



*Optimal Solutions for the Future*

# PUMA SMX series



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**Super  
Multi-tasking  
Turning center**

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**PUMA SMX series**

PUMA SMX2600  
PUMA SMX3100 / L  
PUMA SMX2600S  
PUMA SMX3100S / LS

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ver. EN 160502 SU



Features

Basic Structure  
Main Units  
Machine  
Performance

Technical Information

Standard/Option  
Technical Diagram  
Specification

Customer Support Service



# PUMA SMX series

PUMA SMX series, Doosan's next generation Multi-tasking Turning Center, features high productivity, high precision and easy operation. By integrating the capabilities of multiple machines into one system, the PUMA SMX series provides best in class machining capability by using multi-tasking functions which minimize the machining time and the number of machining operations. The PUMA SMX series also provides excellent performance for high precision machining by minimizing thermal deformation and applying an accuracy control feature based on multiple thermal compensation functions. Ergonomic design considering operator convenience and efficient maintenance provides an optimal solution that meets the customer's needs.





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### Higher Productivity through Powerful Multi-tasking Functions

Decreases the total processing time and number of machining operations by using a single setup. This provides excellent high speed performance for component manufacturing processes which require accurate and complex machining.

- Complex machining capabilities of left spindle, right spindle, B-axis and milling spindle
- High-rigidity machine construction using structural analysis design
- Maximized Y-axis machining area through orthogonal design structure

### Enhanced Precision through High Accuracy Control Functions

Maintains excellent precision during long-term machining processes by minimizing the thermal deformation of the spindle and the feed axis, and maximises precision through the 0.0001° axis resolution control function.

- Minimized thermal deformation of the spindle and feed axis using oil cooler
- Adoption of Roller LM Guideways with high-rigidity and high precision
- Equipped with 0.0001° B-axis and C-axis accuracy control function

### Easy and Convenient Operation through an Ergonomic Design

Features excellent maintenance as well as usability and convenience through customized functions.

- Front located tool magazine
- Side-to-side movable swiveling operation panel with adjustable height
- Convenient ATC - MAGAZINE operation panel



## Basic Structure

Highly Rigid Design.  
All units are located on the main frame vertically for high rigidity.

### Features

- Basic Structure
- Main Units
- Machine
- Performance

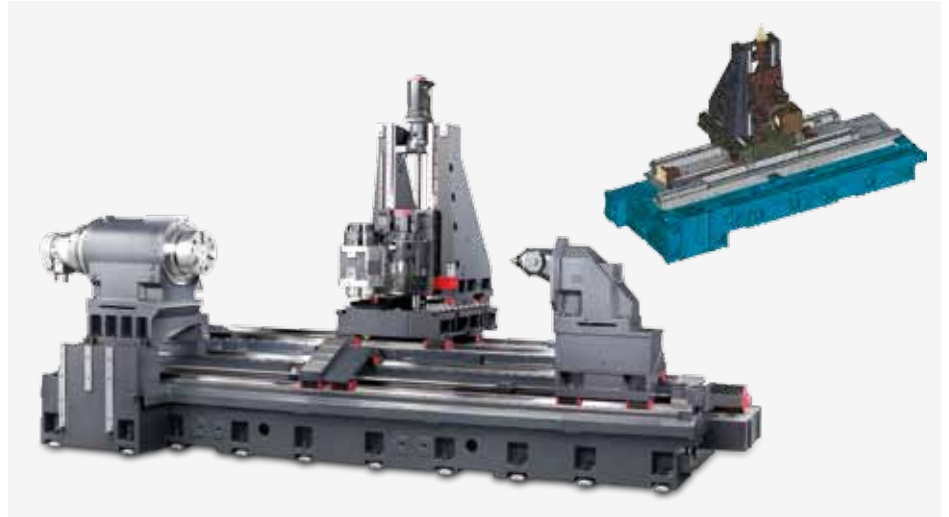
### Technical Information

- Standard/Option
- Technical Diagram
- Specification

### Customer Support Service

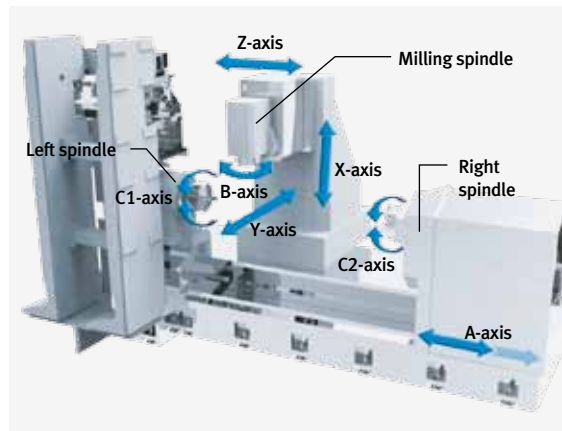
## Robust Design

FEM (Finite Element Method) analysis results in superior machine stability. All guideways are sealed with a protective covers, preventing high temperature chips and coolant from contacting the guideways, thus maintaining unsurpassed long-term accuracy.



## Feed Axis

Extended axis travel distance and improved rapid traverse rate improve workpiece machining and provide excellent productivity. The X, Y and Z-axis move orthogonally to reflect high precision machine accuracy into machining accuracy.

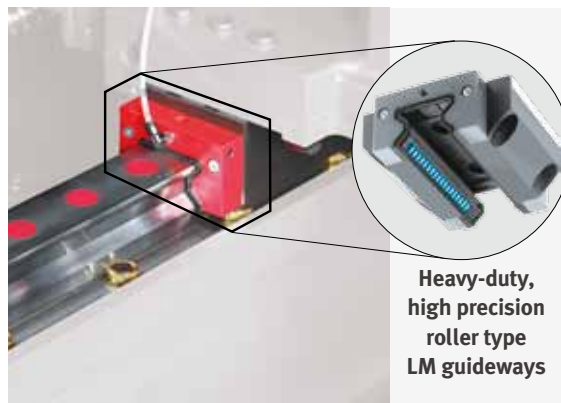


| Travel |  |                                   |
|--------|--|-----------------------------------|
|        | PUMA SMX2600/S, 3100/S   | PUMA SMX3100L/LS                  |
| X-axis | 630 mm (24.8 inch)   |                                   |
| Y-axis | 300 (±150) mm (11.8 (±5.9) inch)                                     |                                   |
| Z-axis | 1585 mm (62.4 inch)  | 2585 mm (101.8 inch)              |
| A-axis | 1605 mm (63.2 inch) <sup>①</sup><br>1562 mm (61.5 inch) <sup>②</sup> | 2500 mm (98.4 inch) <sup>①②</sup> |
| B-axis | 240 (±120) deg   |                                   |

① Right spindle ② Servo tail stock

## High Precision Roller type LM Guideways

SP class roller type LM guideways for extra load capacity and rigidity are used on all axes to enable high rapid traverse rates.



Heavy-duty, high precision roller type LM guideways

| Rapid traverse rate |                                    |                                   |
|---------------------|------------------------------------|-----------------------------------|
|                     | PUMA SMX2600/S, 3100/S             | PUMA SMX3100L/LS                  |
| X-axis              | 48 m/min (1889.8 ipm)              |                                   |
| Y-axis              | 36 m/min (1417.3 ipm)              |                                   |
| Z-axis              | 48 m/min (1889.8 ipm)              | 30 m/min (1181.1 ipm)             |
| A-axis              | 30 m/min (1181.1 ipm) <sup>③</sup> | 20 m/min (787.4 ipm) <sup>③</sup> |
| B-axis              | 40 r/min                           |                                   |

③ Right spindle (Servo tail stock is not applicable)



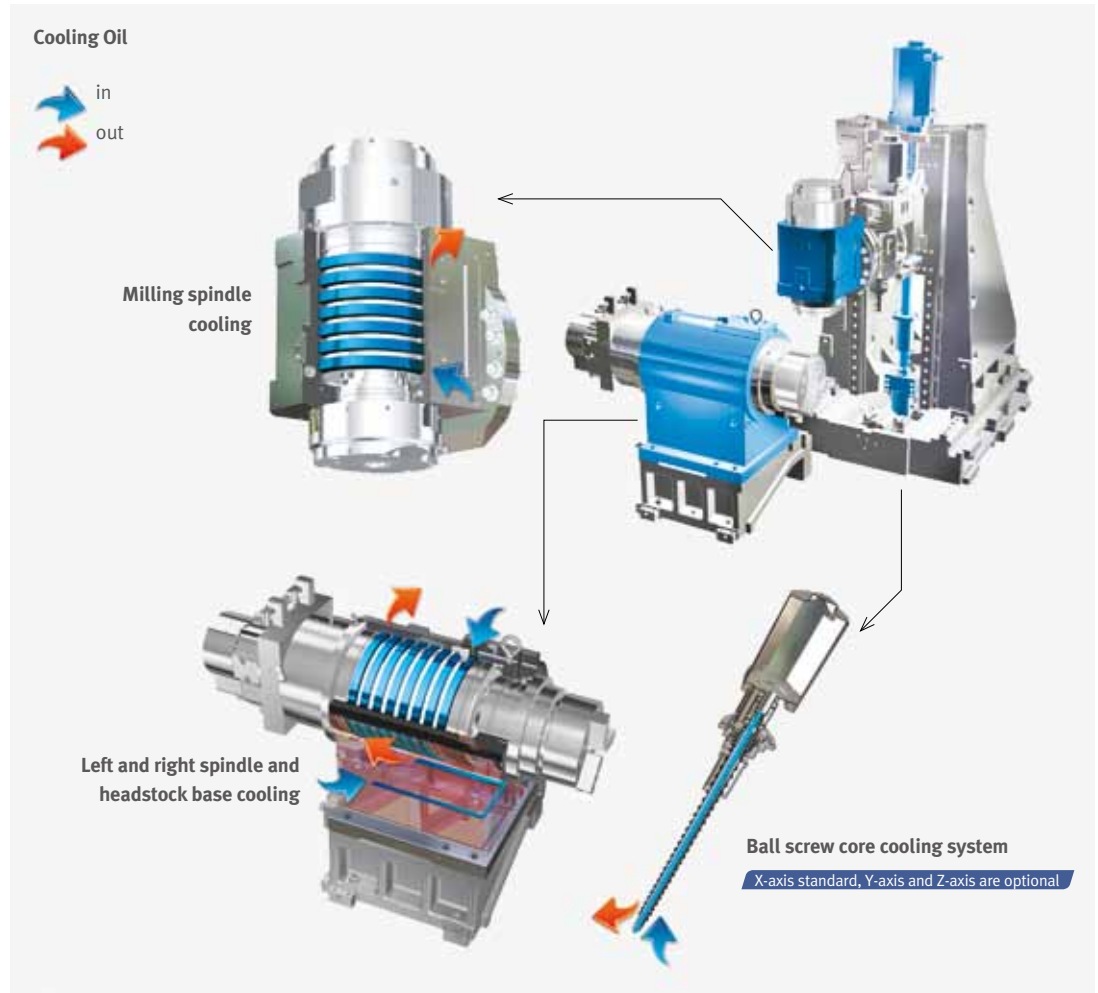


## Basic Cooling Concept for Higher Accuracy in a Long time Machining

Structural preparation to minimize thermal error and ensure superior accuracy for a long time operation

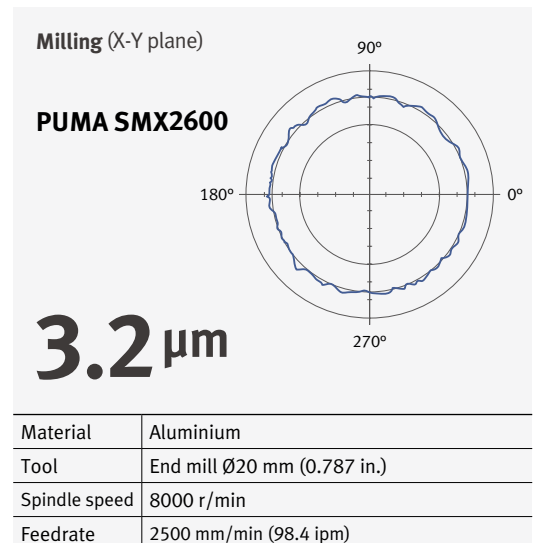
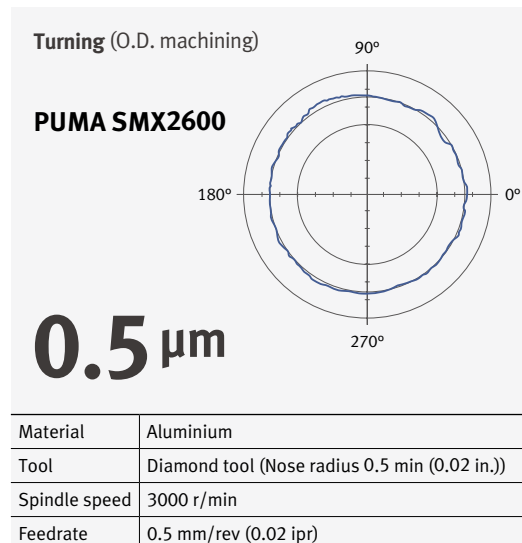
### Minimization of Thermal Deformation by Oil Cooling

Spindle and ball screw core cooling system minimizes thermal deformation during long machining processes and enhances high accuracy performance.



### Cutting Accuracy

By performing extended test procedures of individual machine elements and detailed analysis of results, the SMX series achieves a high level of precision and reliability that fulfills customer satisfaction.



\* This test is performed under Doosan Machine Tool's test environment.

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## Spindle

Perfect combination of 3 key spindles to ensure machining stability under various cutting conditions.

### Perfect combination of key- rotation axis

Both left and right spindle are capable of high accuracy C-axis control and perform various machining functions like turning, milling and synchronized cutting using single set-up with milling spindle.



**Milling Spindle**  
**12000 r/min**  
**26 kW (34.9 Hp)** option 8000 r/min

**Tool shank of Milling Spindle**  
**CAPTO C6**  
option HSK-A63

**Left Spindle of SMX 3100 series**  
**12inch** optional 15 inch

**Right Spindle (on only S/LS model)**  
**10inch** optional 12 inch



| Model               | Spindle       | Standard Chuck (inch) | Spindle speed (r/min) | Power kW (Hp)         | Torque N·m (lbf.ft) | Condition   |
|---------------------|---------------|-----------------------|-----------------------|-----------------------|---------------------|-------------|
| PUMA SMX2600/S      | Left Spindle  | 10                    | 4000                  | 26 / 22 (34.9 / 29.5) | 700 (516.6)*        | 30min/cont. |
| PUMA SMX3100/S/L/LS |               | 12                    | 3000                  | 30 / 25 (40.2 / 33.5) | 1203 (887.8)        | 30min/cont. |
| PUMA SMX2600S       | Right Spindle | 10                    | 4000                  | 26 / 22 (34.9 / 29.5) | 700 (516.6)*        | 30min/cont. |
| PUMA SMX3100S/LS    |               |                       |                       |                       |                     |             |

\* On S3 25% operation

| Model               | Spindle         | Tool shank | Spindle speed (r/min) | Power kW (Hp)                       | Torque N·m (lbf.ft) | Condition              |
|---------------------|-----------------|------------|-----------------------|-------------------------------------|---------------------|------------------------|
| PUMA SMX2600/S      | Milling Spindle | CAPTO C6   | 12000                 | 26 / 18.5 / 15 (34.9 / 24.8 / 20.1) | 124 (91.5)*         | 2.5min / 10min / cont. |
| PUMA SMX3100/S/L/LS |                 |            |                       |                                     |                     |                        |

\* On S3 10% operation




### High Precision Control of Spindle axes(C & B-axis)

Machining operation is mainly done by Left and Milling spindle. C-axis of left spindle and B-axis of milling spindle with Y-axis control realize multi-tasking turning center that can drill, tap and end mill in any angle and also deliver the ability to cut precise angles and sculpted contours(5-axis simultaneous controlled specification is option).

**C-axis positioning control**

To enhance C-axis positioning accuracy of left spindle, the position compensation sensor has been adopted. Left spindle can have C-axis positioning control of every 0.0001° in 360°.




**Left spindle**  
**0.0001°**  
Note) C-axis of Right spindle : 0.001°

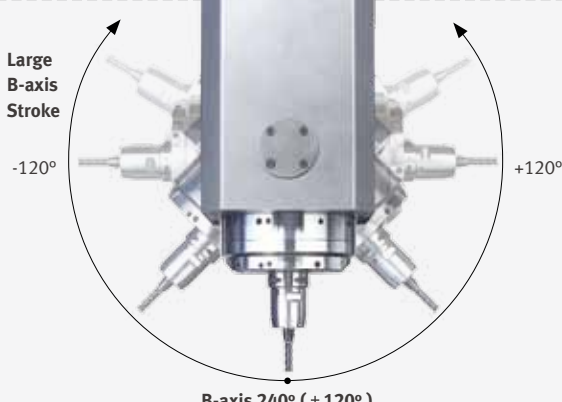
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**B-axis positioning control**

**Precise continuous index**

B-axis index that can have swivel positioning of every 0.0001° in ±120° performs not only horizontal front face machining but also angular machining.





**B-axis 240° (±120°)**

Swivel and indexing of B-axis is by servo motor and roller gear cam with high-rigidity and high-precision

**Dual pressure braking**

Depends on cutting condition, braking index of B-axis can be controlled.

**Braking index at a random angle**

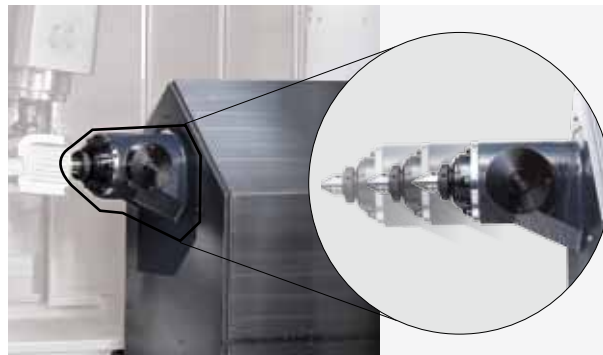
Within its swivel ±120°, B-axis can be indexed and braked precisely at a random angle.

### Tailstock

More easier and faster set-up of the tailstock using M-code program by servo motor and ball screw

#### Servo driven tailstock

Servo tailstock make part set-up faster and easier. The operator inputs the proper M-code information in the control and tailstocks move to its proper positions automatically by linear motion control of servo motor and ball screw. No manual adjustments are required.



| Model               | Tail stock travel<br>mm (inch) | Max. quill thrust force<br>kN (lbs) | Tail stock center                     |
|---------------------|--------------------------------|-------------------------------------|---------------------------------------|
| PUMA SMX2600 / 3100 | 1562 (61.5)                    | 10 (2248.0)                         | Built-in type<br>Dead center,<br>MT#5 |
| PUMA SMX3100L       | 2500 (98.4)                    | 15 (3374.4)                         |                                       |

## ATC Automatic Tool Changer

Servo ATC and Servo tool magazine ensuring fast and reliable tool indexing

### Servo driven ATC & Tool magazine

The tool magazine can be increased up to 80 tools without any change of machine floor space. Tools are selected by a fixed address method that follows the shorter path.

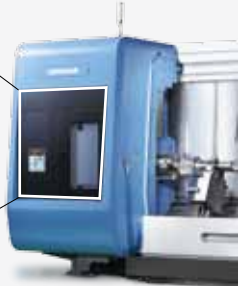
**Tool storage**

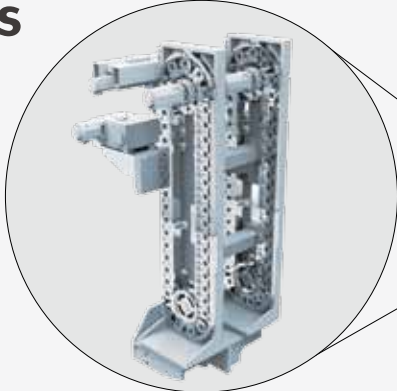
# 40 tools

option 80 tools

The photo is tool magazine of 80 tools

**Front located tool magazine ensuring easy tool maintenance**





|  |                    |
|--|--------------------|
| Max. tool length (from gauge line)           | 450 mm (17.7 inch) |
| Max. tool weight                             | 12 kg (26.5 lb)    |
| Max. tool diameter (continuous)              | 90 mm (3.5 inch)   |
| Max. tool diameter (adjacent pots are empty) | 130 mm (5.1inch)   |

### ATC-MAGAZINE Operation Panel


The status of ATC and the tool magazine unit are identified visually by using a graphic touch panel display and touch operation. The touch screen also operates the ATC, the tool magazine and the tool feed pot carrier individually.

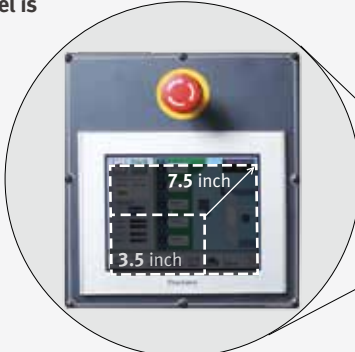
**Enlarged touch screen panel is available as an option**

# 7.5 inch

option 3.5 inches

option 7.5 inches






#### Display and touch operation

Displays ATC – MAGAZINE related information and supports manual operation by touchscreen. 7.5-inch large screen specification is available for the ATC – MAGAZINE operation panel.



#### Capable of photographing and recording

Includes black box function that photographs and stores the image as the ATC mechanism operates. An additional function can be added that records the ATC internal state using a surveillance camera and displays the operation on the screen.



#### Tool information display

Improves the tool management by saving and displaying useful tool related information.







## Additional Tool Magazine

As option just for PUMA SMX3100L/LS, long boring bar magazine is available to ensure more easy application to long tube machining

### Tools magazine for Long boring bar option for PUMA SMX3100L / LS

PUMA SMX3100L/LS can be equipped with long boring bar magazine as option.

#### Tool storage

# 3 tools ①

PUMA SMX3100L/LS can accommodate workpieces as long as 2540mm between centers. The machine can process long tube such as landing gear axle requiring the center bore. Because the Automatic tool changer on this model cannot handle long boring bar, the separate tool magazine just for these tools can has 3 tool stations for tools as long as max. 600mm



Max. Tool size

# Ø 60 x L 600 mm

(Ø 2.4 x L 23.6 inch)

Max. Weight

# 15kg

(33.1 lb)

or

Max. Tool size

# Ø 30 x L 800 mm ②

(Ø 1.2 x L 31.5 inch)

Max. Weight

# 15kg

(33.1 lb)

① You can select tools storage capacity 2+1 tools instead of 3 tools. The 2+1 tools storage means 2 tools of Ø60 x L600 mm or Ø30 x L800 mm and 1 large diameter tools, Ø190 x L200 mm can be mounted in long boring bar magazine.

② Ø30 x L800 mm sized tool is not Long boring bar but Gun drill. We do not recommend long boring bar sized Ø30 x L800 mm.



## Powerful Multi-tasking



## Higher Efficiency

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## Machining Area

Expands machining capacity using an orthogonal structure and enables machining of large size workpieces through the extended turning diameter.

### Maximized Y-axis Machining Area Using Orthogonal Structure Design

Maximized Y-axis machining area because of orthogonal structure design allows the machining of a wide range of workpieces.

Unit : mm (inch)

**Y-axis machining area**

**300 mm**  
(11.8 inch)

X-axis :  
**630 mm (24.8 inch)**

**Y-axis : 300 mm (11.8 inch)**

### Extended Machining Area

The extended machining area allows machining of large diameter and long workpieces.

**Max. machining diameter**

**660 mm**  
(26.0 inch)

**Max. machining length**

**1540 mm**  
(60.6 inch)

**2540 mm\***  
(100 inch)

### Large Bar Working Diameter

Both SMX2600 and 3100 models provide large bar diameter capacity through the spindle drawtube.

**PUMA SMX2600**

**81 mm**  
(3.2 inch)

**PUMA SMX3100**

**102 mm**  
(4.0 inch)

**Maximum**  
**102 mm**  
(4.0 inch)

Spindle cross section



## Cutting Performance

Powerful machining capability in various operation such as turning, milling and drill and tapping and multi-tasking performance ensuring more higher machining efficiency.

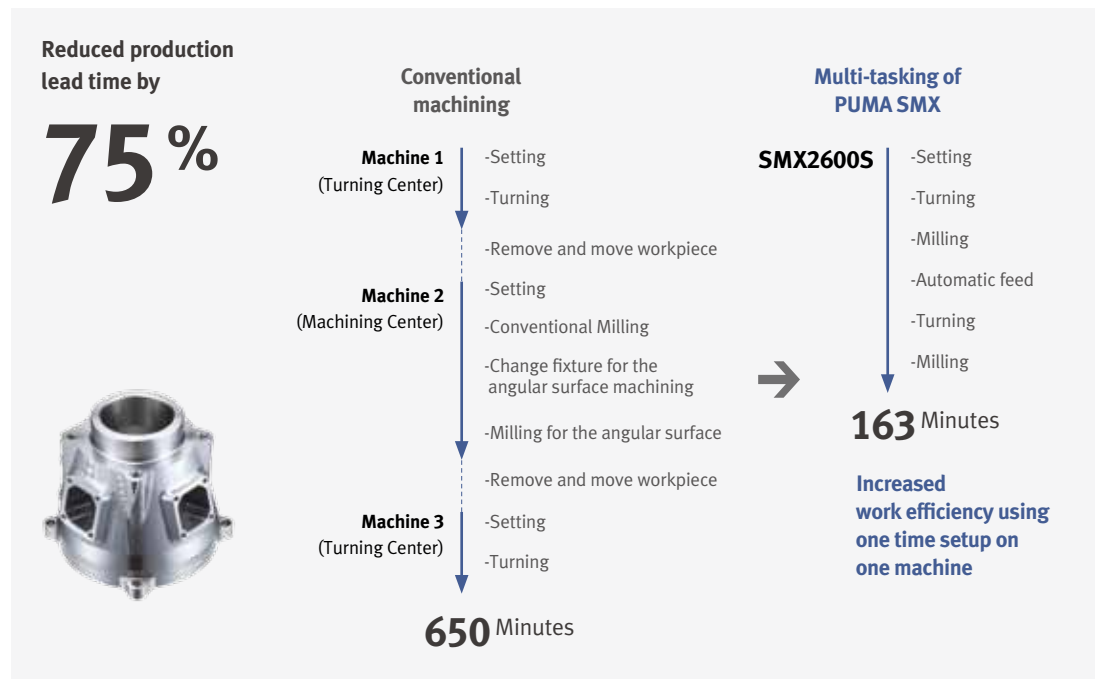
### Powerful Machining

| O.D. cutting (PUMA SMX3100) |                           |                            |   |  |
|-----------------------------|---------------------------|----------------------------|---|--|
| Spindle speed               | Cutting speed             | Feedrate                   | Radial cutting depth                                      | Material removal rate                                      |
| 253 r/min                   | 210 m/min<br>(8267.7 ipm) | 0.55 mm/rev<br>(0.022 ipr) | 8.5 mm<br>(0.3 inch)                                      | 1405 cm <sup>3</sup> /min<br>(85.7 inch <sup>3</sup> /min) |
| U-drill (milling)           |                           |                            |   |  |
| Tool                        | Milling spindle speed     | Feedrate                   | Material removal rate                                     |  |
| Ø63 mm<br>(2.5 inch)        | 1010 r/min                | 131 mm/min<br>(5.2 ipm)    | 409 cm <sup>3</sup> /min<br>(25.0 inch <sup>3</sup> /min) |  |
| Face milling                |                           |                            |   |  |
| Tool                        | Milling spindle speed     | Radial cutting depth       | Feedrate  | Material removal rate                                      |
| Ø80 mm<br>(3.1 inch)        | 1100 r/min                | 5 mm<br>(0.2 inch)         | 1117 mm/min<br>(44.0 ipm)                                 | 357 cm <sup>3</sup> /min<br>(21.8 inch <sup>3</sup> /min)  |
| End milling                 |                           |                            |   |  |
| Tool                        | Milling spindle speed     | Radial cutting depth       | Feedrate  | Material removal rate                                      |
| Ø25 mm<br>(1.0 inch)        | 382 r/min                 | 25 mm<br>(1.0 inch)        | 200 mm/min<br>(7.9 ipm)                                   | 125 cm <sup>3</sup> /min<br>(7.6 inch <sup>3</sup> /min)   |
| Tapping                     |                           |                            |   |  |
| Tool                        | Milling spindle speed     | Feedrate                   |   |  |
| M30 x P3.5 mm               | 212 r/min                 | 742 mm/min<br>(29.2 ipm)   |   |  |

\* The results, indicated in this catalogue are provides as example. They may not be obtained due to differences in cutting conditions and environmental conditions during measurement.

### Higher Productivity by Multi-tasking performance

Faster machining time compared to many conventional machines provides superior productivity and machining capability.



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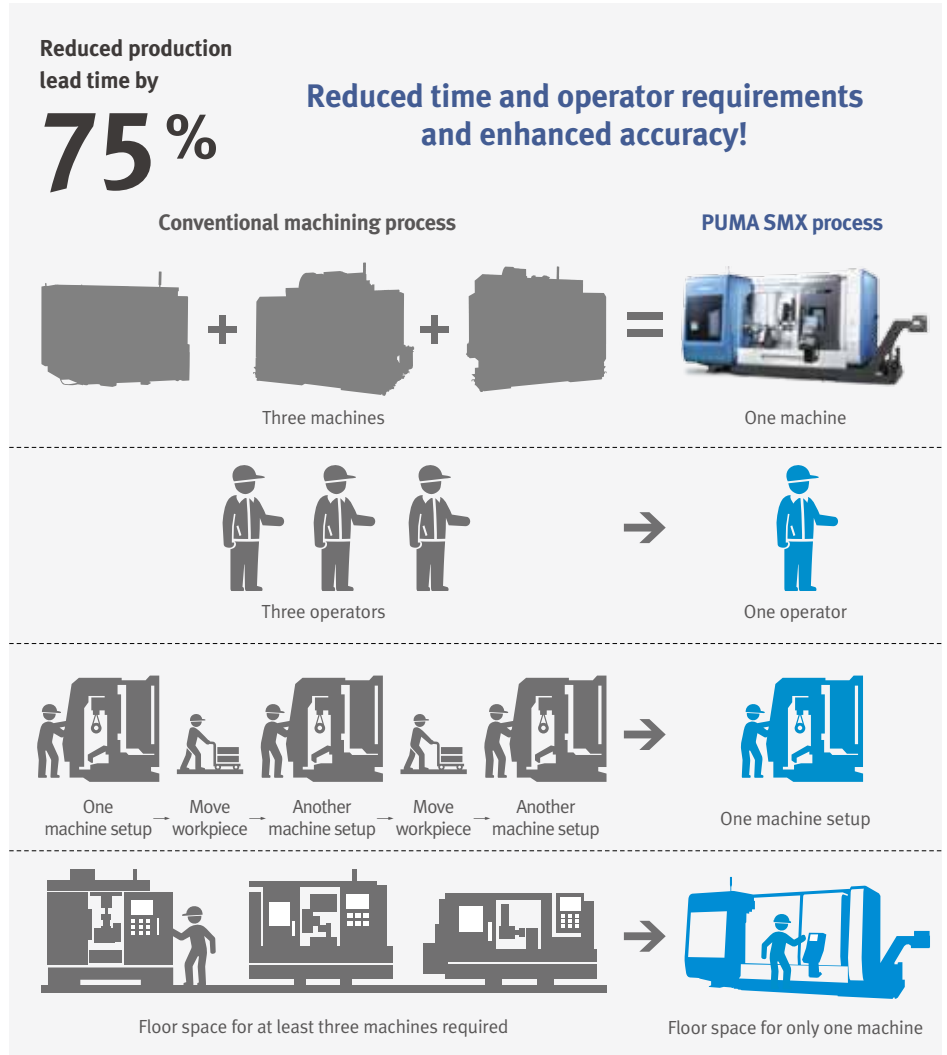


**Application Performance**

Multitasking, which is performing more than one duty at once, This can lead to as much as a 40 percent increase in productivity and can positively impact your company's bottom line.

**Benefits of Multi-tasking operation**

Using a single set up, one machine is capable of performing all machining processes that generally require two three or even more machines. By minimizing time and labor, the process cost is reduced and lead times are shortened by up to 75%. This provides a significant advantage when manufacturing small batches of a variety of products.

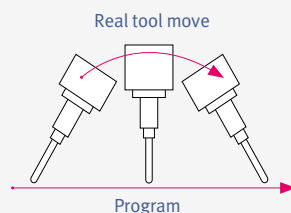


**Providing 5-axis Complex Machining Capabilities (Standard when applying FANUC 31i-5)**

Simultaneous 5-axis machining functions such as TCP\* are built-in, thereby making the machining of complex shapes easier, such as an automotive engine impeller or an aero engine blade.

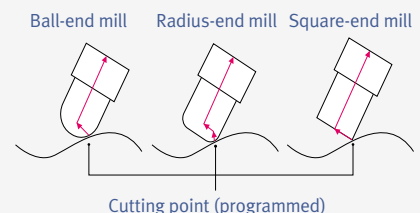
**Tool Center Point Control**

- Facilitating the high precision machining of the surface by automatic control of tool path
- Decreasing the time for the machining setup and the cutting process



**3-D Cutter Compensation**

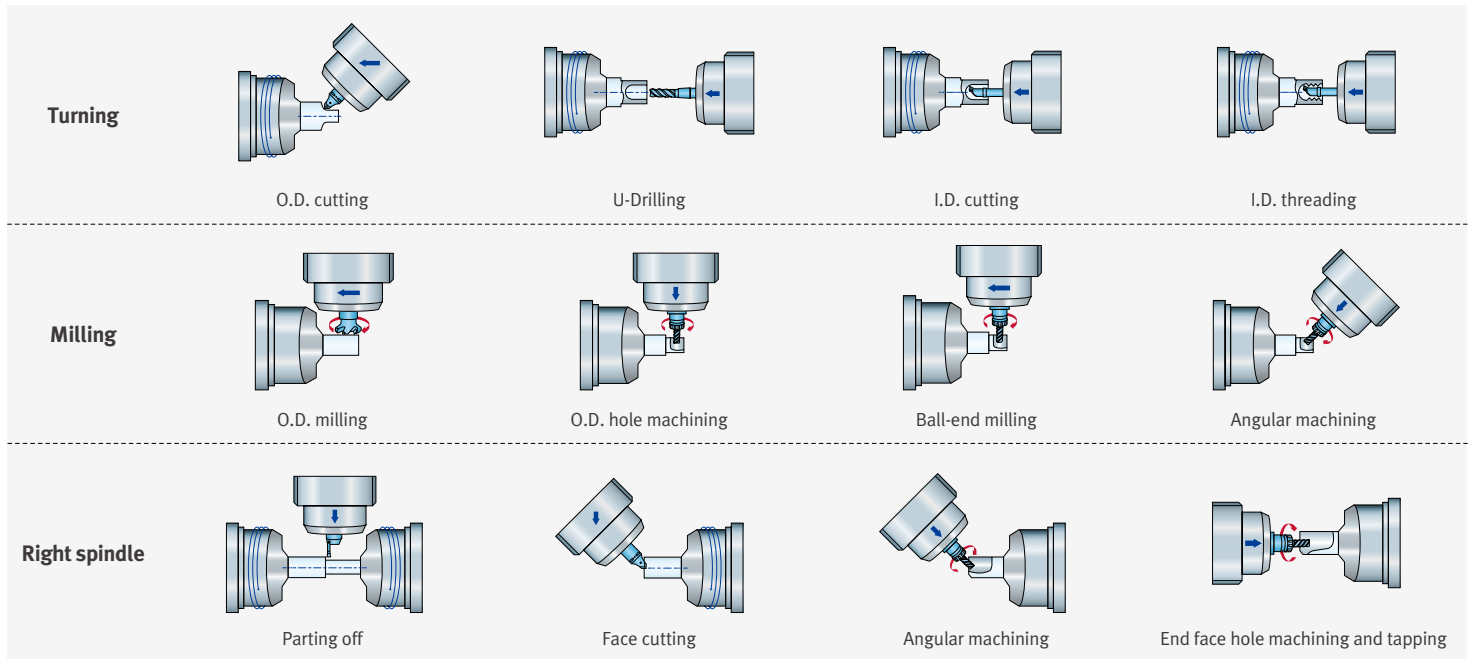
- Increasing the productivity by automatically compensating when using various tool tips without changing the machining program
- Performing effective tool correction



\* TCP : Tool Center Point

## Various Application

Just single machine, PUMA SMX series can meet all machining requirements. That's why, your investing in PUMA SMX series that boost your capabilities can take your operations to the highest level of performance, including your all-important return on investment.



## Application Sample

Optimal Applications of High Productivity

Complex machining capabilities of the PUMA SMX series enable machining over a wide range of applications in various industries, such as aerospace, energy, shipbuilding, medical, etc.

**A wide range of applications based on high productivity**



### Drill bits

Industry | Energy  
Size | D165 X D175  
Material | Stainless steel  
Tools | 15



### Shaft

Industry | General  
Size | D150 X L350  
Material | Aluminum  
Tools | 14



### Die roller

Industry | Medical  
Size | D185 X L330  
Material | Aluminum  
Tools | 9



### Valve

Industry | General  
Size | D300 X L450  
Material | Stainless steel  
Tools | 6

Optimal Applications of Accuracy

Stable control technology and excellent level of accuracy enables delicate and detailed workpiece machining.

**Wide range of workpieces based on high precision**



### Housing

Industry | General Machinery  
Size | D150 X L300  
Material | Aluminum  
Tools | 19



### Impeller

Industry | Aerospace  
Size | D120 X L80  
Material | Aluminum  
Tools | 6



### Barrel

Industry | Electronics  
Size | D70 X L50  
Material | Aluminum  
Tools | 50



### Bucket blade

Industry | Energy  
Size | 85t x D120 x L600  
Material | Stainless steel  
Tools | 8



## Ergonomic Design

Maximizes user's convenience by employing ergonomic design concept

### Ease of Machine Setup through Ergonomic Design

By laying out the operation panel and tool magazine in a user-friendly way, tooling and workpiece setup become easier for the operator.



#### Award



An excellently designed PUMA SMX series has received the world's leading design awards, such as the **2014 German Red Dot**, the **2013 Australian AIDA** (Australian International Design Award), the **2013 Korean Good Design**, etc. Thus, it is internationally recognized for its shape, function, quality, safety sustainability and innovation.

#### 1. Operation panel with side-to-side movement, swivel action and adjustable height

Swivel angel adjustment : 100°  
Height adjustment : 190 mm (7.5 inch)  
Longitudinal movable : 1350 mm (53.1 inch)



#### 2. Convenient ATC-MAGAZINE operation panel

Easy ATC and magazine condition check by using a touch screen



#### 3. Easy access for the operator to the spindle through the angled style exterior front cover

Minimum distance for operator reach to reduce fatigue



#### 4. Extended front window

Enables the operator to easily monitor the machining operation using the large front window



## Safety Design to decrease Collision-caused Damage

### Machine Airbag Function

Machine airbag function minimizes damage in the event of a machine collision, defect or heavy load by detecting sudden axis load increase.

**The Principle of Machine Airbag Function**

If a collision is detected by a sudden increase in torque during axis movement, the servo motor immediately moves in reverse to partially retract the cutter.






## Easy Operation and Maintenance

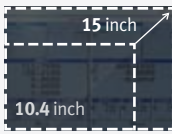
Enhances ease of operation by the design based on the operator's functions and also provides maintenance functions that reduce downtime by decreasing the MTTR.\*

### User-friendly Operation Panel

The operator panel is designed to provide easy operation and also maintenance functions to reduce downtime. A large size 15-inch screen is applied as standard on the customized operator panel.



**15-inch wide screen display unit**





**Optimized system design that reflects Doosan's know-how from long-term experience and the customer's needs**

|  |  |
|--|--|
| <b>A design for easy operation</b>       | easy and convenient user interface, enhanced lamp visibility, optimized button size for easy operation and long life, use of a partition-type layout to prevent incorrect button operation |
| <b>Addition of simple option buttons</b> | additional function buttons can be easily fitted to spare sections of the operator panel   |
| <b>Customized function support</b>       | attachment of customized function switches and customized additional panel design  |

### Simple Alarm Function

Doosan's EOP\* system enables the user to operate the NC\* system more conveniently.


#### Alarm Guide Function

- Alarm notification for user check-up
- Alarm notification of actuator and sensor status

**Easy check-up of alarm status and troubleshooting problems by access to 3D displays of internal mechanisms**

#### Periodic Maintenance Notification Function



- Avoids unexpected downtime
- Reduces maintenance cost
- Increases production efficiency
- Optimizes the performance

**Manages and extends the lifespan of cutting tools**

\* EOP : Easy Operation Package / NC : Numerical Control

### Tool Load Monitoring

It is possible to display various types of information about each tool and to monitor the tool load in real-time.

