QUARTERLY 2017 VOLUME 9 ISSUE 34

THE CHALLENGER

global quality and service system of metal working industry

Newsroom
- EMO Hannover 2017 Exhibition News

Product
- Microcut M series

R&D Zone
- Model of Contactless Power Transfer System for Linear Track

Application
- Uniformly digital order management – Connected Machining

Key Component
- Deciding factors - Sauter relies on complete machining
- Spindle performance optimization

People
- Live for love, from youth to age – the centenarian Fr Andrés Díaz de Rábago

SMT + ART Features
4th Industrie Revolution Products

AXILE Line

SAUTER®

Mit uns dreht die Welt!

437 SERIES

- Built-in motor design, saves 25% installation space.
- Tool speed up to 12,000 rpm.
- Suitable for back machining.
- Special cooling design for long-term period cutting.
- Extremely quiet running.

75% Saving space | High speed | Back machining | Special cooling | Quiet running

SAUTER ASIA CO., LTD.
No. 368, Sec. 4, Huanzhong Rd.,
Nantun District, Taichung, Taiwan
TEL:+886-4-2380-5836
FAX:+886-4-2380-5832
http://www.sauter-group.com
E-mail:info@sauter-asia.com

Shanghai De Xiao Precision Machinery Co., LTD.
No.99, Lane 333, Changdong Road, Xinqiao Town,
Songjiang District, Shanghai
TEL:+86-21-5764-9075
FAX:+86-21-5764-9076
http://www.sauter-group.com
E-mail:infocn@gptrading.net

TÜVRheinland CERTIFIED ISO 9001:2008 Management System

2017 Symposium : Breakthrough - Targeting Industrie 4.0

CONTENTS

02 From the Publisher
- Why is Axile launched

03 Newsroom
- EMO Hannover 2017 Exhibition News

05 Global Outlook
- United Kingdom

08 Product
- Microcut M series

10 Distributor
- XYZ Machine Tools Limited (UK)

12 R&D Zone
- Model of Contactless Power Transfer System for Linear Track

16 Application
- Uniformly digital order management – Connected Machining

18 Event
- The Success of AXILE New Brand Launch

20 Key Component
- Deciding factors - Sauter relies on complete machining
- Spindle performance optimization

23 FAQ
- Procedure to copy log book out in Heidenhain TNC controller

25 People
- Live for love, from youth to age – the centenarian Fr Andrés Díaz de Rábago

Publisher: Paul Chang | info@mail.buffalo.com.tw
Editor: Iris Chen | a15@mail.buffalo.com.tw
Editorial board: Paul Chang | Iris Chen | Juan Martin | Kelly Chuang | Doris Lin
Layout and typesetting: Treasure Map Advertising Corp.
apchen.ap@msa.hinet.net

Subscription: Buffalo Machinery Co. Ltd.
56, Lane 318, Desheng Road, Daya District,
Taichung City 428-46, Taiwan
TEL: +886-4-25 60 37 59 | FAX: +886-4-25 60 37 69
www.buffalo-machinery.com

AXILE MICROCUT

Article contribution is welcome!

The Challenger welcome submission from all fields of machine tool industry related. The Challenger is committed to prompt evaluation and publication of submitted articles. Company profiles, production experience, feedback of using MICROCUT's products are the most valuable article to share with "The Challenger" readers. Please send the article and pictures (if any, images resolution in 300 dpi or above) to the local Challenger Factory Outlet or email to info@mail.buffalo.com.tw

Why is Axile launched ?

It is interesting and exciting to hear people are still asking " Why Buffalo Machinery launched the new brand AXILE" ? Almost two months now after the brand presented on the Targeting Industrie 4.0 symposium and TIMTOS 2017. The whole marketing team must have something done right and good, so we see the feedback is strong and positive. It is certainly not only a new brand for the company, it is an additional or separate brand to stand for a line of high tech products, by this way Buffalo is happy to support all the distributors doing a great job, and benefit the end users finding a new line of high speed machine which meet the needs of a company who intends to enter the new manufacturing environment, it is ushering in the fourth industrial revolution. It is the internet of thing (IoT) and service capability.

In the future, businesses will establish global networks that incorporate their machinery, warehousing systems and production facilities in the shape of Cyber-Physical Systems (CPS). In the manufacturing environment, these Cyber-Physical Systems comprise smart machines, storage systems and production facilities capable of autonomously ex-changing information, triggering actions and controlling each other independently. This facilitates fundamental improvements to the industrial processes involved in manufacturing, engineering, material usage and supply chain and life cycle management. The smart factories that are already beginning to appear employ a completely new approach to production. Smart products are uniquely identifiable, may be located at all times and know their own history, current status and alternative routes to achieving their target state. The embedded manufacturing systems are vertically networked with business processes within factories and enterprises and horizontally connected to disperse value networks that can be managed in real time – from the moment an order is placed right through to outbound logistics. In addition, they both enable require end-to-end engineering across the entire value chain. (Ref)

To reach above mentioned target, products or devices are required to be able to predict its Mean Time Between Failure (MTBF), it should be produced on high reliability, process and components monitoring become possible, and all these data are designed to be transmitted via internet which enable the management group of user company and equipment producer to analyze, if any of these information reach a level of failure, service technician will be able to make service appointment. And the equipment will be able to be replaced or adjusted to the right and good condition of its shape, it makes the production as planned. This is the goal of the fourth industrial revolution, in the meantime, to ensure customer satisfaction.

A new line of products covered by AXILE is designed and developed based on this target. AXILE product is going to create a better performance, energy saving and linkable to user's production system which makes the future manufacturing smart. The nature and feature of this line is different to the traditional line, the reason why it is important to carry with the new name, because the products carry with Smart Machining Technology and Agile Reliability Technology, they work smart and service smart.

Dr. Paul Chang
May 2017

The President of Buffalo Machinery,
A Smart Machining Technology Service

EMO Hannover 2017 Exhibition News

Visit Buffalo at the EMO 2017
Hall 27 Stand A46

After a four-year interval, the global leading machine tool exhibition EMO 2017 is approaching on 18th September in Hannover, Germany. The trade fair will be showcasing the entire bandwidth of modern-day metalworking technology with the latest machine and solutions, technical services, which will attract visitors from all major industrial sectors. In last time in 2013, there were 2,131 exhibitors from 42 countries coming to Hannover exhibition to make a resounding success including Buffalo Machinery. There were total of 143,000 international visitors' arrival to the trade fair, among them, 41% are international visitors coming from outside of Germany and about 80% of all visitors were directly involved in purchasing decisions. This year, there are around 2,000 exhibitors from 42 different countries participated in the event with booking area of 152,000 square meters.

The theme of EMO 2017 is "Connecting systems for intelligent production". As the world's leading trade show and the sector's highlight of the year, the EMO's organizers are confident that the EMO Hannover 2017 will generate important impetus for implementing the much-discussed concept of Industry 4.0 or the Internet of Things (IoT). There will be numerous presentations of solutions and technology related to digitization and networking to increasing productivity and reducing downtime, including big data analytics applications, condition monitoring, predictive maintenance and augmented reality. "Experts expect networking to trigger a quantum leap forward in terms of improving productivity and competitiveness among users in all sectors," says Christoph Miller, Trade Fair Director at the VDW, speaking at the EMO's press conference in Nairobi on 1 March 2017.

AXILE

Gantry type 5-Axis Vertical Machining Center

- Best dynamics supported by gantry design
- High-performance built-in spindle
  - 7/39 kW spindle up to 15000 rpm
  - 25/35 kW spindle up to 20000 rpm
- Automatic Tool Changer with 32 to 120 tools capacity
- Automatic roof for overhead crane loading and unloading
- Linear scale with 0.1 μm minimum measuring step in three axes
- High accuracy enhancement
  - Tool-tip Positioning Control (TPC)
  - Axial Accuracy Control (AAC)
- High reliability enhancement
  - Spindle Vibration Supervision (SVS)
  - Reliability Maintenance (RM)

C-type 3-Axis Vertical Machining Center

- Entire body made of high-quality casting
- Wide Y-axis guideway distance
- Wide selection of high-performance spindle
  - In-line spindle 12000 rpm
  - Built-in spindle from 15000 rpm to 24000 rpm for selection
- Automatic Tool Changer with 30/32/40 tools
- High accuracy enhancement
  - Tool-tip Positioning Control (TPC)
  - Axial Accuracy Control (AAC)
- High reliability enhancement
  - Spindle Vibration Supervision (SVS)
  - Reliability Maintenance (RM)

EMO Hannover 18-23·9·2017

BUFFALO MACHINERY
HALL 27 STAND A46

Right before EMO 2015, Buffalo announced the establishment of Microcut Europe, the European service center and machines and spare parts warehouse in Croatia to offer the best support to Buffalo's European distributors and customers. After that, Buffalo made spur growth during the period by starting delving into the Industrie 4.0 technology. Buffalo persisted in not only continued efforts to refine the quality of original products but did in-depth study in research and development on mechatronic design and reliability technology to extend beyond the automation, which later on has made it a successful launch of the new brand AXILE in TIMTOS 2017.

Encouraged by the previous success of EMO exhibition, and to create better experience of visitors, in EMO 2017 Buffalo reserved a bigger booth and plans to showcase both of its innovative products of new brand AXILE and the high performance generalist brand Microcut in the important global trade fair. All AXILE 3-axis and 5-axis machines are built for high-speed machining and feature the integration of Smart Machining Technology (SMT) and AXILE Reliability Technology (ART) to ensure and enhance the excellent machining performance and high reliability to meet the Industrie 4.0 needs. Besides, the newly upgraded Microcut line, including multitasking machine and heavy duty lathe will be sure to catch customers' attention.

MICROCUT

Linear Way Vertical Machining Center

M1200

- Four-low linear recirculating ball bearing guideways
- Optimal rigidity by high-quality casting
- Reinforced with heavy ribs to resist vibration.
- High precision roller type linear guideways
- Wide selection of high-performance spindle
  - Belt Drive spindle 10,000 rpm
  - In-line spindle 12,000 rpm
  - Built-in spindle 14,000 rpm
- Cartridge spindle for easy maintenance
- Multiple flush solution for easy chip clean out

Twin-Spindle Single-Turret Slant-Bed Lathe

LD65

- One-piece Meehanite casting base with ribbed bed for maximum stiffness
- 30 degree slant bed for easy chip removal
- Max turning diameter Ø380mm; Max turning length 520/1020mm
- Primary spindle 4000 rpm; Second spindle 5000 rpm
- Y-axis with 100 mm motion distance
- Rotary C-axis with braking system
- Compact design with small floor occupation

Slant-Bed Heavy-Duty Lathe

117HT

- One-piece 45 degree slant with all-box-way structure
- Max turning diameter Ø700mm; Max turning length 1.3 m~3.8 m
- Large bar capacity of 117mm
- Fast hydraulic turret of 8 or 12 stations
- Cartridge type headstock for easy replacement
- 2-step gear box providing high spindle power and torque output.
- Programmable tailstock
- Y-axis with +-50 mm motion distance (option)
- Rotary C-axis with braking system (option)

Reference

- *EMO Hannover. Global machine tool business set to gather momentum in the EMO year. January 23, 2017. Available: http://www.emo-hannover.de/home*
- *EMO Hannover. EMO Hannover 2017 heading for a record. December 14, 2016. Available: http://www.emo-hannover.de/en/press/press-information/press-releases/press-release_2368.xhtml*

United Kingdom

The changing kingdom

United Kingdom located in north-west of European continent with a total area of 242,500 square kilometers, is the 78th-largest sovereign state in the world and the 11th-largest in Europe. The United Kingdom consists of four countries: England, Scotland, Wales, and Northern Ireland.

The UK joined EU in 1973 and shared a long and rocky relationship since then. On 23 June, 2016, the EU referendum took place and the people of the United Kingdom voted to leave the European Union. Comparing with the previous referendum in 1975, the anti-EU voice got much stronger in this one after 43 years. The referendum attracted the record breaking turnout of more than 30 million people voting since 1992. The UK has voted by 52% to 48% to leave the European Union. Leave won the majority of votes in England and Wales, while every council in Scotland saw Remain majorities.

Economy

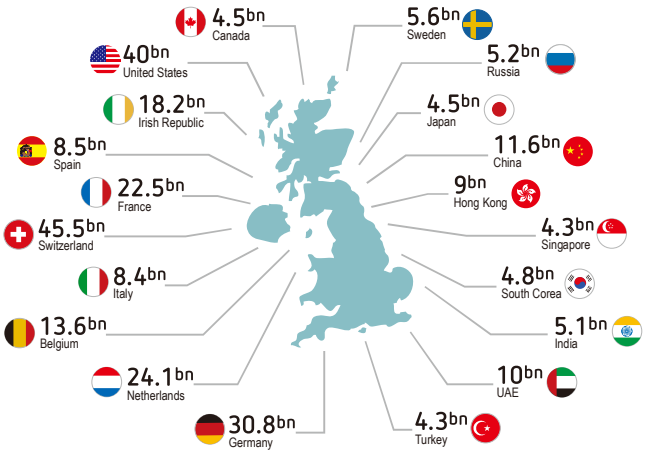
A Changing Landscape

The UK has strong trade links with the EU of all time; in 2015, 44% of the UK's goods and services were exported to the EU. EU remains the UK's largest single trading partner. In addition, strong economic growth in many emerging economies outside of the EU has resulted in non-EU economies growing in importance to UK trade. These emerging economies include the frequently referenced BRIC markets of Brazil, Russia, India and China; however a significant proportion of UK trade remains with long-established trading partners such as the US, the UAE, South Korea and Japan.

UK trade with EU and non-EU countries 2015
Goods and Services

	Exports		Imports		Balance
	£ billion	%	£ billion	%	£ billion
EU	230	44%	291	53%	-61
Non-EU	287	56%	257	47%	31
Total	517	100%	547	100%	-30

(Source: ONS Balance of Payments Stat Bulletin)



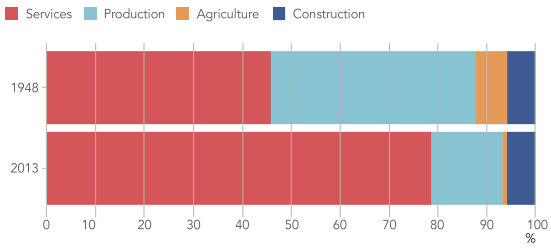
(Source: The Office for National Statistics, 2014)

Gross Domestic Product

In the Monthly Economic Commentary of Office for National Statistics released in February 2017, the UK economy has a year growth rate of 1.8% in 2016, which is some way below the average rate of calendar year GDP growth in the decade. The UK GDP growth in Quarter 4 2016 still showed a continuation of strong consumer spending. The economy growth over the years was driven by strong consumer spending, while business investment declined.

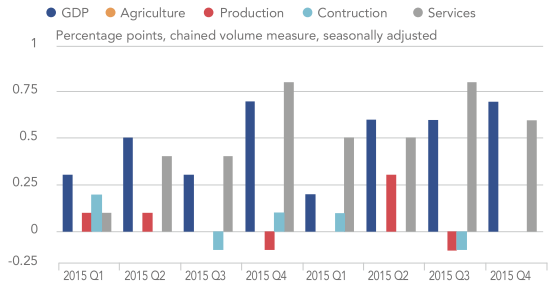
The UK runs a trade deficit in goods and a trade surplus in services with the EU. Gross domestic product (GDP) growth is the main indicator of economic performance. There are 3 approaches used to measure GDP: the output approach, the expenditure approach and the income approach. Today's UK economy is dominated by the service sector. According to Office of National Statistics(ONS) report, the services industry accounts for 78.8% of the country's GDP and contributes the most to GDP growth, even stronger than production sector.

Percentage of GDP coming from the services, production, agriculture and construction sectors, UK, 1948 and 2013[2]



(Source: Index of Services, ONS)

Output components percentage contribution to UK GDP growth, quarter-on-quarter Quarter 1(jan to Mar) 2015 to Quarter 4(Oct to Dec) 2016



(Source: ONS)

Inflation and Consumer Prices Index

According to the latest inflation report released by ONS, the CPIH (Consumer Prices Index including owner occupiers' housing costs) inflation rate, which ONS started to use for replacing CPI as the new consumer price inflation gauge in the 2017, 12-month rate of 2.6% in April 2017 has climbed steadily since late 2015. Comparing to the inflation rate in the United Kingdom which averaged 2.58 percent from 1989 until 2017, the latest official figure shows it is the highest inflation rate since September of 2013.

CPIH 12-month rates for the last 10 years: April 2007 to April 2017

(Source: Office for National Statistics)

The inflation rate has been on an upward trend since the Brexit vote last year due to a fall in the sterling value, meantime, the gradually rising prices are reflected in the consumption of people's livelihood supplies, which may be challenging for British households.

Manufacturing

With vast demand for vehicles from abroad, UK car production just hits its best month in 17 years in March 2017. A total of 1.7m cars were produced in UK in 2016, and the SMMT (The Society of Motor Manufacturers & Traders) believes the number could surpass 2m by 2020, breaking the previous record of 1.92m set in 1972.

CAR MANUFACTURING

	Feb-16	Feb-17	% change	YTD-16	YTD-17	% change
Total	141,764	153,041	8.0%	279,316	301,004	7.8%
Home	36,884	34,143	-7.4%	67,995	64,170	-5.6%
Export	104,880	118,898	13.4%	211,321	236,834	12.1%
% export	74.0%	77.7%		75.7%	78.7%	

Overseas demand drives output, with 13.4% growth in February taking year-to-date output to 301,004 (Source: SMMT)

The UK manufacturers have reported strong growth in orders both from domestic UK manufacturing and from abroad over the first quarter of 2017, according to the latest quarterly CBI (Confederation of British Industry) Industrial Trends Survey. Meanwhile the export orders also recorded the strongest growth in six years.

In a 2017 Manifesto of EEF (The Manufacturers' Organization), it urges the government to use the opportunity to fully commit to a comprehensive industrial strategy and to build on the momentum created by the recent increase in GDP and PMI in manufacturing performance.

However, the weak pound may stoke inflation and push up costs. CBI chief economist, Rain Newton-Smith commented, "Exports have surged and firms are at their most optimistic about selling overseas in over four decades. Even so, the combination of the weak pound and recovering commodity prices means that cost pressures continue to build, and manufacturers report no sign of them abating over the near-term."

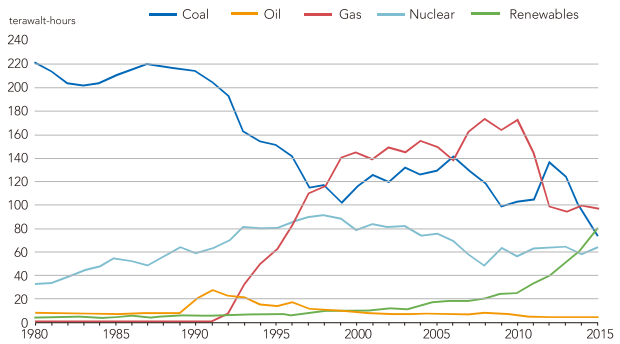
Energy

The UK as the most energy-rich advanced industrial country in Europe has various resources of coal, oil, natural gas, nuclear power and water, etc., and is one of the world's large energy producer countries. Besides, the UK was the first European country to liberalize its electricity market. Over the years, the government has been working to build a low-carbon future and included de-carbonization as important target to ensure energy security by developing a diverse energy market.

With the adjustment of energy policy, the latest Carbon Brief analysis showed that the UK's CO2 emission has fallen by 5.8% after a massive reduction in coal use. The result is contributed by lower coal consumption and higher carbon prices. The government made an important decision to coal power plants by 2025 and plan to replace the energy with cleaner source. In response to changing demand, a new car tax rule has kicked on April 2017 that people will pay a rate based on the vehicle's CO2 emissions level. The purpose of the rule encourages the use of electric vehicles or hybrid cars to reduce carbon emissions.

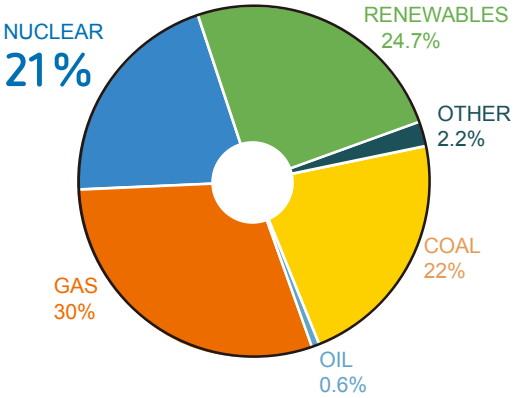
In today's UK, gas and renewable energy are the main fuels used for UK electricity generation. Renewable energy has grown steadily since 1980. In 2015 renewables overtook coal for the first time to become the second largest generator of electricity, accounting for 24.7% of total UK electricity generation. Of this, 60% came from wind and solar power.

Electricity supplied by fuel type, UK, 1980 to 2015



(Source: UK energy in brief 2015, Table 23 and Energy Trends Table 5.1 for 2015 data)

Energy consumption in 2015



(Source: NIA, Press Releases)

The UK is also the first country in the world to set up a "Climate Change and Energy Department" that deals with climate change issues. As we know that carbon dioxide is responsible for the largest amount of greenhouse gas emissions, and according to report that it accounts for 82% of the total in 2014. The UK has both international and domestic targets for reducing Greenhouse Gas GHG emissions. The 2008 Climate Change Act established the world's first legally binding emission target of reducing greenhouse gas emissions by at least 80% of 1990 levels by 2050.

The Challenger summarizes and organizes information from various sources, and take no responsibilities for its correctness, immediacy, or completeness.

Reference

1. *Massey, F. (2017, February 22). Monthly economic commentary: Feb 2017. Retrieved from https://www.ons. gov.uk/economy/nationalaccounts/uksectoraccounts/articles/monthlyeconomiccommentary/feb2017*
2. *Office of National Statistics (2017). Available: http://visual.ons.gov.uk/uk-perspectives-2016-trade-with-the-eu-and-beyond/*
3. *BBC (2017). UK service sector sees strong expansion in December. Available: http://www.bbc.com/news/business-38515971*
4. *ONS Digital. (2016, September 29). Five facts about… the UK service sector. Retrieved from http://visual. ons.gov.uk/five-facts-about-the-uk-service-sector/*
5. *Hughes, M. (2017, February 22). Second estimate of GDP: Quarter 4 (Oct to Dec) 2016. Retrieved from https://www.ons.gov.uk/economy/grossdomesticproductgdp/bulletins/secondestimateofgdp/quarter4octtodec2016*
6. *Tucker, J. (2017, May 16). UK consumer price inflation: Apr 2017. Retrieved May 17, 2017, from https://www.ons.gov.uk/economy/inflationandpriceindices/bulletins/consumerpriceinflation/apr2017*
7. *Trading Economics (2017) United Kingdom Inflation Rate. http://www.tradingeconomics.com/united-kingdom/inflation-cpi*
8. *ONS Digital. (2016, May 25). UK Perspectives 2016: Energy and emissions in the UK. Retrieved from http://visual.ons.gov.uk/uk-perspectives-2016-energy-and-emissions-in-the-uk*
9. *"How important is the EU to UK trade?" Royal Mail, www.royalmail.com/corporate/your-business-matters/news-and-updates/eu-and-uk-trading-relationship. Accessed 19 May 2017.*

M series Linear Way Vertical Machining Center

Buffalo is committed to constantly improving the products for customers. Therefor Buffalo just launched a series of new, upgrading and highly versatile vertical machining center --- M series. M series provides customers with an extensive travel range and versatile spindle options of vertical machining center that customers can adapt to the ever-increasing demands on machining job.

The new M series is built with the robust and compact structure design to provide high rigid durability and reliability.
The M series brings high efficiency performance in terms of rigidity and versatility in its class, and is ideal to apply to high speed die & mold machining, green energy industry, automobile industry and high grade training institutions.

M-1050

Highlights

- **Cartridge spindle design for easy maintenance**
- **Precision ground ballscrew**
- **High rapid speed of 30 m/min on three axes**
- **Optimal chip removal design**
- **Quick and stable ATC**

M-760
Table(mm) 900 x 410
XYZ travel(mm) 760 x 440 x 460
Table load(kg) 350

M-800
Table(mm) 900 x 520
XYZ travel(mm) 800 x 500 x 500
Table load(kg) 450

M-1050
Table(mm) 1200 x 600
XYZ travel(mm) 1050 x 600 x600
Table load(kg) 800

M-1200
Table(mm) 1400 x 710
XYZ travel(mm) 1200 x 730 x 650
Table load(kg) 1000

M-1400
Table(mm) 1500 x 600
XYZ travel(mm) 1400 x 800 x 800
Table load(kg) 1000

M-1600
Table(mm) 1500 x 600
XYZ travel(mm) 1400 x 800 x 800
Table load(kg) 1000

Rigid foundation

- Solid Meehanite cast iron base
- Rib enhancement
- Structure optimization during design phase by using FEM simulation in ANSYS

MICROCUT
Your Reliable Partner


M-760


M-800


M-1200

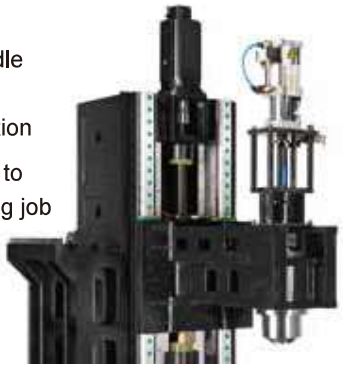
Spindle

High performance

- Spindle dynamic balancing
- High capacity cartridge spindle
- One-piece deign headstock
- Various spindle speed selection

Highly flexible spindle options to choose for variety of machining job

In-line Spindle
ISO40 Spindle Taper
12,000 rpm



Belt Drive Spindle	In-line Spindle	Built-in Spindle
ISO40 Spindle Taper 10,000 rpm	ISO40 Spindle Taper 12,000 rpm	HSK A63 Spindle Taper 14,000 rpm

Ballscrew

Robust capability - C3 Class Pretension Ballscrew

- Minimize heat deformation for high accuracy and repeatability
- Better damping effect to minimize chatter
- Direct-coupled servo ballscrew motor provide better contouring and threading

Automatic Tool Changer

Arm type ATC

- Stable and reliable tool change
- Quick tool change time
- Direct-coupled servo ballscrew motor provide better contouring and threading

24 tools 30 tools

High Precision Linear Guideway

- linear guideway on X/Y/Z axes to ensure high positioning accuracy with little friction resistance and
- Achieve loner life with high motion accuracy.
- XYZ axes rapid feed rate of 30 meters per minute

Ball type	Roller type
M760	M800/M1050/ M1200/M1400/M1600

XYZ Machine Tools Limited (UK)

What should be known about XYZ

XYZ is a company with more than 30 years of history and dedicated to selling machine tools in the UK. Buffalo started the cooperation with the company for MCU-5X (UMC-5X) took place in April 2017 with a series of well-organized events including press day, European day, VIP UMC day and general open day.

XYZ ensures to offer their customers with “the very best in its class” for every machine tool they sell. They assemble the Proto Trak controllers in the milling machines, and they test and customize VMC´s and Lathes in their impressive Devon Factory. Now, after incorporating Buffalo’s MCU-5X under its product portfolio with its own brand (with product name of UMC-5X within XYZ line), XYZ is ready to offer wide range and more high-tech level machine tools for the UK customers.

XYZ factory in Devon is a 10,000 square meters beautiful, clean and well organized machine tool assembly and preparation line. With a 2,000 square meters multilevel stock for spare parts which gives XYZ the ability to dispatch them at the same day of customers’ request. In addition to having Devon factory, XYZ has 5 showrooms and training centers across the UK, and offers free training at any XYZ Center. Customers can expect tailor-made service plan from XYZ to ensure trouble-free machine running and get support from well-trained XYZ team to bring optimum value of every investment they made with XYZ machines.

With a total of 70 staff, XYZ reaches turnover of 40 M€ which is around 5% of all UK consumption for machine tools. XYZ has 11 salesmen to cover the whole country and customers can expect solutions from professional XYZ service team which includes 14 service field engineers, 5 support engineers on their service advice and programming help hot-line and 6 application engineers for training and free support for programming throughout the lifetime of the machine are guaranteed for every customer. Having so well-organized company structure, professional personnel and passion for machine tools, XYZ successfully makes the brand well known in the UK and has more than 5,000 customers in UK with over 20,000 machines installed till now.

A great success of MCU-5X (UMC-5X) launch

Undoubtedly, as a well-established company, XYZ's managing director, Mr. Nigel Atherton, together with his team have their strategy to make the business continue to grow. It is straightforward to find out why XYZ could be so successful by looking how they organized a product launch. On 19th and 20th April, XYZ made a successful event to present Buffalo's MCU-5X for its VIP days. The two days event took place in their HQ in Tiverton, Devon (South-west) on the 19th and their showroom in Nuneaton, Birmingham (Centre) on the 20th.

Before the VIP days, XYZ made the most elaborate preparations for the event by having advertisement on the first page of important machine tool magazine, issuing very nice product catalogues, inviting media MTDCNC to discuss unique selling points of MCU-5X and hand delivering invitations for its VIP customers. XYZ's commitment to offering best service could also be found by how they understood customers' needs by having XYZ sales people, WNT (the tooling company), FeatureCAM (the CAM company producing the 5-axis program), Heidenhain and Siemens representatives for the controller, finance agent and Buffalo ready at customer's disposal during VIP days.

All the hard work paid off and totally around 35-40 VIP customers with genuine interest showed up for the VIP days. The VIP program was repeated 4 times (two sections per day) and consisted of a Keynote presentation by XYZ's application manager Mr. Mike Corbett and the production of an aluminum DEMO test part showing MCU-5X's capacities in roughing, 3-axis, 3+2 and 5-Axis simultaneous machining. The feedback of VIP days can be expected in the following few weeks but from the discussion with Mr. Nigel Atherton and XYZ's sales manager Mr. Martin Burton after the VIP days, they were very optimistic and believed 4-5 customers with hot projects on hand might place orders within the first month and some others were serious in making investment for MCU-5X in the following 6 months.

UK machine tools market is picking up after the uncertainty about Brexit is getting clarified. Buffalo expects XYZ to sell more than 10 machines in the first year after the product is well established in UK market and we together with XYZ can gain more market share of 5-axis machine tools in the UK which consumed more than 170 sets of 5-axis machine in 2015!!

Nigel Atherton, Managing Director of XYZ Machine Tools Limited

The Challenger would like to acknowledge XYZ for the contribution of photos.

Model of Contactless Power Transfer System fo

Dr. Yi-Lin He, Dr. Ching-Feng Chang

ABSTRACT

This paper proposed a model of Contactless Power Transfer System(CPTS), which adopted a transformer with big air-gap and long primary wires. The system has the characters of long leakage inductance, small magnetizing inductance and low coupling coefficient. It makes the transmission efficiency very low, this model improved system efficiency by adopting resonance of compensation capacitance and leakage inductance in transfering energy to the load. The Maxwell/IsSpice simulation is applied to verify the feasibility. A contactless power transfer system for linear track is confirmed. The experimental evidence reported 0.21 Ω primary impedance and 7 A primary current. The transferring efficiency of CPTS can reach 76%.

Keyword: Contactless Power Transfer System (CPTS)、contactless transformer

I. INTRODUCTION

Recently, modern technology brings up dated knowledge to improve a lot of products quality.Products with small volume, multiple functions, convenient to carry, safety and easy to repair, become keypoints of deuelopat. However, metal oxidation of electric plug and dust cover in the environment often leads to reduced transmission efficiency or contact problem. In fact, the research and development of this technology is not popular. To improve the knowledge development, it is value to study the fundamental principle and design guideline of a contactless switching mode, Fig.1 shows a model of contactless power transmission system for linear track.

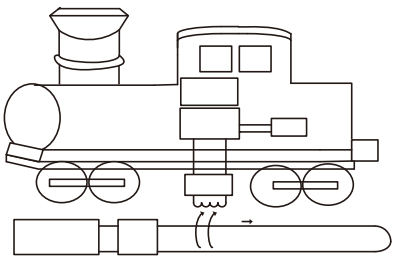


Fig.1 model of contactless power transfer system for linear track

II. Literature review

The basic structure of contactless power transmission system consists 4 components as shown in Fig. 2, they are power energy conversion device, coupling device, system compensated circuit and rectifier/filter circuit. The power energy emission system. And system compensated circuit and rectifier/filter circuit contains an energy receptive and regulatory system. Although these two units are relatively independent, but they interact each other due to the coupling relationship between their magnetic fields [3-4].

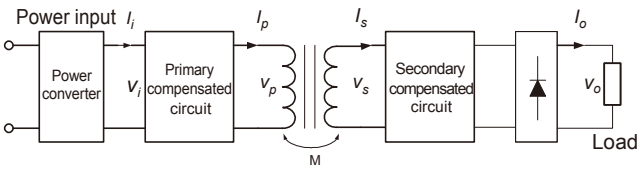


Fig. 2. Structural diagram of contactless power transmission system

According to Laws of Faraday's and Ampere's. The concept of contactless coupling induction system for linear track is based on the electromagnetic induction coupling, the current and electromagnetic field transmission of primary coil to independently isolated equipments. The transmission of power and energy from the electromagnetic field is similar to the magnetic power transmission of wireless microwave[1-2]. The only difference is that wireless microwave transmission is rating higher frequency and lower energy.

Fig.3 shows a basic structure of the contactless power transmission system. There are two independent systems that transmit electrical energy for mutual inductance coupling in between the litz wire and the transformer. Analysis shows that contactless power transmission system related papers are mostly related to circuit applications [3]. Papers [4-7] depict the coupling relationship between primary side and secondary side of litz wire and transformer and the contactless power transmission system working efficiency analysis. Also, paper [8] shows the iron core, and relative locations of air gap and winding intended to seek best coupling coefficients.

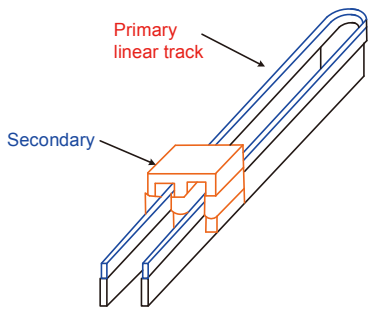


Fig.3 model of contactless power transmission system for linear track

III. SYSTEM DESIGN

System construction

Fig. 4 shows an DC to DC converter, The input is equipped with voltage 110 volt and 60 hertz .A full-bridge rectifier and a high frequency curve gain through the standardized half-bridge DC/AC switching circuit. Further, the high frequency curve passes through matching transformer and contactless coupling induction coil,which can be considered as isolated input and output stage. At the output stage, full-bridge rectification circuit is applied,the power been conducted thru the rectifier and filtering device. Finally, DC 14-16V voltage is provided for the load device. Power switching S1 and S2 in half-bridge conversion circuit is high-frequency MOS switch IRF640.

or Linear Track

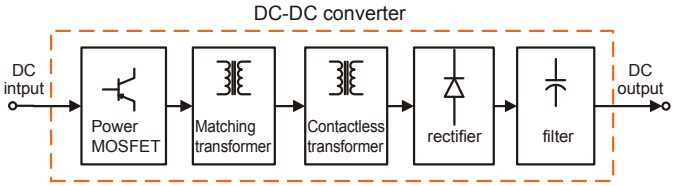


Fig.4 main system construction

3.1 Control circuit

Fig. 5 shows the main circuit. A self-oscillate half-bridge driver IR2153 is used in the main controller. The half bridge driver provides features of low loss and adjustable oscillator's function operating frequency. The RC oscillator constituted by C and R are determined as Eq. (1)

$$f = \frac{1}{1.4(R_T + 75)C_T} \tag{1}$$

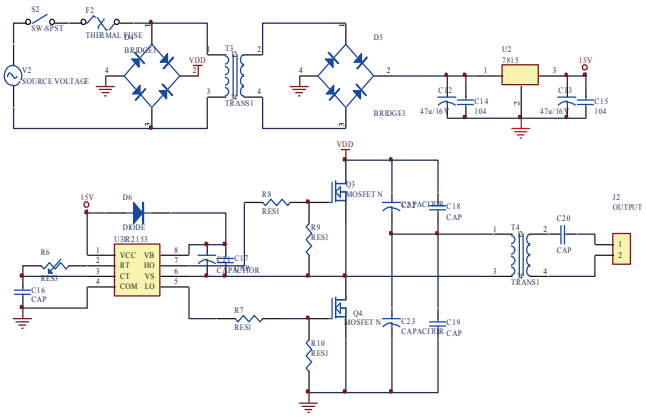


Fig.5 Structural diagram of circuit

3.2 Design of contactless transformer

Fig.6 shows the transformer construction. A switch type power supply is used as a half-bridge converter and its input power is DC. L_p represents as the inductance of primary side C_p represents as power switching S1 and S2 adopted in half-bridge conversion circuit which is high-frequency MOS switch IRF640. A series of compensation at primary side been used. Therefore, a composed circuit called "LCL resonant circuit is done". Impedance on LCL resonant circuit reflected by load is the magnetic coupling coefficient of the secondary side, and it represents as M. C_s is the inductance value of the coil of the secondary side.

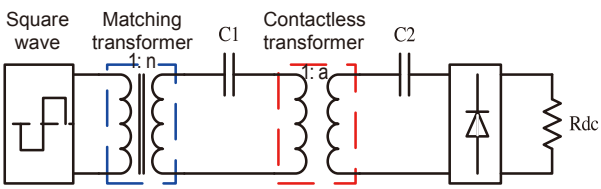


Fig.6 transformer construction

Fig.7 shows an equivalent model of the contactless transformer. "a" is determined as Eq. (2), and "a" may not be equal to actual turns ratio "N_1/N_2" of the transformer, coupling coefficient "K", which is determ ined as Eq. (3), which is less than 1. If "K" is equal to 1, then "a" become the ratio of "N_1/N_2". Here, "L_{lk}" and "L_m" are the leakage inductances and magnetizing inductance of magnetically coupled coils, L_{lk} and L_m are determined as Eq. (4) and (5), respectively. In Fig. 7, leakage inductance can be divided in winding inductance, L_{wp}, and leakage inductance of core L_{lk}. Hence, all there datas can be analyzed and measured.

$$a = \frac{L_s}{M} \tag{2}$$

$$K = \frac{M}{\sqrt{L_p L_s}} \tag{3}$$

$$L_{lk} = L_p\left(1 - K^2\right) = L_p - \frac{M}{a} \tag{4}$$

$$L_m = \frac{M}{a} = L_p K^2 \tag{5}$$

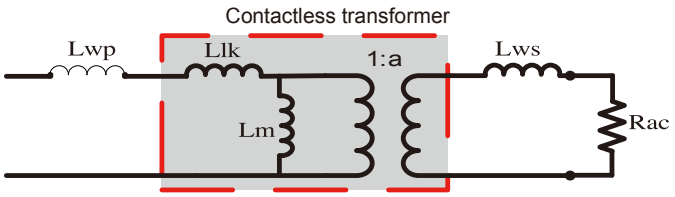


Fig.7 Equivalent model of the contactless transformer

A capacitive output filter is applied for resonant converter and A current source is driven the rectifier. A square wave of voltage appears at the rectifier. Thus, the equivalent ac resistance is given by:

$$R_{ac} = \frac{8}{\pi^2} = R_{DC} \tag{6}$$

$$R_{in} = \frac{R_{ac}}{n^2 \times a^2} \tag{7}$$

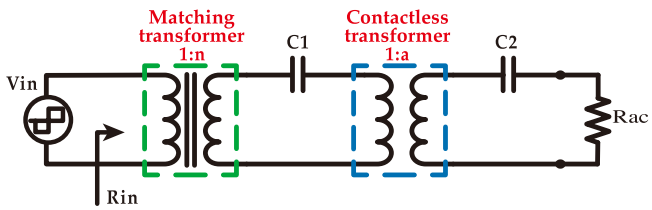


Fig.8 Equivalent model of the transformer

3.3 Design of compensation capacitor

In general, contactless transformer has large air gap, long primary wire does not contact with transformer core. Therefore, transformer leakage inductance is larger than magnetizing inductance. Which create a result with low coupling coefficient (k) and the overall system efficiency is not good as expected. In

order to minimize the detrimental effects of large leakage inductance, small magnetizing inductance and low coupling coefficient of contactless transformer, a half-bridge resonant converter topology is selected.

Fig. 9 show a contactless power transfer system which adopts series resonant converter, the primary resonant frequency f_p between C_p and L_{lk} is equal to secondary resonant frequency between L_m and C'_s primary resonant frequency. f_p, f_s and C_s are determined in following equations.

$$f_p = \frac{1}{2\pi\sqrt{L_{lk}C_p}} \tag{8}$$

$$f_s = \frac{1}{2\pi\sqrt{L_m C_s'}} \tag{9}$$

$$C_s' = a^2 C_s \tag{10}$$

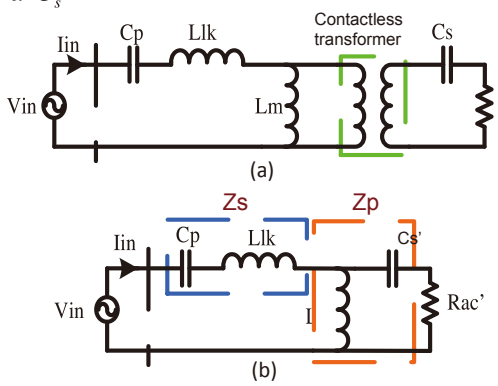


Fig.9 Equivalent model of series resonant converter

VI. SIMULATION AND EXPERIMANT

Figure 10 shows the simulation results performed by Maxwell to observe the magnetic flux distribution of the proposed contactless transformer. At shows a smoothly magnetic field, a stable output transmission is given.

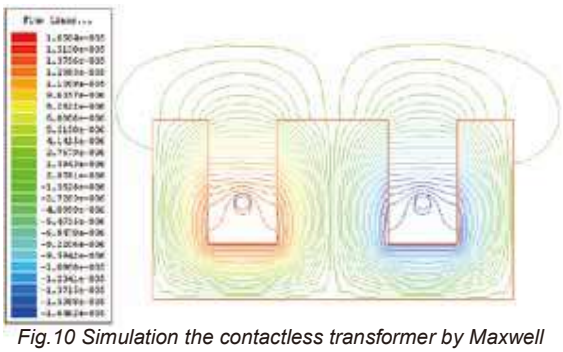


Fig.10 Simulation the contactless transformer by Maxwell

Table I shows specifications and parameters of the contactless transformer. Primary and secondary compensate capacitors are 3.47uF and 34uF, respectively.

Table I parameters

Primary self inductance (L_P)	8.43uH
Secondary self inductance (L_S)	793.20 uH
Leakage inductance (L_{lk})	8.12 uH
Contactless transformer Turns ratio (a)	12
Coupling coefficient (K)	0.19
Primary winding resistance (R_p)	0.21 Ω
Primary compensate capacitors (C_s)	3.47uF
Secondary compensate capacitors (C_p)	34uF
Matching Transformer turns ratio (a)	0.04

In this paper, the Is-Spice is used for simulation, Fig. 11 shows Is-Spice simulation circuit diagram of the contactless charge system. In this simulation, the system power is replaced by a 150V DC and assumed the internal impedance is negligible.

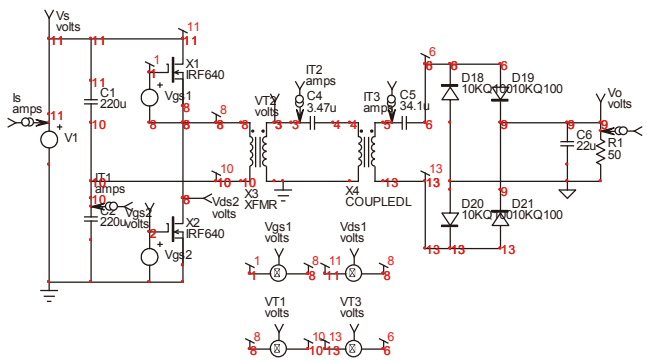
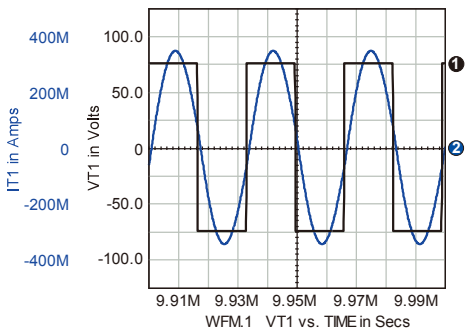
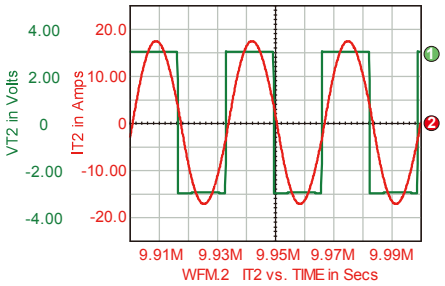


Fig.11 Is-Spice simulation circuit

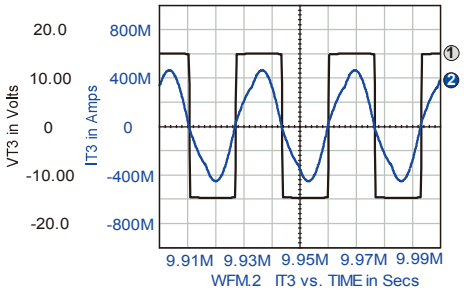
Fig.12(a) shows the simulation waveforms of the voltage and the current in the matching transformer. Fig.12(b) shows the voltage and the current in the contactless transformer. Fig.12(c) shows the voltage and the current in the load.



(a) primary input of matching transformer



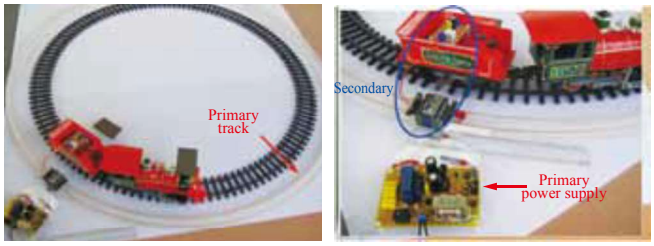
(b) secondary output of matching transformer



(c) output of contactless transformer

Fig.12 simulation waveform

The experiment test is shown in Fig. 13. Fig. 13(a) shows a complete system, and Fig. 13(b) showa a zoom photo of primary and secondary.



(a) *(b)*

Fig.13 experiment system

Fig.14(a) shows the experiment waveforms of the voltage and the current of the matching transformer. Fig.14(b) the voltage and the current of the contactless transformer. Fig.14(c) the voltage and the current in the load. Fig.15 shows the waveform of input voltage and output voltage in the system. The output voltage of the linear induction transformer is just the rectified waveform obtained by a bridge rectifier. The output voltage connected with the 50Ω load is 16.1V. The experimental results meet the value and output of simulation.

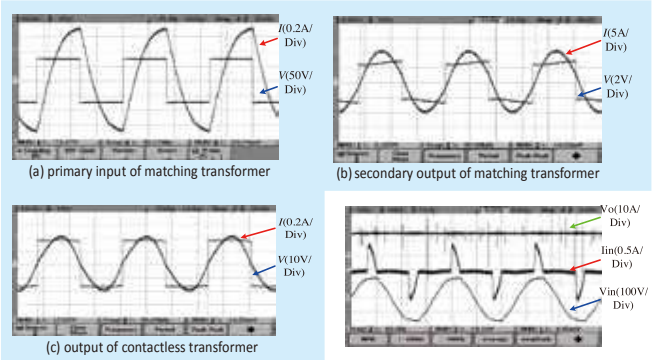


Fig.14 Experiment voltage and current of waveforms

Fig.15 system input voltage and output voltage of waveform

V. CONCLUSION

In this paper, contactless power transfer system been studied and a contactless power transfer system for linear track been developed. We analyzed and designed the verified system through Maxwell and IsSpice simulation. The result shows as followings: 1. the primary current of the contactless transformer is 7A. 2. the primary resistance of the contactless transformer is 0.21Ω with loss of 10W, which is about 50% of total power. We conclude that the magnetic system and the power electronics is up to 76% if the loss is deducted.

REFFERENCE

[1] B. M. Song, J. H. Kim and J. S. Lai, "A Multilevel Soft-Switching Inverter with Inductor Coupling," IEEE Transactions on Industry Applications, Vol. 37, pp. 628-636, March-April 2001.

[2] R. J. Wai, et. al., "High-efficiency Fuel-cell Power Inverter with Soft-switching Resonant Technique," IEEE Transactions on Energy Conversion, Vol. 20, pp. 485-492, June 2005.

[3] O.H. Stielau and G..A. Covic, "Design of loosely coupled inductive power transfer systems," International Conference on Power System Technology, Vol. 1, pp.85-90, December. 2000.

[4] A. Ecklebe and A. Lindemann, "Analysis and Design of a Contactless Energy Transmission System with Flexible Inductor Positioning for Automated Guided Vehicles," Conference on IEEE Industrial Electronics, pp 1721-1726, 2006.

B. Choi and J. Nho, "Contactless Energy Transfer Using Planar Printed Circuit Board Windings,"

[5] Electronics Letters, Vol. 37, No. 16, pp. 1007-1009, August 2001. X. Liu, P.W. Chen, and S.Y.R. Hui, "Equivalent circuit modeling of a multilayer planar winding array structure for use in a universal contactless battery charging platform," Proc. of IEEE Applied Power Electronics

[6] Conference, vol. 2, pp.1366-1372, March. 2005. F. Nakao, et. al., "Ferrite Core Couplers for Inductive Chargers," Power Conversion Conference,

[7] Vol. 2, pp. 850-854, April 2002. C. S. Wang, O. H. Stielau, and G. A. Covic, "Design Considerations for a Contactles Vehicle Battery Charger," IEEE Transactions on Industrial Electronics, Vol. 52, No. 5, pp.1305-1314, October 2005.

[8] M. Ryu, et al., "Comparison and Analysis of the Contactless Power Transfer Systems Using the Parameters of the Contactless Transformer," Power Electronics Specialists Conference, pp 1-6, June 2006.

[9] S. C. Rho, et al., "A study on power transmission system using resonant frequency tracking method and contactless transformer with multiple primary winding," International Conference on Electrical Machines and Systems, pp 1635-1639, October 2007.

Uniformly digital order management
– Connected Machining

The well functioning transfer of knowledge contributes decisively to the success of any company. To transfer knowledge quickly and without loss, effective communication via e-mail is just as much a matter of course as the universal availability of electronic production documents or the transfer of data to merchandise management systems and production activity control systems. The tools and raw materials in stock, tool data, fixture setups, CAD data, NC programs, and inspection instructions must be available to machine operators across all shifts. Eco- nomic manufacturing therefore demands an efficiently working process chain and a numeric control connected to this network.

The Heidenhain TNC640, with its **Connected Machining** package of functions, integrates itself flexibly into your process chain and helps you to optimize the transfer of knowledge within your company. So let your workshop also profit from all the information and intelligence available in your company. **Connected Machining** makes uniformly digital order management possible in networked manufacturing. You thus profit from:

- Easy data usage
- Time-saving procedures
- Transparent processes

The networked TNC 640

By integrating the TNC 640 with its **Connected Machining** functions in your company network, the control connects the workshop with PCs, programming stations, and other data storage devices in other areas of your company:

- Design
- Programming
- Simulation
- Production planning
- Production

Even in its standard version, the TNC 640 features a latest-generation Gigabit Ethernet interface in addition to its RS-232-C/V.24 data interface. The TNC 640 communicates with NFS servers and Windows networks in TCP/IP protocol without needing addition- al software. The fast data transfer at rates of up to 1000 Mbit/s guarantees very short transfer times. The TNC 640 offers the best technological conditions for **Connected Machining**, the networking of the control in the workshop with all areas of your company that accompany production.

Standard performance range

In order to be able to use the data that you have transmitted to the control via the standard network connections, the TNC 640 offers you several interesting applications, even as part of the standard scope of functions. A CAD viewer, PDF viewer oder the web browser Mozilla Firefox make the simplest form of **Connected Machining** possible: access to manufacturing process data right at the control.

The operation of web-based documentation software or ERP systems is just as possible here as access to your e-mail inbox. The following file formats can also be opened directly on the TNC:

- Text files ending with .txt or .ini
- Graphic files ending with .gif, .bmp, .jpg, or .png
- Table files ending with .xls or .csv
- HTML files

Data transfer with Connected Machining
An additional solution for uniformly digital order management as part of **Connected Machining** is the free **TNCremo** software for PCs. With it, and even over the Ethernet interface, you can

- transfer remotely stored part programs and tool or pallet tables in both directions
- start the machine.

With the powerful **TNCremoPlus** PC software you can also transfer the screen contents of the control to your PC using the live-screen function.

Using order-related data on the control With the **REMOTE DESKTOP MANAGER (option 133)** you operate a Windows PC directly from the TNC 640. You can access IT systems of the process chain directly from the control, and you also profit from much more efficient setup procedures by eliminating tedious journeys between the machine and the office. Technical drawings, CAD data, NC programs, tool data, work instructions, parts lists and warehouse information are digitally available at the machine. E-mails can be sent and received very easily. With a simple keystroke on the machine operating panel you can switch between the control screen and the screen of the Windows PC. It can be a computer in the local network or an industrial PC in the machine's electrical cabinet.

With the IPC 6641, HEIDENHAIN offers an industrial PC with very high computing power and the newest processor architecture for installation in an electrical cabinet. This enables you to easily and efficiently solve even the most computationally intensive tasks in CAD/ CAM on your TNC control.

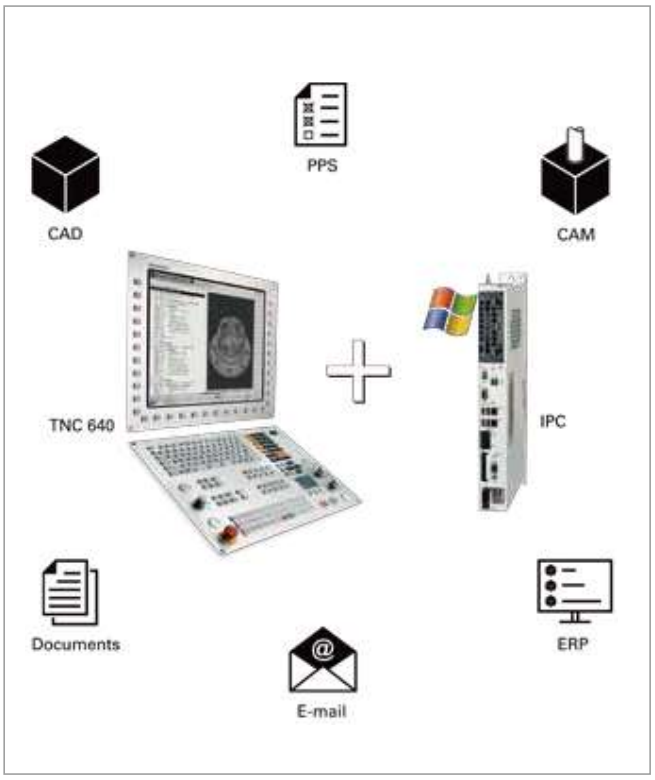
Detailed data for an optimal organization of the production process HEIDENHAIN DNC* has several functions, including the connection of TNC controls to merchandise management systems and production activity control systems. For example, this interface can be used for the configuration of automatic feedback messages about active production processes. This increases transparency in manufacturing even with a batch size of one and supports timely order management.

With the TNC 640 and **Connected Machining**, uniformly digital order management becomes surprisingly simple. Optimize your processes and use the full innovative potential of your workshop.

* The machine must be prepared by the machine tool builder for this function.

Your benefits

- **Windows-based applications directly on your TNC 640**
  Operate CAD/CAM system or manage job orders
- **Enhance competitiveness through an optimized information flow**
  Gaps in information cost valuable time and resources: optimized your data flow on the TNC 640
- **Use PC functions without draining on your machine's performance**
  Remote access removes the burden from the TNC control
- **More efficiency in manufacturing**
  Uniform data exchange and optimally coordinated processes enable economical production
- **Numerous functions in the standard version**
  Even without options, the TNC 640 enables you to improve many processes in the workshop



The Challenger would like to acknowledge Heidenhain for the contribution of material.

The Success of AXILE New Brand Launch

In March, Buffalo Machinery achieved the success in launching the new brand AXILE with a series of high-end machine tools in both the biennial Buffalo technology symposium and TIMTOS exhibition, to officially introduce the new brand AXILE to the global high-end machine tool markets.

Symposium

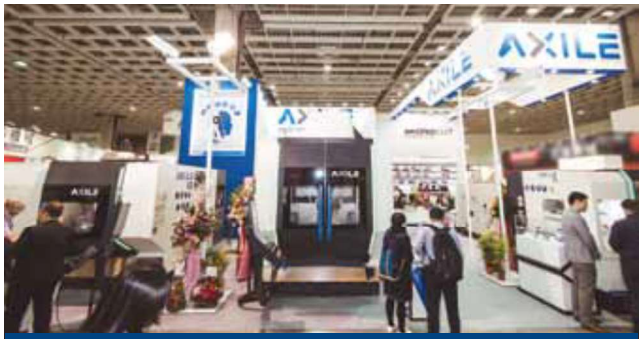
BREAKTHROUGH –Targeting Industrie 4.0

On 6 March 2017, the day before the Taipei International machine tool show TIMTOS, Buffalo hosted biennial symposium and grandly rollout of a high-end brand AXILE at ribbon cutting ceremony at Taipei Garden Hotel. Meanwhile, Buffalo made the public debut of AXILE machine series: V series (for 3-axis high-speed machining center) and G series (for 5-axis simultaneous high-speed machining center), and related solutions for Industrie 4.0. There were around one hundred attendees gathered for this event, including Buffalo's global distributors, professor from research institutes and academics, as well as technical partners and suppliers.

The keynote speeches were given and followed by two workshop sessions. The speakers are experts and experienced in the field to deliver information focus on the machine tool digitalization. Buffalo presented the spirit and design concept of the new brand AXILE and Industrie 4.0 solutions, in addition to the guidance of AXILE G series and V series with the advanced features and their competitiveness. There were also various aspects of Industrie 4.0 were presented, including monitoring of key components, such as spindle and guideways, manufacturing processes networking, cloud-based data analysis, together providing a broad view concept of Industrie 4.0.

At the workshop sections, attendees actively aired their opinions and discussed the adaptation and operation to the Industrie 4.0 and practical issues related to promote the market in both sections of R&D discussion and Marketing & Sales discussion, and talked about the competition in the industry. These discussions show the importance of the market trend and also make a great opportunity to more communication interactively.

In the 2017 symposium, Buffalo officially unveiled the new brand and its technology which reflects Buffalo has high-level innovation capability and related technology that meet the Industrie 4.0 requirements, from mechanical design, Mechatronic technology, IT operation and reliability maintenance. Buffalo believes that such an occasion will benefit all partners to head into an Industrie 4.0 future.



Buffalo booth in TIMTOS 2017

TIMTOS 2017

2017 Taipei International Machine Tool Show TIMTOS was successfully held from March 7 to 12. There were a total of 1,100 exhibitors participating to display their cutting-edge technology and products. According to official information, the exhibition attracted 50,146 visitors to the event, of which a total of 7,339 foreign buyers accounting for growth of 2.3% when compared with the previous. China, Japan, Malaysia, South Korea and Thailand are the top five countries contributing visitors. Among the European visitors, Turkey and Russia contributed the largest number of visitors for it. According to TAITRA, this exhibition has created the records on the number of exhibitors, booths and overseas visitors for the third session in a row.

Dr. Chang and distinguished guests hosted a ribbon cutting ceremony to celebrate the launch of new brand identity AXILE.

Dr. Paul Chang and keynote speakers

The theme of TIMTOS this year was “Industry 4.0 Plus and Smart Manufacturing”, featuring a series of machine tools with information technology integrated for intelligent machining. The exhibits of the exhibition were in line with the trend of Industrie 4.0 and comply to the demands of industrial upgrading, demonstrating products such as five-axis machining centers for aerospace and medical industry, automated machinery and manufacturing solutions, aiming to provide industrie 4.0 solutions for smart manufacturing and smart factory to meet the needs of one-stop shop for international buyers.

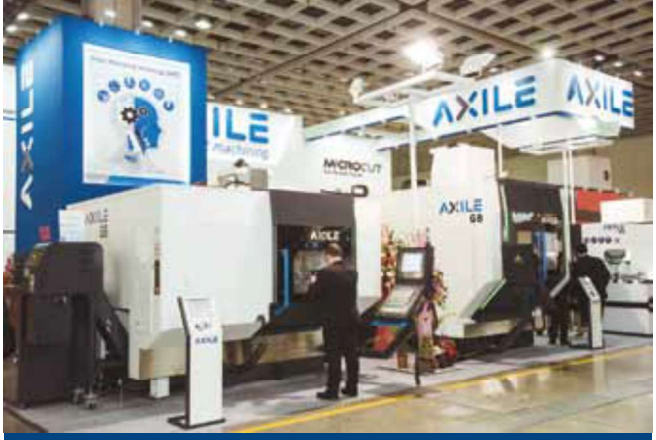
Through the long-term development of exclusive intelligent processing technology and real-time machine reliability monitoring technology, Buffalo has successfully developed high-speed machine tools that can be applied to the industrie 4.0 environment with high reliability. Buffalo also took this great opportunity to officially launch the high-end brand AXILE and its products to the market.

During the exhibition, more than 45 global distributors visited Buffalo's booth for business meetings, in addition, around 100 potential distributors were highly attracted to the booth and with interests in AXILE V series (High-Speed Vertical Machining Center) and G series (High-Speed 5-Axis Vertical Machining Center) and the competitive cutting-edge technology for Industrie 4.0. An on-site demonstration of real-time machine reliability monitoring through self-developed application platform successfully displayed Buffalo's exclusive monitoring solution and reliability maintenance technology. Buffalo received recognition on the innovative progress from many attendees. The newly launched MICROCUT LD-65 (Twin-Spindle Single-Turret Slant-Bed Lathe) was also exhibited at the booth, which provided visitors a great choice when considering a high productivity cutting lathe.

What is worth to mention is Buffalo ignited a bright start at the very beginning by giving impression to visitors. The visitors from all direction could easily be surprised by the large and bright AXILE posters on side of the exhibition hall and at the front entrance along the taxi/bus stops with curiosity over what was AXILE. AXILE attracted everyone's attention even in the venue and turned out to be the eye-catching talk of the show.

Buffalo’s Intelligent Technology for Industrie 4.0

In order to ensure the machining accuracy, energy saving and quality of the products, Buffalo proposed Smart Machining Technology (SMT) since 2009. All applications embraced are patented in the United States and Taiwan. In addition, in response to the needs of industrie 4.0, Buffalo delved into the development of reliability application technology - AXILE Reliability Technology, called ART, to strengthen the mechanical reliability and the real-time monitoring the mechanical status.

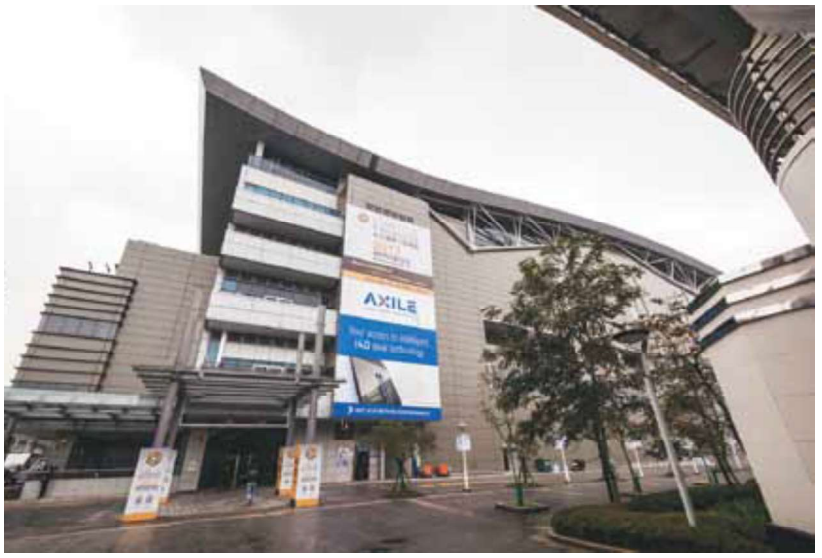


AXILE G5 and G8

AXILE V5

Microcut LD-65

In order to manufacture smart machines which meet the Industrie 4.0 requirements, Buffalo installed a variety of detection systems and sensors on the main components of machine to collect the available data and do further cloud-based analysis. Then the system generates the effective information for user’s reference. The concept about real-time monitoring of mechanical status during operation is to reduce or avoid machine unexpected downtime. ART particularly ensures the machine not only arranging energy control and achieving high productivity, but also combines with the end-user's ERP system to do more efficient production management, which is in full compliance with the requirement of the 4th generation of industrial revolution ---Smart Factory.



Buffalo integrated SMT and ART in AXILE new brand machines, which ensures consistent performance with high degree of productivity and reliability. Buffalo Machinery is the first Taiwan manufacturer which announced the machine tool with industrial 4.0 ready in TIMTOS 2017.

Continuous innovation

Buffalo holds a great vision to achieve the goal of being the largest manufacturer of high-end machine tools in Taiwan. To reach this specific target, Buffalo meticulously arranged in phases and made effort for each step: Starting from implementing Total Quality Management system (TQM) to boost enterprise competitiveness, followed by expanding plants in 2014, establishing machines and spare parts warehouse and service center in Croatia in 2015, and then developing the strategy of new brand in 2016, and officially announcing AXILE and products to the market in 2017, all were with step by step roadmap to achieve the great vision. Through the five-year roadmap of developing high-end machine tool for industrie 4.0, coupled by the strategies toward high-end market, today Buffalo has attained its first aim and is confident to confirm the feasibility of the goal of Vision.

With the successful global rollout of AXILE machines, Buffalo was convinced that the company is moving in the right direction, and will keep achieving maximum benefit by constantly innovation and continuous evolution to customer satisfaction.

development of reliability application technology - AXILE Reliability Technology, called ART, to strengthen the mechanical reliability and the real-time monitoring the mechanical status.

Deciding factors

Sauter relies on complete ma

Sauter Feinmechanik GmbH reacted to this trend with the pledge to manufacture complex components in as few settings as possible, with high precision and reduced idle times. In addition, the requirements for milling and turning operations are constantly increasing.

Thus milling performance is becoming ever more important for the tool turret. With this in mind, Sauter has created a new generation of turrets. With the powerful direct-drive tool turret, every lathe manufacturer now has the option of bringing the performance characteristics of its products close to that of a milling machine. (Figure1)

In the past, the central tool drive of turrets proved to be a weakness for high-performance machining. With impact loading, complex gear trains with bevel gears are subject to increased wear. This is particularly the case for milling with an interrupted cut or for polygon turning. With the patented Sauter solution – a tool drive motor directly integrated in the turret disc – the tools are now driven directly. Therefore the performance can be fully exploited.

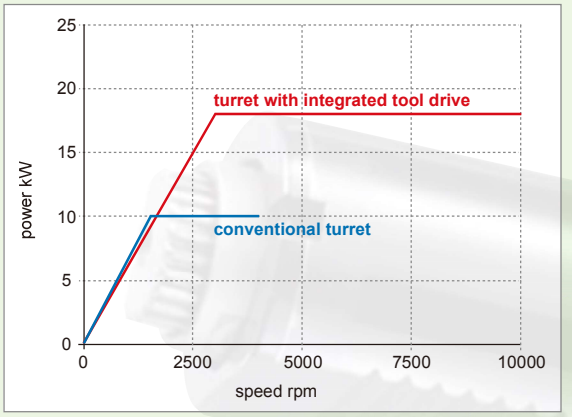


Figure 1: In comparison with conventional tool turrets the performance of a direct-drive turret is almost doubled.

The direct tool drive permits a maximum tool speed of 10,000 rpm (model size 20). The performance characteristics of the turret demonstrate the great potential when compared with the tool drive of a conventional turret. Whereas processes requiring high speeds were difficult to implement in the past, a speed of 10,000 rpm is achieved with the direct tool drive.

chining

To fully ensure process reliability with these new performance characteristics the turret manufacturer recommends using special Sauter direct-drive tools. A new range of tools resulted from the development of the turret concurrently. This protects the turret system and transmits the high power reliably to the cutting edge.

To summarize, the direct-drive tool turret has the following performance characteristics:

Max. speed: 10,000 rpm
Max. torque: 56 Nm
Torque: 33 Nm (100 per cent ED) Max. power: 18 kW
Rated power: 10.5 kW
(Values based on turret size 20)

Sauter motor spindles

To meet the market demand for more flexibility, precision and automation, increasing numbers of lathe manufacturers are relying on the additional application of motor spindles and B-axis. Sauter Feinmechanik recognised this trend and is continuously expanding its product range in this area.

Compact, precise and flexible – that is what makes Sauter motor spindles stand out from the crowd. The power spindles score points with features such as spindle bearing relief or our in-house-developed tool release unit, as well as a flexible construction.

One of the main features of the Sauter turning/milling spindle is its robust and precise construction. A three-part Hirth coupling, split into 7.5 degrees, enables the end user to carry out a multitude of turning operations with all kinds of geometries. For customers who wish to approach smaller angular positions, the experts from Metzingen replace the Hirth coupling with a multi-disc clutch. This enables all cutting areas to be reached.

Also unique is a full spindle bearing relief, by means of a second Hirth coupling. This absorbs the high forces resulting from the turning operation and guides them into the housing – and not across the sensitive spindle bearing. This increases the lifetime of the bearing by about 50 per cent.

Process reliability is extremely important to the Sauter experts. Therefore a sensor and a tool mount monitoring system watch over the status of the tool during operation. The current status is displayed on the machine control system. Thanks to this monitoring, the machine operator can easily observe the tools and take preventative action if necessary.

That every situation has been thought of is proven by the replaceable tool interface. Usually, the tool interfaces are permanently attached to the main spindle, not at Sauter. In case of damage, the screw-on unit can be easily replaced. Lubrication with long-life grease offers additional protection. With this maintenance-free spindle.

B-axis technology

In a package with a rotating unit, the Sauter power spindle becomes a B-axis. This additional axis enables five-axis machining, thus enabling workpieces with complex geometries to be machined. In addition, a preloaded, backlash-free gearbox and a high-precision encoder system enable an interpolating machining process.

Sauter motor spindles are available in sizes HSK 40 - 125 and Capto C4 - C8 X

The Challenger would like to acknowledge Sauter for the contribution of material.

Spindle performance optimization

X-life cylindrical roller bearings

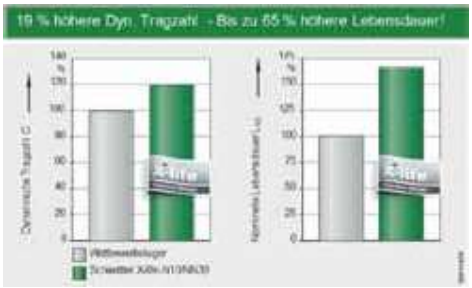
A new series of roller bearing with plastic cage which provide higher speeds, increased load ratings, reduced running noise and more design options

The new X-life generation, it has achieved an up to 19% further increase in the basic dynamic load ratings of its proven series N10 and NN30 high-precision cylindrical roller bearings in the bore diameter range between 30 mm and 120 mm. The bearings are equipped with a window-type cage made of PPA (polyphthalamide) high-performance plastic. Tests have shown that the X-life generation offer significantly improved speed capability compared to bearings with brass cage, and this applies to double row bearings in particular. Bearings with the new polyamide cage feature up to 12 K lower operating temperatures. At the same time, it achieved up to 25% higher speeds in the limiting speed test due to this reduced heat generation. More advantage of the lower running temperatures with polyamide cages in comparison to brass cages is longer grease operating life. The use of the light-weight plastic cage with better damping properties also has a positive effect on the running noise – the bearings run much quietly. With their increased limiting speeds, the new X-life cylindrical roller bearings enable significantly performance-enhanced designs to be implemented. This is especially true in combination with high-speed axial bearings of series BAX. Speed parameters of almost one million mm/min are possible with minimal quantity oil lubrication.

Bearings from Vacrodur – top performance for the future

One way to increase the load carrying capacity of bearings whilst keeping the speed capability constant is to use of superior bearing ring materials. The rolling bearings with rings of Cronidur have represented the top of the range for many years now in terms of superior load carrying capacity and grease operating life. In comparison, the new Vacrodur high-performance steel provides even higher static and dynamic load carrying capacity in conjunction with excellent wear behavior. Vacrodur is a powder metallurgically produced high-performance steel. Its fine, homogenous microstructure provides an excellent combination of hardness and strength. It has demonstrated exceptional wear behavior even under conditions of lubricant starvation and contamination, since the material is harder than most dirt particles. The great surface hardness also ensures lower sensitivity brilliant. Bearings made from Vacrodur can support higher loads without plastic deformation in the raceway. The basic dynamic load rating compared to a bearing with the same interior design made from 100Cr6 increases by 65%. It offers spindle bearings from Vacrodur as a special solution for very heavily stressed bearing supports. Further fields of application for this high-performance steel include bearing supports that are subject to risks arising from mixed friction and contamination as well as high static loads.

X-life cylindrical roller bearing with plastic cage



Increased basic rating life thanks to X-life technology

Source: Schaeffler Germany

New FAG spindle bearing with running accuracy P4

Milling spindle in operation

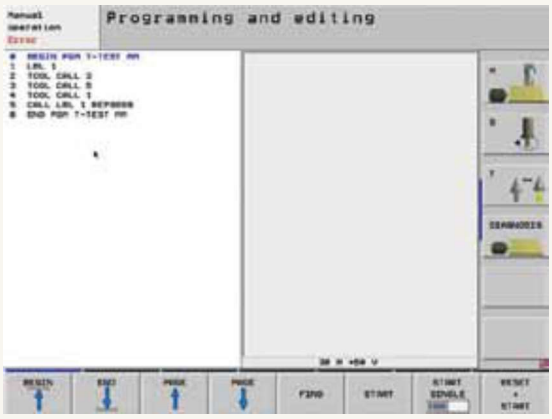
X-life cylindrical roller bearing on top of new telescope box

The Challenger would like to acknowledge Schaeffler for the contribution of material.

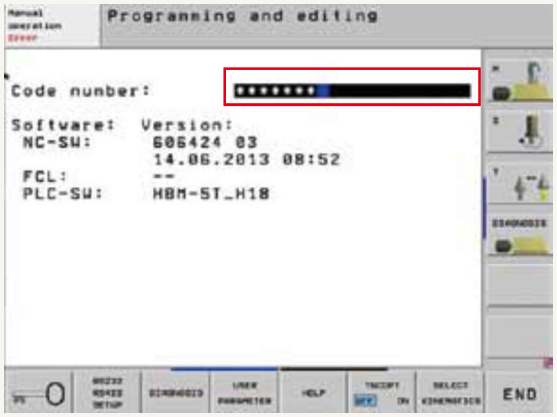
Procedure to copy log book out in Heidenhain TNC controller

A log book contains records of important operating status, error messages, and pressed keys, etc. Please follow the steps below to access the log book for reference.

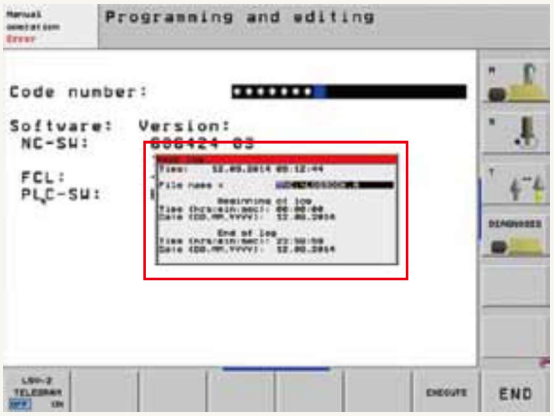
1. In **Programming** mode of operation, press the **MOD** key on TE operation panel.



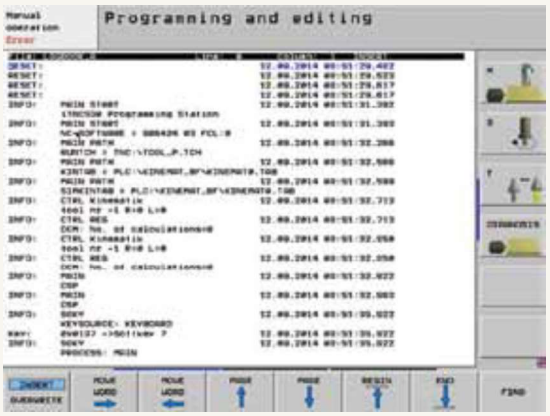
2. Enter the code number **LOGBOOK**.



3. In popup dialog, enter “File name (the file route in TNC controller)”, “Beginning of log”, and "End of log" by sequence.

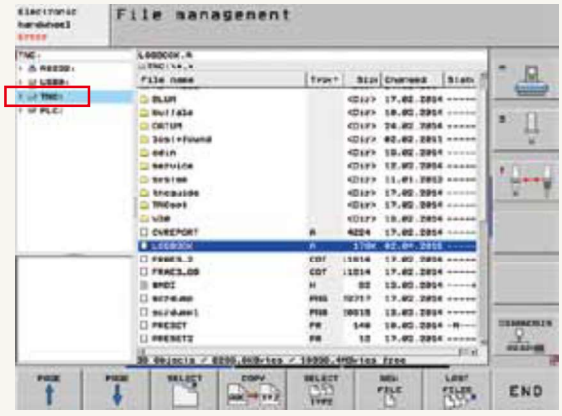


4. Press the **EXECUTE** soft key, the log contents will display on the screen and being stored in the path of File name (the file route entered in step 2).

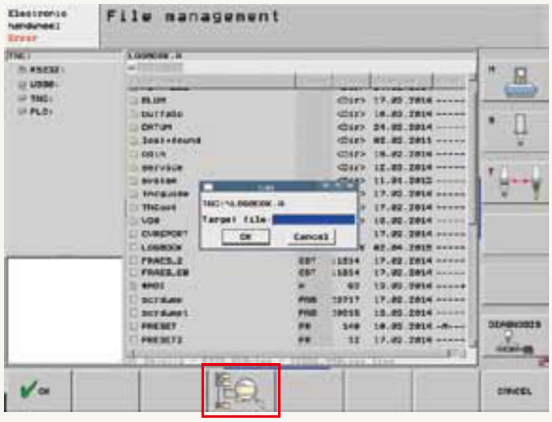


5. Insert a USB flash drive into USB port.

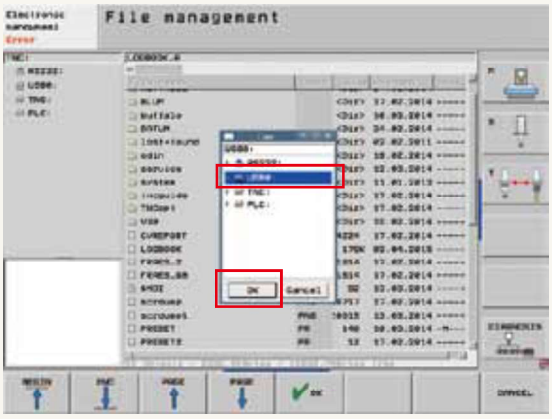
6. Move the cursor to the file and press the **COPY** soft key.



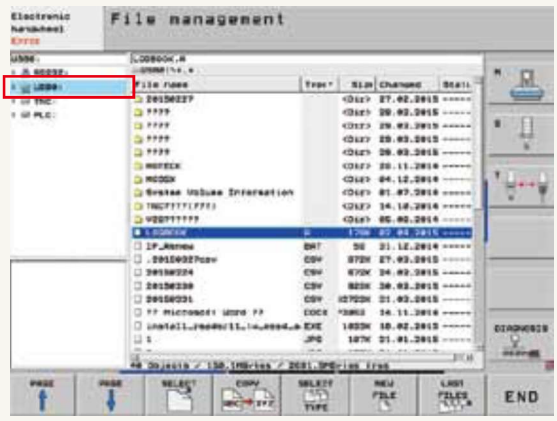
7. When Copy dialog pop-ups, press the **Search** soft key below to search for the USB drive.



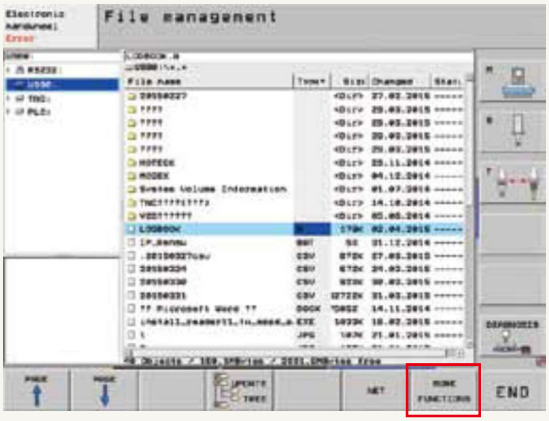
8. Select USB drive and press Ok.



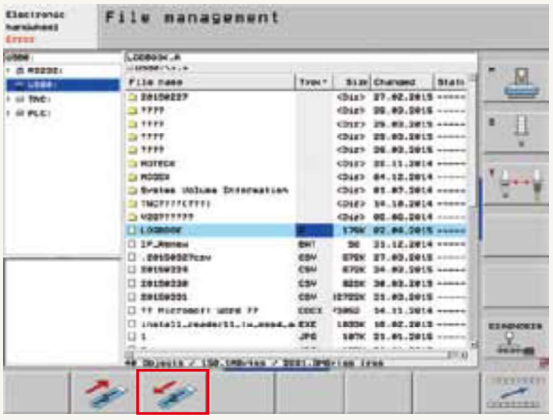
9. Move the cursor to USB drive, the LOGBOOK.A file is saved in file list.



10. To remove the USB drive please press the **MORE FUNCTIONS** soft key.



11. Select the function to remove USB devices from the directory tree.



Live for love, from youth to age

– the centenarian Fr Andrés Díaz de Rábago

Fr Andrés Díaz de Rábago

Profile

Fr Andrés Díaz de Rábago was born on 3rd October 1917 in a very devoted Christian family in Spain, has just celebrated his 100th birthday in Oct 2016 (in Taiwan, this is count from the year of conception). After graduated from medical school, he joined the Jesuits and earned a doctorate in medical from the University of Madrid. To prepare using his medicine specialty to preach the gospel of God as his lifetime career, he arrived in China in 1947. He left China after his priestly ordination in 1952, and then he was in the Philippines for nine years, and East Timor for eight years.

Fr Rábago arrived in Taiwan as a missionary in 1969 with doctorates in both medicine and theology, he taught at medical school of National Taiwan University. In addition to teaching for more than 48 years now, he serves as a counselor for the medical problems at the Church Guting of the Sacred Heart of Jesus. He becomes a friend of the children at the Sunday school of the church and visits the patients in the hospitals. People see the portrait of Jesus and feel the love of God from his selfless giving and passionate support to others. Vice President of Taiwan, Chien-jen Chen praised Fr Rábago as someone with the vigor of a Spanish bullfighter, the passion of a flamenco dancer, the diverse thinking of Picasso and Gaudi, and the religious mission of Ignatius and Xavier. (Ref: City News, Taipei City Government)

'Care for others makes me feel happy and fulfilling'

-Fr Andrés Díaz de Rábago

Fr Andrés Díaz de Rábago is now the most famous Spanish Taiwanese in Taiwan. He is the first foreign national to be naturalized for his special contribution to Taiwan under the revised Nationality Act which was amended on 21st December 2016, allows foreigners to naturalize without losing their original nationality.

Fr Rábago has received the Order of the Brilliant Star Medal in 2015, and was informed by the Taiwan government authority on 3rd February 2017, that he was eligible to be naturalized base on his achievements. With the assistance of Zhong-zheng District household registration office, 2 months later, on 13 April, Fr Rábago has officially received his Taiwanese personal ID.

The day of Naturalization

The origins

Fr Rábago was born in 1917 in Galicia, the province is adjacent to Portugal and was financial difficulty. His grandfather taught Hebrew and Sociology at the university, but his most concerned was the problem of rural poverty, and had been trying to help the development of his beloved Galicia. His grandfather wrote a lot of books, and among them there was a very influential article on rural credit. After his death, the youngest son (father of Fr Rábago) inherited part of the land, he did not hesitate to sell the whole land to set up fish factory, hoping to provide long-term job opportunities for those who were unemployed.

Family of Fr Rábago

Fr Rábago's mother had the same mind of compassion and social concerns as his father. Her family set up a family bank, specializing in operating loans for farmers, and to deal with the business of farmer production and sales funds savings. She was also active in charity, and with all ladies in the village started to build cheap residential units, so that the poor could have their own house, and this was only one of her several charity initiatives. Fr Rábago said, "My mother was always busy, she always helped the poor and my father's factory, and she loved us very much. When I decided to join the Jesuits, and later decided to go to China, she told me: do not worry about your father and me, just do what you think must do. "

Fr Rábago's family is not only has a deep-rooted Christian faith, but also with the pioneer consciousness of social concerns. "My parents' love to help the disadvantaged has deeply affected me. I decided to learn medicine because of this, and embarked on missionary life also because of the same reason, my parents' life is my example.", said Fr Rábago.

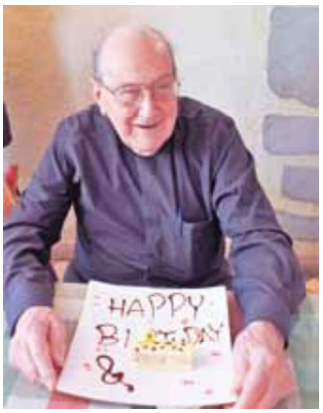
There are 10 siblings in Fr Rábago's family, 6 brothers and 4 sisters, Fr Rábago is the 7th child of the family. A brother of Fr Rábago who was also a physician, and later served as director of a hospital. Once he publicly expressed regret about the health status of the Spanish hospitals, and was forced by the Minister of Health to withdraw his speech, or had to resign from the position. He chose to leave without hesitation. The youngest brother of Fr Rábago was also a Jesuit, and later became a pioneer in Spanish distance learning.

There was political turmoil in Spain in the first half of the twentieth century, the opposition between the right and the left was becoming more and more intense, and finally the civil war broke out in 1936. It is sad to mention that Fr Rábago had a brother who died in the war.

At the end of the civil war, Fr Rábago finished his medical study and afterwards decided to join the Jesuits in Salamanca in 1940 to start a new chapter of life.

'To fall in love with the place you live'

-Fr Andrés Díaz de Rábago



Fr Andrés Díaz de Rábago at his birthday party

My ‘girlfriends’

“I love China” said Fr Rábago, “The friendship that had been established in those days of adversity was rooted deeply.”

Fr Rábago arrived in Beijing in 1947 to fulfil his dream, and had been stayed in Anqing and Shanghai. He was in Shanghai from 1949 to 1952, and was ordained there, that was the last batch of foreign missionaries to be ordained in China after the Communist took over China.

Fr Rábago was forced to leave China for Philippines in 1952 and stayed there for 9 years until 1961. He earned the doctorate in theology in Philippines and later became a teacher in a university in Manila. “I was very busy at that time,” said Fr Rábago, “the tasks were one after another, but guess what? I fell in love with Philippines just as I fell in love with China. Even I had my new love, I would never forget the previous one.”

Shortly after, Fr Rábago again fell in love with another country – East Timor. In 1961, he accepted the appointment as the Rector of the Seminary in East Timor and stayed there for eight years.

At that time, the education in East Timor was not universal, the general adolescents have no chance to study, therefore, the seminary opened to young people, so they would have the opportunity to be educated. There were 3 bishops who were from the alumni of the seminary, and one of them, Bishop Carlos Felipe Ximenes Belo who won the 1996 Nobel Peace Prize for his efforts to resolve peace in East Timor with justice and peace. Furthermore, Kay Rala Xanana Gusmao who founded East Timor and served as the first president of East Timor, who was also a student of Fr Rábago. Whenever talking about those students, Fr Rábago is always very proud of them. In 2008, Fr Rábago and the Bishop Belo were coincidence encounter in Portugal, both were very excited.

Love you to the end - TAIWAN

“After I joined the Jesuits, I have four ‘girlfriends’, the first one is China, the second one is Philippines, the third one is East Timor and my forth one is Taiwan. I do not forget my previous three ‘girlfriends’, but now my ‘girlfriend’ is Taiwan.” said Fr Rábago. If not because Mao Zedong's authority took over China which destroyed his missionary mission in China, he would not be in Taiwan. “Thanks to Mao,” he always said. He was 52 when he arrived Taiwan in 1969, and fell in love again. And indeed, this is the longest love of his life, because he is still here today!

Fr Rábago and friends, left one at front row is Vice-President of Taiwan, Chien-Jen Chen

Fr Rábago loves Taiwan

Fr Rábago was employed at School of Medicine of National Taiwan University, and taught medical and pharmacy ethics for almost 30 years. His students from doctors, nurses to pharmacists were distributed in all sizes of hospitals in Taiwan, so he was as familiar with any hospital as it was his home. Fr Rábago also taught Latin in the University, in addition to medical students, more students were from Department of literature and law.

Because of the medical background, Fr Rábago is particularly concerned about the patients, he is not only the guardian of health in the Jesuits of Taiwan, but always visits the patients in the hospital; if the illness, even late at night, when he received the phone call, he must immediately go to the hospital for the Anointing of the Sick. Often you see Fr Rábago in the hospital, not for himself but to visit others and always provides professional advices.

Fr Rábago is always busy to visit patients in the hospitals and homes for elders.

"If I had decided to marry as a doctor, my life would not be as fruitful as it is today. The reason I decided to come in the missionary life would seem to be the same as it was seventy years ago, and these reasons had become more realistic." "I am very grateful, at age of 23, I have made the decision that was God's will. I have never doubted of my choice, even when I encountered difficulties in my life." "A missionary must love with the piece of land he lives in." said Fr Rábago. And He decided to love Taiwan to the end.

Postscript

How often you will meet an energetic centenarian in your life time? When the author first met Fr Rábago was amazed by his younger appearance than his age and his active daily schedule. His secretary Ms Huang told the author, "If you are not here for this interview, Fr Rábago will still find something else to do. He always keeps himself busy, and always has plans every day." The interview finished at 11:30 and he has already engaged himself in another schedule at 13:30 to visit the home for elders.

When the author asked Fr Rábago how to cope with the chaos today, such as the high criminal rate, drug issues among young people, public protests against the government, dishonest politicians, etc., at this turbulent time, people panic with no peace. "Let me tell you a story" Fr Rábago said, "this was a story I read in Reader's Digest long time ago in Philippines which has changed my life." "One day there was a lady from American had been caught in Russia and sent to Siberia. A Russian old lady told her, "I have been here long, and you are the first time here, if you want to survive and live well here, do not be self-centeredness, only think of others and care for the others, always consider someone else first. In this way, you will help yourself and others. I have seen a lot of ladies here went crazy, because of self-enclosed and always thought about self but others." In other words, to love others as yourself, this is also the gospel of God. The secret of Fr Rábago's longevity is obviously "Live for Love".

Always pray for others

The life story of Fr Andrés Díaz de Rábago has been filmed and just completed in April 2017 to appreciate his incomparable contribution to Taiwan. For sponsorship or more information please contact Jesuits, Taiwan (https://goo.gl/6my1Ma)

Reference:

- http://www.amdgchinese.org, Society of Jesus, Chinese Province
- Renlai issues May 2009, article by Fr Benoît Vermander,S.J.
- Taipei city government, city news: Centenarian Naturalized Based on Contributions to the Nation under Revised Nationality Act
- http://www.asianews.it/news-en/Fr-Andr%C3%A9s-D%C3%ADaz-de-R%C3%A1bago,-a-great-missionary,-celebrates-his-first-100-years-38933.html
- Cardinal Tien Cultural Foundation
- http://www.youtube.com/watch?v=HyIHztishbo
- http://www.youtube.com/watch?v=H781qXp5Ep4
- 我的可愛 – 天賜甘霖 口述：賴甘霖, 撰稿：吳慧琨

Exhibition Calendar

Month	Period	Title of Exhibition / City, Country	Distribution Company
May	18~19	Open house –Samobor, Croatia	Microcut Europe d.o.o.
	23~26	Nitra Fair - Slovakia	ADATE, s.r.o.
September	TBA	Great opening	BPK
	19~22	Open house / La Roche sur Yon / France	DIDELON MACHINES OUTILS
	18~23	EMO – Hall13 / A19	VOLZ
October	19 & 20	Open House	OPTIMUM HUNGARY
	24~26	SIANE / Toulouse / France	DIDELON MACHINES OUTILS
Oct.~Nov.	31~2	METAVAK Gorinchem	De Ridder
November	9~10	Autumn Open Days, Samobor, Croatia	Microcut Europe
	15~17	VOLZ - Open House / Germany	VOLZ Maschinenhandel GmbH & Co. KG