

HSM Jet Spindle

User Manual



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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.

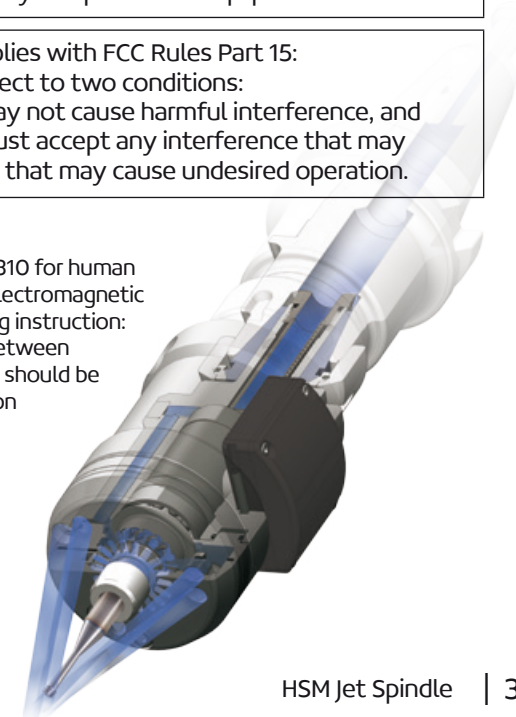


WARNING! Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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.



1. General

1.1 Safety First

	<p>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, supplier, owner, and all organizations responsible for the prevention of accidents.</p>
	<p>Ensure the Following: 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.</p>
	<p>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.</p>
	<p>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.</p>
	<p>Warning: Always use safety glasses or protective screens to protect your eyes.</p>
	<p>Only install 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. Secure 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.</p>

1.2 Statement of Conformity

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 (HSM), spindle (20K RPM Yellow, 30K RPM Red, 40K RPM Blue). It is driven by the CNC machine spindle's coolant-through-flow, at a minimum pressure of 20 bar.

The HSM Jet Spindle does not require any special installation, aside from mounting onto the machine spindle. It operates as any other standard toolholder in the tool magazine or ATC.

1.4 Case Contents

The HSM Jet Spindle case includes:



Fig. 1. Spindle case contents

- 1. Nut ER11 GHS
- 2. Wrench ER11 SMS
- 3. Shaft Lock Flag Key
- 4. Allen key - Hexagonal 2.0 mm
- 5. Battery - Lithium metal non-rechargeable, CR2 type

* Actual size and types of accessories may vary due to configuration and manufacturing process

The wireless RPM display case includes:



Fig. 2. Display case contents

- 1. TSD - wireless RPM display
- 2. AC/DC 5V power supply

* For USA/Japan: Include EU to US/Japan AC adapter plug



Fig. 3. Shaft lock flag key and wrench

1.5 Main Features

The HSM Jet Spindle system uses the machine's existing coolant or cutting fluid supply as a pressurized energy source (20 to 40 bars), rotating a turbine in the range of about 50,000 RPMs.

It offers an ideal solution for a wide range of semi-finishing and finishing applications such as milling, drilling, thread-milling, engraving, chamfering, deburring, fine radial grinding and more. The Jet Spindle is equipped with real-time wireless RPM transmitting and monitoring; to optimize cutting conditions.

HSM Jet Spindle type	TJS 20K...	TJS 30K...	TJS 40K...
Operating range of coolant pressure [bar]	20 - 40	20 - 40	20 - 40
Operating range of coolant flow rate [l/min]	12-18	12-18	12-18
Rotational spindle speed [Krpm]*	30 - 45	35 - 55	40 - 60
Optimum cutting tool diameter [mm]	Drilling 0.5-2.0, Milling 1.0-3.5	Drilling 0.5-2.0, Milling 1.5-3.5	Drilling 0.5-1.0, Milling 0.5-1.2

Fig. 4. Spindle selection

- * Notes:
- Rotational spindle speed is based on coolant pressure and flow rate.
 - Coolant pressure is measured from the spindle inlet.

1.5.1 Wireless Rotation Speed Display - Overview



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 rotation speed during machining. The spindle housing is fitted with a wireless transmitter that sends RPM data to the display unit (receiver) mounted outside of the machine.

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

The transmitter is powered by a non-rechargeable CR2 lithium battery.

Display Information

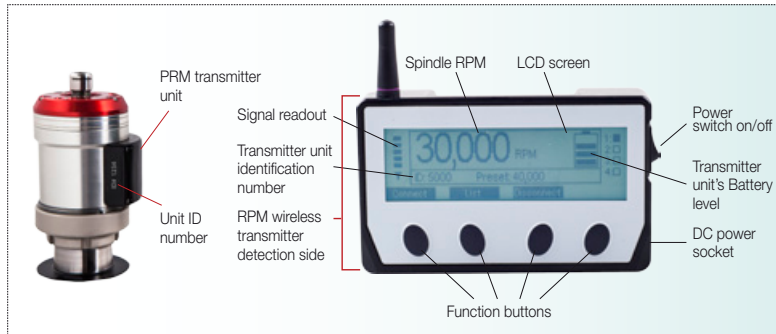


Fig. 6. Wireless RPM display main view

- 2.4 GHz radio frequency transmission
- Direct wireless rotational speed monitoring, range up to 10m
- Externally powered receiver display
- Connection up to 127 tools. Displays information from only one operating unit
- Internal battery-powered transmitter unit
- Individual ID number for each transmitter unit

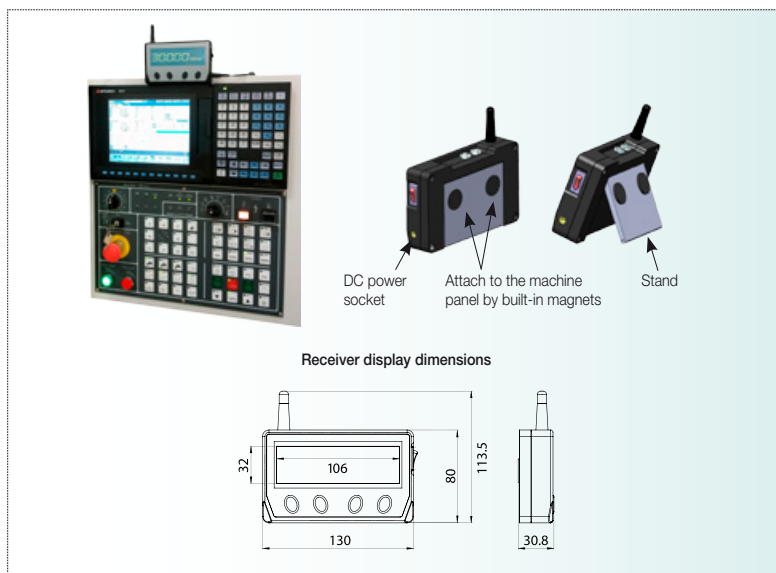


Fig. 7. Wireless RPM display mounting options

1.5.2 Built-in and Direct Mounting System to CNC Spindle

The HSM Jet Spindle is available with several mounting adaptation options:

- ER32 collet chuck with a special tightening nut, suitable for all standard toolholders with an ER32 adaptation.
- Integral options for various other adaptations are available upon request.



Fig. 8. HSM Jet Spindle with mounting adaptation options (for illustration purposes only)

1.5.3 Shaft Locking for Tool Clamping

The shaft lock mechanism provides a simple, easy way to change the cutting tool on the HSM Jet Spindle. For tool mounting instructions, see page 21.



Fig. 9. HSM Jet Spindle with shaft lock mechanism



Warning:

Do not hold the Flag Key while tightening/loosening the shaft lock mechanism. Key may break off in the shaft lock causing damage.



Shaft lock protection plug must be in place at all times during spindle operation. It is strictly prohibited to operate the HSM Jet spindle if the shaft lock protection plug is damaged or missing.

1.5.4 Integrated Coolant Nozzle System

Integrated coolant nozzle system provides direct jet coolant application for fast efficient chip evacuation.



Fig. 10. Integrated coolant nozzle system

1.5.5 Tool Clamping

The HSM Jet Spindle is compatible with ER11 collet chuck. It is recommended to use ER 11 high-precision spring collets.

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

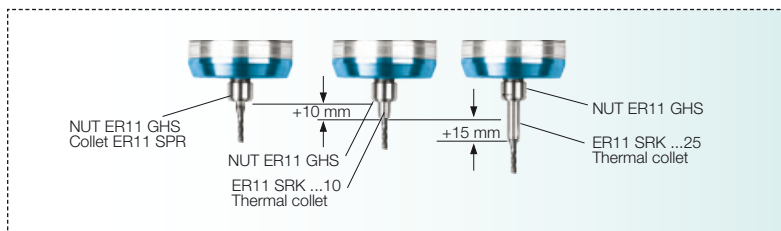


Fig. 11. Overhang solution types

2. Installation

2.1 Battery Installation for RPM Wireless Transmitter

Install battery into the RPM transmitter:

1. Unscrew the 4 battery case cover screws using a hexagonal 2 mm Allen key.
2. Remove the case cover.
3. Make sure the O-ring inside the cover is seated well, and is intact.
4. Insert the CR2 lithium battery in the correct direction.
5. Replace the battery case cover.
6. Replace the 4 screws to secure the battery case cover.
7. The transmitter is ready for operation.

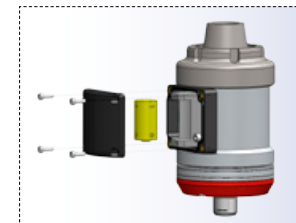


Fig. 12. Battery case opening

2.2 Display

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

2.2.1 Prerequisite for Display Installation

Make sure that the following prerequisites are met:

1. Electrical power: 220/110V AC, standard socket.
2. Distance from HSM Jet Spindle to display unit: no more than 10 m.
3. Create space for the display unit to provide close-up and unobstructed viewing.

2.2.2 Display Installation Workspace

1. Mount the display onto a metallic surface using the magnet on the back of the display, or place on a flat and level surface.
2. Connect the display to an AC socket.
3. Switch the display ON.



Fig. 13. Switch display ON

2.2.3 Connect HSM Jet Spindle to Display

The display and the HSM Jet Spindle must be connected (paired) so they can “identify” each other. Each transmitter unit has an individual ID number (See images below) How to connect the HSM Jet Spindle to the display:

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



Fig. 14. Several HSM Jet Spindles (not working simultaneously) connected to one display

2.2.4 Display Screens

When turned on, NO SIGNAL / 0 RPM screen will appear.



Fig. 15. NO SIGNAL displayed

While connecting the HSM Jet Spindle you will see CONNECTING displayed, then <device ID> CONNECTED - notice that the battery level of the HSM Jet Spindle is shown. Make sure <device ID> on connected screen corresponds to ID # signed on to the RPM transmitter unit.



Fig. 16. Connection screens

The main display screen shows the HSM Jet Spindle currently operating. The HSM Jet Spindle ID number, rotation speed, and battery level appear.



Fig. 17. Main display screen

To view a list of all HSM Jet Spindles connected to the display, press the “List” button.



Fig. 18. List of connected HSM Jet Spindles on display

Note: Disconnected feature will turn OFF internal battery consumption in the transmitter unit.



Fig. 19. Disconnected display

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



Fig. 20. More than one device working simultaneously screen

Select “List” to select 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 screens

If the connect or disconnect procedure is not successful for any reason, an appropriate message is shown - see page 27 for troubleshooting.



Fig. 23. Connection failed screen



Fig. 24. Disconnect failed screen

If the battery of the HSM Jet Spindle currently in operation is running low, the following warning is shown - see page 27 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

2.2.5 Disconnect HSM Jet Spindle from 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 the <device ID> on disconnected screen corresponds to the ID # signed on to the RPM transmitter unit.

2.3 HSM Jet Spindle

2.3.1 Prerequisite for 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. Active mist collector.
7. With emulsion coolant, use an anti-foaming agent additive suitable for emulsion to prevent foaming.
8. With oil coolant, high pressure increases the amount of oil fumes:
 - a. Use appropriate means of fire protection and extinguishing.
 - b. Use anti-dissolution additive suitable for the oil.

2.3.2 HSM Jet Spindle Installation to CNC Machine

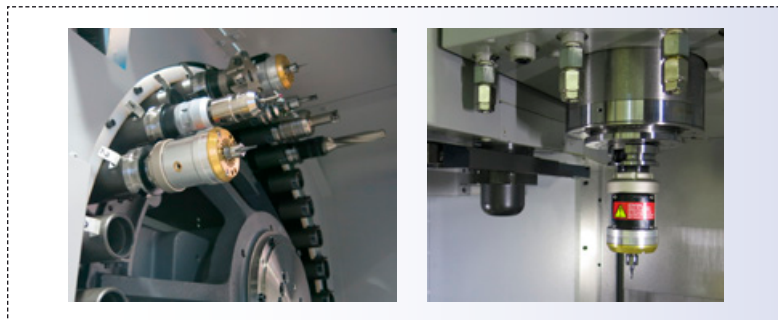


Fig. 28. HSM Jet Spindle on CNC machine

When the HSM Jet Spindle is mounted on the machine, the CNC machine spindle should be stationary, except for tool check procedure or Z-offset measurement. In these cases, tool must be rotated at min. RPMs to avoid risk of breakage/injury.

To avoid 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.

2.3.3 Placement of HSM Jet Spindle in Toolholder

Caution: Deviation from these steps may lead to locking of the tightening nut to the HSM Jet Spindle.

The HSM Jet Spindle only operates with a toolholder that has a coolant through channel.

To secure the HSM Jet Spindle in a toolholder: See steps in Figure 29 (left to right).

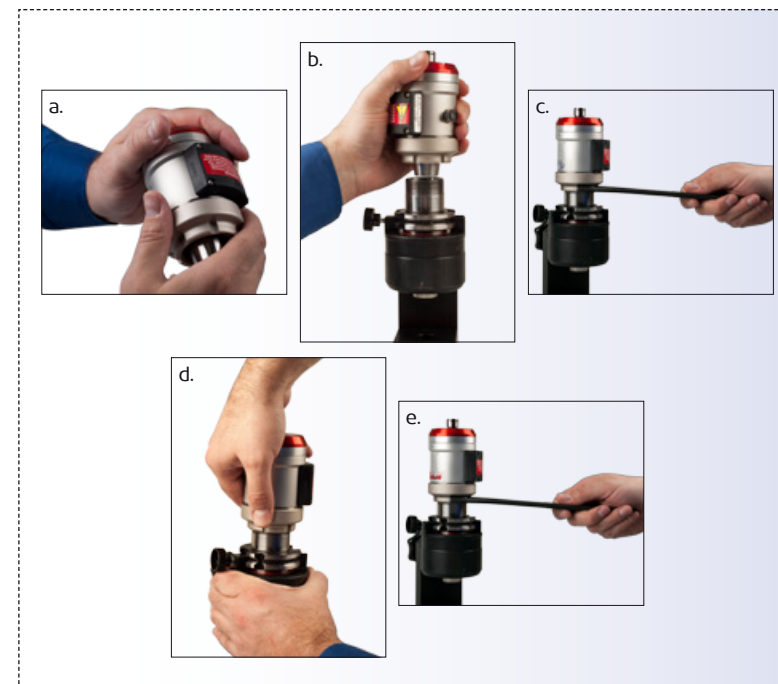


Fig. 29. Placement of HSM Jet Spindle in toolholder

1. Use a standard toolholder 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



Fig. 30. Example of toolholder with a coolant-through hole

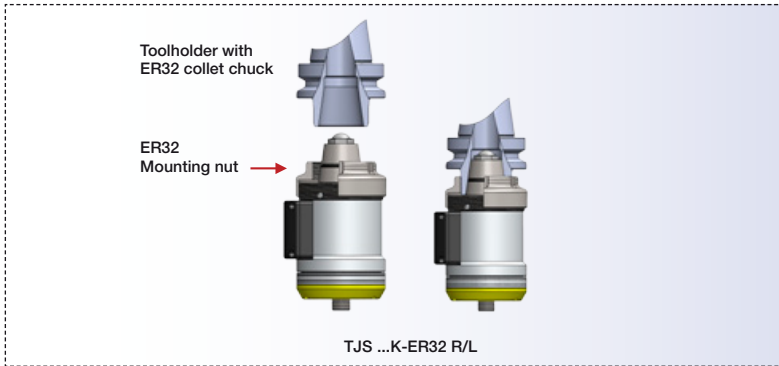


Fig. 31. HSM Jet Spindle holding ER32 collet chuck

2.3.4 Tool Prerequisites

HSM Jet Spindles are used in applications with tool shank diameters up to 6 mm.

HSM Jet Spindle type	TJS 20K...			TJS 30K...			TJS 40K...		
Operating range of coolant pressure [bar]	20	30	40	20	30	40	20	30	40
Operating range of coolant flow rate [l/min]	12-18			12-18			12-18		
Rotational spindle speed [Krpm]*	20	30	40	20	30	40	40	50	60
Optimum cutting tool diameter [mm]	Drilling 0.5-2.0, Milling 1.0-3.5			Drilling 0.5-2.0, Milling 1.5-3.5			Drilling 0.5-1.0, Milling 0.5-1.2		

2.3.5 Tool Installation for 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

1. Insert the Flag Key in the shaft lock hole, on the side of the spindle.

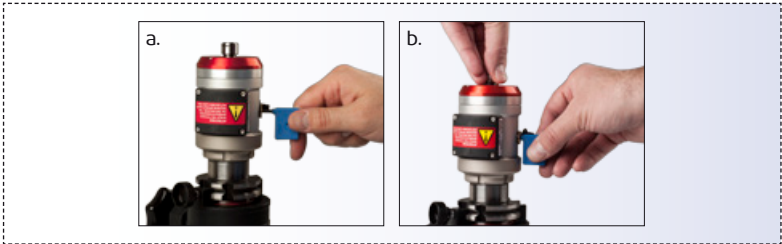


Fig. 32. Inserting the Flag Key into the HSM Jet Spindle

2. Turn the shaft, while pushing the Flag Key in, towards the center of the HSM Jet Spindle, until the Flag Key penetrates all the way, and the shaft no longer rotates.



Fig. 33. Flag Key in HSM Jet Spindle

	Warning: Do not hold the Flag Key while tightening/loosening the shaft lock mechanism. Failure to obey this warning may lead to a broken spindle shaft.
	Shaft lock protection plug must be in place at all times during spindle operation. It is strictly prohibited to operate the HSM Jet spindle if the shaft lock protection plug is damaged or missing.

3. Loosen the ER11 nut with the provided ER11 wrench, and remove the nut.



Fig. 34. Loosening ER11 nut

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



Fig. 35.

6. Tighten the ER11 nut with the provided ER11 wrench.
7. Check that total runout is less than 0.01 mm.



Fig. 36. Tightening ER11 nut

2.3.6 Tool Clamping and Runout Check (Recommendations)

The HSM Jet Spindle is designed to perform high speed operations with small diameter cutting tools for very accurate machining.

It is very important to properly perform the instructions related to cutting tool setup, correct clamping procedure and tool runout.

Standard clamping tools, such as ER11 spring collets and standard clamping accessories are used on the HSM Jet Spindle.

To get a minimum runout value use ER11 SPR...AA or AAA spring collects with exact hole size.

According to ISO 15488, the collet runout tolerances should be checked as shown in the image.

SPINJET housing should remain static!

Runout is measured by rotating the shaft manually or running an air supply through the machine Spindle.

Dynamic Balancing System

- Shaft G0.4

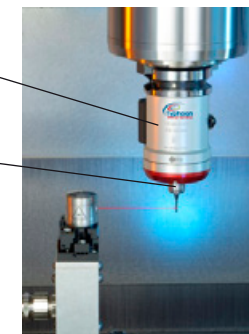


Fig. 37. Testing of runout tolerance



3. Maintenance

3.1 Periodic Maintenance

The HSM Jet Spindle is free from periodic maintenance.

3.2 Battery Change on RPM Transmitter

The battery in the RPM transmitter mounted on the HSM Jet Spindle will lose power over time.

To change the battery, please proceed as in chapter 2 (Installation p.11)

3.3 Recommended Operating Environment

- Temperature range: 15-30° C
- Max. altitude: 2000 m

3.4 Storage

3.4.1 Pre-Storage






Before storing the HSM Jet Spindle:

- Clean the HSM Jet Spindle by air blowing for 10-15 seconds.
- Do not use air in the shaft lock hole.
- Disconnect the HSM Jet Spindle from the display device.
- Place the HSM Jet Spindle back 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)

	Warning: It is strictly prohibited immerse the HSM Jet Spindle in a fluid bath.
	Clean external adaptor and ER11 nut using alcohol and treating with oil.
	Clean internal shaft using air pressure only. DO NOT use air in the shaft lock hole.
	Shaft lock protection plug must be in place at all times during spindle operation. It is strictly prohibited to operate the HSM Jet spindle if the shaft lock protection plug is damaged or missing.
	Any damage caused by one of the above "Warnings" will not be covered by limited warranty.

4. Working with the HSM Jet Spindle



Warning:
Use the utmost caution when working with rotating tools.

The HSM Jet Spindle system was developed to enable optimal cutting speed conditions for small diameter, solid carbide tools requiring high RPMs.

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.

HSM Jet Spindle Types by Cutting Tool Diameter

HSM Jet Spindle Type	TJS 20K...	TJS 30K...	TJS 40K...*
Cutting tool diameter [mm]	2.0-3.5	1.0 -2.5	0.2-1.5
Spindle speed [K RPM]**	20	30	40
Recommended cutting speed [m/min]	For steel 200		
	For aluminum 200		

In order to take advantage 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 Recalculation of Table Feed for HSM Jet Spindle

There are two calculation methods for table feed F [mm / min], with the HSM Jet Spindle:

- Existing machining process (transition from machining with a machine spindle to an HSM Jet Spindle)
- New machining process

4.1.1 Existing Machining Process

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

The feed per tooth fz should remain constant while the table feed F changes. Calculate the table feed F [mm/min] according to the following formula:

$$F \approx \text{Ratio} \times F \text{ current}$$

F - New table feed

Ratio - The ratio between the machine spindle speed and HSM Jet Spindle speed, (new speed divided by the current speed).

F Current - Current table feed with original machine spindle.

For example:

If using a machine spindle at 8,000 rpm, with a table feed of 160 [mm/min], and the HSM Jet Spindle set to 30,000 rpm, then the new recommended table feed is as follows:

$$\text{New table feed} = 30,000 / 8,000 \times 160 = 3.75 \times 600 \text{ [mm/min]}.$$

In this example, the new table feed should be 600 mm/min.

4.1.2 New Machining Process

Calculate the table speed, F [mm/min], according to the formula:

$$F = n \times z \times fz$$

Rotation speed - n [rpm] rotation speed for table speed calculation, can 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 tool vendor's recommendations, taking into consideration the machining material, application and the tool geometry.

Note:
First trial for both machining processes: It is recommended to increase the table feed gradually.

5. Troubleshooting

5.1 Display Messages

Display Message	Indication	Action Required
NO SIGNAL	No HSM Jet Spindle connected is operating within range	If no HSM Jet Spindle is currently operational - no action is required If a HSM Jet Spindle is operating - wait 10 sec. If message persists, disconnect and then reconnect
MULTIPLE SIGNAL	More than one device is working simultaneously	Press LIST button, then disconnect one of the HSM Jet Spindles
LOW RPM	HSM Jet Spindle is rotating too slowly	Check: HSM Jet Spindle, coolant pressure, and cutting parameters
HIGH RPM	HSM Jet Spindle is rotating too quickly	Check: HSM Jet Spindle, and coolant pressure
FAILED TO CONNECT	Connection did not succeed	Retry connection process. If still not working, replace the HSM Jet Spindle battery.
FAILED TO DISCONNECT	Disconnection did not succeed	Retry disconnection process. If still not working, replace the HSM Jet Spindle battery.
LOW BATTERY	Battery is low on power	Replace the battery

5.2 HSM JET Spindle Shaft Does Not Rotate or RPM Not Corresponding 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 minutes while idle.
3. If issue persists - call for technical assistance.

5.3 HSM Jet Spindle Not Used Within the Past Month

Before working with an HSM Jet Spindle that has not been recently operated, first assemble it on the CNC machine. Then run coolant through the Jet Spindle for 3 to 5 minutes. Ensure that the Jet Spindle reaches a speed corresponding to the coolant pressure being pumped through it.

6. Warranty Summary

HSM Jet Spindle and Display Unit Warranty Frame

The manufacturer warrants that its spindles are to be free from defects in material, design and workmanship under normal use. Maintenance and service, for a period commencing from the date of invoice referenced by the spindle serial no. imprinted on the spindle housing, is valid until: 12 months from the date of invoice.

Within the frame of warranty, the following conditions are in effect:

- Warranty does not apply to spindles that have been subject to operator / programmer error (i.e. crashed or improper preventative maintenance, installation errors, and/or contamination)
- Warranty does not apply to spindles that have been repaired, or have attempted to be repaired by anyone other than a manufacturer authorized representative.
- Warranty does not apply to worn-out bearings.
- Claim of defect must be issued by returning the spindle in its original packaging accompanied by a written claim form; with an explanation of the malfunction, inclusion of the spindle serial no. and a copy of the product invoice.

The manufacturer's liability under this warranty shall be limited to the repair of, or replacement of, at the manufacturer's discretion, any part determined to the manufacturer's satisfaction to be defective, and which has not been found to have been misused, abused, abnormally used, or damaged by accident or improper maintenance, altered, or carelessly handled.

Upon determination by the manufacturer that a warranty claim is valid, a refurbished or new spindle will be shipped as a replacement, on a no charge bases. All spindles repaired under warranty will remain under the initial warranty timeframe for the balance of the valid warranty period.

Customer shall pay shipping and handling costs for the spindle's return to the manufacturer's premises. Return of the repaired or replacement spindles under warranty shall be sent to the customer's premises only, at the expense of the manufacturer.

The manufacturer reserves the right to choose the method of shipment on all replacement parts supplied under warranty.

The customer shall bear all shipping costs related to spindles which are not under warranty.

Repair and Refurbishment: HSM Jet Spindle and Display Unit Warranty Frame

A Spindle that has undergone repair by the manufacturer not within the warranty cover terms and/or valid time frame shall be entitled to a limited warranty period of 6 months from the invoice date; all warranted repairs must be performed by the manufacturer as the sole certified entity. Using any repair service other than a manufacturer authorized rep, will immediately terminate the warranty; validity, scope and terms.

The repaired spindle warranty is subject to the above-mentioned restriction terms as equally applied and specified for the "HSM Jet Spindle and Display Unit Warranty Frame".

This warranty document supersedes all and any previous warrant policy information published by the manufacturer, including warranty assurances and conditions stated in the product User Manuals.

The manufacturer reserves the right to make changes in products or specifications at any time, without prior notice.

This warranty shall not apply to:

- Claims or damage resulting from customer or third party repairs or modifications to the product, or other circumstances beyond the manufacturer's control.
- Claims or damage due to non-compliance with recommended installation, operation and maintenance procedures, as specified by the manufacturer, including, without limitation; abuse, neglect, misuse of the product by the customer, its agents, employees or contractor.

- Damage resulting from operation of product not within the working parameters and working environment it was designed for.
- Claims or damage resulting from the use of third party replacement parts.
- Any direct or indirect loss, consequential loss, personal injury or damage to property, loss arising from interruptions or delays in production.
- Claims or damage resulting from buyer's non-compliance with applicable laws, regulations, codes or by-laws, and standard industry practices.

Transfer of Warranty

Spindles are only covered under warranty to the original buyer of the spindle and this warranty is non-transferable to, and may not be enforced by, any third parties, including, but not limited to; subsequent buyers, users or assignees of the spindle.

7. Customer Service after Purchase

Whenever a malfunction cannot be solved by the solutions mentioned in the troubleshooting section, you are requested to consult the ISCAR/IMC representative for further assistance or instructions.

The unit should not be returned before receiving written approval from ISCAR/IMC. The serial number for the unit must be indicated on your claim form (you can find this information on the rear of the unit housing).

We hope this information will be helpful. Our goal is to provide the best possible service to our customers.



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