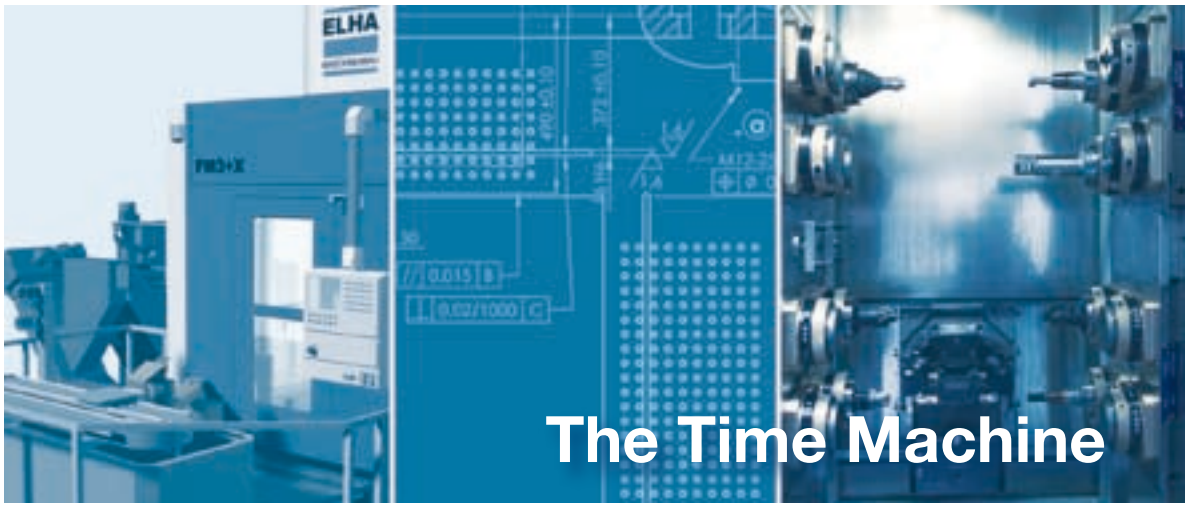
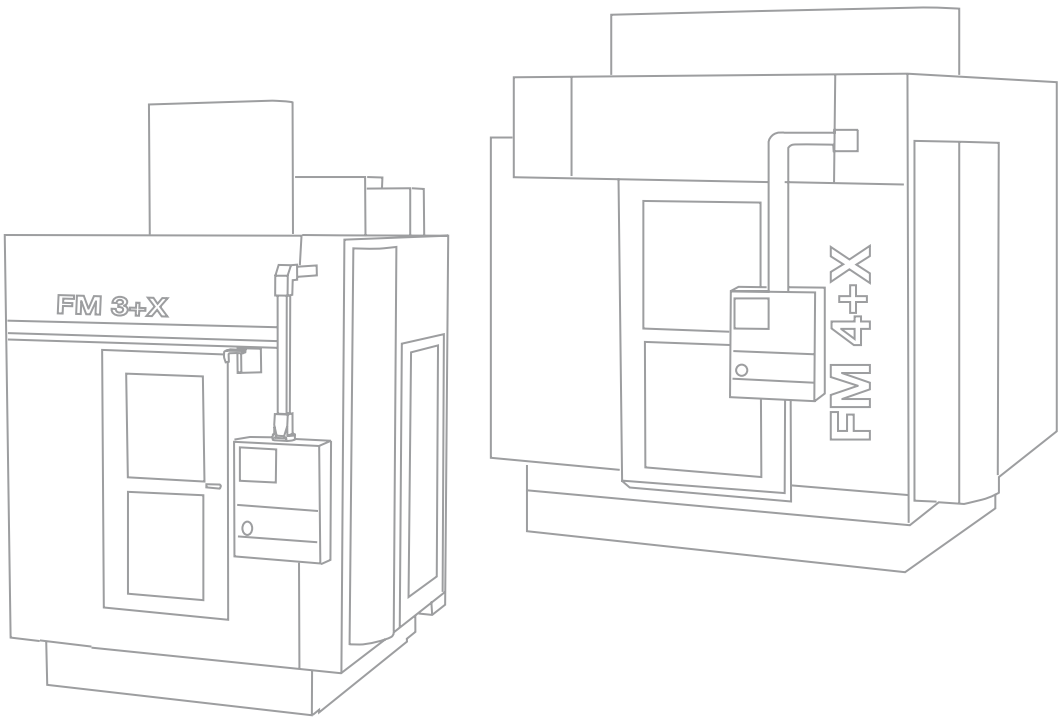
ELHA
MASCHINENBAU

Production Modules

From the developer of the Production Modules —
the new generation of reconfigurable machine tools





The Time Machine

Reduce your non-productive times!

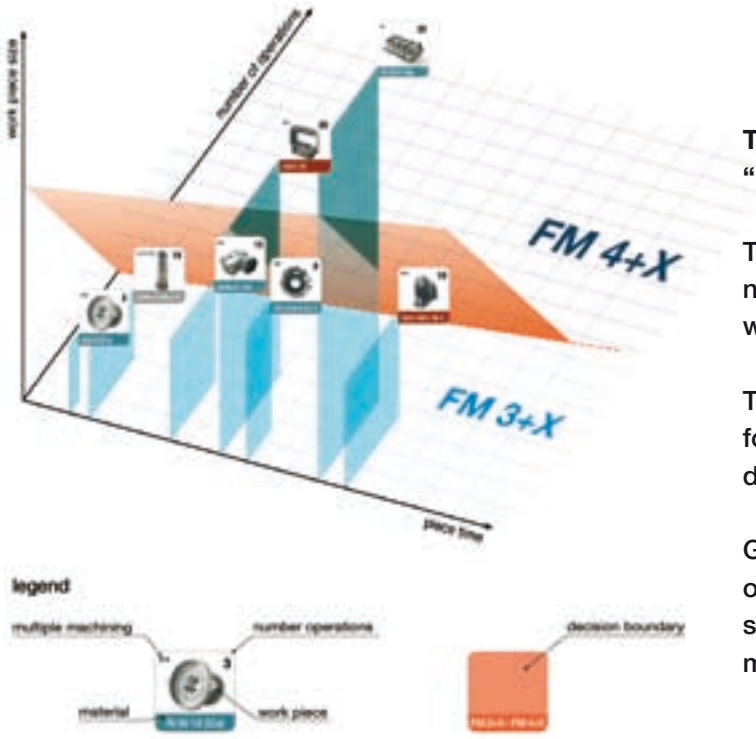
Today modern tools enable cutting of light metals and also steel and castings with productive times of often less than one second. Unproductive tool change with machining centers and work piece transport with dial or linear transfer machines usually take a multiple of the productive time.

The solution
Closely oriented, driven tools and a highly dynamic fixture that rapidly moves the work piece from one operation to the next. Our Production Modules FM 3+X and FM 4+X offer all of the above.

Reduce your non-production costs!

Modern machine tools use “non-active” fixtures primarily for cycle-time-parallel loading of the machine. These fixtures are not utilized for cutting during the loading and unloading period and therefore do not add value to the work piece. However, they have to be paid for, increase the quality control effort and require complicated automation.

The solution
There is only ONE fixture in the machine, which uses its mobility to load the work pieces itself by a pick-up method.



The decision between the “small” FM 3+X and the “large” FM 4+X

The three parameters: piece time, work piece size and number of operations define the application range in which every machining task can be positioned.

This range is divided into the preferred applications for the FM 3+X and the FM 4+X by the depicted decision boundary.

Generally, very large work pieces and a large number of operations require the use of the FM 4+X. The same applies to heavy machining which demands a more solid machine.

- die cast aluminum
- complete machining in two fixture positions with 2 FM 3+X
- 2 work pieces simultaneously

- die cast aluminum
- complete machining in one fixture position with 1 FM 3+X
- 2 work pieces simultaneously

- die cast aluminum
- complete machining in one fixture position with 1 FM 3+X
- 3 work pieces simultaneously

- die cast aluminum
- complete machining in one fixture position with 1 FM 3+X
- 2 work pieces simultaneously

Automation

The layout variations

- single module with 2-axis robot
- single module without conveyor, with 5-axis robot
- single module with conveyor, with 2-axis robot
- double module with individual conveyors
- double module with continuous conveyor

- die cast aluminum
- complete machining in one fixture position with 1 FM 3+X
- 1 work piece

- forged aluminum
- complete machining in one fixture position with 2 FM 3+X
- 2 work pieces simultaneously

- chilled aluminum casting
- complete machining in one fixture position with 2 FM 3+X
- 2 work pieces simultaneously

- die cast aluminum
- complete machining in one fixture position with 1 FM 3+X
- 1 work piece

Concept and Practical Realization

The concept
- each necessary tool has its own spindle that is optimally configured for its requirements
- a dynamic 4-axis system that picks up the work piece with the fixture and performs all rapid and feed motions

The machine
- the core of the machine is a massive, heavily enforced and closed cast iron frame
- the vertically positioned frame divides the machine in a front side and a back side
- the front side of the frame mounts the project-specific equipment such as the fixture and the multi-spindle-heads and creates the working space
- the back side mounts the CNC 4-axis system and creates the machine space
- the machine space is hermetically separated from the working space

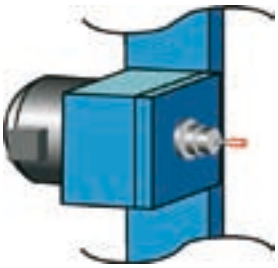
Conceptual advantages
- no tool changer
- no break downs due to failure of the tool changer
- no tool change inaccuracies
- chip-to-chip times usually of less than one second
- 100 % tool capacity with individually configured spindles
- high spindle speeds AND high torques in ONE machine
- only ONE fixture in the system
- no “non-active” fixtures
- reduced effort for statistical quality control
- flexible during unforeseen work piece modifications
- work piece loading by the machine using a pick-up method

Machine-specific advantages
- vertical machining space
- small floor space requirements, optimal chip fall
- closed working cycle without long return movements
- effective separation of the machine elements and the chip area
- elimination of failure prone assemblies (tool changer, telescopic ways, mechanical end switches)
- easily accessible and maintainable machine construction
- machine and project-specific equipment from a large and standardized system (5th NC-axis, spindles HSK 32 to HSK 100, AC motors up to 37 kW)
- shared components with multi machine operation (coolant system, chip conveyor, exhaust system)

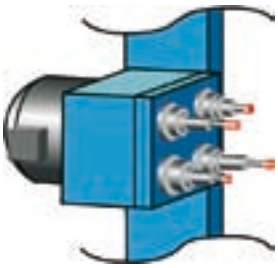
configuration for turbo charger rings (spin casting)
- partial machining in one fixture position
- six work pieces simultaneously
- piece time: 30 seconds

configuration for wheel hub (cast steel)
- partial machining in one fixture position
- three work pieces simultaneously
- piece time: 33 seconds

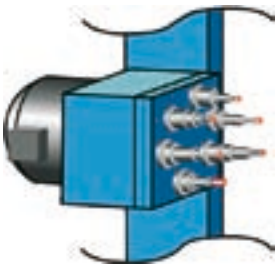
FM Configurations



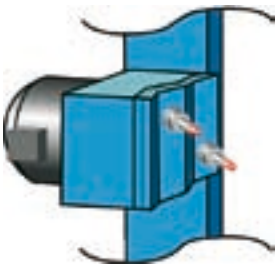
Spindle-head with single spindle
for heavy single spindle machining and precise positioning



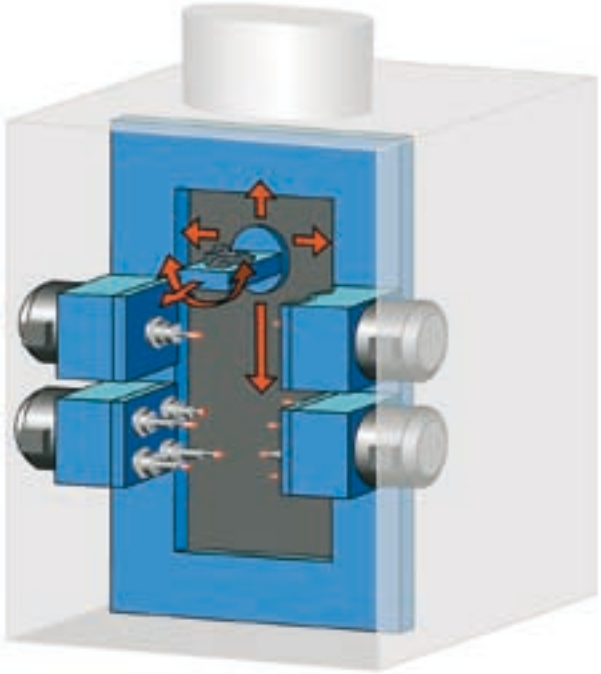
4 spindle-head
for dual spindle machining with two different toolsn

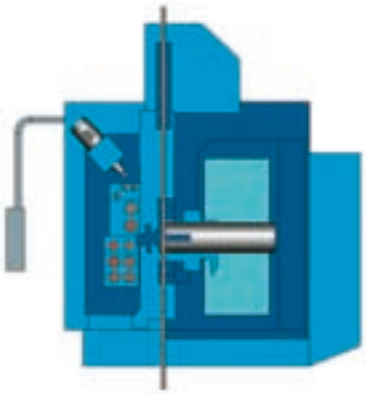


Hole pattern multi-spindle-head
for the productive machining of hole patterns



Angled spindle-head
for 5-sided machining with a 4-axis machine using axis interpolation





Working space
project-specific, to mount the clamping fixture and multi-spindle-heads

Machine space
standard, to mount the CNC 4-axis unit, hermetically separated from the working space

configuration for front cover (die cast aluminum)
- complete machining in one fixture position
- one work piece
- piece time: 62 seconds

configuration for worm housing (die cast aluminum)
- complete machining in one fixture position
- two work pieces simultaneously
- piece time: 48 seconds

PRODUCTION MODULE

FM 3+X

Single module with standard automation

Module Layout
variations as
- single Module
- double Module
- triple Module

Module groups include a shared chip conveyor and coolant system. The automation has standardized 17 pallets.
Module distance 3100 mm
Machine height 3950 mm

FM 3+X basis frame mounts the work piece specific configuration and the C-axis

Working space with tools, fixtures and two work pieces

- forged steel
- complete machining in two fixture positions with 3 FM 3+X
- 4 work pieces simultaneously

- extruded aluminum
- complete machining in one fixture position with 4 FM 3+X
- 2 work pieces simultaneously

- cast iron
- partial machining in one fixture position with 1 FM 3+X
- 2 work pieces simultaneously

- GGG 70
- Complete machining in one fixture position with 1 FM 3+X
- 2 work pieces simultaneously

ELHA MASCHINENBAU

Technical Data FM 3+X

Travel	X-Axis Y-Axis Z-Axis	(cross) (vertical) (ram stroke)	mm mm mm	400 1000 500
Velocity	all axes	max.	m/min	40
Acceleration	all axes		m/sec^2	6
Feed force	all axes		daN	700
CNC rotary table 4th axis	table diameter working range C-axis velocity dividing accuracy admissible torque on clamped table	 max. max.	mm rpm sec Nm	300 360000x0.001° 60 +/-5 1500
Work piece loading height	ram center above floor	min.	mm	1100
Work spindles 1 - 12 work spindles are driven by 1 motor	drive power speed torque **spindle type** 40 63 63 S 100	max. pro Spindle S1-100% max. max. **spindle diameter** 50 60 75 90	kW rpm Nm **holder** HSK HSK HSK HSK	20 20000 200 40 63 63 100
Overall dimensions Basis Modul	width depth height transport height		mm mm mm mm	3050 3500 3950 3200
Connected load power	req. at 3AC 400 V/50 Hz compressed air	max.	kVA bar	60 6
Weight	single module with complete periphery and automation	approx.	kg	14500

- extruded aluminum
- complete machining in two fixture positions with 2 FM 3+X
- 2 work pieces simultaneously

- die cast aluminum
- complete machining in two fixture positions with 2 FM 3+X
- 2 work pieces simultaneously

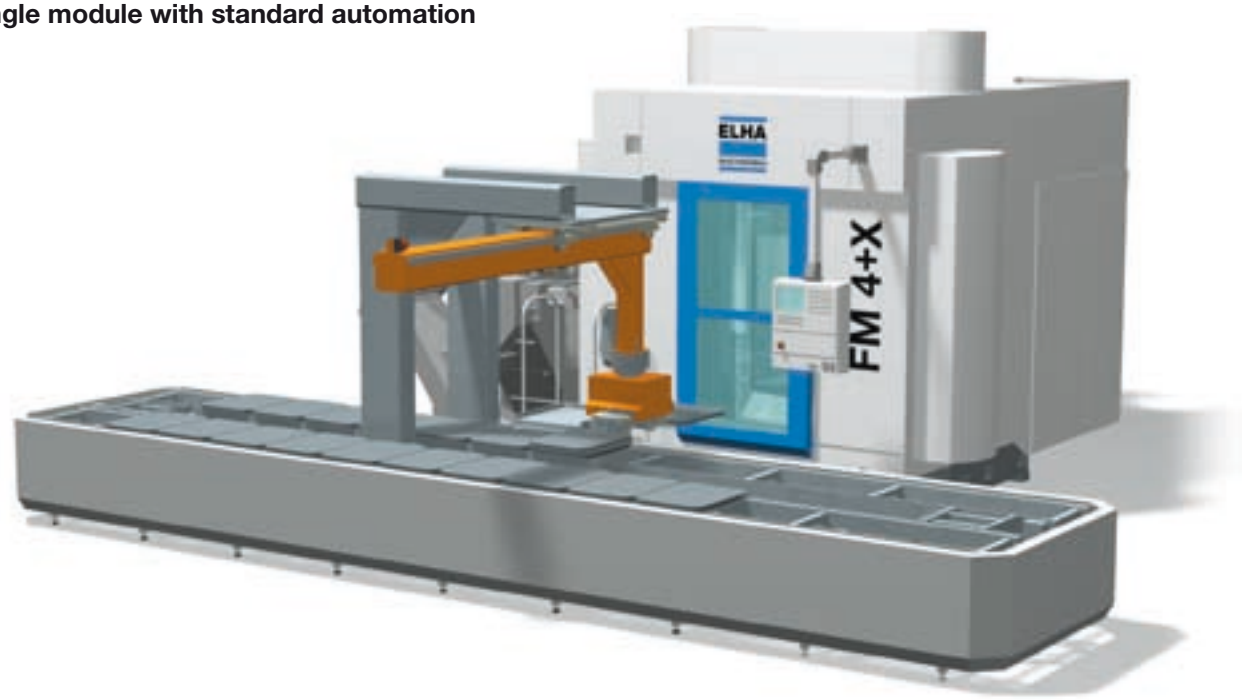
- spin casting with 35% Cr
- partial machining in one fixture position with 1 FM 3+X
- 6 work pieces simultaneously

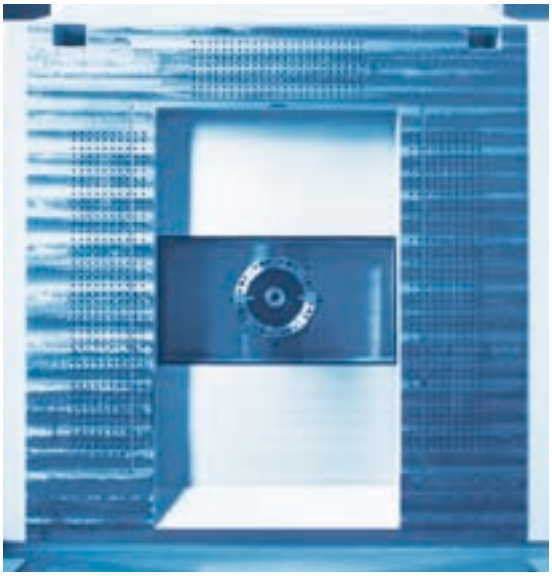
- die cast aluminum
- complete machining in one fixture position with 1 FM 3+X
- 2 work pieces simultaneously

PRODUCTION MODULE

FM 4+X

Single module with standard automation





FM 4+X basis frame

mounts the work piece specific configuration and the C-axis

Module Layout

variations as

- single Module
- double Module

Module groups include a shared chip conveyor and coolant system. The automation has standardized 17 pallets.
Module distance 5000 mm
Machine height 3950 mm

- aluminum
- partial machining in several fixture positions with FM 4+X
- 1 work piece

- cast iron
- complete machining in two fixture positions with 2 FM 4+X
- 2 work pieces simultaneously

- aluminum
- complete machining in one fixture position with 1 FM 4+X
- 1 work piece

- GGG 40
- partial machining in two fixture positions with 2 FM 4+X
- 2 work pieces simultaneously

ELHA MASCHINENBAU

Technical Data FM 4+X

Travel	X-Axis Y-Axis Z-Axis	(cross) (vertical) (ram stroke)	mm mm mm	800 1400 800
Velocity	all axes	max.	m/min	48
Acceleration	all axes		m/sec^2	6
Feed force	X-Axis Y-/Z-Axis		daN daN	4000 2000
CNC rotary table 4th axis	table diameter working range C-axis velocity dividing accuracy admissible torque on clamped table	 max. max.	mm rpm sec Nm	400 360000x0.001° 80 +/-5 4000
Work piece loading height	ram center above floor	min.	mm	1100
Work spindles 1 - 12 work spindles are driven by 1 motor	drive power speed torque **spindle type** 40 63 63 S 100 125	max. pro Spindle S1-100% max. max. **spindle diameter** 50 60 75 90 120	kW rpm Nm **holder** HSK HSK HSK HSK HSK	37 20000 800 40 63 63 100 125
Overall dimensions Basis Modul	width depth height transport height		mm mm mm mm	3500 4525 3950 3400
Connected load power	req. at 3AC 400 V/50 Hz compressed air	max.	kVA bar	80 6
Weight	single module with complete periphery and automation	approx.	kg	30000

- GGG 50
- partial machining in one fixture position with 1 FM 4+X
- 2 work pieces simultaneously

- cast iron
- complete machining in one fixture position with 1 FM 4+X
- 2 work pieces simultaneously

- aluminum
- complete machining in one fixture position with 1 FM 4+X
- 1 work piece

- steel
- complete machining in one fixture position with 1 FM 4+X
- 2 work pieces simultaneously

Technical Features

The frame assemblies
- basis frame to mount the spindle- and NC-units made from massive and artificially aged GG 30.
- machine housing to mount the basis frame and the electrical, hydraulic and pneumatic assemblies made from welded sheet metal

The CNC 3-axis. unit
- reinforced, weight- and strength optimized construction made from GGG 40
- preloaded linear bearings
- zero maintenance AC servo-feed drives
- preloaded precision revolving-ball spindles
- direct and absolute measurement systems
- linear guides and drive spindles automatically lubricated

The 4th, rotational full-NC-axis
- high-strength steel casing (FM 3+X) or round Z-ram with hydrostatic guide (FM 4+X)
- preloaded radial-axial roller bearing
- zero-maintenance AC servo-feed motor with highly geared-down transmission (FM 3+X) or torque motor (FM4+X)
- direct and absolute encoders
- zero-play hydraulic clamping
- rotary table with 9 (FM 3+X) or 13 (FM 4+X) hydraulic and pneumatic ports to mount and power the clamping fixture and an additional 5th axis (optional)

The spindle units
- massive, artificially aged GG casing to house 1 to 16 spindles, HSK 32 to HSK 100, standardized system
- drives either with frequency controlled or AC main spindle motors with max. 20 kW (FM 3+X) or 37 kW (FM 4+X)
- drive distribution using a 2-stage transmission
- spindle drives free of radial forces with a separately guided coupling
- spindle bearings preloaded and thermo-symmetrically configured
- high pressure inner coolant supply up to 80 bar
- oil mist lubrication and air pressure seal at the spindle head

The control
- Siemens SINUMERIK 840D, PCU 50 with OP 10C 10,4” TFT, SPS-S7, ASI-Bus
- coordinate transformation for simple spatial machining
- Safety Integrated

The options
- chip conveyor, vacuum rotational filter, exhaust system, tools, automation, tool monitoring systems and special installations
- service from the planning stage to production support

- die cast aluminum
- complete machining in one fixture position with 1 FM 3+X
- 2 work pieces simultaneously

- die cast aluminum
- complete machining (5 sides) in one fixture position with 2 FM 3+X
- 1 work piece

- forged aluminum
- complete machining in one fixture position with 1 FM 3+X
- 1 work piece

- die cast aluminum
- complete machining in one fixture position with 1 FM 3+X
- 2 work pieces simultanously

ELHA-MASCHINENBAU

The company ELHA-MASCHINENBAU Liemke KG is a mid-size family business with 180 employees.

The company has two locations: the main plant in the town center of Hövelhof houses the division Manufacturing Systems as well as the administration and the machining facilities.

The recently founded division Production Modules was relocated in a new plant in the industrial zone of the town in 2002. There are about 55 employees working in sales, design and assembly working at this plant.

Assembly facility Production Modules

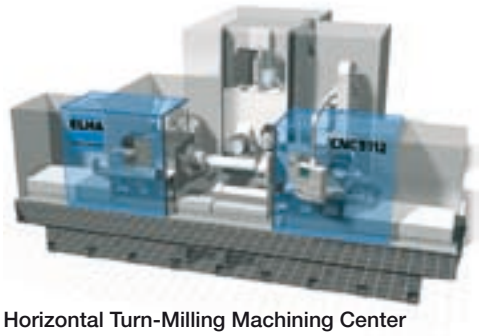
Quality and Environment Management

Since 2005 the company is certified according to DIN EN ISO 9001:2000 and DIN EN ISO 14001:2005.

Manufacturing Systems

Planetary Table Machining Center

6-Axis Rotary Table Machining Center



Horizontal Turn-Milling Machining Center

ELHA-MASCHINENBAU
Liemke KG

production facility 1
Division Manufacturing Systems
Allee 16 ▪ D-33161 Hövelhof
P. O. Box 12 54 ▪ D-33156 Hövelhof
Germany

Phone	+49 (0) 52 57 / 5 08 - 0
Fax	+49 (0) 52 57 / 5 08 - 28
E-Mail	info@elha.de
Internet	www.elha.de

production facility 2
Division Production Modules
Otto-Hahn-Straße 27 ▪ D-33161 Hövelhof
P. O. Box 12 54 ▪ D-33156 Hövelhof
Germany

Phone	+49 (0) 52 57 / 5 08 - 0
Fax	+49 (0) 52 57 / 5 08 - 208
E-Mail	module@elha.de
Internet	www.elha.de

09 / 2006