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FCC Compliance Statement

This device has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in residential installations. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio and television reception.

However, there is no guarantee that interference will not occur in a particular installation. If this device does cause such interference, which can be verified by turning the device off and on, the user is encouraged to eliminate the interference by one or more of the following measures:

- Re-orient or re-locate the receiving antenna.
- Increase the distance between the device and the receiver.
- Connect the device to an outlet on a circuit different from the one that supplies power to the receiver.
- Consult the dealer or an experienced radio/TV technician.



WARNING!

Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device complies with FCC Rules Part 15:

Operation is subject to two conditions:

- 1. This device may not cause harmful interference, and
- 2. This device must accept any interference that may be received or that may cause undesired operation.

To comply with FCC Section 1.310 for human exposure to radio frequency

electromagnetic fields, implement the following instruction:

A distance of at least 20 cm between the equipment and all persons should be maintained during the operation of the equipment.





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1. General

1.1. Safety first

<u>^!</u>	Read the manual Safety of the operator is a main concern. This equipment is as safe as we are able to make it. Avoid accidents by reading the safety alerts, investing a few seconds of thought and a careful approach to handling equipment. You, the operator, can avoid many accidents by observing the following precautions. Review the safety instructions of the manufacturer, suppler, owner, and all organizations responsible for the prevention of accidents.
<u>!</u>	 Ensure that: The work area and the area around the CNC machine are free of obstacles The work area is properly lit This equipment is operated only by a responsible adult trained in this operation This equipment is not operated by a person under the influence of drugs or alcohol This equipment is not operated by a person with any illness or physical condition that might reduce reflexes or awareness and increase exposure to risk. Before starting any kind of work, install all of the safety devices prescribed by the builder of the machine or power tool are in place Shaving/dust suction equipment must be used at the same time as the tool
<u>^!</u>	Warning: Rotating Tools, Entanglement Hazard To avoid risks associated with the use of rotating tools it is strongly recommended to use the utmost caution and concentration when working.
<u>^!</u>	Warning: Rotating Tools, Cut or Severe Hazard Always wear correctly sized gloves that allow the sensitivity necessary to operate the tool correctly and give adequate protection in the event of the blade being touched during use.
<u>^!</u>	Warning: Always use safety glasses or protective screens to protect your eyes.
<u>_!</u>	 Install only tools in perfect condition that are recommended for the material to be worked and that are suitable for the type of machine used Do not use cracked or deformed tools Check that the balancing, keying and centering of rotary tools are carried out correctly Fix the tool correctly using the proper tightening and adjustment devices Remove all tightening and adjustment devices before use Check that the tool rotates in the correct direction Never exceed the limits of a piece of machinery. If its ability to do a job, or to do so safely, is in question - DON'T TRY IT



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1.2. Statement of Compliance

The HSM Jet Spindle meets the following standards

1.2.1 European standards (CE)

- EMC: EN 301489-1/17
- Radio: EN 300328 V 1.8.1
- Safety: EN 61010-1:2010

1.2.2 American standards (UL)

- EMC: FCC Part 15 B
- Radio: FCC Part 15 C
- Safety: UL 61010-1

1.2.3 International standards

- Safety: IEC 61010-1:2010

1.3. Introduction

The HSM Jet Spindle is a unique High Speed Machining spindle (20 krpm, 30 krpm & 40 krpm). It is driven by the CNC machine/turret spindle coolant thru flow at minimum pressure of 20 bar. SpinJet does not require any special installation aside from the installing it to the spindle/turret. It then operates like any other standard tool holder in the magazine.

1.4. SpinJet Contents

The wireless RPM display case includes:





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The HSM Jet Spindle includes:





1.5. Main Features

The HSM Jet Spindle spindles are best used when high RPMs is required for small diameter tools on limited RPM CNC machines. The system utilizes the CNC machine tool's existing coolant supply driven by a high pressure pump (minimum 20 bar) as an energy source to rotate a turbine up to 60.000 RPM. The HSM Jet Spindle can be supplied either as right-hand or left-hand option.

The HSM Jet Spindle is not intended to replace the CNC machine spindle, but rather to upgrade the existing CNC machine, providing improved performance, faster machining, better surface quality, and extended tool life. The new spindles can be used for semi-finish and finish machining applications such as milling, drilling, and jig grinding.

HSM Jet Spindle models operating ranges:



Fig. 3: Rotation speed vs. tool diameter

HSM Jet Spindle	Coolant pressure					
type / RPM	20 bar	30 bar	40 bar			
SJ 20-ER32	20000*	30000*	40000*			
	RPM	RPM	RPM			
SJ 30-ER32	30000*	40000*	50000*			
	RPM	RPM	RPM			
SJ 40-ER32	40000*	50000*	60000*			
	RPM	RPM	RPM			
 * approximitate RPM values - depend on pressure, flow rate and used coolant type 						

Fig. 4: The relation between coolant pressure & RPM value based on HSM Jet Spindle



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1.5.1 Wireless Rotation Speed Display general view



Fig. 5: HSM Jet Spindle wireless transmitter and display

The HSM Jet Spindle is equipped with an integrated wireless display system, allowing real-time monitoring of the rotating speed during machining.

This system consists of a transmitter installed on the spindle housing, and a receiver display.

The receiver is powered by a 5 VDC universal AC/DC power adaptor connected to either a 220 VAC or a 110 VAC power source.

The transmitter is powered by an exchangeable CR2 lithium battery.

Display Information



Fig. 6: Wireless display and RPM transmitter unit main view

- 2.4 GHz radio frequency transmission
- Direct wireless rotational speed monitoring up to 5 m range
- Externally powered a receiver display
- Enables reading of all HSM Jet Spindle systems being used on a specific CNC machine This is limited to 127 tools
- Internally battery's powered RPM transmitter unit
- Own ID number for each RPM transmitter unit



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Fig. 7: Wireless RPM display mounting options

1.5.2 Built-in and Direct Mounting System to CNC Spindle

HSM Jet Spindle is available in several mounting adaptation types:

- ER32 collet chuck with a special tightening nut, suitable for all standard tool holders with an ER32 adaptation This is the default type.
- Integral options with various adaptations are available upon request.





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1.5.3 Shaft Locking for Tool Clamping

The shaft lock mechanism provides you with a simple and easy way to change the tool installed on your HSM Jet Spindle spindle. For instructions on installing the tool into the spindle see page 21.



Fig. 9: HSM Jet Spindle with pin mechanism locked

<u>^!</u>	Warning: Do not hold the pin handle while tightening/loosening the shaft lock mechanism. Failure to obey this warning might lead to a broken spindle shaft.
	It is strictly prohibited to use the HSM Jet spindle if shaft lock hole's protection plug is damaged or missing.





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1.5.4 Integrated Coolant Nozzle System

The Integrated coolant nozzle system provides 3 main advantages:

- Direct jet coolant application
- Better and faster chip evacuation
- Prevents tool thermal shock



Fig. 10: Integrated coolant nozzle system

1.5.5 Tool Clamping

The HSM Jet Spindle is compatible with ER11 collet chuck.

The assembly of rotating elements (collet, nut and tool) must be balanced to a G2.5 at 40,000 RPM. We recommend that you use ER 11 high precision spring collets.

When longer overhang is required, 10 & 25 mm long ER11 thermal shrink collets are available.



Fig. 11: Overhang solutions types



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2. Installation

2.1. Battery installation into the RPM wireless transmitter

To install the battery into the RPM transmitter:

- 1. Unscrew the 4 screws holding the battery case cover using a hexagonal 2 mm Allen key.
- 2. Remove the battery case cover.
- 3. Make sure the O-ring inside the cover is seated well, and intact.
- 4. Put in the CR2 lithium battery in correct direction
- 5. Return the battery case cover to its place.
- 6. Fasten the battery case cover with the 4 screws that were removed.

Now the transmitter is ready to work.



Fig. 12: Battery case open

2.2. Display

The HSM Jet Spindle is equipped with an integrated wireless display system, allowing real-time monitoring of the rotating speed during machining.

2.2.1 Prerequisites for display installation

Make sure that the following pre-requisites are met:

- 1. Electrical power: 220/110 VAC, standard socket.
- 2. Distance from HSM Jet Spindle to Display: no more than 5 m.
- 3. Available space for the display so that operator will have a close and unobstructed view of it.

2.2.2 Display Workspace Installation

1. Mount the display onto a metallic surface using the magnet on the back of the display, or place on a flat and leveled surface.

detection side

- 2. Connect the display to an AC socket.
- 3. Switch the display ON.





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2.2.3 Connect the HSM Jet Spindle to the display

The display and the HSM Jet Spindle must be connected (paired) so they can "identify" each other.

Each transmitter unit has an own ID number (See Fig. 6)

To $\ensuremath{\textbf{connect}}$ the HSM Jet Spindle to the display:

- 1. Make sure the display is ON.
- 2. Press ,CONNECT' on the display panel, then slide the transmitter (assembled on the HSM Jet Spindle) across the left side (detection side) of the display unit, as shown in the picture.



Note: Connecting feature is the turning ON of the internal battery consumption on the transmitter unit. To save a battery energy and in case that SpinJet is not in use - do **Disconnection** procedure (see paragraph 2.2.5).



Fig. 14: Many HSM Jet Spindles (not working simultaniusly) can be connected to one display

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2.2.4 Screens





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Note:

Disconnecting feature is the turning OFF of the internal battery consumption on the transmitter unit.

Fig.19: Disconnection display



If the display detects more than one HSM Jet Spindle working at any time, a "MULTIPLE SIGNAL" is shown (see Fig. 20).

Fig. 20: Multiple signals screen



Select "List" to choose the device to disconnect from the next screen.

Fig. 21: Disconnection list for multiple signals screen





The display can be cleared from all connected HSM Jet Spindles, or a list of previously connected devices can be viewed.

Fig. 22: Disconnect all sensors screen



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If the connect or disconnect processes don't succeed for any reason, an appropriate message is shown - see page 26 for troubleshooting.

Fig. 23 & 24: Connection / Disconnection failed screen



If the battery of the HSM Jet Spindle you are currently using is running low - the following warning is shown - see page 26 for troubleshooting.

Fig. 25: Low battery screen



If the HSM Jet Spindle is not spinning fast enough, the "LOW RPM" alert is shown.

Fig. 26: Low RPM screen



If the HSM Jet Spindle is spinning too fast, the "HIGH RPM" alert is shown.

Fig. 27: High RPM screen



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2.2.5 Disconnect the HSM Jet Spindle from the display

- 1. Make sure the display is ON.
- 2. Press ,DISCONNECT' on the display panel, then slide the transmitter (assembled on the HSM Jet Spindle) across the left side (detection side) of the display unit, as shown in the picture.



While disconnecting the HSM Jet Spindle you will see the "Disconnecting" screen. "<device ID> disconnected screen" - notice that the battery level of the HSM Jet Spindle is shown.

Make sure that <device ID> on disconnected screen corresponds to the ID # signed onto the RPM transmitter unit.

2.3. HSM Jet Spindle

2.3.1 Prerequisites for the CNC Machine

- 1. Coolant flow through the main CNC machine spindle
- 2. Minimum coolant pressure, at main machine spindle outlet: 20 bar
- 3. Maximum coolant pressure, at main machine spindle outlet: 40 bar
- 4. Minimum flow rate: 12 L/min
- 5. Minimum coolant filtration level: 100 µm
- 6. An active mist collector
- 7. With the emulsion coolant, use an anti-foaming agent additive suitable for your emulsion to prevent foaming.
- 8. Use emulsion coolant with oil percentage higher than 4%
- 9. With oil coolant, the high pressure increases the amount of oil fumes:
 - a. Use appropriate means of fire protection and extinguishing.
 - b. Use anti-dissolution additive suitable for your oil.



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2.3.2 HSM Jet Spindle Installation onto the CNC Machine



Fig. 28: SpinJet on CNC machine

While the HSM Jet Spindle is mounted on the machine, the CNC machine spindle should be stationary, except for tool checking procedure or Z-offset measurement. In those cases it must not exceed 3000 RPM, or risk breaking/injury. To avoid the CNC machine spindle rotation during the HSM Jet Spindle operation use the correct software M-code to lock the Spindle orientation.

For example: "M19" code locks the spindle in a defined angle position.

Before installing a HSM Jet Spindle with a filter on the machine spindle, make sure that the filter is clean.

SpinJet Installation onto turret

See Manual "Driven tools"





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2.3.3 Placement of HSM Jet Spindle in the Toolholder

Caution: Deviation from these steps might lead to locking of the tightening nut to the HSM Jet Spindle. The HSM Jet Spindle will only work with a toolholder that has a coolant through channel. To fix the SpinJet Spindle in a toolholder: See steps from left to right in Figure 29.



Fig. 29: Placement of HSM Jet Spindle in toolholder steps

- 1. Use a standard tool holder with ER32 collet chuck
- 2. Loosen the HSM Jet Spindle tightening nut 1.5 full turns
- 3. Insert built-in ER32 taper shank into ER32 collet chuck until the HSM Jet Spindle tightening nut will be placed on the toolholder
- 4. Fasten the HSM Jet Spindle tightening nut onto the toolholder, without turning the HSM Jet Spindle relative to the nut
- 5. Fasten the HSM Jet Spindle tightening nut to clamp the HSM Jet Spindle and the toolholder together with an ER 32 spanner, use hand force only



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Fig. 30: Example of a toolholder with a hole for coolant flow



2.3.4 Tool prerequisites

HSM Jet	Spindle	spindles a	are for	applications	reauirina	tool shar	nk diameters	of up to	6 mm.

HSM Jet Spindle type	SJ 20		SJ 30			SJ 40			
Rotational Spindle speed [Krpm]**	20*	30*	40*	30*	40*	50*	40*	50*	60*
Coolant pressure range [bar]***	20	30	40	20	30	40	20	30	40
Recommended coolant	10.10		10.10			10.10			
flow rate range [l/min]	12-18		12-18		12-18				
Milling		0005		1005		0.0.1.5			
Recommended Cutting tool diameter [mm]	2.0-3.5		1.0-2.5			0.2-1.5			
Drilling						< 1.0			
Recommended Cutting tool diameter [mm]	≤ 2.0		≤ 2.0		≤ 1.2				
Grinding	< 10.0		< 10.0						
Recommended Cutting tool diameter [mm]	≤ 10.0		≤ 10.0		-				
Thread milling	< M5								
Recommended Cutting tool diameter [mm]	≤ M5		≤ IVI5		-				
Chamfering & Engraving									
Recommended Cutting tool diameter [mm]	≤ 6 mm tool shank		≤ 6 mm tool shank		≤ 6 mm tool shank				
Recommended cutting speed [m/min]		for steel ≤ 200							
		for aluminium ≥ 200							

* approximately rotational spindle speed

*** recommended coolant pressure 30-40 bar

^{** 20} Krpm based on min. coolant pressure 20 bar & min. flow rate 12 l/min



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2.3.5 Tool Installation into the HSM Jet Spindle

The HSM Jet Spindle can hold various tools that use an ER11 collet. **To set a tool into the HSM Jet Spindle:**







Fig. 34: Loosening ER11 nut



- 4. Insert the tool into the collet.
- 5. Place the collet in the spindle.

Fig. 35: Collet and tool in the HSM Jet Spindle



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2.3.6 Recommendations for tool clamping and cutting tool's run-out checking

The HSM Jet spindle is very precision product, designed for high speed machining with a small diameter cutting tools for the accurate machining. We attached great importance to the cutting tool's setup, correct clamping procedure and tool's run-out cheching. On the HSM Jet spindle we use a standard clamping tools, as ER11 spring collects and standard clamping accessories. To get a minimum run-out value we propose the using a precised spring collects with exact hole size. According to ISO 15488 the collet run-out tolerances should be checked as shown at the sketch below.





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For tool shank diameter from 3.0 up to 6.0 mm the distance "L" run-out measure gauge placement- should be 16 mm. Allowed run-out tolerance at this measuring point on the test mandrel is up to 0.01 mm.

The diameter of the test mandrel is the nominal diameter of the collet hole.

The recommended torque for ER11 nut is 8-10 Nm. The maximum torque for clamping nut shall not be more than 25% above the recommended tightening torque. Higher tightening torque may result in the deformation of the

toolholder (ER11 seat).

Higher clamping force of the clamping nut at the same time means higher stress on the toolholder (ER11 seat).





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3. Maintenance

3.1. Periodic Maintenance

The HSM Jet Spindle is free of periodic maintenance.

3.2. Change Battery on RPM Transmitter

The battery in the RPM transmitter mounted on your HSM Jet Spindle will be drained over time. To change the battery please make procedure as in chapter 2 (Installation p. 11)

3.3. Operation Conditions

- Operation temperature range: 15-30° C
- Altitude: 2000 m

3.4. Storage

3.4.1 Pre-Storage

Before storing the HSM Jet Spindle:

- Clean the HSM Jet Spindle with an air blow for 10-15 sec.
- Disconnect the HSM Jet Spindle from the display that it is connected to.
- Place the HSM Jet Spindle in its case.

3.4.2 Storage Conditions

The HSM Jet Spindle must be stored in conditions meeting the following requirements:

- Sheltered from possible adverse weather conditions.
- Ideal Storage Temperature Range: 15 °C to 27 °C.
- Humidity Range: 30% to 60% relative humidity (RH)

<u>!</u>	Warning: It is strictly prohibited immerse the HSM Jet Spindle in a fluid bath.
	It is strictly prohibited to use the cleanser, different from the coolant, allowed for using on HSM Jet Spindle.
	Any damage caused by one of the above "Warnings" will not be covered by limited warranty.



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4. Working with the HSM Jet Spindle

The HSM Jet spindle system was developed to create machining conditions that would enable applying optimal cutting speed conditions for small diameter solid carbide tools requiring high RPM.

The HSM Jet spindle rotates at its rated speed when idle. When the cutting tool enters the workpiece, it is expected that the rotation speed might slow down by several thousand RPM.

If the HSM Jet spindle rotation speed drops by more than several thousand RPM, when the cutting tool enters the workpiece, review the cutting process parameters and adjust them accordingly.

In order to use the advantages of high speed machining, minimize cutting forces and reduce wear,

tool diameter should be selected according to the spindle speed (when possible).

- Always select the smallest tool diameter, according to the application requirements.
- Always select cutting tools in grades that are suitable for high speed machining.

4.1. Recalculating of the Feed for HSM Jet Spindle

There are two calculating methods of feed F [mm / min], operating with the HSM Jet spindle:

- Existing machining process (transition from machining with a machine spindle / driven tools to an HSM Jet spindle)
- In case of selecting a new machining process

4.1.1 Existing machining process

The feed per tooth fz remains constant while the feed F increases in the same proportion to the HSM Jet Spindle rotation speed.

The feed per tooth fz should remain constant while the feed F is changed.

Calculate the feed F [mm/min] according to the following formula:

 $F \approx Ratio \times F$ current F - the new feed.

Ratio - Is the ratio between the machine spindle / driven tools speed and HSM Jet spindle speed, meaning the new speed divided by the current speed.

F current - the current feed that you would use with your machine.

For example:

If using machine spindle / driven tools at 8,000 RPM, and the feed was 160 [mm/min], and you set HSM Jet spindle to 30,000 RPM, then we suggest that your new feed be: New feed = $30,000/8,000 \times 160=3.75 \times 600$ [mm/min]. In this example your new feed should be 600 mm/min.

4.1.1 New machining process

Calculate the speed F [mm/min] according to the formula: F = n x z x fzRotating speed - n [RPM] The rotating speed for speed calculation will be determined only after reading the actual rotation speed obtained when the tool has engaged the material. Number of teeth - z

Feed per tooth - fz [mm/tooth] - Select according to the tool's vendor recommendations, taking into consideration the machining material, the application and the tool geometry.

Note:

For the first trial at both machining processes, it is recommended to increase the feed gradually by of 3.0-3.5 (not directly 3.75), before setting the feed to the above calculated value.



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5. Troubleshooting

5.1. Display messages

Display message	Indicates that	Action required		
NO SIGNAL	No connected HSM Jet Spindle working in range	If no HSM Jet Spindle is currently at work - no action required If a HSM Jet Spindle is working - wait 10 sec. If message persists disconnect and then reconnect it		
MULTIPLE SIGNAL	More than one device is working at once	Press LIST button, then disconnect one of the HSM Jet Spindle		
LOW RPM	HSM Jet Spindle is spinning too slow	Check: HSM Jet Spindle, coolant pressure, and cutting parameters		
HIGH RPM HSM Jet Spindle is spinning too fast		Check: HSM Jet Spindle, and coolant pressure		
FAILED TO CONNECT	Connection did not succeed	Retry the connection process. Still not working? Replace the HSM Jet Spindle battery		
FAILED TO DISCONNECT	Disconnection did not succeed	Retry the disconnection process. Still not working? Replace the HSM Jet Spindle battery		
LOW BATTERY	Battery is low on power	Replace the battery		

5.2. The HSM Jet Spindle shaft is not rotate or RPM does not correspond correctly to coolant pressure (may result in "low RPM" message)

- 1. Check coolant and pressure in cooling system.
- 2. Run coolant through HSM Jet Spindle for 5 min. while idle.
- 3. If issue persists call for technical assistance.

5.3. The HSM Jet Spindle has not been used in the last month

Before working with the HSM Jet Spindle that has not been used recently, run coolant through the HSM Jet Spindle, when it is assembled on your CNC machine, for 3 to 5 min. Make sure that the HSM Jet Spindle reaches a speed that corresponds to the pressure of the coolant that is pumped through it.





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6. Warranty

The warranty period is two years, starting on the date of delivery ex works od EWS, with the exception of wear parts such as gaskets, etc. and consequential damages caused by these wear parts.















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