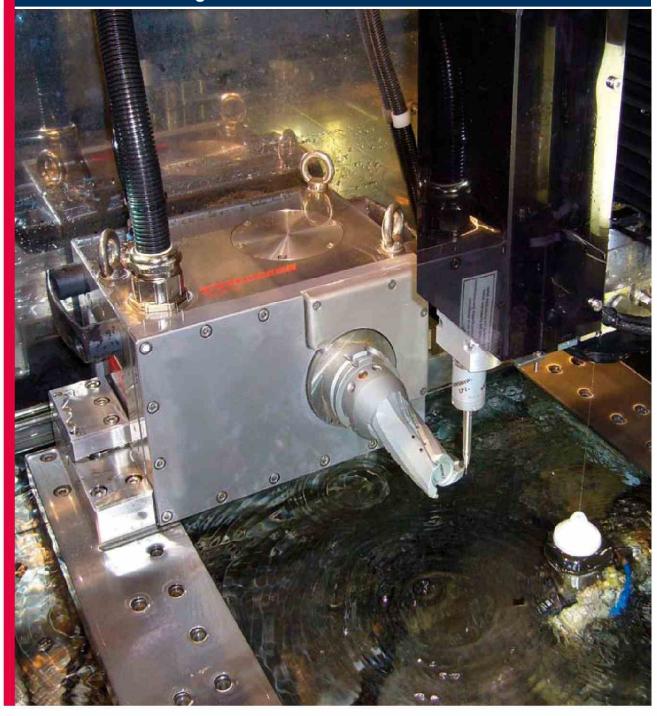
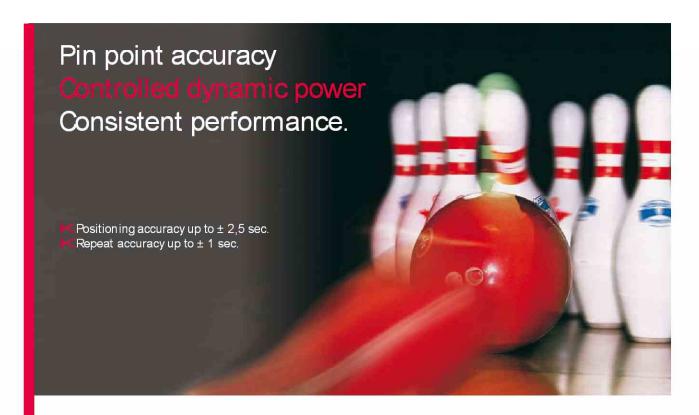
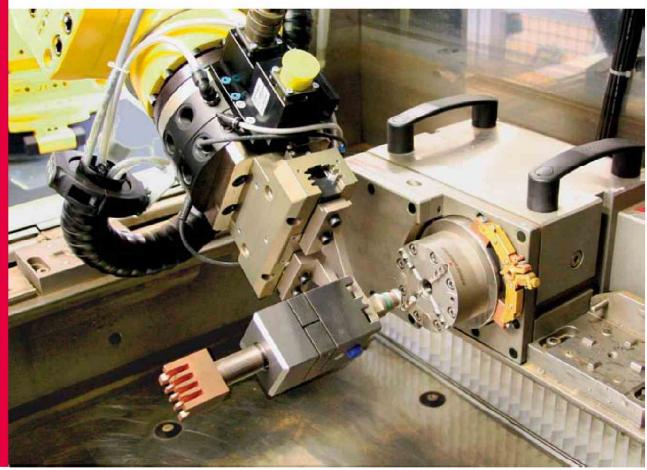


Catalogue RE 2008

# ROTARYINDEXING TABLES, A-AXES and ROTATING SPINDLES for Wire and Sinking EDM







Automatic loading of workpieces with robot

#### Contents

#### Operation

All Rotary Indexing Tables and A-Axes are supplied with operating and mounting manuals. Interface information is also included. Observe all operation instructions of machine manufacturer when Rotary Indexing Tables, A-Axes and Rotating Spindles are connected with the machine control systems. Correct operation cannot be ensured and danger to personnel and machine cannot be excluded unless these operating instructions or information given in this catalogue are observed.

#### Service and Maintenance

Since Rotary Indexing Tables and A-Axes are subject to chemical and physical influences, maintenance and service has to be performed with special care.

EDM current flow requires a good conductive connection (contact) to machine table. The conductivity of water (Wire EDM) and chlorides normally contained in water can influence the rust-resistant properties. Residues (varnishes, eroded particles etc.) from the electrical discharge process should be removed on a daily basis. Contact your local HIRSCHMANN dealer for recommended products to use.

#### **Technical Modifications**

All products shown in this catalogue are subject to ongoing improvements and developments; we reserve the right for technical modifications without notice

#### Quality according to EN9100

All HIRSCHMANN products are produced using state of the art production methods. They are subject to quality management system as per EN 9100 (aerospace industry standard) both during production and in the assembly stage.

#### Warranty

We provide a 12 month warranty for all Rotary Indexing Tables and A-Axes, starting from the invoice date, and assuming correct use and maintenance as specified.

The warranty is restricted to replacement or repair, free of charge, of any defective parts. Claims arising from improper use or handling shall not be considered. Warranty claims must be submitted in writing and without delay.

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HIRSCHMANN GmbH

## Rotary Indexing Tables, A-Axes and Rotating Spindles for Wire- and Sinking EDM

## Rotary Indexing Tables, A-Axes

Many erosion tasks cannot be solved efficiently without using a Rotary Indexing Table or an A-Axis, as for example wire cutting of carbide tipped tools. HIRSCHMANN Rotary Indexing Tables and A-Axes are especially designed for the field of erosion. They are completely sealed (IP68) and can therefore be used in the dielectric of sinking and wire EDM. The high-precision HIRSCHMANN Rotary Indexing Tables and A-Axes are based on many decades of experience and knowledge of the erosion problems.

## **High Speed Rotating Spindles**

The High Speed Rotating Spindles open new possibilities in spark erosion production. They enable erosion "turning' of the smallest parts with high surface quality not possible with conventional machining. An additional feature is the ability to accurately index the spindle as well as simultaneous processing with several other axes (turn while burn).

## **Application**

- M Medical technology (systems, instruments, implants)
- M Aerospace (sensor measuring systems, micro-pumps, micro-valves, turbine blades)
- M Automotive (electric plug connections (injection moulding))
- M PCD/CBN processing
- M Tool making (production of electrodes, direct structuring of workpieces, building of ejector pins
- M Machine building in general



Controlled High Speed Rotating Spindle H80R.MNCM...

## **Precision**

HIRSCHMANN Rotary Indexing Tables and A-Axes are high-precision products. They are subject to strict quality inspections. A measurement report with the measured values is enclosed to every Rotary Indexing Table and A-Axis.

HIRSCHMANN Rotary Indexing Tables and A-Axes are equipped with precise Heidenhain direct measuring systems (encoders) and high-grade, backlash free drives. They offer the conditions for highest positioning accuracy and a high dynamic control.

The dividing accuracy depends on the quality of the measuring system (encoder). As standard we use measuring systems with a system accuracy of  $\pm 5$ " (  $\pm 10$ " or  $\pm 2.5$ " optionally). For a precise control a stiff and backlash free drive is essential.

#### Control

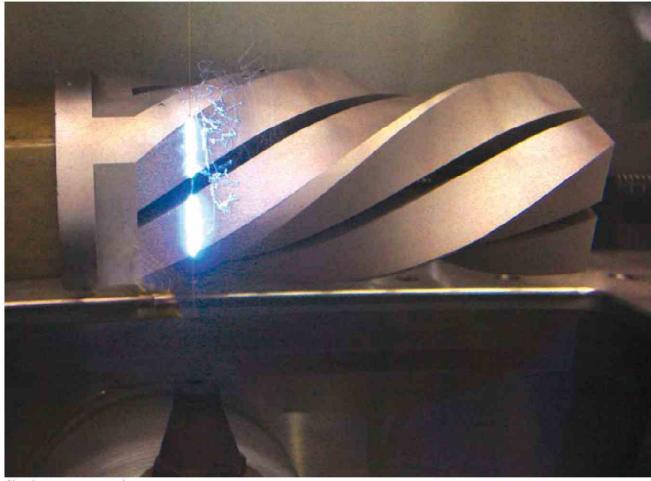
HIRSCHMANN Rotary Indexing Tables and A-Axes can be controlled directly through the machine control. If this is not possible, they can be controlled by the HIRSCHMANN Control H1625xx.

For the easy and quick integration into the machine control, the Rotary Indexing Tables and A-Axes are equipped with drive components, measuring systems and plug connections which are adapted and adjusted to the machine control. The advantages of the integration are the possibility of simultaneous processing as well as programming in the machine control.

(We cannot guaranty our standard accuracies with some OEM encoders)

## HIRSCHMANN Rotary Indexing Tables and A-Axes are compatible to the following EDMs:

ACCUTEX, AGIE, BES, CHARMILLES, ELECTRONICA, EXERON, FANÚC, JOEMARS, MAKINO, MITSUBISHI, ONA, OPSINGERSOLL, SODICK etc.



Simultaneous processing

#### Common features

- M Precise direct measuring system for highest positioning accuracy (system accuracy optional ±10", ±5", ±2.5")
- M Stiff and backlash free drive for best dynamic behaviour during simultaneous processing (turn & burn)
- M! Compact, stainless design machined from solid blocks
- M Low maintenance
- M Completely sealed (IP68) for the use in wire, sink and small hole EDM
- M Size from y 180 mm until y 1800 mm face-plate diameter

## Rotary Indexing tables

## A-Axes

## **High Speed Rotating Spindles**

## H80R.NC

25 kg loading weight Manual clamper



## H100R.NC,,, series

Face plate y !100 mm 25 kg loading weight

#### Options:

- manual clamper
- pneumatic clamper
- clamper of other manufacturers
- adjustable clamping element
- customised devices

## H80R.MAC

Rotary speed 0 - 1500 min-1

#### Designs:

- adjustable clamping element
- manual clamper
- clamper of other manufacturers

## H100R.NC

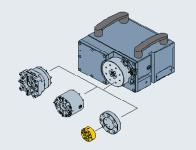
50 kg loading weight Face plate y !100 mm

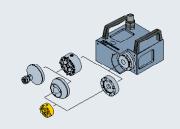


## H160R.NC

100 kg loading weight Face plate y !160 mm







## H250R.NC

250 kg loading weight Face plate y !250 mm

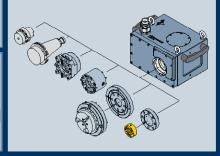


#### H150R.NC... series

50 kg loading weight

## Designs:

- SK, HSK machine taper mounting
- -face-plate y !150 mm
- manual clamper
- pneumatic clamper
- adjustable clamping element
- clamper of other manufacturers

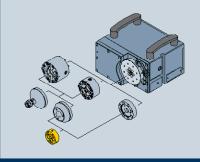


## H80R.MNC.. (positionable)

Rotary speed max. 1000 min<sup>-1</sup> Indexing accuracy ± 5"

## Designs:

- -face-plate
- adjustable clamping element
- manual clamper
- pneumatic clamper
- clamper of other manufacturers



## H400R.NC 450 kg loadin

450 kg loading weight Face plate y 400 mm



## H800R.NC

2000 kg loading weight Face plate y !800 mm



Further designs on inquiry

## Selection criteria

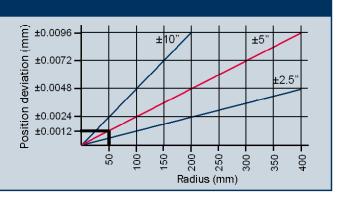
## System accuracy

The positioning and indexing accuracy is dependent on:

- the measuring system (encoder)
- design and assembly of the axes
- controlling system

The influence of the encoder system accuracy is shown in the chart aside.

**Example:** In case of an encoder system accuracy of  $\pm 5^{\circ}$  and a radius of 50 mm the position deviation (straight line) is max.  $\pm 0.0012$  mm.



## Selection criteria

- 1. Size of workpiece and fixture (weight, diameter, length)
- 2. Workpiece mounting (face-plate, 3-jaw chuck, taper shank, clamping system)
- 3. Positioning accuracy (alternatively ±10", ±5", ±2.5")
- 4. High rotary speed (for the production of dynamically balanced parts in rotation)
- 5. Available space (size of machine table, travel, mounting possibility)
- 6. Control (integated to the machine or HIRSCHMANN control)

For detailed information contact HIRSCHMANN directly.

Application form		
m!!Rotary Indexing Table	m‼ <b>A-Axis</b>	m!!Rotating spindle!!!
m!H80R.NC !!!m!H100R.NC !!!m!H160R.NC !!!m!H250R.NC !!!m!H400R.NC !!!m!H800R.NC	m!H100R.NC m!Face plate y !100 mm  m!H160R.NC !!!!!!m!Manual clamper m!H250R.NC !!!!!!m!Pneumatic clamper m!H400R.NC   IIIImlAdjustable clamping element m!H800R.NC m!Other Type:	!!!m!Series H80R MAC! !!!!!!m!Manual clamper H6.16R !!!!!!m!Manual clamper H8.16R !!!!!!m!Manual clamping element m!Other Type:
!!!m!!Special design	!!!m!Series H150R NC. !!!!!!m!SK50 taper shaft collet	!!!!!!m!!HIRSCHMANN-Steuerung m!!Other
Encoder system accuracy !!!ml!±2.5" !!!m!! <b>±5" (standard</b> ) !!!m!!±10" !!!m!!Other:	IIIIIImIHSK taper shaft collet (A,F): IIIIIImIFace plate y I150 mm IIIIIImIFace plate y I150 mm IIIIIImIPneumatic clamper IIIIIImIPneumatic clamper IIIIIImIAdjustable clamping element IIIIIImI3-jaw chuck mIOther Type:	IIImISerie H80R MNC. IIIIIImIFace plate y l80 mm IIIIIImIManual clamper H6.16R IIIIIImIManual clamper H8.16R IIIIIImIPneumatic clamper IIIIIImIAdjustable clamping element mICther Type:
Controlled by: !!!m!!HIRSCHMANN control !!!m!!Machine control ! Manufacturer: Type:	Encoder system accuracy !!!m!!±2.5" !!!m!! <b>±5" (standard</b> ) !!!m!!±10" !!!m!!Other:	Encoder system accuracy !!!!!!m!l±2.5" !!!!!!m!l±5" (Standard) !!!!!!m!l±10" !!!!!!m!lOther:
	Controlled by: !!!m!!HIRSCHMANN control !!!m!!Machine control Manufacturer: Type:	Controlled by: !!!!!!m!!HIRSCHMANN control !!!!!!m!!Machine control Manufacturer: Type:

## Rotary Indexing Tables

All HIRSCHMANN Rotary Indexing Tables are equipped using direct measuring system with a system accuracy of  $\pm 5$ " (except the H 100R.NC) and an electromagnetic or pneumatic braking. DC drives are standard with AC drives offered as an option.

#### Common characteristics

- J Direct measuring system
- J‼Backlash free drive
- J!!For horizontal and vertical use (except H80R.NC)
- J!IDC drive, (available also with AC drive)
- J‼Stainless steel
- J!!Completely sealed IP68



## H80R.NC Rotary Indexing Axis (stainless steel)

with manual clamper H6.16R or H8.16R for pallets and holders of the HIRSCHMANN Fixturing System 5000 (other systems on request). Horizontal use only.

Dimensions (W/D/H) 230/252/130 mm (9/9.9/5.12") 0.001°/3,6° Min. indexing step Indexing accuracy (standard encoder) n !±5' n !±3" Repetitive accuracy max. 25 kg (55.125 lbs) Loading weight Direct measuring system accuracy ±10, ±5 or ±2,5" DC motor Brake holding force (electromagnetic) 20 Nm 20 min 1 Speed max. Weight approx. 35 kg (77.175 lbs)



## H100R.NC Rotary Indexing Table (stainless steel)

Face plate (mounting surface) y 1100 mm, for horizontal and vertical use.

Dimensions (W/D/H) 188/125/135 mm (7.41/4.93/5.32") Min. indexing step 0.001°/3,6" n !±25" Indexing accuracy Repetitive accuracy n !±10" Loading weight max. 50 kg (110.25 lbs) Direct measuring system ERN 480 Drive DC motor Brake holding force (pneumatic) 25 Nm Speed max. 10 min-1 15 kg (40 lbs) Weight approx.



## H160R.NC Rotary Indexing Table (stainless steel)

with face plate (mounting surface) y  $\,|160\,$  mm, for horizontal and vertical use.

Dimensions (W/D/H) 265/203/148 mm (10.5/8/5.8") 0.001°/3.6° Min. indexing step Indexing accuracy (standard encoder) n !±5" Repetitive accuracy n !±3" Loading weight max. 100 kg (220.5 lbs) ±10, ±5 or ±2.5" Direct measuring system accuracy DC motor Brake holding force (electromagnetic) 40 Nm Speed max. 7 min-1 Weight approx. 40 kg (88.2 lbs)

## Rotary Indexing Tables





with face plate (mounting surface) y 1250 mm, for horizontal and vertical use.

Dimensions (W/D/H) 340/290/135 mm (13.4/11.4/5.3")
Indexing accuracy (standard encoder) n !±5 "
Repetitive accuracy n !±3 "
Loading weight max. 250 kg (551 lbs)
Direct measuring system accuracy ±10, ±5 or ±2,5"
Drive DC motor
Brake holding force (electromagnetic) 40 Nm
Speed max. 5 min-1
Weight approx. 60 kg (130 lbs)



## H400.NC Rotary Indexing Table (steel) H400R.NC Rotary Indexing Table (stainless steel)

similar to H250R,NC but with face plate y I400 mm

Dimensions (W/D/H) 490/410/175 mm (19.3/16.2/6.9")

Loading weight max. 450 kg (992 lbs)

Weight approx. 200 kg (440 lbs)

Brake holding force (electromagnetic) 40 Nm

## H800.NC Rotary Indexing Table (steel) H800R.NC Rotary Indexing Table (stainless steel)

similar to H250R,NC with face plate y |800 mm Dimensions (W/D/H) 820/800/250 mm (32.3/31.5/9.9")

Loading weight max. 2000 kg (4410 lbs)
Weight approx. 620 kg (1367 lbs)
Brake holding force (electromagnetic) 350 Nm



## H1625.DC CNC Control

Dimensions (W/D/H)

Positioning control for H80R.NC, H160R.NC, H250R.NC.

approx. 520/420/230 mm (19.3/15.8/9")

Power supply 115/ 230 V 50/ 60 Hz
Weight approx. 12 kg (25 lbs)

## H1625.DC1 CNC Control

similar to H1625.DC, for H400.NC, H400R.NC

#### H1625.DC3 CNC Control

similar to H1625.DC, for H100R.NC

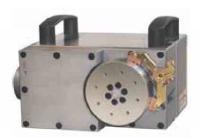
## H1625.DC4 CNC Control

similar to H1625.DC, for H800.NC

## A-Axis series H100R.NC

#### General

The stainless steel A-Axes of the series H100R.NCx are equipped with a face-plate diameter 100 mm. Optionally, the A-Axes can be equipped with a manual or pneumatic clamper, an adjustable clamping element or with customised devices. The encoder system accuracy is  $\pm 5$ " seconds as standard (see equipment possibilities). Optionally it can be delivered with an integrated air supply for pneumatic clampers or customised devices. The axes can be integrated directly to the machine control for indexing and simultaneous multi-axes erosion (turn while burn). Or, indexing only with the HIRSCHMANN H1625.AC1 control.



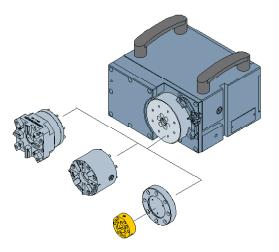
H100R.NCx000 with face-plate

## H100R.NC... A-Axis

with face-plate y !100 mm, centering seat  $15^{H7}$  and eight fastening screw threads M6, for horizontal and vertical use.

Dimensions (W/D/H) 230/215/130 mm (9.1/8.5/5.12")

Indexing accuracy (standard encoder) n ±5' Smallest indexing step (standard encoder) 0.0005° (1.8") Radial run-out n 0,005 mm Axial run-out n 0,005 mm Moment of inertia of the workpieces n !375 kgcm<sup>3</sup> Weight approx. 30 kg Speed max. 20 min-1 Protection class IP68 Max. weight of workpiece horizontal use: 15 kg vertical use: 25 kg



## **Options**

#### Workpiece mounting\*

- manual HIRSCHMANN clamper H6.16R, H8.16R
- -pneumatic HIRSCHMANN clamper H6.11.10R, H8.11.10R
- manual and pneumatic clampers of other manufacturers
- customised devices
- integrated air supply for pneumatic clampers and devices

## Encoder system accuracy \*

- ±10°
- ± 5" (standard)
- ±2,5°

## Electrical equipment\*

For the adaption to the machine control the A-Axes can be equipped with different drives and connectors.

\* Please specify when ordering



## H1625.AC1 CNC control

for A-Axis series H100R.NC. and H150R.NC.

 Dimensions (W/D/H)
 approx. 520/420/230 mm

 Power supply
 115/230 V 50/60 Hz

 Power input
 max. 400VA

 Weight
 approx. 12 kg (25 lbs)

## A-Axis series H150R.NC...

#### General

The stainless steel A-Axes of the series H150R.NC are equipped as standard with a pneumatic SK50, CAT50 or HSK63 machine taper chuck. Optionally, the A-Axes can be equipped with a face-plate y !150 mm, a manual or pneumatic clamper, an adjustable clamping element or with customised devices. The drive components are matched to the machine control and the accuracies are dependent on the measuring system (encoder).



H150R.NCwith SK50 taper chuck



H150R.NCwith HSK63 taper chuck

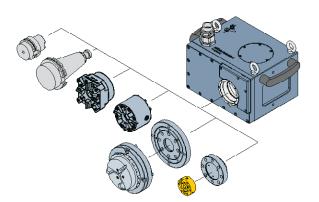
## H150R.NC.. A-Axis

alternatively with SK50, CAT50 or HSK63 (form A or F) taper chuck. For horizontal and vertical use.

Dimensions (W/D/H) approx. 265/215/160 mm

(10.43/8.47/6.3")

Indexing accuracy (standard encoder) n !±5' Repetitive accuracy (standard encoder) n ±3' Smallest indexing step (standard encoder) 0.0005° (1.8") Radial run-out n 0,005 mm Max. weight of workpiece 50 kg max. 20 min-1 Speed Weight approx. 45 kg Erosion current max. 50 A Protection class **IP68** 



#### **Options**

## Workpiece mounting\*

- -manual HIRSCHMANN clamper H6.16R, H8.16R
- -pneumatic HIRSCHMANN clamper H6.11.10R, H8.11.10R
- -manual and pneumatic clampers of other manufacturers
- -face-plate y !150 mm
- jaw chuck
- customised devices
- integrated air supply for pneumatic clampers and devices

## Encoder system accuracy \*

- ±10°
- ± 5" (standard)
- ±2,5°

### Electrical equipment\*

For the adaption to the machine control the A-Axes can be equipped with different drives and connectors.

\* Please specify when requesting a quotation

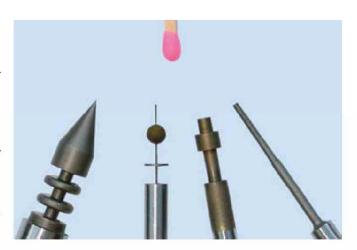
## High Speed Rotating Spindle H80R.MAC

## Advancing into new technology

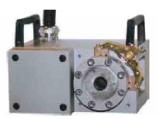
High speed rotary spindles open new possibilities in spark erosion production. They enable erosion "turning of the smallest parts with high surface quality (Ra 0.1 mm and better) not possible with conventional machining. (Lathes and grinding machines) This is now possible with HIRSCHMANN high speed rotary spindles.

#### Characteristics:

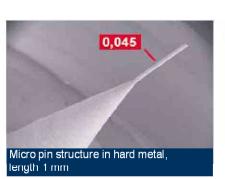
- J Aternative to hard turning or precision grinding of dynamically balanced parts with highest surface quality
- J Economic production of parts with minimal structures, as well as micro electrodes made of stainless steel, hard metal or nonferrous metal and even conductive ceramics.













with manual clamper H8.16R (for clamping journal H5.611R). Rust-proofed, maintenance free AC-Drive.

Dimensions (WxDxH) 190/191/98 mm (7.5/7.52/3.9")
Speed 0-1500 min<sup>-1</sup>
Axial accuracy n ! 0,003 mm (0.00012")
Weight approx. 20 kg

## H80R.MAC.6 Rotating Spindle

Similar to H80 R.MAC but with manual clamper H6.16 R (for clamping journal H6.611 R).

## H80R.MAC.44 Rotating Spindle

Similar to H 80R.MAC but equipped with adapter disc for mounting the Adjustable Clamping Elements H5.83.46R-xx. With an integrated bore for long workpieces y 18 mm, 100 mm deep.

## H1680.AC4 Speed Control Unit

for speed control of the H80 R.MAC. Rotating Spindles.

Dimensions (W/D/H) 270/330/320 mm

Mains voltage 230V / 50/60 Hz

Power input max. 500 VA

## H1680.AC4I1 Speed Control Unit

Same as H1680.AC4 but including a interface for automatic start and stop of the spindle via the machine control (M-code).





## High Speed Rotating/ Positioning Spindle H80R.MNC

The H80 R.MNC high speed rotating and indexing spindle allows complete production of complex parts in the same set-up. Depending on the machine control the axes can be integrated directly to the machine control for indexing, spinning or simultaneous multi-axis erosion (turn while burn). If direct integration is not possible, high speed rotation and indexing can be controlled through the HIRSCHMANN H1625.AC3 control with communication to the machine via M-code.



Rotating/ Positioning Spindle with clamper

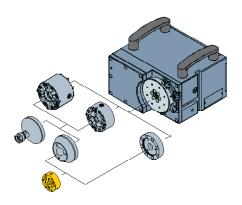
## H80R.MNC.. Rotating/ Positioning Spindle

Rust-proof, long-life AC drive

Dimensions (W/D/H) approx. 265/212/120 mm

(10.43/8.35/4.72")

Speed 0-1000 min-1
Indexing accuracy (direct measuring system) ± 5"
Axial accuracy n 0,003 mm
Loading weight max. 30 kg
Weight approx. 31 kg



#### **Design versions**

- -face-plate y !80 mm
- manual clamper H6.16R, H8.16R
- pneumatic clamper H6.11.10R, H8.11.10R
- support for adjustable clamping element H5.83.46R-xx
- clamper of other manufacturers



## H1625.AC3 Control

for Rotating/Positioning Spindle H80R.MNC.

 Dimensions (W/D/H)
 520/420/230 mm (19.3/15.8/9")

 Power supply
 230 V 50/60 Hz

 Power input
 max. 1000 VA

 Weight
 approx. 10 kg (22.05 lbs)







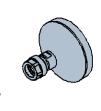
## Adjustable Clamping Element / collet supports for High Speed Rotating Spindles

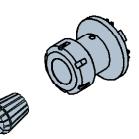
## Adjustable Clamping Element —erosion grinding with high precision

High accuracy requires a precise concentricity. With the HIRSCHMANN Adjustable Clamping Element the concentricity can be quickly and easily adjusted to n 0,001 mm.









## H5.83.46R-xx Adjustable Clamping Element (Brass)

for the precise adjustment of the workpiece concentricity. The Adjustable Clamping Elements are mounted to the Clamping Element Holder HI5.83.45R or directly to the Rotating Spindles rsp. A-Axes equipped with Adjustable Clamping Elements.

Concentricity adjustable to < 0.001 mm Clamping range (xx) from y !1 mm until y !20 mm (When ordering, please state the exact clamping diameter (xx))

#### H5.83.45R Clamping Element Holder (stainless)

for mounting the Adjustable Clamping Bements H5.83.46R-xx in the Rotating Spindles, Axes and Presetting Spindles with HIRSCHMANN clampers.

Please order Clamping Journal H5.611R rsp. H6.611R separately!

## H5.83.40 R.MAC Collet Holder (stainless)

Clamping nut nickel plated. For collet H50.41.

Concentricity (without collet) 0,005 mm

Please order Clamping Journal H5.611R rsp. H6.611R separately!

## H50.41 Collet ER/ ESX 16 (non stainless)

Clamping range infinitely variable from y |0.5-y|10 mm. Collet size from y |1-y|10mm, in 1 mm increments. Radial deviation until y |5mm = 0.01, from y |6mm = 0.02 mm Stainless edition on request.

#### H5.83.50R Collet Holder (stainless)

Clamping nut nickel plated. For collet H5.50.51 (ER40). Clamping range y 3 - y 26 mm.

Concentricity (without collet) 0,01 mm Weight 1,1 kg

Please order Clamping Journal H5.611R rsp. H6.611R separately!

## H5.50.51 Collet ER/ESX 40 (non stainless)

Clamping range infinitely variable from y  $\frac{1}{3}$  - y  $\frac{1}{2}$ 6 mm. Collet size from y  $\frac{1}{4}$  - y  $\frac{1}{2}$ 6 mm, in 1 mm increments. Radial deviation luntil y  $\frac{1}{6}$ mm = 0.015, from y  $\frac{1}{7}$ mm = 0.02 mm







## Accessory / Presetting Spindle

## Presetting workpiece concentricity

The Presetting Spindle allows the adjustment of concentricity outside the machine tool simultaneous to machine operation. After alignment the Clamping Bement or collet holder holding the workpiece can be accurately loaded manually by hand or automatically with a robot into the Rotating Indexing Spindle or A-Axes within seconds.



## H5.83.70R Collet Holder (stainless)

Clamping nut nickel plated. For collet ER50 (clamping range y !3 - y !34 mm).

Concentricity (without collet) 0,01 mm Weight 1.6 kg

Please order Clamping Journal H5.611R rsp. H6.611R separately!



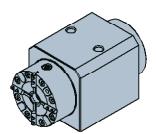


## H5.611R Clamping Journal and H5.611.1R Centering Bush (stainless)

to use the holders H5.83.45R, H5.83.40R.MAC, H5.83.50R and H5.83.70R in the clamper H8.16R.

## H6.611R Clamping Journal (stainless)

to use the holders H5.83.45R, H5.83.40R.MAC, H5.83.50R and H5.83.70R in the clamper H6.16R.



## H5.83.60R Presetting Spindle (Clamper H8.16R)

to preset the concentricity of the parts which are clamped in the Adjustable Clamping Element H5.83.46R and mounted to the Clamping Element Holder H5.83.45R.

Concentricity n 0,002 mm

H6.83.60R Presetting Spindle (Clamper H6.16R) similar to H5.83.60R but with Clamper H6.16R

Presetting Work Stations on request.



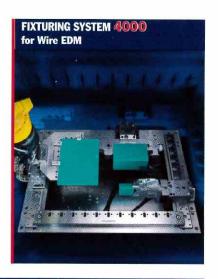




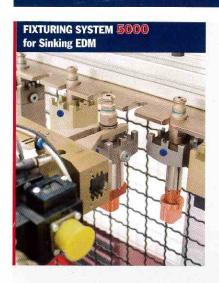


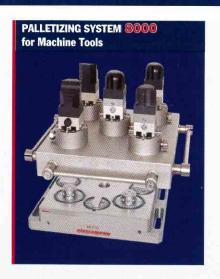
## SKÄRPVERKTYG AB

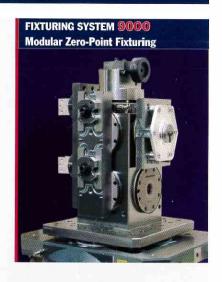
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431 53 MÖLNDAL
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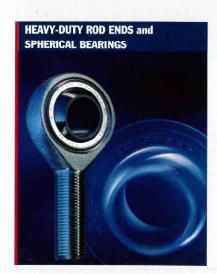


## PRODUCT OVERVIEW









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