High Performance Machining Center

- Exceptional accuracy
- 5-axis simultaneous machining
- Combined mill-turn machining
- Upscale speed and dynamics
- Compact
**S-191V Flexible Modularity**

- Ideal ergonomics
- Modular
- Multiple machine configurations

- Acceleration 1,2G
- 50 m/minute
- Linear drives and motors
- 30'000 rpm in 1,5 sec
- B axis swivel 0 to 90° in 0.35 sec
- 5 axis simultaneous machining
- Tool magazine 30 / 60 or 90 pockets
- HSK40 or Capto 4
- Exceptional accuracy
- Exceptional rigidity
- Excellent thermal stability
- Increased output

**S-191V - A safe value**

The BUMOTEC S-191 V is the combination of proven SWISS MADE mechanics and state-of-the-art CNC control and drive technology. The cast iron machine base ensures the highest rigidity, vibration dampening and static counterweight, granting the best surface qualities and shortest cycle times.

Configured as a 3, 4 or 5 axis machine, with or without turning, the BUMOTEC S-191 V permits multiple operations on one machine.

**Examples of possible machine configurations**

- **Basic (3 axis)**
  - X- Y- Z axis
  - Clamping table 500 x 300 mm
  - (Max. table load: 30 kg)

- **Flex (5-axis continuous mill / turn)**
  - X- Y- Z axis
  - B- axis swiveling spindle
  - C- axis integrated in machining table
  - Turning function option
  - Allows multiple clamping systems

- **“Plus” (5 axis)**
  - X- Y- Z axis
  - B- axis swiveling spindle
  - C- axis rotation ø 300 mm
  - (torque motor with 226 Nm)
S-191V
A complete range

- Adapted solutions for each individual challenge
- Multiple combinations possible
- Combined mill/turn machining
- Flexibility

B-Axis
Swiveling spindle
The machining spindle is mounted on B-axis direct drive with 226 Nm (339 Nm on the “plus” model)
The generous swivel range grants uncompromised machining access at all angles for a perfect 5-sided part.

Clamping system
A large selection of clamping devices provides the best solutions for machining from a blank or from bar.

Fixed machining table
500 x 300 mm with T-slots.
To increase flexibility, a turn/mill C-axis can be integrated in the table.
Power: 15kW
Torque: 68 Nm
Max.: 6,000 rpm

C-axis can receive multiple clamping systems
Up to 6,000 rpm (optional)

C-axis rotation ø 300 mm
226 Nm torque (direct drive) 250 rpm

A large array of clamping devices are at your disposal. Our engineers can integrate your existing clamping solutions into our machine.

As option, the bar pusher with unloading gripper supports unattended manufacturing.

Technical data
Max bar length: 400 mm
Max bar diameter: 36 mm
collets F-type or jaw-chuck clamping systems
S-191V Direct drive technology and outstanding thermal stability

- Exceptional machining precision
- Wear free
- Unmatched surface quality

Linear drive technology
Linear drives in the horizontal plane
Linear drive technology is the Bumotec difference in precision, speed, surface finish and stability.

Comparison Linear Drives vs. Ball Screw Spindles

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Linear motor</th>
<th>Ball screw spindle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acceleration</td>
<td>Up to 1.2 G</td>
<td>0.8 G limited by the inertia of masses</td>
</tr>
<tr>
<td>Vitesse</td>
<td>Large, limited by linear guidance and the measuring system</td>
<td>Limited by the inertia of masses</td>
</tr>
<tr>
<td>Wear</td>
<td>Little, the guidance is the only wear part</td>
<td>High, especially at high speeds and accelerations</td>
</tr>
<tr>
<td>Reliability</td>
<td>Very high</td>
<td>High</td>
</tr>
<tr>
<td>Number of mechanical elements</td>
<td>Little</td>
<td>Big</td>
</tr>
<tr>
<td>Cooling system</td>
<td>Indispensable</td>
<td>Indispensable due to high speeds</td>
</tr>
<tr>
<td>Backlash</td>
<td>None</td>
<td>Little but steadily growing with wear</td>
</tr>
</tbody>
</table>

Contouring precision
The production log below demonstrates the interpolation accuracy achieved with the combination of linear slides and 1/100 micron resolution glass scales.

Surface quality
The best possible mechanical accuracy, state-of-the-art CNC and linear technology delivers exceptional surface finishes, the shortest cycle times and excellent tool life. Above: A Winding Rotor weight demonstrates the accuracy and intricate engraving capabilities of the S-191V.

Thermal stability
A separate cooling circuit with monitored temperature ensures an extremely stable manufacturing process, eliminating long warm up cycles and tolerance chasing from shift interruptions.

Reduction of manufacturing time
Time savings comparison of machine equipped with linear motor slides vs. ball screw.

More linear motor advantages
- Reduction of non-productive times
- Better contouring accuracy at higher speeds due to better dynamics.

The reduction of mechanical components helps eliminate vibrations and wear, ensuring a steep increase in precision and positioning, even at high speeds. The result is exceptional surface quality and excellent tool life.

Example of tolerance retention after running for 24 hrs, stopping for 8 hrs and restarting.

ISO 230-4 Circular deviations

Roundness 1.4µm

Surface finish
The best possible mechanical accuracy, state-of-the-art CNC and linear technology delivers exceptional surface finishes, the shortest cycle times and excellent tool life.
S-191V

The machining spindle

- High speed and torque
- Outstanding rigidity
- Designed for longevity

Swivelling B-Axis
The machining spindle carrier axis is controlled by a torque motor with 226 Nm (339 Nm on the “Plus” model)

Advantages:
- Outstanding positioning and movement response characteristics.
- Excellent surface quality.
- High speed design (0° to 90° in 0.35 sec).
- Free of any backlash.
- Zero lifetime wear.

Through spindle coolant
The spindle is designed for through spindle coolant pressure up to 100 bar.

High acceleration/deceleration of the spindle

Oil-Air lubrication
Supporting high spindle speeds and longevity.

Shock protection
An ingenious design guarantees precise positioning of non-rotating tools (e.g. turning) at 84° while protecting transmission of shocks to the hybrid bearings for exceptional longevity.

Sealing
A pressurized labyrinth seal keeps contaminants out.

Speed and Longevity
Ceramic hybrid ball bearings support:
- High acceleration.
- High constant speed.
- High rigidity

B-axis and spindle cooling
Outstanding results during 5-axis simultaneous machining and TCP (Tool Center Point) programming. Stable dependable accuracy at all times.

FANUC 31i series

- Latest generation CNC
- Easy to use
- Advanced man to machine interaction

Ease of use:
BUMOTEC has developed many interactive user friendly menus/macros for set up ease.

Multiple menus:
Many easy to use menus, including characteristic data, ensure programs are properly linked to the part and interchangeable between identical machines.

Intelligent interface
Through ongoing dialogue with our customers, we created an easy-to-use, intelligent interface, resulting in a well received program which assures easy learning, safe and simple operation, and best of all, higher productivity.

- Solar tool management
- Automatic setting of reference points
- Alignment routines
- Simplified loading/unloading procedures
- Intelligent spindle monitoring
- Cutting force load monitoring
- Monitoring of manufacturing time

CNC Functions:
A wide range of CNC functions are integrated into the package to increase complex machining capabilities. Below, function examples:

Function TCR G43.4 H:
TCF function (tool center point) for 5 axis machining controls the movement at the tool center point to follow the programmed path even if the tool axis direction changes.

Maching path programmed path

Function G43.1 I J K H Q:
The function facilitates the programming angle of the B axis.

Tool axis I L K Tool length H

Function G41.2 D G42.2 D 5 axis radius compensation
This replaces the need for recalculation of the tool path in the CAM module during tool replacement, increasing productivity.

Larger tool radius programmed path

3D radius compensation
Detect tool path interfaces over tool paths are larger than programmed paths.

Larger tool radius programmed path

Small tool path programmed path

The workplace setting errors are detected through measuring cycles which determine the setting error and automatically correct the error prior to starting the standard part program.

Workplace setting

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TCR G43.4 H</td>
<td>5 axis machining control</td>
</tr>
<tr>
<td>G43.1 I J K H Q</td>
<td>Tool center point programming</td>
</tr>
<tr>
<td>G41.2 D G42.2 D</td>
<td>5 axis radius compensation</td>
</tr>
</tbody>
</table>

S-191V
<table>
<thead>
<tr>
<th>Power S1/S6</th>
<th>Torque S1/S6</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.3 kW</td>
<td>106 / 226 Nm</td>
</tr>
<tr>
<td>13 kW</td>
<td>12.5 Nm (15.5 Nm)</td>
</tr>
</tbody>
</table>

S-191V Plus
<table>
<thead>
<tr>
<th>Power S1/S6</th>
<th>Torque S1/S6</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.3 kW</td>
<td>166 / 339 Nm</td>
</tr>
<tr>
<td>13 kW</td>
<td>12.5 Nm (15.5 Nm)</td>
</tr>
</tbody>
</table>
**S-191 Accessories**

- A large array of different equipments are available to increase the 24/7 capability of the S-191 V

**Automation**
A unique integrated loading/unloading pallet system requires no mechanical adjustments for part changeovers. The part grippers store in the tool magazine providing allowing the simple programmed movement of the tool spindle to replace the complexity and space rof a robot system. Ideal for types of blank part production.

**Tool Probe**
A 3 axis touch probe provides automatic tool offsetting as well as broken tool detection.

**Wireless probe**
Ideal for in-process gauging of parts, as well as the aligning of blanks for reference points.

**Tool holders**
A wide variety of HSK or Capto holders.

**High Pressure Coolant**
The low maintenance Hydrofluid HP3 system delivers:
- Cutting fluid cooling
- Filtration to 5 microns
- High pressure up to 100 bar
- Reverse flow, maintenance free filter cleaning

**Paper band filtration**
An ideal filtration method for precious and low chip applications

**Tool magazine 30 / 60 / 90 pockets**
Milling/turning tools are stored in a disc magazine. The design allows easy access, fast visual tool inspection and an intelligent interface for monitoring tool operating time. Tool change time: 1.8 sec.

**Overview of axis travels**

**Footprint**
Easy view and easy access to machine support systems and components.
## Technical data S-191V LINEAR

<table>
<thead>
<tr>
<th>Base machine</th>
<th>S-191V Standart</th>
<th>S-191V Plus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Longitudinale stroke (linear drive)</td>
<td>X</td>
<td>400 mm</td>
</tr>
<tr>
<td>Transversal stroke (linear)</td>
<td>Y</td>
<td>200 mm</td>
</tr>
<tr>
<td>Vertical stroke (ball screw)</td>
<td>Z</td>
<td>410 mm</td>
</tr>
<tr>
<td>Power axis / axis force</td>
<td>X</td>
<td>7.2 kW/350 daN</td>
</tr>
<tr>
<td></td>
<td>Y</td>
<td>7.2 kW/350 daN</td>
</tr>
<tr>
<td></td>
<td>Z</td>
<td>4.8 kW/750 daN</td>
</tr>
<tr>
<td>Rapids</td>
<td>X</td>
<td>50 m/min</td>
</tr>
<tr>
<td></td>
<td>Y</td>
<td>50 m/min</td>
</tr>
<tr>
<td></td>
<td>Z</td>
<td>50 m/min</td>
</tr>
<tr>
<td>Acceleration</td>
<td>X-Y-Z</td>
<td>10.4 m/S2 (1.1g)</td>
</tr>
<tr>
<td>Resolution</td>
<td>X-Y-Z</td>
<td>0.0001 mm</td>
</tr>
</tbody>
</table>

### Machining spindle

<table>
<thead>
<tr>
<th>Power S1 100% (56 60%)</th>
<th>8 kW (9.6 kW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Torque S1 100% (56 60%)</td>
<td>9.5 Nm (11.5Nm)</td>
</tr>
<tr>
<td>Max. rpm</td>
<td>30'000 min⁻¹ (36'000 option)</td>
</tr>
<tr>
<td>Toolholder clamping force</td>
<td>8 kN</td>
</tr>
<tr>
<td>Toolholder interface</td>
<td>HSK-A40</td>
</tr>
<tr>
<td>Through spindle coolant</td>
<td>100 bar (option)</td>
</tr>
</tbody>
</table>

### Tool magazine

| Number of tools | 30 - option 60 or 90 |
| Chip-to-chip time | 3.4 sec |
| Max. Tool-diameter | 40 mm (80 with adjacent pockets empty) |
| Max. Tool-length | 130 mm (150 on one magazine disc level) |
| Max. Tool-weight | 1.2 kg |

#### OPTIONS

<table>
<thead>
<tr>
<th>B-axis / Tilting spindle</th>
<th>B</th>
<th>Direct drive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Torque contin. / peak</td>
<td>106 / 226 Nm</td>
<td>166 / 339 Nm</td>
</tr>
<tr>
<td>Rotation speed</td>
<td>36000°/min (7500°/S2) (0 to 90° in 0.35sec)</td>
<td>36000°/min (7500°/S2) (0 to 90° in 0.35sec)</td>
</tr>
<tr>
<td>Clamping torque</td>
<td>200 Nm</td>
<td>200 Nm</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.0001°</td>
<td>0.0001°</td>
</tr>
<tr>
<td>Tilting range</td>
<td>-25°/+115°</td>
<td>-25°/+115°</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C-axis / Turning spindle</th>
<th>C₁</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power</td>
<td>15 kW</td>
</tr>
<tr>
<td>Torque S1 / S2 / S3</td>
<td>41 / 51 / 68 Nm</td>
</tr>
<tr>
<td>Max. Bar-diameter</td>
<td>Ø 50 mm</td>
</tr>
<tr>
<td>Max. rpm turning mode</td>
<td>6000 min⁻¹</td>
</tr>
<tr>
<td>Clamping force</td>
<td>9500 N (at 5bar)</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.0001°</td>
</tr>
<tr>
<td>Clamping systems</td>
<td>F38/F48/Ottet/Mecatool/Hainbuch/Jaw-chucks</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C-axis / Rotary (w/o turning)</th>
<th>C₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>Torque contin. / peak</td>
<td>106 / 226 Nm</td>
</tr>
<tr>
<td>Max. Bar-diameter</td>
<td>Ø 50 mm</td>
</tr>
<tr>
<td>Rotation speed</td>
<td>9000° min⁻¹</td>
</tr>
<tr>
<td>Holding torque</td>
<td>250 Nm</td>
</tr>
<tr>
<td>Clamping force</td>
<td>9500 N at 6bar</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.0001°</td>
</tr>
</tbody>
</table>

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Authorized dealer

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