

*Parallel Kinematics Machining Center  
(Seven Generation)*

*One Set-up Solution*



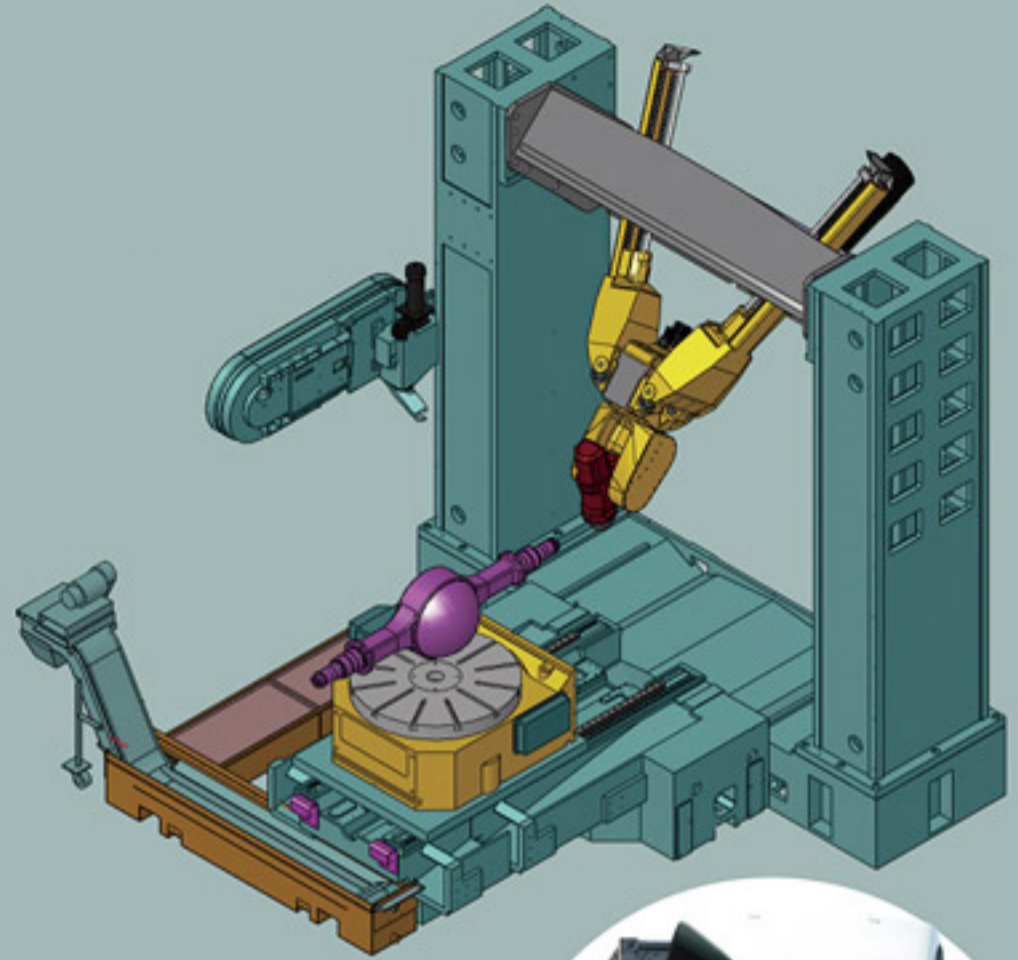
**X-700R**

## Parallel Kinematics Machining Center (Seven Generation)

- Breakthrough of traditional machine construction but combine the flexibility with the accuracy and stiffness of traditional Machine Tool.
- Spindle at any of machining position maintain the machine rigidity.
- High acceleration as well as high rigid of construction, to achieve 3G acceleration.
- It's suitable for agile machining and one setup machining for complex parts with five or six sides, holes with compound angles, curved surfaces, and etc.
- This machine has a large machining envelope, breakthrough traditional machining center of working envelope limitation.
- Machining at once save the time of loading/unloading as well as accuracy guarantee.
- Widen machine construction, could match different kind of frame, such as bridge type, horizontal, moving column, gantry.
- It's suitable for aerospace, car industry, and special manufacturer for high speed, variety machining conditions.

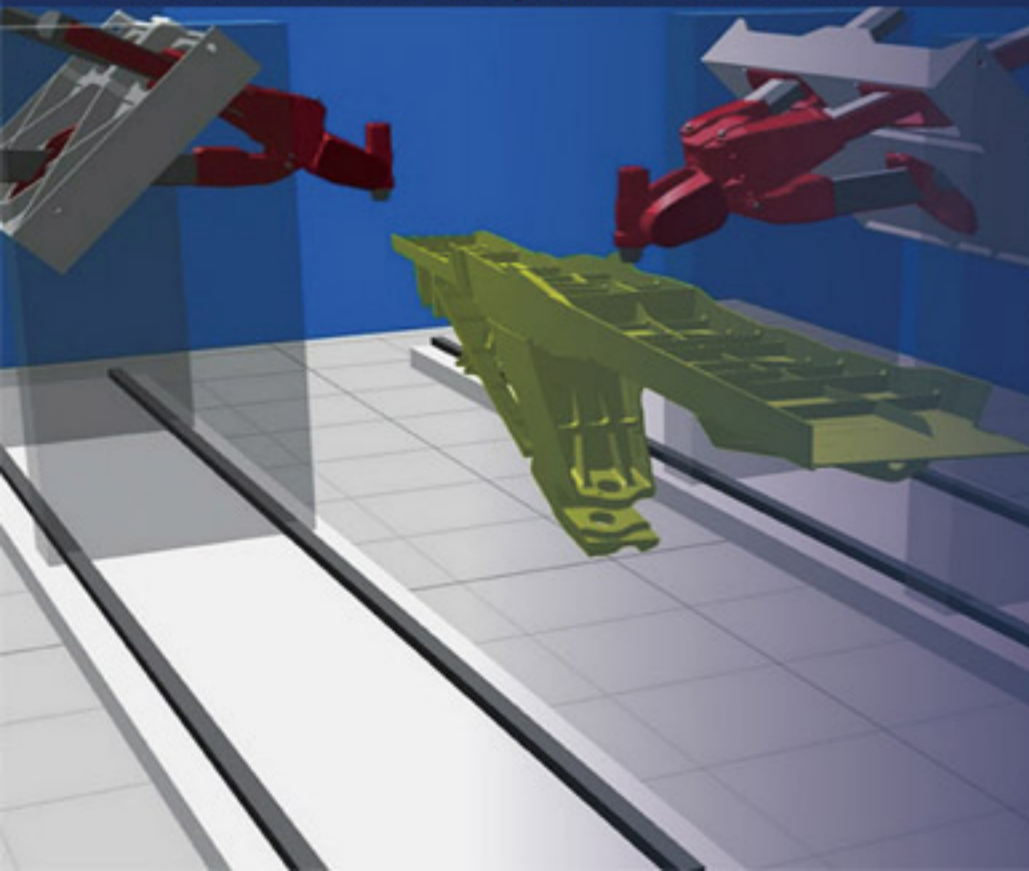
### ▣ X-700R in Automotive Frames

- X-700R various application for automotive industry including turn tables and produces high volumes of the front and rear axle.



### ▣ X-700R in Aerospace Structures

- The applications are mainly drilling and trimming and this is performed on large structural aero plane parts where X-700R machines are mounted horizontally on rails going parallel with the parts. While moving along the parts the machine performs an area by area probing sequence to guarantee that the machine coordinate system correlates with the part coordinate system before machining (agile machining).



## ▣ Side-mounted Tooling System (Opt.)

- X-700R offer 16 tools ATC system and the tool magazine is isolated from the machining area. The cam drive provides smooth, reliable tool changes, and it is easy to maintain.



### Agile Machining

A well known problem in conventional 3-Axis machining is the fact that the coordinate system of a part most of the times has reference points that are either inside the part or not consistent with the desired centre line of the part, therefore it is a costly and time consuming work to align a part to the coordinate system of the machine. In conventional machines this is solved either by using very expensive and un-flexible servo controlled fixtures or by adjusting each part manually using advanced offline measuring equipment.

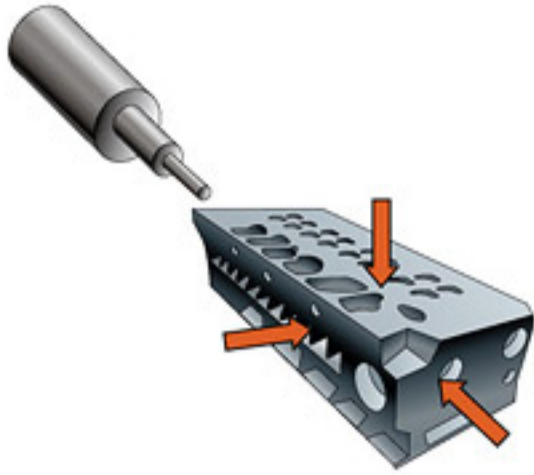
A PKM machine can easily carry a laser probe or conventional probe and in combination with a machine that has 5-Axis capability and extreme acceleration and rapid motion, generates the possibility to fly over the part in a couple of seconds and measure everything that needs to be analyzed and adjust relevant programming data accordingly before machining. One example could be an engine block where the cylinder liners are not consistent and has to be probed individually, calculated and put into the machine coordinate system before machining, all in a few seconds. In the same way a frame for a car, plane, train or construction machine, can be probed in production and all features that are important can be measured and taken in consideration before the final machining. This technology has been proven and is in production at Boeing.



### One Setup Machining

Another problem in 3-Axis conventional machining is that to be able to machine all six sides of e.g. a cylinder head, a minimum of two and normally three fixtures has to be used. This technology requires a number of machine setups in a transfer line concept which creates a lot of problems like if one of the machines goes down the whole line stops. Another problem is tolerance stack-ups coming from moving the part from fixture to fixture with consequential CPK problems, and finally the cost of designing and manufacturing several different fixtures is substantial.

With the unique capability of a PKM machine, that allows the spindle to actually point all the way backwards, the machine literally can machine all sides of a cylinder head or a bumper in only one setup. If this technology is used with the above described probe concept it creates the possibility to use really low cost fixtures with no repeatability or build in accuracy as long as they are stable and rigid. As a consequence all tolerance stack-up problems disappears and the CPK values of the parts increases. This technology has been proven and is in production at numerous PKM machine users.



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### Compound Angle Machining

Due to the more and more advanced design of cars, mostly in the bodies, but also in advanced frames and engines, the requirements for complex machining and compound angles becomes higher every day. To perform this type of machining with a 3-Axis machine that by default is designed for cubical machining, a lot of add-on equipment is required. This equipment could be everything from an additional full 2-Axis table to an additional angular head or an offline special machine. In all cases the additional equipment is expensive, difficult to calibrate and maintain, especially if the part only requires e.g. one compound angle hole and nothing more.

A PKM machine with its capability does not notice any differences between a perpendicular hole or surface compared to a compound angle one and therefore it is very suitable for all complex machining that is expected to be performed on the cars of the future. Also, it is easy to imagine that a part for an airplane, train, or construction machine requires even more advanced machining that today can not be done with conventional machines other than a PKM machine. This technology has been proven and is in production at numerous PKM machine users.



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### Multi path blending and tool-drag elimination

An old problem in 3-Axis conventional machining is the fact that to be able to machine a perfect flat surface, with multi paths, it requires a very rigid and accurate machine and even then it is in reality almost impossible to avoid a small hatch between the passes. There are mainly two ways to solve this with conventional machines and one is to use a cutter that cover the whole surface, which required a lot of horse power and stability, or to mechanically lean the spindle a couple of thousands of degrees in a so called attack angle but this requires that all passes comes from the same direction which cost time.

As earlier mentioned, a PKM machine does not care whether the spindle is perpendicular to the surface or not so it is very easy to pre-program the a PKM machine paths with a defined attack angle and just let it use this angle whenever it machines a surface. Another advantage is that the rear side of the cutter does not touch the part and therefore the tool life time is increased, especially in the foundry industry where remaining sand otherwise comes up behind the front of the cutter and jams between the rear of the cutter and the part and kills the tool quickly. This technology has been tested at several users.

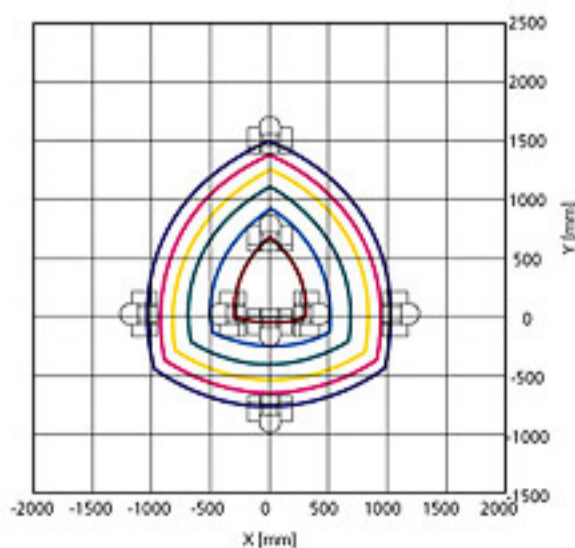


## ■ X-700R in Other Applications

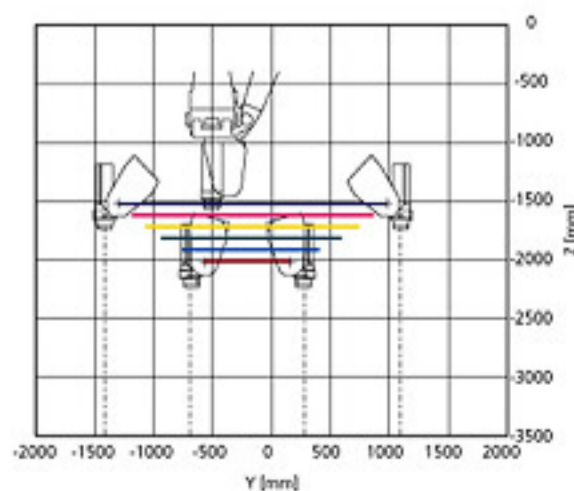


- X-700R is used of Automotive Power Train, especially focus on machining of engine blocks and cylinder heads.

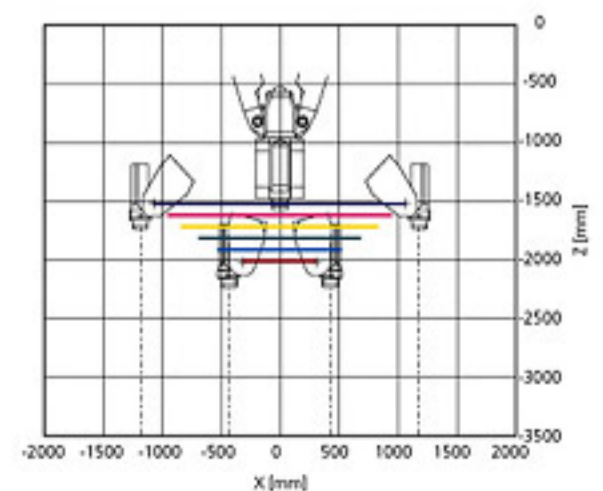
X-700R Envelope in X-Y



X-700R Envelope in Y-Z



X-700R Envelope in X-Z



## MACHINE SPECIFICATIONS

ITEM	MODEL	X-700R	
<b>CAPACITY</b>		Unit	
Axis 1 travel	mm(in)	700 (27.5)	
Axis 2 travel	mm(in)	700 (27.5)	
Axis 3 travel	mm(in)	700 (27.5)	
Axis 4 travel angle	deg	±360°	
Axis 5 travel angle	deg	-2.5° ~ 140°	
<b>SPINDLE</b>			
Spindle speeds	min <sup>-1</sup>	18000	
Spindle nose (nominal size, NO.)		Capto C6	
Spindle bearing inner diameter	mm(in)	70 (2.75)	
Spindle motor	KW	32.5	
Max. spindle torque	Nm (ft.lbf)	28 (20.64)	
Tool clamping force	kg (lb)	3671 ± 500 (8076 ± 110)	
<b>FEEDRATE</b>			
Axis 1 rapid traverse	m/min (IPM)	22 (866)	
Axis 2 rapid traverse	m/min (IPM)	22 (866)	
Axis 3 rapid traverse	m/min (IPM)	22 (866)	
Axis 4 rapid traverse	R.P.M	45	
Axis 5 rapid traverse	R.P.M	45	
<b>MOTORS</b>			
Axis 1 rapid motor	KW(HP)	4.9 (6.6)	1FT-7084
Const torque	Nm	20	
Thrust force	kgf	1708	
Ball screw	mm	ø36 x P6 x 1259L	
Axis 2 rapid motor	KW(HP)	4.9 (6.6)	1FT-7084
Const torque	Nm	20	
Thrust force	kgf	1708	
Ball screw	mm	ø36 x P6 x 1259L	
Axis 3 rapid motor	KW(HP)	4.9 (6.6)	1FT-7084
Const torque	Nm	20	
Thrust force	kgf	1708	
Ball screw	mm	ø36 x P6 x 1259L	
Axis 4 rapid motor	KW(HP)	2.09 (2.8)	1FK-7063
Const torque	Nm	11	
Axis 5 rapid motor	KW(HP)	2.09 (2.8)	1FK-7063
Const torque	Nm	11	
<b>POWER SOURCES</b>			
Electrical power supply	KVA	70	
Compressed air pressure	Mpa (psi)	0.6 (87)	
Compressed air flow rate	L/min	400	

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※ All performance are based on 220V/3PH/60HZ. Specification are subject to change without notice.