

DMU 60 eVo
Project no: 330/684435-2

We are pleased to present the following quotation of the above mentioned machine with the following specification:

DMU 60 eVo
Stock machine: 15475754364



Highlights

- **Revolutionary Machine concept** with optimized Gantry for highest rigidity and accuracy
- **By CELOS simple operation and holistic integration in the business organization***
- **Large working area** at small foot print with extremely convenient access to the machine table
- **From basic to dynamic version** with linear drive and 80 m/min rapid traverse speeds
- **High-output motor spindle** of 20.000 min⁻¹ in standard
- **Dynamic NC-swivel rotary table** for 5-axis simultaneous machining in standard
- **Tool magazine with 30 pockets** in standard, optional up to 120 pockets
- **Chip conveyor** in standard

DMG MORI DMU 60 eVo

Basic machine

- S-A3188* Universal machining centre DMU 60eVo
New DMG MORI Design
traverse path X/Y/Z 600/500/500 mm /
X/Y/Z 23.6/19.6/19.6 in
motorspindle speedMASTER® SK 40/BBT
speed range 20 - 18.000 min⁻¹ SK40
speed range 18.000 - 20.000 min⁻¹ SK40-
BIG PLUS®
35 kW (40% ED); 25 kW (100% ED)
46.9 hp (40% DC); 33.5 hp (100% DC)
tool taper SK40 (DIN ISO 7388-1-A, AD)
for Pull-Studs DIN ISO 7388-3-A, AD
NC swivel rotary table
chain type tool changer with 30 positions
and double gripper
active cooling
direct measuring system
full cabin
Swarf conveyor (scraper type); spray gun
MPC (Machine Protection Control)
3D-Control, ERGOline® control
- S-A3077* Dynamic package for DMU 60 eVo linear
linear drive X/Y-axis with 80 m/min // 262.48
ft/min
rapid feed X/Y/Z 80 m/min // 262.48 ft/min,
Acceleration X/Y/Z 10 m/s² // 32.8 ft/s²

Control

- S-B3204* CELOS with Siemens 840D sl Operate
includes 21,5" ERGOline® Control with
Multi-Touch-
Screen.
APPs simplify machine operation and
support integrated management,
Documentation and visualization of orders,
process and machine data. Interactive with
CAD / CAM and compatible with PPS/ ERP

Spindle

S-E3168* Motor spindle speed MASTER® HSK-A63
Spindle speed 20 - 20,000 min⁻¹
Output 35 kW / 25 kW
(47 hp / 33 hp)
Torque 130 Nm / 86 Nm
(96 ft lbs / 63 ft lbs)
(40 / 100 % duty cycle)

Working table

S-C3045* NC rotary table with swivel axis,
size 600 x 500mm / 23.6 x 19.6in,
swiveling range B-axis -5° to 110°,
C-axis 360°,
table load 400kg/ 881lb,
direct measuring systems,
incl. cooling of the table

Cooling media / chip removal

S-K3624* Internal coolant supply (ICS)
with paper type filter,
40 bar/23 l/min / 600-l tank
580 psi/6 gallon/min /160 gallon
air purge for linear measuring system,
bed flushing

S-K3469 Extended swarf flushing
Additional flushing of the working area door
left hand side,
y axis and right cabin wall
volume of the flushing adjustable manual
(only in combination with internal coolant)

S-K3471 Double cartridge filter,
Finesse of filtration 25 µm
(only in combination with internal coolant)

S-K3628 Rotating clear-view window

S-K3375 Oil and emulsion mist separator
Mechanical

S-K3121* Air blast through spindle centre
activated by M function,
maintained air with low oil rate

Measuring / Monitoring

S-K3349* Infrared touch probe
type Renishaw PP 60 optical (OMP60)

- S-K3411* Laser tool measuring of tool length and diameter, automatically turn away of the measuring unit under table level including Calibration tool
- S-K3493 3D quickSET
Tool kit for control and compensation of the cinematic accuracy of 5 axis machine configurations (only with option touch probe)

Automation

- S-K3202* Signal lamp, 4 colours

General options

- S-N3241 Laminated safety glass at operators door and side panel
- S-H3046* Operation mode 4
Process monitoring in the production

Options for CELOS with Siemens / Siemens

- S-H2507 Application Tuning Cycle ATC programmable feed parameter selection for machining task:
accuracy/surface/speed

Options for CELOS with Siemens

- S-H3110* Energy meter for 3D control Siemens 840D solutionline
Operate with CELOS

CELOS Products

- D-CEL200* **DMG MORI NETSERVICE**
Qualified support by Internet-based remote diagnostics

Special constructions services

- SK002 Transportation of machine and accessories, DAP customer's site (INCOTERMS 2010)
Excl. unloading and transport to installation point
- SK003 Installation of all quoted equipment at customer's site
Incl. travel and accommodation costs
- SK004 Training at customer's site, 4 days
Incl. travel and accommodation costs
To be performed at one single occasion and within six months from delivery

Attachment

Technical Description

S-A3188

Universal machining centre
New DMG MORI Design

Traverse range:	X = 600 mm / 23.6 in Y = 500 mm / 19.6 in Z = 500 mm / 19.6 in
Rapid traverse speed:	X-/Y/-Z- axis 50 m/min / 164 ft/min (with option dynamic package X-/Y/-Z- axis 80 m/min / 262 ft/min)
max. feed speed:	X-/Y/-Z- axis 50 m/min / 164 ft/min (with option dynamic package X-/Y/-Z- axis 80 m/min / 262 ft/min)
max. acceleration:	X-/Y/-Z- axis 6 m/s ² / 19.6 ft/s ² (with option dynamic package X-/Y/-Z- axis 10 m/s ² / 32.8 ft/s ²)
max. feed force: (standard version)	X axis 5.3 kN / 1,191 lbs Y axis 7.2 kN / 1,618 lbs Z axis 4.6 kN / 1,034 lbs
max. feed force: (with option dynamik package)	X axis 3.86 kN / 868 lbs Y axis 6.1 kN / 1,371 lbs Z axis 3.86 kN / 868 lbs
Feed drive:	X-/Y/-Z-axis digitally controlled AC-motors, recirculating ballscrews
Guideways:	roller guideways in all linear axes
Linear measuring systems:	direct, absolut, resolution 0.0001 mm / 0.0000039 in photo-electrical (in combination with Heidenhain control) magnetic (in combination with Siemens control)
Positioning accuracy: (to VDI / DGQ 3441)	X-/Y/-Z-axis P= 0.008 mm / 0.00032 in
Temperature compensation Z-axis:	electronic, temperature sensor
MPC:	Machine Protection Control Machine protection by quick shutdown

Accuracy depends to a large extent on external thermal influences.
The highest accuracy is achieved in the temperature range of 20°C +/-2°C.
Direct sunlight, strong draughts, vibrations caused by other units and
build up of heat have to be avoided.

Active cooling for main spindle, drives and table up to ambient temperature max.40°Celsius.

Main drive:	AC motor spindle vertical digital control
Standard speed range:	up to 20.000 min ⁻¹
Tool mounting:	up to 18.000 min ⁻¹ Tool holder DIN ISO 7388-1-A,AD40 Pull-Studs DIN ISO 7388-3-A,AD40 at speeds > 18.000 min⁻¹ BIG-PLUS® Dual Contact Patent stipulated (BBT in case of option BT tool holder)

At speeds > 18.000 min⁻¹, the use of tools with dual contact system (BIG-PLUS®) is stipulated.

Drive capacity:	35 kW (40% ED); 25 kW (100% ED) 46.9 hp (40% DC); 33.5 hp (100% DC)
max. Spindle torque:	130 Nm (40% ED); 86 Nm (100% ED) 94.25 ft lbs (40% DC); 62.35 ft lbs (100% DC)
Coolant circulation:	liquid cooling
Lubrication:	oil-air-lubrication
Speed range optional:	up to 24.000 min ⁻¹ (HSK-A63) up to 15.000 min ⁻¹ (SK40/HSK-A63) high torque
Tool draw-in power SK40:	11,2 kN (+2/-3,2 kN) / 2,469 lbs (+450/-719 lbs)
Tool draw-in power HSK-A63:	25 kN (+10/-7 kN) / 5,512 lbs (+2248/-1574 lbs)
Tool magazine:	program controlled tool change in working spindle, double gripper magazine integrated into machine cabin; loading during machining possible, 30 pockets (chain-type)
Tool magazine options:	60 / 120 pockets (chain-type)
max. tool diameter:	80 mm / 3.14 in
at free neighboring pockets:	130 mm / 5.10 in
max. tool length:	300 mm / 11.81 in (from spindle nose)
max. tool weight:	6 kg / 13.23 lbs
max. loading weight of tools in tool magazine (30 pockets):	120 kg / 265 lbs
tool magazine (60 pockets):	240 kg / 529 lbs
tool magazine (120 pockets):	480 kg / 1058 lbs
Chip-to-chip-time: (magazine with 30 / 60 / 120 pockets)	approx. 5 s

Note:

Tool mounting fixtures and tools should have a balancing grade of G6.3 (up to 5kg / 11.02 lbs) and G2.5 (>5kg / 11.02 lbs).

The following tool dimensions should be chosen for

up to 14,000 min ⁻¹ :	max. tool permissible tool length	200 mm / 7.87 in
	max. tool dia.	80 mm / 3.41 in
up to 18,000 min ⁻¹ :	max. permissible tool length	200 mm / 7.87 in
	max. tool dia.	50 mm / 1.97 in
up to 24,000 min ⁻¹ :	max. permissible tool length	180 mm / 7.08 in
	max. tool dia.	50 mm / 1.96 in

Required air pressure: 6 bar / 87.02 psi

Average compressed air consumption: machine without air tool cooling:
approx. 35 m³/h / 9,250 gal/h
machine with air tool cooling (continuous operation): approx. 60 m³/h /
15,850 gal/h

Central lubrication: automatic minimum lubrication for roller guideways and ballscrews

Electric Cabinet: active cooling unit

Cabin: fully protective cabin including roof with sliding door, DMG LIGHT *line*® provides optimum visibility of machine status

Swarf conveyor: Swarf conveyor, scraper type with slotted hole screen

Protection: acc. to EU directives, laminated steel covers for the longitudinal guideways and sheet metal box for vertical guideways, inclined surfaces are arranged for the best possible swarf removal

Cooling lubricant supply: multi-nozzle unit
delivery rate: 20 l/min at 2.5 bar /
5.3 gallon/min at 36.3 psi
capacity of cooling lubricant tank:
approx. 180 l / 47.5 gallon

Note: Only use cooling lubricant (emulsion) according to manufacturer's machine specific recommendations! For an oil content > 15% in emulsion there is a risk of evaporation or explosion; additional safety package is necessary. The ignition point of the emulsion must be higher than 140°C.

Spray gun for swarf removal

Machine lamp: "Planon Light", 24 V DC, rated power 50 W

Working hour recording: on the electrical cabinet for "control voltage on" and "program is running"

Operation mode: Operation mode 2 + 3 activated
2 pieces SMART Key with operation mode 2+3 included

Paint:
"Design version BLACK":
machine foot (iron cast): titan grey (DMG-specific special colour)
iron cast parts: titan grey / calcit white
side Panels: calcit white
electrical cabinet: titan grey
machine door/side panel working area: stainless steel, sheets in calcit white (DMG-specific special colour)

Optionally:
Design version "WHITE"
front panel frame in colour calcite white

Installation measurements and weight:
Space required (incl. space for maintenance & operation)
D x W x H (approx.): 6.29 x 6.78 x 2.87 m 20.64 x 22.24 x 9.42 ft

Modified dimensions with swarf conveyor and ICS: 6.29 x 7.67 x 2.87 m 20.64 x 25.16 x 9.42 ft

Weight without accessories:

with 30 tools approx. 8.9 t / 19,621 lbs
with 60 tools approx. 9.1 t / 20,062 lbs
with 120 tools approx. 9.5 t / 20,944 lbs

weight of cross beam: approx. 280 kg / 617 lbs

Ambient conditions:

Room temperature (machine operation is ensured). +15 - +35 °C

Room temperature (achieve assured accuracy): +20 - +23 °C
Temperature fluctuation / h: <0,4 °C
Temperature fluctuation / 24h: < ± 1,5 °C

humidity at 20°C: 20-75%

max. installation altitude: 1000m / 3280 ft above nsl

Connected load

power input standard machine (with ICS):
spindle 20.000 min⁻¹: 31 (34) kVA
spindle 24.000 min⁻¹: 31 (34) kVA
spindle 15.000 min⁻¹: (high torque): 36 (39) kVA

In max standard machine (with ICS):

spindle 20.000 min⁻¹: 47 (51) A
spindle 24.000 min⁻¹: 47 (51) A
spindle 15.000 min⁻¹: (high torque): 54 (58) A

Pre-fuse standard machine (with ICS) at 400V:

spindle 20.000 min⁻¹: 50 (63) A
spindle 24.000 min⁻¹: 50 (63) A
spindle 15.000 min⁻¹: (high torque): 63 (63) A

Operating voltage:

3 L / N / PE / 400 V (±10%), 50 Hz (±2%)

Note:

Load-carrying neutral conductor N (zero conductor)
or special transformer required!

Electrical connection:

For electrical installation please
ensure that EN 60 204,
part 1, point 6.3.3 "protection for
automatic switch off of power supply"
is adhered to.

See also IEC 364-4-41 (DIN 57 100,
VDE 0100, part 410).

The machine must not be connected to a
line circuit with FI protective switch.
See EN 50 178, point 5.3.2.3
(old VDE 0160, extract 5.5.3.4.2)

Due to the measures for electromagnetic
compatibility, the machine has leakage
currents higher than 3.5 mA and must there-
fore be connected firmly.
EN 50178, point 5.3.2.1
(old VDE 0160, extract 5.5.3.4.1 and 6.5.2.1)
Apart from that, one of the following
measures has to be taken:
a) Protective conductor profile at least
10 mm² Cu (copper)
b) Control of the protective conductor by
means of a device which makes sure that
in case of an error the machine is
switched off
c) Laying of a second conductor, electrically
parallel with the protective conductor,
over separate clamps. This conductor alone
must meet the requirements acc. part 543 of
harmonization documents (hd) 384.5.54 S1
(old DIN VDE 0558, part 540)
for protective conductors.

Noise measuring:

according to DIN 45635-16-cl.2, LpA < 78 dB

Machine transport:

by crane (lifting gear) or industrial trucks

Transport lifting equipment: inclusive

Machine installation elements: 5 leveling elements (height adjustable), 4 leveling elements for adjusting

Machine Construction

The machine is based upon FEM-optimized, rigid and ribbed cast iron components and a machine base made of vibration reducing polymer concrete. The high-quality machine frame ensures permanent accuracy and high machining performance throughout the life time. The Gantry design of the Y-slide, generous strutting and ribs in all main parts and the new developed cooling concept guarantee high bending and torsional strength, high thermal stability and high guiding accuracy. Wide guideway distances are a special feature of the machine. Steep inclined surfaces of the working room facilitate optimum swarf clearance.

The well-thought out design provides the basis for the following:

- Complete compact unit (small space required, inherently rigid, precision, long life time)
- Short time required for installation and commissioning
- Various options to meet all customer requirements.

Guideway system in the linear axes

The new generation of proven roller guideways provides high dynamics at high feeds and rapid traverses with the efficient digital drive technology and the powerful control system. Rigidity and good damping lead to improved surface quality of the workpiece and longer tool life (cost reduction). Outstanding features of the roller guideways are low heat build-up, low friction, no stick-slip effect, permanent accuracy (protection from wear) and extremely low lubrication. Minimum lubrication of roller guideways and recirculating ballscrews is automatic.

Measuring systems

The standard machine is equipped with absolute measuring systems. The measuring systems are encapsulated. Their good arrangement guarantee high availability and protection against chips and coolant. An absolute angle measuring system is standard in every axis of the NC rotary table with swivel axis.

Feed drives

Direct digital AC drives offer high dynamics at reduced maintenance. Minimum control periods and high acceleration in connection with the roller guideways result in short positioning times (short down times), high dynamics and therefore a high standard of surface quality and contour accuracy on the component.

Vertical spindle

Direct motor spindle drive.

The stable working spindle has high-precision hybrid bearings and comes with a closed cooling cycle (water cooling) to reduce the temperature. An electronic temperature sensor (incl. evaluation unit) compensates geometry changes caused by heating of the milling spindle. Permanent monitoring and regulation is performed via the machine control. Special bearings and a robust construction guarantee high constant speeds.

Tool clamping

Clamping by disk spring assembly. The unclamping cylinder is operated hydraulically.

Tool change / tool magazine

The tool magazine, placed protected outside of the working area, is combined with double gripper to achieve shorter tool changing times. Loading of the magazine during primary processing time is easy and ergonomic. The tools hang in tubulars in the chain magazine to avoid contamination of the taper by coolant and swarf. At each tool change, the tool taper is cleaned with compressed air. The tool changer flaps are positively controlled.

Central lubrication

Minimum grease lubrication with automatic lubrication cycle for roller guideways and the recirculating ballscrews.

Coolant unit

The large sealed tank and an efficient pump, short piping and the good arrangement of jets (adjustable spherical jets) ensure functional supply with cooling lubricant. An additional feature are jets at the spindle head for air blast cooling. For cooling either air or coolant can be used. Easy-to-clean sieves remove chips from the coolant.

Swarf removal

To facilitate automatic swarf removal is used a scraping conveyor.

Optional internal coolant supply unit

The internal coolant supply unit guarantees optimum coolant rinsing as well as the efficient use of modern tools. Furthermore, constant cooling and rinsing with a large quantity of coolant lead to a improved workpiece quality.

Machine enclosure / machining area

The machine is equipped with a very compact, rigid and sound-absorbent fully-protective cabin. Optimum access to the machining area, large view window (polycarbonate) for good viewing and easy cleaning are outstanding design features.

Documentation

Documentation available in: German, English, French, Italian, Spanish, Dutch, Swedish, and Danish.

E-Plan only available in:

German, English, French, Italian

Delivery quality

During manufacture the machines undergo several intermediate tests and a careful final examination. A test certificate of the final examination is issued and given to the customer upon machine delivery

S-A3077

Dynamic package DMU 60 eVo linear

The machine is equipped with a linear drive on X- and Y-axis and more powerful motors. The tool changer especially the chip-to-chip time was adapted to the more advanced requirements.

Rapid traverse:	X/Y/Z-axis	80 m/min // 262.48 ft/min
ma. feed:	X/Y/Z-axis	80 m/min // 262.48 ft/min
Acceleration:	X/Y/Z-axis	10 m/s ² // 32.8 ft/s ²
max. feed force:	X axis	3.86 kN / 868 lbs
	Y axis	6.1 kN / 1,371 lbs
	Z axis	3.86 kN / 868 lbs

Chip-to-chip-time: appr. 4.5 s
(30/60/120 tools)

Connected load

power input standard machine (with ICS):

spindle 20.000 min-1: 54 (57) kVA
 spindle 24.000 min-1: 54 (57) kVA
 spindle 15.000 min-1 (high torque): 59 (62) kVA

NoMinal current (In max) standard machine (with ICS):

spindle 20.000 min-1: 80 (84) A
spindle 24.000 min-1: 80 (84) A
spindle 15.000 min-1 (high torque): 87 (91) A

Pre-fuse standard machine (with ICS) at 400V:

spindle 20.000 min-1: 100 (100) A
spindle 24.000 min-1: 100 (100) A
spindle 15.000 min-1 (high torque):100 (100) A

S-B3204

CELOS® provides a uniform user interface for all new high-tech machines from DMG MORI. On a unique 21.5" multi-touch screen CELOS® APPs to support integrated management, documentation and visualization of orders, process and machine data. In addition, the operation of the machine is simplified, standardized and automated.

CELOS® connects the machine on a uniquely way with the parent company structures and thus creates the basis for a consistently digitalised, paperless manufacturing. With CELOS® faster to a product through a direct coupling of ERP / PPS and PDM.

Screen / Control panel:

21,5" ERGOline® Control with multi-touch screen
Infinitely variable adjustment of screen and keyboard
Display of admission
Button for quick entry confirmation

APP SELECTOR:

Central selection mask for direct access by means of intuitive
Touch control and access to all available applications,
divided into five major groups:
Production, Utilities, Support, Monitoring, Configuration

APPs "Production":
CONTROL:

Machine control system with touch screen operation
Familiar control interface with Touch-functionality
Additional SideScreen for state information, for example, to
Drive load, tool condition, operating modes, etc.

JOB MANAGER:

Systematic planning, managing and preparing orders
Machine-related creation and configuration of new orders
Structured storage of all production-relevant data and documents
Simple visualization of jobs including NC programs and
Resources

JOB SCHEDULER:

Production planning for the machine
Record, manage and schedule various jobs for production.
Overview of the whole orders of the machine.

TOOL HANDLING:

Display of all tools required for a job, including the automatic
generation of a loading list. Generation of an unloading list through
automatic
detection of all tools not required for subsequent jobs
intuitive loading and unloading of the tool magazine

JOB ASSISTANT:

Complete jobs / processing of orders
Menu driven set-up of the machine and processing of
Production orders in the dialog

	Reliable error prevention through notes with binding acknowledgement function
APPs "Utilities": TECH CALCULATOR:	Calculating of technology data, dimensions and values Material - and process-dependent calculation process optimized Data for example for speed, feed, or spindle load Standards-conforming discovery defined dimensions, Providing data/dimensions as required by the standards for example, for Fits or thread Scientific calculator
CAD-CAM-VIEW:	visualizing of workpieces and optimizing of program data Direct remote access to external CAD/CAM-computer Central master data as the basis of the part visualization Immediate change options for processing steps NC programs and CAM strategies directly to the control
DOCUMENTS:	Digital library of full-text search Clear library structure for easy and quick orientation Digital storage of all machine-relevant manuals, Documentations and customer data Full text search and bookmark feature for recurring Lookup fields Documentation with intuitive commenting function
ORGANIZER:	Calendar, and memo functions User-defined messaging functions Individual messages with SMART key® Identification Simplifies communication by sharing of notes between connected CELOS instances
APPs " Support": NETSERVICE:	Qualified support through Web-based remote diagnosis Remote communication with the service of DMG MORI SEIKI directly at the control unit Online troubleshooting and technical support via Internet Highest data security through VPN access
SERVICE AGENT:	Overview of all maintenance work on the machine. Advance warning of upcoming maintenance and service work. List of all necessary spare parts and equipment. In-process support.
APPs "Machine View": STATUS MONITOR:	Machine status in real time Visualization of machine condition (spindle load,...) Displaying job information with quantity, lot size and Term to maturity Maintenance messages and warnings Drive-related energy return feed display Based on main supply Energy recuperation display (Option)
MESSENGER:	Clear live status of the networked machines. Detailed view of the machine history with evaluation of machine running time, idle time and stoppages.

APPs " Configuration":
ENERGY SAVING:

Automated energy management
Categorized balance display for different machine States
(Hold, ready for operation, processing)
Time controlled and Standby circuit with functions for
Machine, pneumatic, screen and lighting of workroom
Utilization - and time-based process analysis as base of the
Consumption optimization

Option:
Categorized energy Consumption display for different
machine states (Standby, Ready-to-Operate, Production)
Analysis of the precise energy consumption per shift,
work piece or cutting process
Analyses the data of individual jobs
in terms of required energy

SETTINGS:

Individualization and personalization
SMART key ® -based user and rights management
Individual APP customization
General system settings

SINUMERIK Operate:

CNC Operation and Programming
with intuitive setup functions, program and
tool management, as well as programming in
programGUIDE including cycle support and
workshop programming ShopMill
3D simulation of 3-5 axes simultaneously

Compatibility:

Disparities between user interfaces, volume of cycles and
programming, as well as a lack of ensured program
compatibility with the previous Siemens 840 D sl systems
up to SW NC 1.5

SINUMERIK MDynamics:

Innovative Advanced Surface motion control
kinematic transformations and a wide range of technology
and measuring cycles
(simple parameterization of mold making applications with
option High-Speed-Settings)

Hardware:

32-Bit-Multiprozessorsystem, decentral bus concept
(MPI, industrial Ethernet, Profibus, ASI-Bus)
NCU 720.3B PN
Program-memory on CF card,
(this memory can be used in standard with EES without
EXTCALL)
PLC: AS 317-2DP with Profibus

Keyboard:

CNC keyboard, Gildemeister control panel

DMG SMARTkey:	personalized authorization of the operator. Customized access rights to the control and the machine. Internal USB memory Scope of supply: 1. SMARTKey: OM 1 2. SMARTKey: OM 3
Block processing time:	0,6 ms
Number of part programs / work pieces in memory:	750 (with EES unlimited)
Number of tools/cutters	200 / 250 (optional: maximum 600 / 1500)
Number of axes:	5 out of 5 linear interpolating, digital 2 circular interpolating, helical interpolation,
user memory:	15 MB on NCU (13 MB free) 4 GB on external CF card
Network connection:	Ethernet interface inside machine control cabinet: Fast Ethernet 10/100 BaseT (100 MBaud) TCP/IP network protocol USB 2.0 interface on command station
Programming:	ShopMill machining step programming and/or G-code: DIN/ISO 66025
Programming aids:	ShopMill Graphic step editor for small series and individual parts without G-code knowledge to operate with input assistance and cycle support through animated elements SINUMERIK programGUIDE DIN/ISO G-code programming and high-level programming commands with input assistance and cycle support through animated elements
Programming graphics:	All geometric elements and NC blocks of the CNC program are shown scaled using dynamic broken-line graphics. The NC program can be quickly implemented as a 3-D preview of the workpiece using the mold making quickview.
Technology/ Milling cycles:	Drilling and milling cycles, Tapping with/without compensating chuck, Reaming, boring, drilling patterns, Milling of grooves, spigots, rectangular and circular pockets, Geometry calculator with contour cycles, Milling of flat surfaces, Measuring cycles
Parameter programming:	mathematical functions: =,+,-,*,/,sin a, cos. a, logical connections: (=,<>, >, >=, <, <=) parenthesis functions, tana, arcs sin, arcs cos, tan, an, en, ln, log, absolute value of a figure, constant p, negation, cancel of numbers before and behind the semicolon, calculation parameter, global user

	parameter (GUDs), local user parameter (LUDs)
Program structure:	Subroutines, program part repetition, conditional jumps to labels, program grouping
Coordinate system	Cartesian, polar
Zero point tables:	Zero point tables with 99 zero points
Coordinate transformations:	Offset, scaling, mirroring, rotation of coordinate systems, so that these are aligned to the workpiece surface.
Position details:	Nominal/actual value, residual value for straight lines and circles in right-angled coordinates, absolute measures, display and input in mm or inches
Contour approach and departure:	via straight line: tangential or perpendicular via circle, via helix
Constant path velocity:	in relation to tool-center-point path In relation to tool cutting edge
Swivel plane/tool:	CYCLE800 (for 4/5-axis-machines) Multiface machining via static swiveled planes. The rotation of the tool coordinate system in the program is automatically converted to rotations of the respective swivel axes of the machine during the machining of the workpiece. Swivel modes – direct, axis-by-axis, projection angle - solid angle.
Cylinder surface interpolation:	TRACYL (for 4/5-axis-machines): The cylinder surface curve transformation TRACYL enables the machining of longitudinal, transverse and varying direction grooves on cylindrical parts. The run of the grooves is programmed in relation to the unwound, flat cylinder surface.
Dynamic 5-axis transformation:	TRAORI (for 5-axis-machines): During the milling operation, the tool is dynamically aligned to the machining surface through interpolation of the linear and rotary axes. The tool length is taken into account and the kinematic compensation movements are initiated by the TRAORI function during the rotation of the rotary axes.
3D tool offset (for 5-axis-machines):	Machining of contours with tools, the orientation of which can be influenced, irrespective of the tool path and the tool shape. Tool offset via normal surface vector.
Retraction logic:	After an emergency stop or a power failure, it is possible to retract from holes, etc. with a swiveled axis without problems (Restriction: Tap and program creation without the swivel function on the machining plane).
Free contour programming:	contour programming (in ShopMill/ShopTurn and programGUIDE)

Manual operation:	Graphical support for typical setup functions, such as for face milling, workpiece measurement, tool measurement, zero point setting.
Parallel operation:	Programming and simulation of a program (in parallel) while another is executed.
CNC simulation:	3D graphical workpiece simulation for multiface machining and 5-axis machining with 3-plane view and volume model of machined part. Automatic calculation of machining time for the simulated process.
Programming graphics:	during contour programming the NC blocks are drawn (2D line drawing).
Machining graphics:	Simultaneous recording of machining graphics during program run (Simultaneous recording).
Machining time:	Display of current and remaining machining time in automatic operating mode
Workpiece counter:	Displays the current workpiece number and number of remaining workpieces
Re-entering the program:	Re-enter any block in the program and approach the calculated nominal position to continue machining, program interruption, contour departure and re-approach.
Advanced Surface:	The latest look ahead algorithms and intelligent block compression for maximum speed during machining and as well as very high surface quality and accuracy. The automatic harmonization of the velocity profiles on adjacent milling paths by the CNC results directly in a higher surface quality.
Compressor functionality: COMPCAD	Through more homogeneous transitions at the block limits, the innovative online compressor provides better results in 3-axis and 5-axis simultaneous milling with perfect contour accuracy and very high machining speeds.
Look ahead function:	Continuous path mode G64, G645 Direction changes are checked by the control at least 150 NC-blocks (configurable) in advance. The feed speed is automatically adapted to the machine dynamics.
Spline interpolation:	The defined rounding at the block limits through the insertion of geometry elements at the block transitions. This results in a much smoother surface as the machine axes are traversed more harmoniously.
High-speed settings:	The SINUMERIK machining cycle for the roughing / rough-finishing and finishing as a simplified high-speed setting for all milling applications particularly in tool and mold making as well as in the aerospace industry. (optional – include in the Option Application Tuning Cycle)

DMG Upperscreen:	Upper screen area for machines with an ERGOline® control console for the visualization of machine-specific information and for the intuitive determination of machine states.
DMG Softkeys:	Freely-assignable direct keys for frequently selected screen or operation sequences.
DMG AUTOshutdown	Intelligent standby control for avoidance of unnecessary energy consumption thanks to the time-controlled shutdown of unused aggregates. Times and shutdown conditions can be individually adjusted for each machine using an easy-to-use NC screen by customers for their production environment.
DMG GREENmode	Intelligent adaptive feed control for reduction of the piece time with concurrent energy saving.
DMG MACHINECheck	Maintenance reminder application. Optional: Maintenance training course for your DMG machine. Optional: DMG Service Agent with notification, instruction and support function for spare part ordering.
DMG Netservice	DMG Netservice client as standard Immediate diagnostics and technical support for DMG machines via online connection

Options:

Application Tuning Cycle:	The SINUMERIK machining cycle for the roughing / rough-finishing and finishing as a simplified high-speed setting for all milling applications particularly in tool and mold making as well as in the aerospace industry.
Turning/Milling:	Machining is done by circular movement around resp. inside the workpiece while the spindle is permanently orientating rectangular to the movement direction, thus the tool moves around the standing workpiece. The following machinings are supported: <ul style="list-style-type: none">- external cylinder turning- cylinder boring- facing a XY-plane- grooving external- grooving inside- grooving on XY-plane- 45°-groove inside- any desired bevel/ facet external- radius inside/ external

Additional options: on request

S-E3168

Integrated motor spindle speedMASTER® HSK-A 63 with 36 months warranty period for the component spindle without restriction of spindle hours.

Speed range: 20 - 20.000 min⁻¹

Tool taper:	HSK-A63 DIN 69893-1 hydro-mechanical clamping
Drive power:	35 kW / 46.9 hp (40% DC) 25 kW / 33.5 hp (100% DC)
max. Spindle torque:	130 Nm / 94.25 ft lbs (40% DC) 86 Nm / 62.35 ft lbs (100% DC)
Spindle bearing Inside diameter	front: 2x 80 mm / 3.15 in rear: 2x 55 mm / 2.17 in
Bearing:	O-arrangement
Coolant circuit (liquid cooling) to reduce heat build-up	
Lubrication:	oil-air-lubrication
Tool draw-in power HSK-A63:	25 kN (+10/-7 kN) / 5512 lbs (+2248/-1574 lbs)

Note:

For speed up to 18.000 min⁻¹ tool mounting fixtures and tools should have a balancing grade of G6.3 (up to 5kg / 11.02 lbs) and G2.5 (>5kg / 11.02 lbs).

The following tool dimensions should be chosen for:

up to 14,000 min ⁻¹ :	max. tool permissible tool length	200 mm / 7.87 in
	max. tool dia.	80 mm / 3.41 in
up to 18,000 min ⁻¹ :	max. permissible tool length	200 mm / 7.87 in
	max. tool dia.	50 mm / 1.97 in
up to 20,000 min ⁻¹ :	max. permissible tool length	180 mm / 7.08 in
	max. tool dia.	50 mm / 1.96 in

S-C3045

NC rotary table with swivel axis

- swivel range (B-axis)	-5° to 110°
- turning range (C-axis)	360°
- clamping area	600 x 500 mm / 23.6 x 19.6 in
- T-slots / No. /spacing	14 / 7 / 63 mm / 14 / 7 / 2.48 in 1x adjustment slot 14 H7 d 30 H6
- centre bore	
- max. torque (40%CD)	
B-axis	2,700 Nm / 1,991 lbs ft
C-axis	1,800 Nm / 1,327 lbs ft
- feed speed/feed rate	
B-axis	60 rpm
C-axis	60 rpm
- positional uncertainty according VDI/DGQ 3441	
B-axis	10 arc sec
C-axis	10 arc sec
- max. table load (table center)	400 kg / 881 lbs
- cooling of drives	recirculating water-cooling
- cooling console	recirculating water-cooling

- recirculating oil lubrication system

S-K3624

Internal coolant supply with paper type filter

- pump pressure 40 bar / 580 psi output (theoretical pump performance);
- 23 l/min / 6 gallon/min
- tank 600l / 160 gallon
- flow rate max. 300 l/min / 79 gallon/min
- filter fineness 0.05/ mm / 0.0019 in
- size L x W x H: approx. 1,50 x 1,30 x 1,70 m / 4.92 x 4.26 x 5.58 ft
- low level detection, automatic filter feed

Air purge for linear measuring system
bed flushing

Standard ICS through spindle centre

Note:

Tool clamping

Standard Pull-stud DIN ISO 7388-3-A, AD

Option Pull-stud DIN ISO 7388-3-U, UD

Internal coolant supply is through the spindle centre.
for HSK shape, internal coolant supply is through an additional coolant pipe
which is not included in the delivery of HSK tool holding fixtures
and has therefore to be ordered separately.

S-K3121

Air blast through spindle centre
activated by M function, maintained air

spindle up to 18.000 rpm 1 drop of oil each 8 minutes
spindle 24.000 rpm 1 drop of oil each 1 minutes
spindle 42.000 rpm 1 drop of oil each 1 minutes

S-K3349

Infrared measuring probe PP 60 optical

The measuring probe is automatically loaded from the tool magazine
into the work spindle.

Functions include:

- Correction of workpiece position by positioning the NC rotary table
- Determination of circle centre and radius of a bore or a cylinder
- Zero shift correction
- Modification of tool correction
- Workpiece tolerance checks

Delivery includes:

- Measuring probe c/w transmitter and receiver unit
- tool taper
- 1 (ball-shaped) probe insert
- 9V Battery

Note:

The NC macros required for automatic operation are not included in the scope of supply.

S-K3411

Laser tool measurement

Length, radius and true running can be measured in the actual clamping system and at nominal speed. Tool or tool mounting defects are directly detected and corrected.

Repetitive accuracy: ± 0.001 mm / $\pm 0,000039$ in

System of protection: IP 68

Power supply: 24 V / 160 mA

Laser class 2

restriction of tool dimensions:

min tool length:	DMU 40 eVo	45 mm / 1.77 in
	DMU 60 eVo	65 mm / 2.56 in
	DMU 80 eVo	65 mm / 2.56 in
max. tool length:	300 mm / 11.02 in	
min. tool diameter:	1 mm / 0.04 in (tool measurement)	
min. tool diameter:	0.4 mm / 0.016 in (tool breakage control)	
max. tool diameter:	130 mm / 5.12 in	

In addition to these specifications, workpiece fixtures are also to be taken into account for tool dimensions. Depending on tool length and diameter collisions with the workpiece might occur.

S-K3202

Signal lamp 4 colour

Red: general error

Yellow: intervention necessary

Green: automatic mode

Blue: set-up mode

S-H3046

Operation mode 4 "Process monitoring in the production"

Manual intervention with open doors of machining area.

Release after check list has been filled in and signed.

1 piece SMART Key with Operation mode 4 included.

Machining of workpiece programs with open doors of machining area without pressing the enabling keys (tool change, pallet change, and internal coolant supply not possible).

Together with the order confirmation the customer receives a check list incl. safety instructions and description of the individual operation modes.

Necessity of the use of operation mode 4 "process monitoring in the production" has to be proven with the check list.

The check list has to be filled in completely, signed legally binding and returned to DECKEL MAHO Seebach GmbH.

Note:

Only after return of the filled-in and legally signed check list operation mode 4 is released for delivery.

Safety-related instructions are given to machine operators during machine commissioning; further training, if necessary, is offered by DMG Training Academy.

S-H3110

Energy meter for 3D control Siemens 840D solutionline operate with CELOS
Functional Expansion in CELOS for the following APPs:

STATUS MONITOR: based on main supply Energy recuperation display

ENERGY SAVING: Categorized energy Consumption display for different
machine states (Standby, Ready-to-Operate, Production)
Analysis of the precise energy consumption per shift,
work piece or cutting process.

D-CEL200

DMG MORI NETSERVICE

The Netservice establishes a secure VPN connection to the DMG MORI Service and is installed on CELOS as Support App.

By the help of the online connection:

- an immediate and comprehensive problem analysis
- direct troubleshooting on machine control
- software adaption can be managed.

Note:

To guarantee a smooth installation, the checklist of the DMG MORI NETSERVICE has to be completed before setting-up the machine.

After warranty, a monthly fee in the amount of 25,00 EUR (net) per machine will be incurred. The calculation is performed automatically after successful connection, unless terminated earlier.

The delivery and terms of use of the DMG MORI NETSERVICE is based on the scope of supply and services for the DMG MORI NETSERVICE .

This information and the checklist for the installation of the DMG MORI NETSERVICE will be sent with the order confirmation of our machine or even go to <http://en.dmgmori.com/products/software/dmg-mori-netservice!>

GENERAL CONDITIONS

For this quotation concerning conditions under NL 09 and NLT 09, with the following exceptions;
If the buyer has the right to liquidated damages the calculation of the penalty amount shall start 14 calendar days from the day delivery should have taken place.

Instead of, as stated in paragraph 13 of NL 09 and section 6 paragraph 3 of NLT 09 relating to maximization of liquidated damages due to the late delivery, the following shall apply; The liquidation damages shall be payable at a rate of 0.5% of the agreed price excluding installation for each commenced week of delay. The liquidation damages shall not exceed 5%.

WARRANTY

18 months on machine and control system, starting from date of completed installation.

PAYMENT TERMS

40% down payment at order, 10 days

50% by delivery, 10 days

10% after installation, 10 days

After the due date, penalty interest on arrears and official discount +8% is charged.

VALIDITY OF THE QUOTATION

This stock machine quotation is valid one month from quotation date with reservation for in between sales.

DELIVERY TERMS

DAP according to INCOTERMS 2010, incl. packing, excl. unloading and transportation to installation point.

DELIVERY TIME

Delivery immediately after return of signed order confirmation and down payment invoice has been issued.

If the order is to be financed by a leasing company, the delivery occurs after the written order from the leasing company is received.

INSTALLATION

Installation of all quoted equipment is included.

Switching in the master power is not included.

Planning and transportation documentation will be sent before hand, at the latest one month before machine delivery occurs. Please note the sections regarding floor and foundation requirements as well as anchoring and connection to water and electrical supply.