



LT-HT-SPT series
CNC Slant-bed Lathe



DUAL series
Dual spindle
CNC Lathe



MCG-5X
5-axes Gantry
type VMC



MU-5X
5-axes VMC



V-Series
V-20/5



MM-Series
Linear
guideway
VMC



MCV-Series
Box way VMC



VM/VMC Series
Medium/Large
Box way VMC



BNC series
Teach-in Flat bed Lathe



BNC-3000/3500/4000
Large bore CNC
Flat-bed Lathe



BNC-5000/6500
4-Guideway Heavy
Duty Lathe



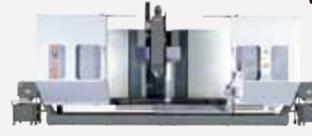
HBM-4
Table-moving
Horizontal Borer



HBM-4T/5T/5TE
Travel-column
Horizontal Borer



TT-40
Bridge type Twin-table VMC



TC Series
Travel Column VMC



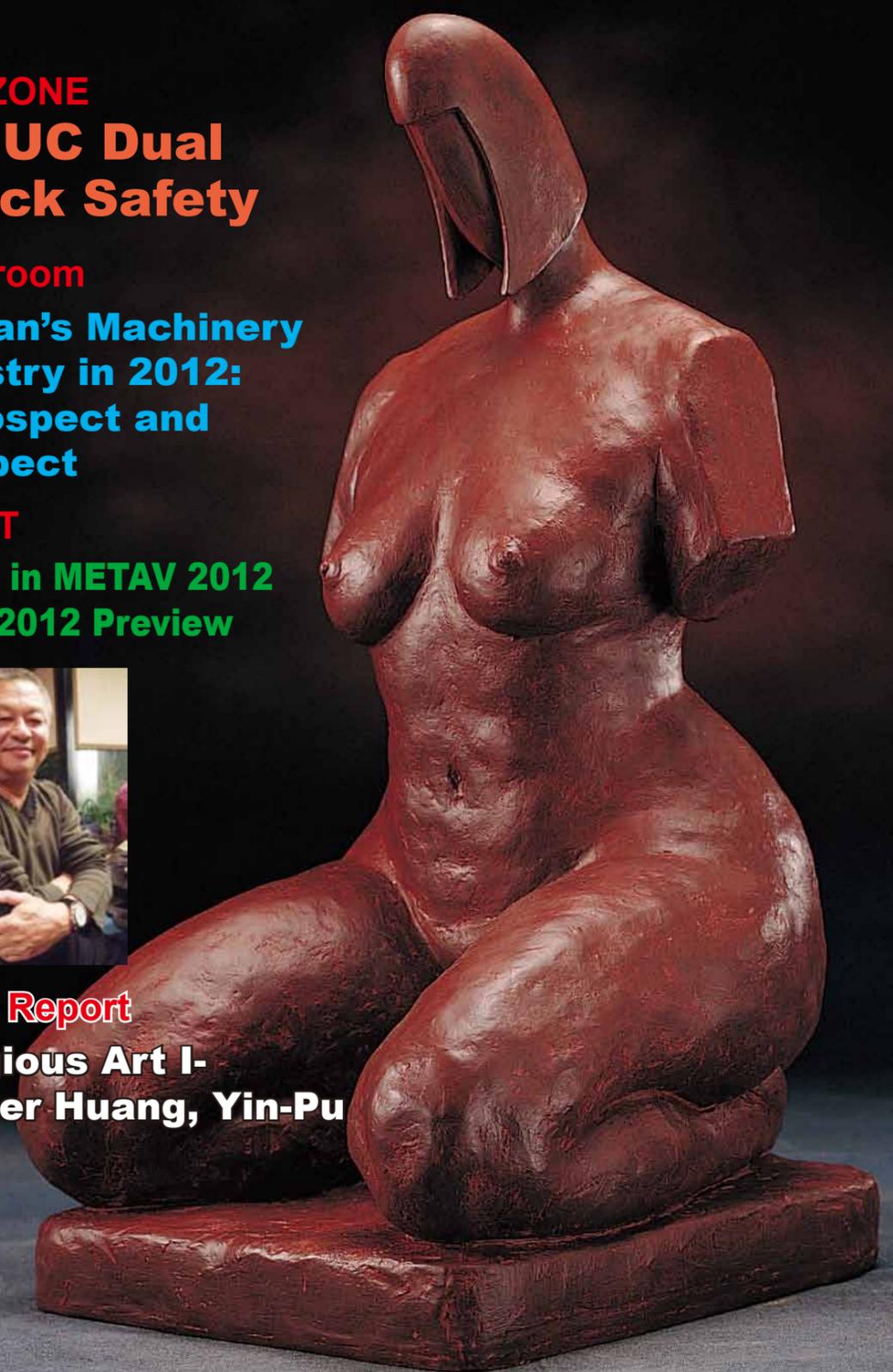
R&D ZONE
FANUC Dual
Check Safety

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Taiwan's Machinery
Industry in 2012:
Retrospect and
Prospect

EVENT
• **VOLZ in METAV 2012**
• **AMB 2012 Preview**



Artist Report
Religious Art I-
Master Huang, Yin-Pu



A NEW SEXY APPEARANCE LAUNCHED FOR BUFFALO'S
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MiCROCUT

THE CHALLENGER



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Welcome user's submission

of company profile, sharing Challengers' Products experience and pictures of people, products. Please send your story and pictures (Images in high-resolution higher than 300 dpi) to your Challenger Factory Outlet or e-mail to t02@mail.buffalo.com.tw Only English version is acceptable.



From the Publisher

According to recently released economic statistics report, the Euro zone didn't grow at all in the first quarter of 2012. All govern-

ors in Euro zone are working hard to relieve from the European debt crisis and decrease the soaring unemployment rate. However, Buffalo Machinery is lucky to work with a strong group of distribution which keeps the business in good shape. The orders incoming are in good level and the backlog remains full for more than six months. It ensures the stability of production and distribution.

May 2012, Buffalo Machinery has earned several special honors on the "Top 1000 Survey" published by Common Wealth Journal, one of the most reputed finance and economics journal in Taiwan. In the list of Taiwan's Top 1,000 best manufacturing Enterprises of year 2011, Buffalo Machinery is ranked 842. Furthermore, Buffalo Machinery is ranked 25 in the list of the 50 fastest growing manufactures and No. 14 of the 25 best operating performance enterprises. The management of Buffalo Machinery work hard to get the company to be better and stronger.

Taiwan Metal Working Machine production growth 0.52% in the first quarter of 2012, in comparing with the same period of 2011, the 2012 full year estimate growth is 0.02%. On the other hand, Taiwan Metal Working Machine export rate reduced 9.85% in the first quarter 2012, in comparing with the 4th quarter of 2011. The main reason of deduction which is the Chinese market has shrunk rapidly since 3rd quarter of 2011. There is nothing significantly improved so far. And the big drop of decrease percentage happened due to Taiwanese metal working machine took 42%-45% of its share of shipment to Chinese market.

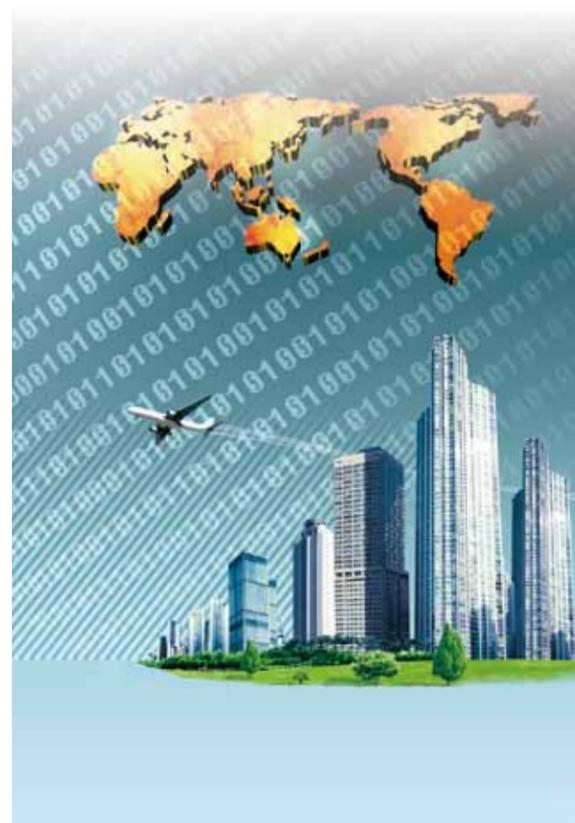
Taiwan machinery industry aims to develop high-end machine tools, such as micro-controller machine tools and intelligent machine tool. With the high technologies and high-level automation and composite machines can widen the technological gap between Taiwan and Mainland China. It will ensue Taiwan maintains the advantage of machine tool products in the global market.

Developing multi-function, high technology machines is always been the target of Buffalo Machinery. Buffalo Machinery has developed the products to meet the requirements of High Speed Machining Technology (HSM) in 3 Axis and 5 Axis machining centre and multiple axis turning center, as well as wide range of table type HBM and floor type HBM. These products support Challenger widely distributing over the global market and also benefit the distributors with complete line of products. The Team appreciates great input from the global distribution net, the commitment in developing all the new products to ensure the right products for market!

 Dr. Paul Chang
May 2012

Reference:

- (1) IEK Q1 2012, *Machine Tool Review*, May 15 2012.
(2) Gardner Republishing Annual Report 2012, May 2012.



MICROCUT Newsroom
THE CHALLENGER

Taiwan's Machinery Industry in 2012: Retrospect and Prospect

The export value of machine tools in Taiwan 2011 created a new record to reach more than USD 4 billion, grew by 35.1% comparing to 2010, and became the fourth largest exporting country in the world when considering the exporting value. It was beyond the level before financial crisis. However, there are many challenges in economic recovery of the world such as China's GDP downgrade, European debt crisis and oil price rise. Taiwan machinery industry should be well-prepared in order to fly against the wind.

Overview of the Machinery Industry

Industry & Technology Intelligence Service (ITIS) of Ministry of Economic Affairs, R.O.C. announced in 21st, February, 2012 that the estimated output value of machinery industry in Taiwan 2012 will be decreased by 4.18% as a result of declined purchase orders in the first half year of 2012. Predicted by ITIS, Taiwan's machinery industry output value can only reach the one trillion Taiwan dollar mark and become a veritable new trillion dollar industry in 2013 or 2014.

After the global financial crisis in 2009, Taiwan's machinery industry demonstrated strong resilience that the machinery industry output grew by 60.42% to achieve a total output of about NTD 848 billion in 2010. In 2011, despite of impacts of 311 earthquake in Japan and severe floods in Thailand, the total output value in Taiwan still grew by 16.18% to reach around NTD 945.3 billion. This year, however, according to ITIS's report, machinery industry is impossible to maintain the same growth rate as last year mainly due to the decline of China market.

According to the global machine tool market survey made by Gardner Publications, Inc, the global machine tool industry performs continuously brilliant in year 2011. The major producing countries, such as Mainland China, Japan, Germany and Taiwan, have output value growth 20-50%. From the report of Gardner Publications, Inc,

global machine tool GDP is approximate \$ 93.8 billion, about 34% growth compared with 2010 harvest. In output value, Taiwan is ranked number 6. The first fives are Mainland China, Japan, Germany, Italy and Korea. In exporting value, Taiwan is ranked number 4, following Japan, Germany and Italy.

Production and marketing value of Taiwan machinery industry 2006~2011 (Value in USD)

Year	Product	Export Value	Interior Value	Import Value	Output Value	Export Ratio	Interior Ratio
2006	Metal Cutting Machine Tool	2,344,677,834	816,543,460	1,927,422,879	3,161,211,294	74.17%	25.83%
	Metal Forming Machine Tools	672,912,282	270,334,539	105,061,167	943,246,820	71.34%	28.66%
	Sum of Machine Tools	3,017,590,116	1,086,877,999	2,032,484,046	4,104,468,115	73.52%	26.48%
2007	Metal Cutting Machine Tool	2,760,861,062	811,219,494	2,460,309,863	3,572,080,556	77.29%	22.71%
	Metal Forming Machine Tools	752,971,847	215,729,873	97,057,655	968,701,720	77.73%	22.27%
	Sum of Machine Tools	3,513,832,909	1,026,949,367	2,557,367,518	4,540,780,276	77.38%	22.62%
2008	Metal Cutting Machine Tool	2,964,484,363	790,404,001	1,427,768,451	3,754,888,364	78.95%	21.05%
	Metal Forming Machine Tools	756,575,328	240,624,261	107,971,304	997,199,589	75.87%	24.13%
	Sum of Machine Tools	3,721,059,691	1,031,028,261	1,535,739,755	4,752,087,952	78.30%	21.70%
2009	Metal Cutting Machine Tool	1,324,126,419	332,481,136	272,548,020	1,656,607,555	79.93%	20.07%
	Metal Forming Machine Tools	419,161,573	128,189,658	68,261,022	547,351,231	76.58%	23.42%
	Sum of Machine Tools	1,743,287,992	460,670,795	340,809,042	2,203,958,787	79.15%	20.85%
2010	Metal Cutting Machine Tool	2,331,286,672	749,166,119	572,370,134	3,080,452,791	75.68%	24.32%
	Metal Forming Machine Tools	630,333,091	202,119,486	131,251,988	832,452,577	75.72%	24.28%
	Sum of Machine Tools	2,961,619,763	951,285,604	703,622,122	3,912,905,367	75.69%	24.31%
2011	Metal Cutting Machine Tool	3,287,867,435	(E)1,032,021,456	714,987,892	(E)4,319,888,891	(E)76.11%	(E)23.89%
	Metal Forming Machine Tools	712,643,516	(E)229,134,621	113,932,544	(E)941,778,137	(E)75.67%	(E)24.33%
	Sum of Machine Tools	4,000,510,951	1,261,156,077	828,920,436	5,261,667,028	76.03%	23.97%

(E): Estimation Data resource: Department of Statistics, Ministry of Economic Affairs & Directorate General of Customs, MOF. Diagram: TMBA Taiwan Machine Tool & Accessory Builder's Association.

Output value of major producing countries of machine tools in the world 2010~2011 Value in million USD



Export value of major exporting countries of machine tools in the world 2010~2011 Value in million USD



For the past ten years, Asia's economic growth has been the main driving force behind Taiwan's machinery industry. The Chinese market is especially the most important exporting country for Taiwan. Due to prolonged European financial crisis, China's economy is expected to slow down with the risk of a hard landing. Western and

Chinese companies therefore cut back their capital expenditures and make conservative investment since the second half of 2011. Besides, Korea had signed the Free Trade Agreement (FTA) with European (EU) and then United States successively. All the factors cause negative effects to Taiwan's machine tool companies.

Exports of Taiwan Machine Tools in 2011 by Continent (Value in USD)

Continent	2011	Share (%)	2011/2010 change (%)	2010	Share (%)	2010/2009 change (%)	2009	Share (%)
Asia	2,678,025,780	66.9%	20.7%	2,218,293,472	74.9%	99%	1,115,985,231	64.0%
Europe	670,130,001	16.8%	100.3%	334,509,246	11.3%	3%	323,468,531	18.6%
America	563,861,441	14.1%	70.2%	331,338,575	11.2%	36%	243,625,453	14.0%
Oceania + Africa	88,493,729	2.2%	14.2%	77,477,279	2.6%	29%	60,205,208	3.5%
Global Total	4,000,510,951	100.0%	35.1%	2,961,618,572	100.0%	69.9%	1,743,284,423	100.0%

Data resource: Directorate General of Customs, MOF. Diagram: TMBA Taiwan Machine Tool & Accessory Builder's Association.

The market requirements of Asian newly developed countries and South-East Asia varied depending on country situations. For example, due to the severe floods, which destroyed numerous equipments of plants, many rush orders from Thailand were placed by business owners to replace new equipments by indemnity insurance. As the European and the U.S. debt problems are gradually resolved with appropriate treatment, and the domestic market in Mainland China continues to grow, it is expected that market requirements from China and South-East Asia will be increased in the second half of this year and make the sum of machinery output value to reach about NTD 905.8 billion in 2012. To sum up, despite the estimated growth rate is negative, the output value of machinery industry can still reach the level of NTD 900 billion and have the opportunity to reach the trillion Taiwan dollar target in 2013 or 2014.

Imports and Exports

The import value of Taiwan's machinery industry were about USD 21.5 billion (NTD 688 billion) in 2011. Compared with 2010, the demand of import equipment was declined by 22.5%, and so the imports of Taiwan's machinery and equipment were also downgoing.

On the contrary, the export value showed a growth rate of 21.6% to reach USD 19.2 billion (NTD 614.4 billion), out of which China was the largest export destination, producing over one-third of the export value.

Important Issues

"Robot kingdom" for integrating machinery equipment industry

Hon Hai Precision Industry Company formalized its plan to build an automated worker manufacturing plant with a letter of intent laying out a soon-to-built "intelligent robots kingdom" in Central Taiwan Science Park. According to the plan, Hon Hai will construct robots and automation equipment by stages. The total investment will be more than NTD 100 billion. Foxnum Technology, part of the Hon Hai Industry, has started producing servo drive system, CNC controller, robots, and injection molding machine in practice, and are expected to generate NTD 7 billion in production value in 2015.

In China, as a result of risen wage and west-going business, plants located in cities along the coast are facing problems of cost increase and labor shortage. The plants thus need automation technology increasingly. Taiwan's supplier of automation equipment, industry robot, and machine tool can therefore gain more profits in China market by the way of providing high value-added "manufacturing service".

Signing of ECFA

From 2012, exports of high-end products to China such as horizontal CNC lathe, CNC horizontal borer and textile machine are entitled to tax-free treatment. Key components including ball screw and linear guide way have the same preferential tax, which is equivalent to no tariffs. Because the competition gap with rivals will be widened, more exports of tool machine are expected in 2012.

With the advantages provide by ECFA, and the zero-tariff incentives in China, the China market has become the perfect stage for Taiwan's brand name products, services,

and export trade. Taiwan is therefore in a favorable position to attract foreign capital to invest in it. To grasp all the chances, Taiwan's machinery industry should upgrade and transform itself through various aspects. Upgrading the 5-axis milling machine, for example, can help the industry to progress toward more advanced and multifaceted development. Except 5-axis machines, intelligent manufacturing can create more perfect manufacturing systems which presents a symbol of Taiwan's advanced technology industry with high global visibility. Moreover, uplift of human resource quality and establishment of production SOP (standard operating procedure) are also important objectives. It can help widening the gap of production quality between Taiwan and other countries, so as to maintain Taiwan's competitive advantage in the global market. As a result, Taiwan's machinery industry has the opportunity to pull itself out from a relatively weak position in the global division of labor and to expand the international influence of the machinery industry cluster.

Outlook

Looking ahead, Taiwan's machinery industry has to upgrade its technical development pressingly. The domestic industry, government, academic and research community should work together to establish a system which integrates research, manufacturing, sales, and value-added services. With the technical development, Taiwan can become the R&D center (headquarter) for manufacturing technology and intelligent machinery in the Asia-Pacific region, and therefore ensure its sustainable economic development.



Global Outlook Guangdong, China



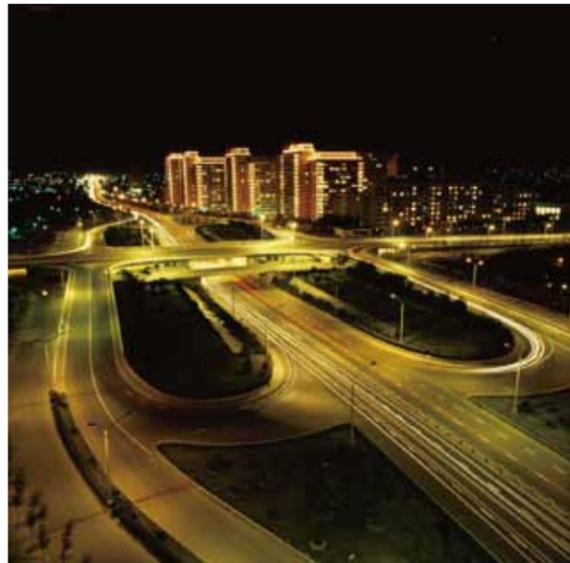
Location

Guangdong, Yue for short, is located in south China, with Guangzhou as its capital city. Thousands of years ago, the Yue people resided here so Guangdong is also called Yue.

Guangdong is a province on the South China Sea coast of the People's Republic of China. The province was previously often written with the alternative English name Kwangtung Province. The provincial capital Guangzhou and economic hub Shenzhen are amongst the most populous and important cities in China. Its coastal line is long and zigzag with numerous offshore islands. It is the top proportional change in China's population; people are flocking to Guangdong because of the job opportunities and higher wages. In year 2011, the population reached 104 million.

Climate

Guangzhou weather is generally warm and humid all year round without a clear division between the four seasons. A yearly average 21 - 29°C (70 - 84°F) makes it a great destination for traveling. Crossed by the Tropic of Cancer in the central part of its continental portion, tropical and sub-tropical Guangdong has a climate marked by high temperature and plentiful rainfall. It has the highest mean temperature of 28°C in July (the hottest month in a year) and the coldest time is from the late January to early February, with a lowest temperature of -3°C (27°F). The greater part of the province has a mean annual precipitation of about 1,500-2,000 mm. and 140-160 rainy days. There will be occasional typhoons in July and August and frequent afternoon thunderstorm.



Economy

Following the policy of the reform and opening in 1978, the CPC Central Committee and State Council decided to set four pilot special economic zones in Shenzhen, Zhuhai, Shantou, and Xiamen in July 1979. Three of the four are located in Guangdong province. As one of the earliest open trading ports to outside world and the starting-point of Maritime Silk Road, Guangdong has a long history of commercial trade. It is also the origin of modern industry as well as national industry of China. Guangdong is not only China's largest exporter of goods, it is also the country's largest importer.

These factors of economics zones and open cities/areas in Guangzhou city and Pearl River Delta have pushed Guangdong province to a new stage of development. By now, Guangdong has been developed into one of the most developed areas of mainland China. Guangzhou, not only plays a role as the political center of Guangdong province, but also the economic, scientific, educational and cultural center. Canton Fair, also called China Import and Export Fair is held twice yearly here and provides great opportunities for international trade between China and the rest of the world. Shenzhen is well-known for its electronic industry while Dongguan, Zhuhai, Zhongshan, Shunde, etc have many factories making household appliances. Many transnational enterprises have set up branches or factories in these cities. Besides, a production base of grain, fruit and sugarcane has grown up around Pearl River Delta.

Since 1989 Guangdong has topped the total GDP rankings among all provincial-level divisions, with Jiangsu and Shandong second and third in rank. According to provincial annual preliminary statistics, Guangdong's GDP in 2010 reached 4.59 trillion (USD 689.02 billion), making its economy roughly the same size as that of Turkey or Indonesia. The province contributes approximately 12% of the PRC's national economic output, and is home to the production facilities and offices of a wide-ranging set of multinational and Chinese corporations.

Year	Gross domestic produce
1980	24,521.00
1985	55,305.00
1990	140,184.00
1995	538,132.00
2000	966,223.00
2008	3,570,000.00
2009	3,908,159.00
2010	4,596,300.00 (Unit:RMB)

Industrial and Guangzhou Industrial Manufacturing Zones

The industrial output of Guangdong Province exceeded 10 trillion Yuan (USD 1.59 trillion) in 2011, from the Statistics Bureau of Guangdong Province; it means the average daily throughput was near 28 billion Yuan.

The three pillar industries in Guangdong Province are **Automobile manufacturing, electronic communications and petrochemical industries** which accounts for about one-third of the city's industrial output value. With the introduction of advanced technology and the upgrade of medicine, light textiles, food, building materials and other traditional industries, many new industries and high-tech industries represented by electronic communications, electrical appliances, fine chemical industries and petrochemical products are developing rapidly.



Guangdong Cuisine

Guangdong cuisine, also named Cantonese or Yue Cuisine, one of the Eight Great Cuisines, emphasizes seafood, and unique, mixed flavorings. The food culture of Guangdong has retained many eating habits and customs of the ancient people, such as food made from Chinese herbals. Gui Ling Gao, also called as Chinese Herbal Jelly, is one of the examples. Despite the bitter taste, Gui Ling Gao is still a well-known and popular food in Guangzhou because of its good treatment for people suffering from excessive internal heat. Taiye chicken is another recommended cuisine when visiting Guangdong. This dish was invented by an ancient country mayor and named after him. Although the cooking method of Taiye chicken is simple, the cold-served chicken is famous for its smoky flavor and the special gravy mixed of salt and honey.



Distribution

JSC "ZETO" Report

Distribution



With the technology provided by Buffalo's equipment, JSC "ZETO" is able to implement the series of GIS technology production in the shortest time.

Velikoluksky Plant Electrical Equipment (JSC "ZETO") is a big-sized manufacturer of electrical equipment. The main activity of which is to develop and manufacture high-voltage equipment and related spare parts for electric power, oil and gas industry, railways, underground and agriculture ...etc. The plant was founded in the town of Velikie Luki, Russia in 1959 and started exporting its goods to China, Albania, and Afghanistan since 1960. In the following years, it enlarged its scale extensively with the construction of new workshops and upgraded its products; it even created a special bureau working out for better equipment in 1970. Until now, JSC "ZETO" has become a company with more than 2,000 workers that 600 of them are highly qualified specialists.

In JSC "ZETO", there are a lot of unparalleled solutions in design and techniques which are far ahead of other competitors in some technical ways. One contributes to this accomplishment is the design school where professional design developers share their experience, knowledge, and traditions to the young specialists. It therefore enhances production development of this company and allows it to produce high level reliable machines. The other important factor is the machine tools selected by the plant. Suitable and high quality machine tools can play core roles in providing high quality products.

JSC "ZETO" has been continuously investing in production line and purchased several Microcut machines since 2008, including CNC lathe LT-65, BNC-4040 and vertical machining center VMC1100, VMC1300 and VMC1600F, as well as horizontal boring machine HBM-4. These machines produce parts and units for the GIS (Geographic Information Systems). Tolerance for the work pieces of GIS is very critical no matter squareness, parallelism, straightness, concentricity or roughness. With Microcut's machines, the production finishing tolerance is much upgraded. Moreover, the productivity has increased while preparation time is reduced.



Distribution

When processing the products, all advanced technology requirements are taken into account; therefore, equipment manufactured by JSC "ZETO" can work reliably under different conditions whether it is continental, cold, or tropical climates. Furthermore, JSC "ZETO" are constantly working on new processes and technology services which can improve quality and reduce cost of the products. The machines and computer-controlled systems provided by Buffalo, for instance, can implement fundamentally new technologies, use any metals and alloys, adopt any solutions, and then increase productivity and quality and save energy and materials.



Machines supplied by Buffalo in the plant

JSC "ZETO" emphasizes environmental protection, aiming to use low-water technologies, high-performance gas treatment plant, and low-toxic materials. The plant therefore reduces harmful effects on the environment and increases in control over these effects progressively. Overall, the effort increases competitiveness of JSC "ZETO", as evidenced by the favorable position in the market.

Over the past 10 years, equipment in all departments of the plant was modernized comprehensively. Today, JSC "ZETO" produces high-performance equipment in clean and spacious shop floor. In production are dozens of machines, CNC machines, laser cutting systems, flame cutting sheet metals, press brakes, and a line of thermal diffusion galvanizing company. The plant is striving to provide effective high quality equipment and achieve a sustainable leadership position in the Russian and international markets. It is believed that only the latest technology and most sophisticated equipment can ensure a reliable supply and guarantee the professional leadership followed by long-term company growth.

Fields of Application for 5-Axis Machining

Productivity and accuracy are important attributes in the competition for machine tools. Five-axis machining provides considerable potential for increasing productivity. In many cases it permits higher metal removal rates than 3-axis machining. Production times can be significantly shortened thanks to a reduction of time required for resetting, for example, or through multi-operation machining in one setup. In any case, with increasingly complex workpiece geometry, 5-axis machining is becoming an indispensable part of the machining process.

By now, 5-axis machining has become indispensable in many areas of metal-cutting machining. Clear economic advantages result from the capability to machine work-pieces completely in one setup: the door-to-door time of a part can be dramatically reduced. At the same time, part accuracy can be significantly increased.

Beyond this, the additional rotary axes allow better access to complex workpiece contours, for example cavities in dies or molds. Often, they permit shorter tools with less inclination to chattering so that even higher metal removal rates are achieved.

With 5-axis simultaneous machining, the cutting speed at the tool tooth can be held within narrow limits even on complex contours. This brings significant benefits with regard to the attainable surface quality. What is more, the use of highly productive tools (e.g. toroid cutters) when milling free-form contours would not be possible at all without 5-axis simultaneous machining.

Parts for Aeronautics and Space Industry

High strength and low weight are essential for the aeronautics and space industry. Integral construction has established itself as the way to minimize the weight of "air-borne" parts: components with complex structure are manufactured completely from a single blank. Metal removal levels can be as high as 95%. This high "buy-to-fly" rate leads to high costs for the raw material of the blanks.



In the area of structural components, 5-axis machining opens new opportunities for reducing weight without loss of component strength. First, a computer-aided topology optimization is conducted that adapts the geometry of the component to the respective loads. The result: the material is brought specifically to where the mechanical load can be highest. In the other areas, material is specifically reduced. For example, the thickness of walls for stiffening can be easily adapted to the load distribution in the component. The wall thickness can decrease with increasing height, for example. This workpiece geometry can be realized in a simple way through 5-axis pocket milling.



Five-axis machining has long become the standard for the machining of jet engines. High efficiency requirements are driving continuous improvements in the flow characteristics of all jet engine components. The resulting component geometries are very complex and are therefore manufactured exclusively in 5-axis simultaneous milling movements.

5-axis machining in automobile manufacturing

Uncounted molds and dies are needed in automobile manufacturing for sheet metal and plastic processing. Dies for sheet metal forming can be up to 6 m long and need to be milled at the very high accuracy of ± 0.02 mm so that the upper and bottom dies can work together with the correct gap. Moreover, a very high surface quality of all functional surfaces is necessary in order to ensure that the forming tools have a long service life.



When manufacturing the tool contour, the machine has to maintain a very small distance between cutting paths in order to fulfill the requirements for high surface quality. This automatically lengthens the run times of the NC programs. The required accuracy of the forming tools is a formidable challenge for machine tools: high accuracy during long program run times on large components necessitates high thermal stability of the machine structure and the feed drives.

Five-axis machining opens new perspectives for shortening machining times because even deeply curved contours of forming tools become more easily accessible. In addition, special tools such as toroid or radius cutters can be used that permit significantly larger path spacing and therefore reduce program run times.

Five-axis machining in the field of medical technology

In the field of medical technology, demand is high for devices that are adapted to special examinations or therapies. This can make treatments considerably more precise and reduce aftereffects on the patients. The devices are often characterized by very complex geometries that make 5-axis machining of single parts on milling machines attractive.

Increasing life expectancy brings with it an increase in demand for tooth and joint implants. Today, hip and knee replacements offer many people the opportunity for a significantly better quality of life. In their external form, tooth and joint implants have to be perfectly fitted to the specific mating surfaces of a human body. Implants are mostly manufactured on milling machines, because milling makes even small batch sizes possible. Due to complex shaping of implants, medical technology is one of the largest fields of application for 5-axis machining. A prerequisite for the economical manufacturing of such sophisticated components is machines with high-accuracy position measurement for accurate and precise feed movements.



In 3 axis milling, the feed axes move within the dimensions of the workpiece plus the tool diameter. Unlike with 3-axis machining, in 5-axis machining the inclination of the tool can be adjusted with respect to the workpiece surface. If the position of the tool center point (TCP) remains unchanged, a change in the cutter orientation usually requires additional movement in the linear axes. These compensating movements necessarily increase the traverse range required by the linear axes. Because increasing traverse range also means increased positioning error, feed axes of 5-axis machines need significantly higher accuracy and reproducibility.

The compensating movements of the linear axes are superimposed on the movements of the tool center commanded by the NC program in X, Y and Z. Due to this superimposition, the axis feed rates for the tool center can significantly exceed the programmed feed rate. The increase in feed velocity results in increased heat generation in the motors, transmission and recirculating ball screw. Depending on the principle of position measurement, the generation of heat can cause significant position error. To prevent faulty workpieces, precise position measurement in the feed axes directly at the moving machine elements is imperative.

FANUC Dual Check Safety

Built-in safety function in conformance with European safety standards

1. Directives According to EU Regulation

Machine tools and their components must satisfy the EC directives listed below.

The FANUC CNC systems with the dual check safety function are compatible with all of these directives.

Directive 98/37/EC 1998	Safety of machinery
Directive 89/336/EEC 1989	Electromagnetic compatibility
Directive 73/23/EEC 1973	Low Voltage Equipment

Related Safety Standards

To be compatible with the directives, especially the machine directive, the international standards and European standards need to be observed.

EN292-1 1991	Safety of machinery - Basic concepts, general principles for design – Part 1: Basic terminology, methodology
EN292-2 1991	Safety of machinery - Basic concepts, general principles for design – Part 2: Technical principles and specifications
EN954-1 1996	Safety of machinery - Safety-related parts of control systems –Part 1: General principles for design
EN1050 1996	Safety of machinery - Principles for risk assessment
EN60204-11997	Safety of machinery - Electrical equipment of machines Part 1: General requirements
DIN V VDE0801 (1990) including amendment A1(1994)	Principles for computers in safety-related systems

General Definition of Terms

Reliability and safety are defined by EN292-1 as follows:

Term	Definition
Reliability	Capability of a machine, machine component, or equipment to perform its required function under a specified condition for a specified period.
Safety	Capability of a machine to perform its function without injuring the health under a condition of use for an intended purpose specified in the operator's manual and allow its transportation, installation, adjustment, maintenance, disassembly, and disposal

Definition of Terms Related to the Safety Function

Safety-related I/O signal

Safety-related I/O signals are input/output signals monitored by two systems. These signals are valid for each feed axis and spindle with a built-in safety function, and are used with each monitoring system.

Example: Protection door state signal.

Safety stop

When a safety stop occurs, power to the drive section is shut off. The drive section can generate neither a torque nor dangerous operation. The following are measures for incorporating the safety stop feature:

-Contactor between the line and drive system (line contactor).

-Contactor between the power section and drive motor (motor contactor).

If an external force is applied (such as a force applied onto a vertical axis), an additional measure (such as a mechanical brake) must be securely implemented to protect against such a force.

Safety limitation speed

When the drive system has reached a specified limitation speed, a transition is made to the safe stop state.

A measure must be implemented to prevent a set limitation speed from being changed by an unauthorized person.

Safety machine position

When the drive system has reached a specified positional limit, a transition is made to the safety stop state. When a positional limit is set, a maximum move distance traveled until a stop occurs must be considered. A measure must be implemented to prevent a set positional limit from being changed by an unauthorized person.

2. Features of FANUC Dual Check Safety

Dual Check Safety function has the following features:

- Two-channel configuration with two or more independent CPUs.
- Cross-check function for detecting latent errors.

Features

- Dual monitoring is available by single module.
- Wiring safety-related signal of the operator's panel is finished just inside operator's panel.

Item	Spec.
DI points	24 points
DI points for safety func.	4 points
DO points	16 points
MPG I/F	Max. 3 units

Detection

A servo motor detector signal is sent via the servo amplifier and is applied to the CNC through the FSSB interface. Then, it is fed to two CPUs: a CNC CPU and a Servo CPU. A spindle motor detector signal is sent via the spindle amplifier and is applied to the CNC connected through the serial interface. Then, it is fed to two CPUs: a CNC CPU and a CPU built into the spindle amplifier.

The safety related signal such as guard signal is sent via the independent I/O unit and is applied to the CNC through the I/O link interface. Then, it is fed to two CPUs: a CNC CPU and a PMC CPU.

Evaluation

The safety function is monitored independently by a CNC CPU and servo CPU or by a CNC CPU and spindle CPU. Each CPU cross-checks data and results at certain intervals.

Response

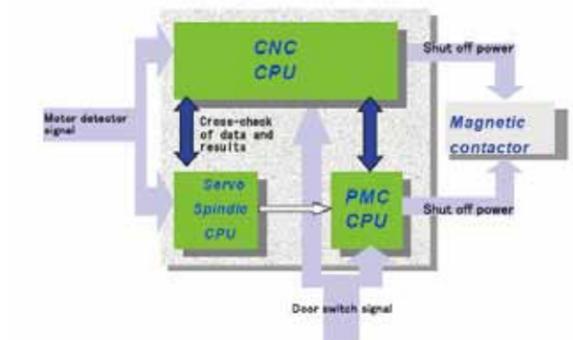
If the monitoring function detects an error, the CNC CPU and the servo/spindle CPU switch off the MCC via independent paths to shut off the power to the feed axis and spindle.

Compliance with the Safety Standard (EN954-1, Category 3)

The dual check safety function satisfies the requirements of Category 3 of the safety standard EN954-1. Category 3 requires the following:

- The safety function of a safety-related portion must not degrade when a single failure occurs.
- Single error must be detected at all times when natural execution is possible.

To satisfy these requirements, the dual check safety function is implemented using the two-channel configuration shown below.



Monitoring of servo motor and spindle motor movement

Data output from the detector built into each motor is transferred to the CNC through the amplifier. The safety of this path is ensured by using motors and amplifiers specified by FANUC.

Cross-monitoring using 2 CPUs

Two CPUs built into the CNC are used to cross-monitor the safety function. Each CPU is periodically checked for errors. If one system fails, the servo system and spindle can be stopped safely.

Power shutoff via two paths

If an error is detected, the power is shut off via two power shutoff paths. The paths need to be tested for built-up failures within a certain time.

Input signal safety

Safety-related input signals such as the protection door lock/unlock signal are monitored doubly. If a mismatch between the two occurrences of a signal is detected, the power to the motor drive circuit is shut off. This cross-check is constantly made.

Output signal safety

A signal is output (via two paths) to the relay used to shut off the power to the motor drive circuit. An error is detected by a MCC off Test. For detection of built-up failures, a MCC off Test needs to be conducted at a certain interval. This MCC off Test is not mandatory when machining is performed with the protection door closed. (The MCC off Test should be performed, before the protection door is opened after a certain interval.)

3.Application Range

The dual check safety function assumes the following configuration:

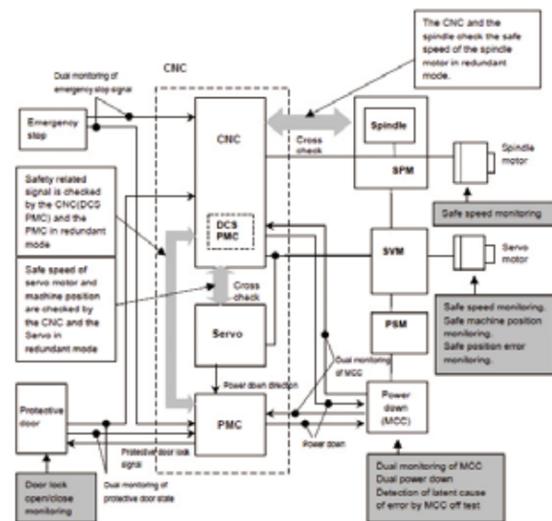
- A) At least, one protective door is provided.
- B) If protective door is closed, safety is assured.

When the operator makes a request to open the protective door, the safety functions are enabled, and the protective door can be unlocked. While the protective door is open, the active safety functions assure safety. When the request to open the protective door is canceled, the protective door is locked, and the safety functions are disabled.

The dual check safety function provides these safety functions while the protective door is opened, as described above. Some of the safety functions continue working while the protective door is closed.

The dual check safety function has the following safety functions:

- 3.1 SAFE-RELATED I/O SIGNAL MONITORING
- 3.2 EMERGENCY STOP
- 3.3 SAFE SPEED MONITORING
- 3.4 SAFE MACHINE POSITION MONITORING
- 3.5 SAFETY POSITION SWITCH FUNCTION
- 3.6 SAFETY RELATED PARAMETERS CHECK FUNCTION
- 3.7 PARAMETER LOCK FUNCTION
- 3.8 SAFETY POSITION ERROR MONITORING FUNCTION
- 3.9 AMPLIFIER CIRCUIT MONITORING FUNCTION
- 3.10 SAFETY BRAKE SIGNAL OUTPUT FUNCTION
- 3.11 CPU SELF TEST FUNCTION
- 3.12 SAFE STOP MONITORING

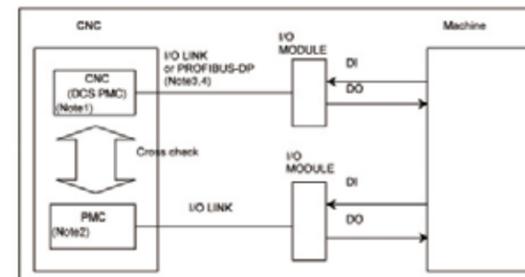


3.1 SAFE-RELATED I/O SIGNAL MONITORING

A set of safe-related I/O signals are connected to the two channels of the I/O respectively. As for safe-related I/O signals, a pair of signals are prepared and connected to each I/O through different paths. The two independent CPUs individually check the input signals. If a mismatch between two corresponding signals is found, the system enters the safe stop state. The following safe-related I/O signals are monitored or output in redundant mode:

- Emergency stop input signal
- Protective door state input signal (Request to monitor for each axis)
- Input signal for selecting safety speed monitoring and safety position monitoring
- Input signal for monitoring the MCC contact state
- Output signal for turning off the MCC (power-down)
- Output signal for position switch
- Output signal for brake control
- User defined safe-related I/O signals

The duplicated input/output signals are always checked for a mismatch, regardless of whether the safety function is active or not. When a signal state changes, the pair of signals may not match for some period because of a difference in response. The dual check safety function checks whether a mismatch between the two signals continues for a certain period of time, so that an error resulting from the difference in response can be avoided. The check period must be specified as a safety parameter.



3.2 EMERGENCY STOP

The Emergency Stop signal is monitored in redundant mode. When the emergency stop is input, the servo motor slows down to a stop and enters the dynamic brake stop. The spindle slows down to a stop as instructed by the PMC (Ladder program), and then the power is shut off.

3.3 SAFE SPEED MONITORING

If the safe speed range is exceeded while the protective door is opened, the dual check safety function immediately enters the stop state. If each axis or spindle is not stopped, the dual check safety function enters the safety stop state. For each feed axis and spindle, up to four safe speed ranges can be specified in safety parameters.

3.4 SAFE MACHINE POSITION MONITORING

While the door is opened, the dual check safety function checks whether the position on each feed axis is within the safe machine position range defined by safety parameters. If it detects a machine position beyond the safety range, the dual check safety function immediately enters the stop state. If each axis is not stopped, the dual check safety function enters the safety stop state. For each feed axis, up to four safe positions can be specified in safety parameters.

3.5 SAFETY POSITION SWITCH FUNCTION

It is checked whether the machine position is within the range of safety position switch. The checked result is outputted to the Safety Position Switch signal. The correspondence between axes and each signal is specified by the parameters. In case of 1 path system, up to 32 points can be specified. And in case of 2 or more paths, up to 64 points can be specified.

3.6 SAFETY RELATED PARAMETERS CHECK FUNCTION

At every power-on, the CNC checks the safety related parameters are destroyed and are transferred to the SV, the SP and the PMC normally. The SV, the SP and the PMC also check the safety related parameters are trans-

ferred from the CNC normally.

If any problem is found in this check, an alarm is generated and the MCC is shut off. (*DCALM=0)

3.7 PARAMETER LOCK FUNCTION

It is possible to lock the rewriting of the safety related parameters. The parameter No.3225 and No.3226 unlock these parameters. The following parameters are locked.

3.8 SAFETY POSITION ERROR MONITORING FUNCTION

Both the CNC and the SV check whether the servo following error of each axis exceeds the limit of deviation specified by the parameters. If the servo following error exceeds, an alarm is generated and MCC OFF signal (*MCFVx) is output immediately.

3.9 AMPLIFIER CIRCUIT MONITORING FUNCTION

The SV and the SP transmit the data of plural axes to amplifiers through one electronic circuit (LSI). The CNC, the SV and the SP check whether this transmission is performed normally without placing data on wrong address.

3.10 SAFETY BRAKE SIGNAL OUTPUT FUNCTION

The CNC and the SV output the Safety Brake signal (*BRKx) to control the mechanical brake. When this signal is "0", mechanical brake must be activated. When this signal is "1", mechanical brake is allowed to be released.

3.11 CPU SELF TEST FUNCTION

The CNC, the PMC, the SV and the SP carry out the following self-diagnosis. If the error is detected, the alarm is generated and sets MCC Off signal (*DCALM) to "0".

3.12 SAFE STOP MONITORING

When a safety door is open, safe stop monitoring for servo axis and spindle can be recognized by the combination of several functions.

Reference: FANUC B-64004EN/02 Dual Check Safety Operator's Manual, Chapter 1-Chapter 3.

Products

Advanced Auxiliary Tool Panel

When machine is under cutting process, calling and managing tooling on an advanced auxiliary tool panel --“Remote Tool Load Station”. So convenient!

Processing program of large-scale machinery or 5-axis machinery often is converted from a CAD CAM software which needs a large number of tools to complete the complex requirements of the workpiece by one set-up. Since the processing time is usually long, the operator need to set up tooling management during machining process. While there are a large amount of tools, it takes much time for tool loading/unloading.

Hence, a Remote Tool Load Station is developed for this demand. An easy-operating panel is installed near the tool magazine for convenience. The device provides tool number from 32 up to 255 tools. By using this panel, operator can save time and access tools easily.

It can simplify tool maintenance and selection procedure, save customers' time for tool change. CW or CCW directional rotations are acceptable. Operators can key-in the tool numbers directly without waiting for tool selection and operate tool table updating/tooling checking without stopping machine. This improves the machine efficiency and increases productivity.

The function description of the Remote Tool Load Station is displayed as below Fig. 1.

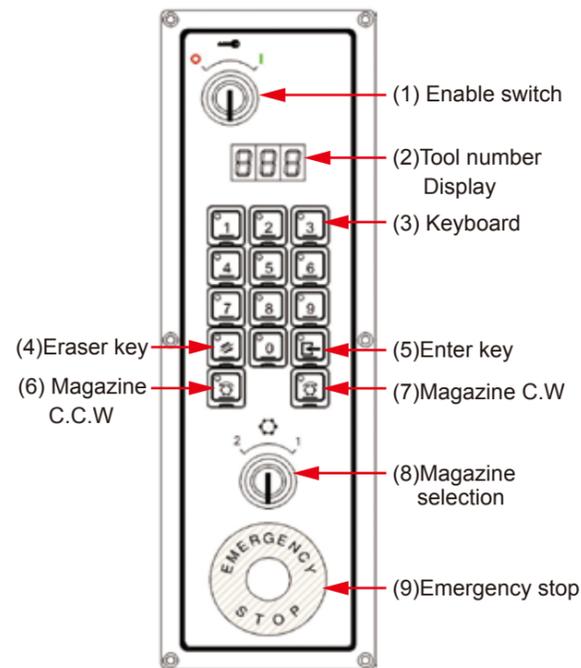


Fig.1 Function key distribution drawing



Safety protection:

The safety protection between machine automatic tool change and the remote tool load station is well considered. While the Remote Tool Load Station is neabled , CNC auto mode tool change will wait until Enable Switch is in “OFF” position and CYSTART is pressed from main operation panel, then CNC will carry out auto tool change. During the automatic tool change mode, the Remote Tool Load Station function will be locked until the mode is finished.

During operation, all messages including stand by model, CNC working and alarm messages are displayed on machine CNC to be easily seen by operator.

Tool selecting functions

Tool selection can be executed manually or automatically. Manual mode is used at single tool pocket rotation when the door opens. Auto mode is to call tool pocket directly. When magazine is more than one set, there is a

selection switch on the station. This is particularly designed for MCG-5X which is possible to have two magazine stations.

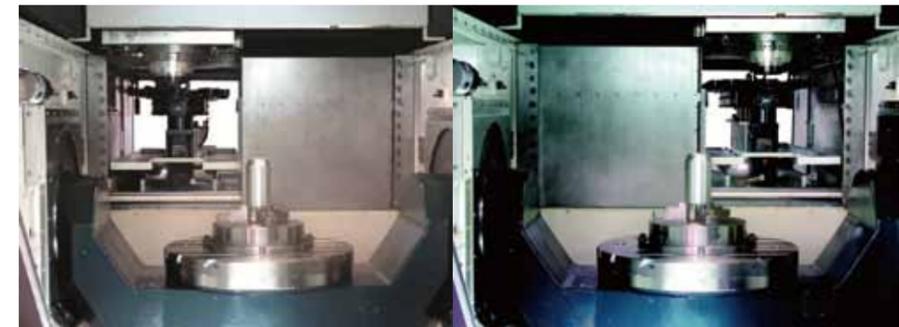


Fig 2. MCG-5X two tool stations



Fig. 3 MCG-5X tool station 96 tools

Maximum pocket number setting

At rear side of Remote Tool Load Station, maximum pocket number is easy to set up through digital keyboard and DIP switch shown as Fig.4. The maximum setting value is 255pockets.



Fig.4 Maximum pocket setting switch

FAQ *Trouble Shooting*

B-axis home position compensation on HBM-4 with Heidenhain controller.

Dear Dean,
The B-axis home position is moved by accident, we need to re-adjust the home position, please give us the procedure.

Dear Mark,
There are four steps to re-adjust the home position, please follow the instruction below.

1. First step: Table parallelism checking

Making sure the X/Z-axis gibs are well fastened and movement is less than 0.005mm before adjusting the alignment of table.



Fig. 1 Z-axis gib



Fig. 2 X-axis gib

Executing B-axis home reference. As shown in fig.3, fix the indicator on the spindle and touch the T-slot when it's clamped to measure the parallelism of T-slots by moving X-axis with portable handwheel. The tolerance should be under 0.02mm.



Fig. 3 Parallelism measurement

If the tolerance of the parallelism of T-slot is over 0.02mm, adjusting the gibs as shown in Fig. 4 to reach this accuracy.

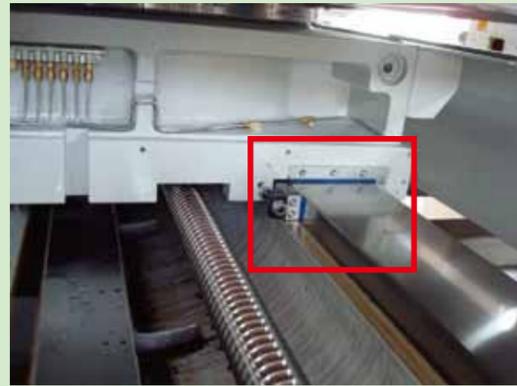


Fig. 4 Gibs under saddle

2. B-axis backlash compensation and drifting value set up

Pressing next page (right arrow) button and then pressing MOD to enter the password page.

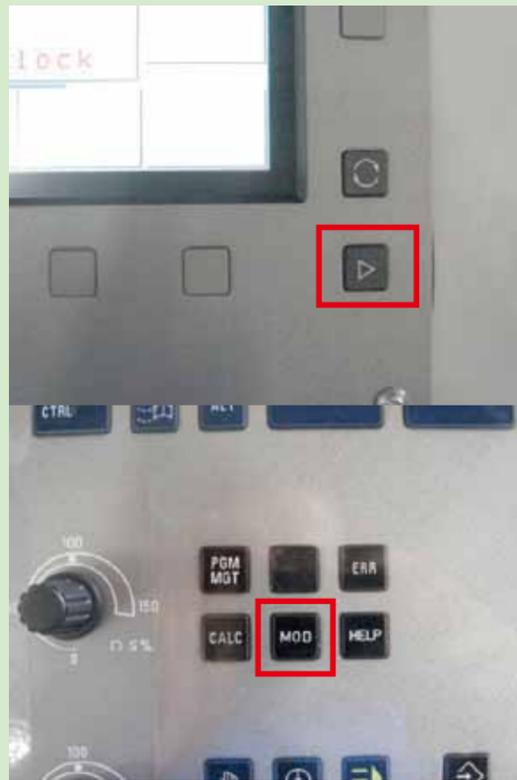


Fig. 5 MOD key

Please key the password "95148" and press ENT to enter to MP parameter setting page.

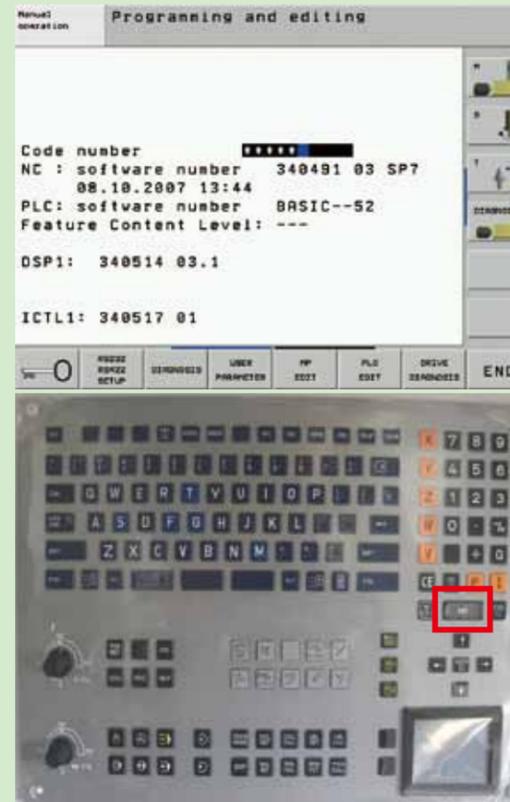


Fig. 6 password

In the MP parameter table, press GOTO, and key in 960 (SHIFT), then choose 960.3 (B-axis shift), key in the value needed, and press END.



Fig. 7 MP parameter table

3. Backlash adjustment.

Please execute the home reference firstly.

Put the indicator on the spindle, and put the probe on the side of the table.



Fig. 8 Indicator on spindle

Execute B axis +30 degree or +45 degree.



Fig. 9 Table rotation

Back to 0 degree and check the error indicator shows, the value is backlash of the B-axis.



Fig. 10 Return to 0 degree

FAQ *Trouble Shooting*

4. B-axis backlash adjustment.

Pressing next page (right arrow) button and then pressing MOD to enter the password page.



Fig. 11 MOD key

Please key the password "95148" and press ENT to enter to MP parameter setting page.

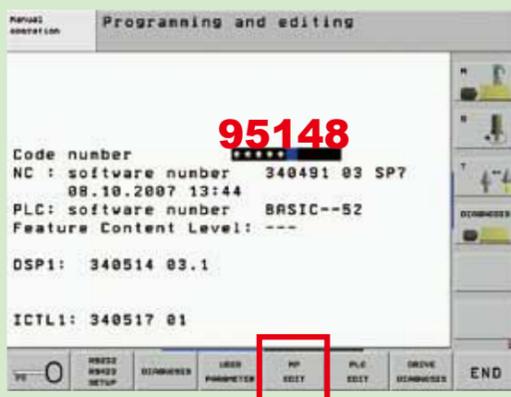


Fig. 12 password

In the MP parameter table, press GOTO, and key in 710 (backlash), then choose 710.3 (B-axis backlash), key in the value measured from step 3 and press END.



Fig. 13 MP parameter table

EVENT METAV 2012

28. Februar – 3. März Düsseldorf

VOLZ in METAV 2012



METAV is the second-largest German metal processing fair held in Düsseldorf, Germany every two years. It displays the state-of-the-art manufacturing technologies in the metalworking industry including machine tools, precision tools, automation technologies, and customization equipments. The international exhibition of manufacturing technology and automation offers a platform for the personal interaction between supplier and investors where industrial customers from Germany and Europe make their earliest investment decision.

The duration of METAV this year was from 28th February to 03rd March. Around 700 exhibitors from 26 different countries and more than 40,000 trade visitors from over 30 different countries came to Düsseldorf for the five days fair. Although a big part of exhibitors and visitors were from Germany, there were considerably more and more European visitors joining the show. According to Dr. Wilfried Schäfer, Executive Director of VDW*, "Foreign customers that need to make investments are now using METAV to inform themselves, to make comparisons and to conclude contracts".

In fact, not only big enterprises, small and medium-sized suppliers also had strong willingness to invest, some of them even placed orders directly at the fair. Each of the customers, who had decision-making authority and specific investment projects, placed 5.8 orders at METAV on average.

VOLZ had displayed a wild range of Microcut's products in METAV. Machine models across all product line were exhibited including CNC lathe (flat bed BNC series 1860/2260/2660), linear machining center MM430, high

speed machining center V20, 5-axis high speed machining center V20/5 and horizontal boring machine HBH-4. The feedback received was very positive that around 80% of these machines were sold during the show.

"The consistently positive mood of visitors and exhibitors, and a good year economy forecast have been talked, especially in the metalworking industry for jobs and sustainable upswing", said Mr. C. Volz. From the order received, Volz made a successful show in the Metav 2012.



METAV 2012 was closed with a tremendous business success that both visitors and exhibitors showed great satisfaction. In related questionnaires, four out of every five exhibitors said that they had reached the targets set for the fair. To summarize the show with what Schäfer said about it, "As the first major metal processing trade fair in the current year, it demonstrated impressively in an uncertain political environment that industry is optimistic and that the sectors supplied continue to be keen to invest."

*VDW: German Machine Tool Builders' Association, the organizer of METAV.

EVENT AMB 2012 Preview

One of the leading events of the metalworking and processing

AMB International Exhibition has a very long tradition and is recognized as one of the highly specialized exhibitions for metal working. AMB Stuttgart 2012, held from 2012-09-18 to 09-22, is going to showcase the latest products and services. And it focuses on further the internationalisation with regard to exhibitors and visitors – Accompanying programme to present the current trends in the industry.

AMB is a key to the market since its convenient location of nearby airport and easy access of public transportation increase the international importance and significance of this trade fair. In 2010, the show increased international characters with 1/4 from outside the Germany, while the proportion of foreign visitors increased from seven to eleven per cent. They were, with a new record, from 80 countries. AMB 2012 has set its goal high, and it is expected to surpass the great success of 2010.

MICROCUT in AMB 2012 THE CHALLENGER

The show is a perfect opportunity demonstrating the machines to Germany and East Europe markets. This year, Microcut – the Challenger is going to present the latest development of Microcut Machine in AMB and expect to have a meeting with all of respected customers on the booth.

Buffalo Machinery is going to present models from various series including 5-axes vertical machine, high speed vertical machining centre, horizontal boring machine and CNC teach-in lathe. In 5-axes vertical machining center, **MCG-5X** and **MU-5X** are presented. These two models are developed to achieve the best working conditions even for extremely complex work pieces; they are therefore perfectly suitable for industries of aerospace, automobile, mechanical engineering and medical engineering in Europe. MCG-5X is gantry type design equipped with 5-axes simultaneous machining function, 1800rpm spindle, 630mm rotary table, 96 ATC and 1200Kg heavy loading. MU-5X, a semi-gantry type machining centre equipped with smaller loading capacity and less ATC numbers, offers shorter tool-changing time. As to high speed vertical machining center, **V30** is exhibited. This model is one of the special series of Buffalo's high speed machining VMC, which is particularly suitable for die and mold manufacturing because of its super accuracy and high speed performance. As for boring machine, **HBM-5T** is presented. It is a column moving type borer equipped with 130mm quill, long travel distances and large loading capacity rotary table, at the

same time, the spindle vibration supervision technology is applied on this model which is specially designed by Buffalo. In the case of CNC lathe, Buffalo owns a complete range of CNC lathe. The BNC series among them are especially recommended for beginning users of CNC lathes. In the exhibition, visitors will see **BNC-1840** displayed as a representative of Buffalo's CNC teach-in lathe.





Religious Art I - Master Huang, Yin- Pu

Master Huang is content with engaging in Buddhist sculpture, though he has been laughed by friends and relatives and suffering from economic constraints. He indulges himself in Buddhist scriptures and studies Chinese and Western Art attentively. He also visited China, Europe and the United State several times with a keen mind to discover his way of artistic creation. He combines both ancient and contemporary as well as Chinese and foreign features and also comprehends the profound meaning of art and finally creates his own art world.

Religious art is an art which is less objective criteria but full of subjectivity color. The expression of the religious art maintains the same as to the different category of human beings. It is a kind of art which can convey the harmony to all different sorts of people. Like a lonely marathon runner with no applause even may have no destination.

Through the way of human's thinking, the Art Work is trying to widen human's living space and makes it more comfortable. Master Huang uses his work to guide people into their depths of the soul and he always has an honest heart during working.

Master Huang believes that human beings can live together with dozens of summer and winter. Whether believes in karma or not, if one can truly understand the scriptures of The Diamond Sutra (one of the important Buddhist scripture) --- "Tathagata is neither whence (to come) nor whither (to go), he is why called the Tathagata. " If everyone can follow the right way to go and keeps the heart of innocence child, the society will be very peaceful without fears and worries. He thinks that rescuing and understanding sorrow is from forgiveness and guidance, not only benevolence. With this philosophy Master Huang created a well- known work in year 1991--- Happy Tathagata.

This Tathagata, shined with joy and amiable gesture of victory, can make people feel Master Huang's generous broad-mindedness.



Huang, Ying-Pu Profile
1956, Taiwan, Changhua

Current Occupation :

- Chief of the board of Taiwan public art research and development association.
- Chairman of the association of honorary Probation officers for Prosecutor's office in Taichung District Court.
- Chief of the board of Chun Hua non-profit organization administration academy.
- Program committee member of public art of Taichung City.



Happy Tathagata (Tathagata is a Buddha's name)

The World of Mortality

The "World of Mortality" is a specific term in Taoism*, referring to the boundless cosmos where human being lives. To be more specifically, there are three different levels when it comes to the meaning of the term in Taoism. The first one is from its literal meaning explicitly - the dust, especially the flying dust. The second one, explained from a broader sense, represents a bustling and flourishing world. The third one is mundaneness which refers to its profound meaning from the viewpoint of religion and philosophy, indicating the universe where lives come and go, live and die. Quoted from the Shurangama Sutra, one of the famous Buddhist scripture in Buddhist countries, "Each of us people born here in the world is like a fine mote of dust which suddenly rises high and suddenly falls low."

Origin of this series is quite special. Why did a Buddha sculptor create statues of naked women? One day when master Huang was sculpturing a Buddha statue, an image of woman face bursted into his brain and kept interrupting him to finish the statue. Because of this image, the Buddha statue could not be finished with a dignified face it should have. Therefore, master Huang decided to start painting numerous figures of naked women in order to eliminate the naked woman image from his mind. Through the process of painting naked women, all the naked images cannot disturb him anymore because these images have become like ordinary objects to him. After finishing the Buddha statue successfully, master Huang started his creation of the "World of Mortality".

"Advantages or disadvantages of art works are not existed". To master Huang, mature heart creates mellow art works, immature heart creates encouraged art works; therefore, there are no right and wrong for art works, any of them created by a conscientious heart has its own unique meaning. Expressing the real living way and feeling is simultaneously showing the sincere nature of an artist.

* Taoism (or Daoism) refers to a philosophy or religious tradition that emphasizes living in harmony with the source and essence of everything that exists.

