning in accordance with the instruction manual of the manufacturer	■ 5.2.2
As needed	Pneumatic couplings and screws	Inspection of proper tightening	■ 5.2.2
	Work area lighting system	Cleaning	■ 5.2.1
	Machine's moving parts	Lubrication	■ 5.3

5.2 ADDITIONAL MAINTENANCE INSTRUCTIONS

5.2.1 Mechanical parts maintenance and inspection

Regular inspection and cleaning of the machine work area and machine parts is very important. Accumulated or flying splinters may get into various places and cause serious damage over time. In order to prevent such damage, observe the following instructions when maintaining the machine:

- **Inspect** mechanical parts of the machine **daily**; make sure parts are free of damage, cracks, etc.,
- **Inspect** the condition and function of **control** and **safety elements daily**:
 - check the function of the emergency stop pushbutton
 - check the function of the door switches
- **Check** whether the machine produces any unusual noises **daily**. If so, try to locate the source of the noise and remove it.



If any part of the machine specified above does not work properly, contact the service or maintenance technician immediately.

- **Remove splinters and dirt from the machine work area daily**, in order to prevent excessive accumulation. Use a shovel, brush, hook with a handle, scraper, etc., to manually remove splinters.



Always use personal protection gear, such as work gloves and eye goggles when cleaning or removing splinters from the machine work area!

- **Clean the glass panels on the work area door daily**. It is prohibited to use benzene or organic paint thinners for cleaning.
- **Inspect** the proper tightness of all mechanical joints and couplings on a **monthly basis**.
- **If necessary, clean the LED strips** in the work area.

Areas enclosed by covers do not allow sufficient ventilation. Therefore, it is recommended to keep the door of the work area open when you finish your work.

5.2.2 Inspection and maintenance of pneumatic parts

When maintaining pneumatic parts it is necessary to observe the following principles:

- Maintenance may only be performed by properly trained persons with the necessary qualifications.
- When replacing pneumatic parts, accessories or cables, use the same or equivalent part types.
- When repairing pressurized air distribution pipes or pneumatic equipment, close the pressurized air supply valve.



Before performing any maintenance (except for inspections and pressure adjustment), close the pressure supply valve and bleed the machine pneumatic system. Further, when the machine will not be used for a long time, close the pressure supply valve and bleed the machine's pneumatic system.

- **Inspect all pneumatic connections/connectors on a monthly basis to make sure that air connectors are properly inserted and tightened.**
- **Inspect and tighten all screws of pneumatic couplings and terminals on a monthly basis.**



Perform inspection of pneumatic units in line with the instructions specified in the relevant manual provided by the unit manufacturer.

5.2.3 Inspection and maintenance of electrical parts

When maintaining electrical parts it is necessary to observe the following principles:

- Maintenance may only be performed by properly trained persons with the necessary qualifications.
- **Keep the electrical distribution cabinet clean** (do not place any foreign objects inside the cabinet), do not use pressurized air to clean the cabinet.
- Make sure to close the door of the **electrical cabinet immediately** after you finish the maintenance.
- **When changing electrical equipment/devices**, use the same or equivalent part type. When replacing adjustable electrical parts such as circuit breakers, make sure to set the same thermal triggering value.
- When replacing cables going through the machine, use types which are resilient to bending stresses.

Without the prior consent of the machine supplier it is prohibited to change the parameters of the control system or the parameters of the regulating units.

- **Inspect** all connections/connectors on a **monthly basis** to make sure that connectors are properly inserted into sockets. Inspect and tighten all screws of electrical connectors and terminals. Perform these inspections only when the main electrical distribution cabinet is turned Off.

5.3 LUBRICATION

All important parts of the machine which need to be lubricated are monitored by the control system. If the lubrication interval is due, the system will display a message on the screen. The message always applies to a particular axis. If the message appears, stop the machine as soon as possible and lubricate the axis via the nipple using Mobil VACTRA No.2 oil.



If necessary, the operator of the machine may lubricate the machine as needed and without waiting for the control system message to appear.

Pay special attention to the air-drop lubrication system and to the tool cooling system (optional accessories). Inspect the level of the oil in the reservoir daily and if necessary, refill it. The amount and type of oil is specified in the instruction manual provided by the manufacturer of the equipment.



Always use the type of oil recommended by the unit manufacturer. Make sure to use new and chemically/mechanically clean oil.

Using unsuitable oil may cause the machine to malfunction or break down.

5.4 TROUBLESHOOTING

If an error message which you cannot fix alone appears on the screen, please contact the machine supplier or manufacturer for the solution.

5.5 REPLACEABLE PARTS

The machine contains the following replaceable parts subject to regular wear and tear:

- Spindle
- Ball screw
- Ball screw nut
- Linear guides
- Carts
- Bearings
- Tool exchanger guides
- Tool exchanger fork
- V-belts and pulleys


If you need to replace these parts, contact the machine supplier or the manufacturer.

6 | DECOMMISSIONING, DISASSEMBLY, STORAGE AND DISPOSAL

6.1 MACHINE DISASSEMBLY AND REMOVAL

When disassembling the machine and individual components, follow the instructions applicable to the machine installation as well as the procedures learned during training, or contact the manufacturer for details. You may also follow the reverse of the assembly steps specified in Chapter 3.

If you need to move the machine to a different location, perform the following:

- 1) Disconnect all energy and media supplies, pneumatic and hydraulic hoses, and electrical cables (optional accessories)
- 2) Use suitable lifting equipment to move the machine to its new location, see  3.

6.2 MACHINE STORAGE

If you are disassembling the machine for storage purposes, follow steps 1) through 3) specified in the previous chapter.

After placing individual machine parts on pallets, lubricate them using common and regular protective lubricants. Cover parts with foils or tarps and attach with tags with descriptions to make later identification easier. Attach them properly to the transportation equipment (for example, pallets, one-way pallets, metal frames, etc.)

6.2.1 Storage requirements

Store the machine and its parts in a dry location protected against harmful weather influences to prevent damage.



Do not place any foreign objects or materials on the stored machine or its parts.

Temperature	from -10°C to +35°C
Air humidity	< 80% at 21°C
Air purity	Dust-free environment
Others	Dry storage area

6.3 DECOMMISSIONING AND MACHINE DISPOSAL



Before you dispose of the machine or its parts, make sure that the machine and its parts cannot be reused. Even old products contain raw materials that may be used. Return these raw materials to the appropriate waste collection center.

When disposing of the machine you must follow the instructions provided by the manufacturers of individual machine components and observe the applicable waste disposal requirements. It is best to have components disposed of at a specialized site which will recycle them properly. Store those parts of the machine which cannot be used at a controlled waste disposal site. When disposing of materials, you must follow the applicable national waste disposal requirements.

7 | WARRANTY

The machine warranty does not cover damage or operational breakdowns caused by an error of the operator, due to negligence, failure to follow the instructions in this manual, using the machine in conflict with its intended purpose or due to neglected or incorrect maintenance. Further, the machine warranty does not cover breakdowns caused by improper machine installation done in conflict with the manufacturer's recommendations, including incorrect repairs or defects caused by the intervention of an outside person or by force majeure.

The warranty, liability for damage and the CE mark apply only to equipment supplied by SolidVision. The CE mark also applies to spare parts and/or parts subject to quick wear and tear specified by SolidVision.

If modifications, changes, software/hardware adaptations are not performed by SolidVision, or by a company authorised by SolidVision, the warranty and the validity of the CE mark will be void. The machine user alone is liable for all risks ensuing from the applied modifications regardless of the type or scope of the modification.

The warranty doesn't include rust on the steel table. Steel table should be cleaned and lubricated after each use.

SLV EDU

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