TIMTOS

2025年 第十七屆工具機研究發展創新產品競賽

參賽作品指南

30th MILESTONE EDITION

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綜合加工機及其加工單元類

Machining Center and Manufacturing Cell

2025年第十七屆工具機研究發展創新產品競賽

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Components for CNC Machine Tools and Other NC Machine Tools

81	**億川鐵工所股份有限公司** DI CHUN IRON WORK CO., LTD.
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綜合加工機及其加工單元類

Machining Center and Manufacturing Cell

大立機器工業股份有限公司
DAH LIH MACHINERY INDUSTRY CO., LTD.

曙光機械有限公司
DAWN MACHINERY CO., LTD.

發得科技工業股份有限公司（遠東機械集團）
FACTORY AUTOMATION TECH. CO., LTD. (FEMCO MACHINE TOOLS)

友嘉實業股份有限公司
FAIR FRIEND ENT. CO., LTD.

高明精機工業股份有限公司
KAO MING MACHINERY INDUSTRIAL CO., LTD.

偉詳工業股份有限公司
WAYSIA INDUSTRIAL CO., LTD.

崴立機電股份有限公司
WELE MECHATRONIC CO., LTD.

大立機器工業股份有限公司
DAH LIH MACHINERY INDUSTRY CO., LTD.

地　　址：41357 台中市霧峰區南勢里豐正路工業巷 3 號
No.3, Kung-Yeh Lane, Fengcheng Road, Nanshin Vil, Wufeng Dist, Taichung City 41357, Taiwan
電　　話：+886-4-23334567　　**傳　　真：**+886-4-23307567
網　　址：www.dahlih.com.tw　　**E-mail：**mail.rd1@dahlih.com.tw

攤位號碼：J0108

主要產品類別：

- 立式綜合加工中心機
- 臥式綜合加工中心機
- 龍門綜合加工中心機
- 五軸加工中心機
- 立式銑車複合加工中心機

參賽作品名稱：

DMC-650 龍門綜合加工機
DMC-650 Portal Type Machining Center

作品圖片：

作品開發背景：

本公司為 C N C 切削中心機專業設計製造廠，從事工具機產品開發已數十餘年，而目前工具機朝向高速化及高精度的需求，傳統的 C 型結構工具機，已漸漸無法符合客戶的精度要求；隨著 AI 與高效能計算 (HPC)、電動車 (EV)、物聯網 (IoT)、5G 基礎建設與設備升級之相關產業的蓬勃發展，高精度加工的需求日益增加，尤其是在消費性電子、車用半導體 (毫米波雷達、ADAS 高階駕駛輔助系統晶片) 與通信產業的需求快速成長。

工具機產業具備精密加工的基礎，若能有效切入半導體封測高階同軸測試座製程，將在高端市場中占據一席之地。這需要掌握精密製造、高效能材料加工與高頻電器性能專業知識，本公司規劃開發用於 0.3mm 以下微小徑高速鑽孔循環加工機能期望能達成 [高階同軸測試座] 成品驗證，進一步打入半導體封測製程產業，依據此原則研發高精度小龍門架構工具機，並降低成本藉以提昇市場競爭能力。

作品特點：

（一）創新性

1. 刀具斷刀監控：大立公司以「能自我學習並監控刀具斷刀之工具機」為基礎方向，開發出 TBM 刀具斷刀監控系統，透過監視主軸之虛擬電流來判斷刀具是否斷刀，並在第一時間停止機器切削動作，目前開發之 TBM 機能，能夠在銑削、鑽孔、攻牙的加工模式下檢測刀具是否斷刀，也可以在程式內進行多段學習，更加利於操作者對程式進行編排。(專利號：M634020)
2. 螺桿進給系統及其預拉裝置：該預拉裝置包含一軸承座、多個軸承、一迫緊組、兩個墊圈、多個彈性變形件及一緊固件。該軸承座包括一安裝孔。該等軸承安裝在該安裝孔內且供該螺桿穿設並用來對該螺桿提供一第一預拉力。該迫緊組設置在該軸承座且用來迫緊該等軸承。該等墊圈套設在該螺桿且併排在該迫緊組的一側。該彈性變形件安裝在該等墊圈且受該等墊圈擠壓而對該螺桿提供一第二預拉力。該緊固件套設在該螺桿且推抵於其中一該墊圈。藉由二段式的預拉設計，能讓該螺桿保持剛性與定位精度，因此預拉效果較佳。(專利號：M664474)
3. 完善冷卻效果：鞍座內部流道設計，隔絕主軸熱源，確保主軸之熱不影響到立柱，有效減低立柱前傾後仰。

（二）智慧化與實用性

大立機器在智能化功能上，提供用戶實用的操作機能，AI 學習、大數據、節能減碳、適應性切削，提升本次 DMC-650 精密立式加工中心的智能應用元素，提供客戶高品質、高價值，包含以下智能化內容：

1. 自適應切削進給控制：在高移除率的粗胚加工製程中，AFC 通過對刀具的即時負載監控，自動調節切削進給速率，以達到穩定切削負載及縮減加工時間的目的，同時對刀具壽命也會增加。
2. 加工程式分析：透過加工程式實際的執行，此應用程式將依序紀錄所有刀具的運行時間和實際切削時間，此資訊可讓操作者清楚知道各刀具實際花費的時間和切削比率，可作為製程改善的依據。
3. 潤滑油耗統計：透過潤滑油的添加，應用程式可自動估算出潤滑油耗的相關訊息，包括平均油耗、可用天數、可用時間、剩餘時間、下次添加日，此資訊可讓操作者知道潤滑油消耗狀況，可提前準備油品或進一步調整潤滑油的使用頻率。
4. 刀具壽命診斷：此機能判斷刀具壽命的方式有二種。第一種為刀具的使用次數或使用時間，不需要繁瑣的設定，操作者只需要設定閥值，當次數或時間到達閥值的 80% 或 100%，系統會自動報警提示。另一種判斷刀具壽命的方式為切削負載，系統會依照設定的負載編號，紀錄刀具每次加工的切削負載，隨著刀具磨耗越嚴重，切削負載越大，當負載到達閥值的 80% 或 100%，系統會自動報警提示。二種方法可獨立使用亦可合併使用。
5. 單機稼動率：此應用程式會連續自動記錄機器運轉狀態，提供機器稼動率資訊，包含每天稼動率清單、每週稼動率、每月稼動率、長條圖、圓餅圖，可讓操作者或管理者即時掌握生產狀況。資料可輸出至 CF 或 USB 記憶卡。
6. 鑽孔斷屑：程式在執行鑽孔循環指令時，系統自動啟動此機能來達到斷屑作用。此機能特色：
   - 切屑呈顆粒狀
   - 切屑不易纏繞於刀具，造成工件表面刮傷
   - 切屑易於清理

（三）綠色、節能與永續

◆綠色製造

1. 三軸進給系統之潤滑系統採用油脂式潤滑，油脂能夠牢固地附著在摩擦表面，不易流失或飛濺，確保持久的潤滑效果，且具有優異的防鏽和防腐蝕性能，能夠有效保護設備，藉由油膜耐磨性提升降低零件損耗使之拉長零件壽命。
2. 主軸模組化設計：可搭配直結、內藏主軸、配合不同控制器廠牌，共用頭部本體鑄件。

◆智慧節能

1. 待機節能機能，客戶可自行設定一段時間，系統會自動判斷機器在這段時間內是否處於無運轉之狀態，待設定時間到達系統會自動關閉油壓系統、冷卻系統、伺服系統，來達到節能目的。一般待機 8 小時約耗 7 度電，使用待機節能機能待機 8 小時約耗 3 度電，減少耗電 57%。
2. 排屑啟停智能化，加工程式結束後自動啟動捲屑裝置，並在設定時間到達時自動關閉，減少不必要之運轉。
3. 加工條件選擇，大立機器提供三段加工模式選擇，速度模式、精度模式、表面品質模式，客戶可以依不同的加工需求做合適的選擇，不同加工模式的伺服加減速不同，對耗電量也不同。
4. 耗電量可視化，客戶可從消費電力畫面了解機器伺服軸、主軸、馬達使用能耗情況，讓加工過程所產生的總排碳量、總用電量，都可以數據化地呈現在介面上，達到碳排資訊可視化之目標，使用者也可以透過查詢功能，瀏覽歷史趨勢數據。

（四）結構、精度與品質

1. 雙柱式門型設計，主軸懸伸距離短剛性高，並經 CAE 分析確保結構穩定性與剛性。
2. 內藏主軸雙層式水套、外水套規劃及流道並連串接，將主軸與外水套分為兩獨立循環進行冷

卻，變形量 Z 方向明顯提升 20%，Y 方向提升 79%。

（五）市場可行性

鑑於先進駕駛輔助系統 (ADAS) 與複雜模具加工的蓬勃發展，預期未來對於高階精度加工機的需求將呈現穩定的高度成長。

（六）審美性

創新美學設計規畫，訴求結構緊湊收斂性外觀設計、輪廓簡潔，機台外觀採用企業識別色藍、白、黑三色系，搭配象徵大立機器代表色之藍色發光 LED 銘牌點綴，機器型號配合俐落線條噴漆於鈑金護罩，操作門關閉與開啟均可容易識別。

（七）其他

此龍門機型亦提供 X、Z 兩軸硬軌的機台，提供加工面刀紋粗糙度更佳需求使用者選擇，搭配卸荷導軌裝置降低頭部鞍座移動負載，同時具有高強度、高精度結構機種之小型中高階工具機競爭力。

DESCRIPTION IN ENGLISH:

(1)Innovation

1. Tool breakage monitoring: Based on the direction of "a machining center that can self-learn and monitor tool breakage", Dahlih Company has developed a TBM tool breakage monitoring system that monitors the virtual current of the spindle to determine whether the tool is broken , and stop the machine cutting immediately. The TBM function currently can detect whether the tool is broken in the processing modes of milling, drilling, and tapping. It can also perform multi- learning in the program, which is more convenience to the operator to edit Programming. (Patent number: M634020)
2. Screw feeding system and pre-tensioning device: The pre-tensioning device includes a bearing housing , bearings, a tightening set , two washers, disc springs and a precision nut . The bearing housing includes a mounting hole , the bearings are installed in the mounting holes for the ball screw to pass through and to provide a first pretension force to the screw. The tightening set is arranged on the bearing housing to tighten the bearings. The washers fit on the ball screw and arranged side by side on one side of the tightening set . The disc springs are installed on the washers and is squeezed by the washers to provide a second pretension force to the ball screw. A precision nut fitted on the ball screw and pushed against one of the washers. The two-stage of pre-tension design allows the ball screw to keep rigidity and positioning accuracy, so the pre-tension effect is better. (Patent number: M664474)
3. Complete the cooling effect: The internal flow channel design of the saddle isolates the heat source of the spindle to ensure that the heat of the spindle does not affect the column, effectively reducing the forward and backward tilt of the column.

(2)Intelligence and Practicality

In terms of intelligent functions, Dahlih Machinery provides users with practical operating functions, AI learning, big data, energy saving and carbon reduction, and adaptive feedrate control to enhance the intelligent application of this DMC-650 precision portal type machining center and provide customers with high quality , high value, including the following intelligent content:

1. Adaptive Feedrate Control
   In the rough machining process with high removal rate, AFC automatically adjusts the cutting feed rate through real-time load monitoring of the tool to achieve the purpose of stabilizing the cutting load and reducing processing time. At the same time, the tool life will also be increased.
2. NC Code Run Time
   Through the execution of the machining program, this application will sequentially record the running time and actual cutting time of all tools. This information allows the operator to clearly know the actual time spent and percentage applied in cutting of each tool, which can be used as a basis for process improvement.
3. Lube Consumption
   By filling lubricating oil, the application can automatically estimate relevant information about lubricating oil consumption, including average oil consumption, available days, available time, remaining time, and the next refill date. This information allows the operator to know the lubricating oil consumption status and can Prepare oil in advance or further adjust the frequency of lubricant use.
4. Tool Life Management
   There are two ways this function can judge tool life. The first is the number or time of tool use. The operator only needs to set the value. When the number or time reaches 80% of the set value, the system will automatically give a warning first. When it reaches 100%, the system will automatically give an alarm again. Another way to judge the tool life is the cutting load. The system will record the cutting load of each processing of the tool according to the

set load number. As the tool wear becomes more serious, the cutting load will increase. When the load reaches 80% and 100% of the set value , the system will automatically alarm. The two methods can be used independently or combined.

5. Uptime
This application will continuously and automatically record the machine operating status and provide machine utilization information, including daily utilization list, weekly utilization, monthly utilization, bar chart, and pie chart, allowing the operator or Managers understand production status in real time. Data can be saved to CF or USB memory cards.

6. Drilling Chip Breaking
When the program executes the drilling cycle command, the system automatically activates this function to achieve chip breaking.
Features of this function:
・Chips are granular
・Chips are less likely to wrap around the tool, causing scratches on the workpiece surface
・Chips are easy to clean

(3)Energy Saving Computation

◆ **Green Manufacturing**

1.The three-axis feed system use grease lubrication. Grease can firmly adhere to the friction surface and is not easy to run off or splash, ensuring long-term lubrication effect. It also has excellent anti-rust and anti-corrosion properties and can effectively protect equipment. The oil film can improve wear resistance, reduce the loss of parts, and extend the service life of parts.

2.Spindle modular design: can be matched with direct-drive, built-in spindle, different controller brands, and share the head casting .

◆ **Smart Energy Saving**

1.It has a standby energy-saving function. Customers can set a period of time, and the system will automatically determine whether the machine is inactive during this period. When the set time is reached, the system will automatically shut down the hydraulic system, cooling system, and servo system to achieve energy saving. Under normal circumstances, 8 hours of standby consumes about 7 kilowatt hours of electricity. Using the standby energy-saving function, when on standby for 8 hours, it only consumes about 3 kilowatt hours of electricity, reducing power consumption by 57%.

2.Intelligent start and stop of chip conveyor , the chip conveyor device automatically starts after the processing program is completed, and automatically stop when the set time is reached, reducing unnecessary operation.

3.Selection of processing conditions. Dahlih Machinery provides three processing mode selection, speed mode, precision mode, and surface quality mode. Customers can make appropriate choices according to different processing needs. Different processing modes have different servo acceleration and deceleration, which affects power consumption.

4.Power consumption visualization. Customers can see the power consumption of the machine's servo axis, spindle, and motor from the power consumption screen, so that the total carbon emissions and total power consumption generated by the processing process can be presented on the interface. In order to achieve the goal of visualizing carbon emission information, users can also browse historical trend data through the query function.

(4)Structure, Precision and Quality

1.Double-column bridge design , short spindle overhang and high rigidity, and CAE analysis to ensure structural stability and rigidity

2.The built-in spindle double-layer water sleeve, outer water sleeve design and flow channel are connected in parallel . The spindle and outer water sleeve are divided into two independent cycles for cooling. The deformation in the Z direction is significantly improved by 20% and the Y direction is improved by 79 %.

(5)Market Feasibility

In view of the booming development of advanced driver assistance systems (ADAS) and complex mold processing, the machine to demand for high-end precision machining is expected to show stable and rapid growth in the future.

(6)Aesthetics

Innovative aesthetic design planning, calling for compact structure, convergent appearance design, and simple outline. The appearance of the machine adopts the corporate identification colors of blue, white, and black, and is decorated with a blue luminous LED nameplate that symbolizes the representative color of Dahlih Machinery. The machine model is painted on the sheet metal guard with clean lines, and the operating door can be easily identified when it is closed or opened.

(7)Others

This gantry machine also provides hard rail on X and Z axis that can provide higher processing surface accuracy requirements, an unloading guide rail device is installed to reduce the moving load of the head /saddle, The high rigidity and high precision structure makes it more competitive in high grade machines.

曙光機械有限公司
DAWN MACHINERY CO., LTD.

地　　址：516022 台灣彰化縣埔鹽鄉員鹿路一段 179 號
No.179, Sec. 1, Yuanlu Rd., Puyan Township, Changhua County 516022, Taiwan
電　　話：+886-4-8659610　　**傳　　真：**+886-4-8653980
網　　址：www.dawn-machinery.com.tw　　**E-mail：**dawn.machine@msa.hinet.net

攤位號碼：M0610

主要產品類別：

- 立式圓筒磨床
- 客製化磨床
- 數控圓台平面磨床（轉盤平面磨床）
- 立臥兩用綜合加工機
- 滾子凸輪蝸桿銑床
- 滾子凸輪蝸桿磨床

參賽作品名稱：

DN-600VH 立臥兩用綜合加工機
CNC Vertical-Horizontal Machining Center

作品圖片：

作品開發背景：

目前許多零件銑削加工幾何精度及尺寸精度要求越來越嚴格，一個五面體需要加工的工件，若不拆下翻面加工，就必須使用五軸機，但五軸機價格昂貴，剛性及精度沒有標準三軸機好，因此我們以三軸機的基礎，結合立式及臥式綜合加工機的結構，搭配一個轉台，達到工件不拆下翻面就可以一次性完成五面體，且相互間的幾何精度能夠達到最小的範圍。把兩台機床的功能合而為一，可以一次性完成基準面及各面加工，保證基準面和各平面的幾何公差，減少更換製程移動工件而造成的安裝誤差。並減少兩台機器的佔地面積，共用轉盤驅動以及一套控制器即可實現兩台機器的功能，達到節能減碳的目的，提高機台的價值。

作品特點：

（一）創新性

有別一般市場上的立式或臥式綜合加工機，此參賽作品為雙立柱、雙主軸一立一臥結構，有各自的伺服滑台及刀庫可進行立臥加工，五面體不用拆工件翻面就能一次性的完成，且將立臥兩台機器合而為一，可以減少移動工件時的校正時間，且三軸的機械剛性遠比五軸機高出許多，因此加工效率及加工精度相對提升許多。

（二）智慧化與實用性

此次參賽的DN-600VH 立臥兩用綜合加工機，採用西門子的 828D 搭配 15” 觸控螢幕，西門子原廠 Create MyVirtual Machine 軟體，在機台還未組裝完成時，事先將虛擬機械建構起來，可以事先進行硬體行程干涉分析，加工動作分析，並模擬客戶的操作應用等。與過往機械完成後再整合測試的作法，大大加速了開發的效率，以及節省動作錯誤時導致機械碰撞等成本。後期，客戶也能利用此模型，先進行工件的模擬切削，以便事先評估加工時間，程式路徑等等。遠端維護，利用西門子 828D 控制器內建的 VNC 伺服器功能，只需將機械連上網際網路，則透過網路可在不同地點連接上機械的控制器。此功能非常方便遠距教學或是售後服務，有時候客戶無法完全清楚的描述問題，此時，只要售服人員連線上客戶的控制器，可以即時並實際了解客戶所要表達的正確問題，增進了教育訓練的便利性，以及售服的時效性。

（三）綠色、節能與永續

此次參賽的DN-600VH 立臥兩用綜合加工機，將兩部機械合而為一，減少兩部機械的佔地面積，共用一個 X 軸及 Y 軸及第四軸轉盤及控制器，原本供應兩台機器的動力電力需求也減少了，達到節能減碳的目標。另外節能監控部分，控制系統上安裝西門子智慧錶，在電源控制方面，當機台閒置，一段時間內都沒有運動動作時，會自動將油冷機 / 切削液 / 電燈 / 空氣關閉，以達成節能減碳的作用。在節能計算面，可統計單一加工耗電量、整日耗電量，用於分析以利節能計算。

（四）結構、精度與品質

此次參賽的DN-600VH 立臥兩用綜合加工機，採用雙立柱，一立一臥結構，共用一個 X 軸及 Z 軸還有第四軸轉盤，當有五面加工需求的工件，能在此機上不拆工件翻面，能夠輕易地完成五面體加工，三軸結構剛性好，若是量產工件，搭配多站式交換盤，可以進行長時間無人化加工。因為不拆工件可做多面加工的緣故，在 600 四方的範圍內，各面的垂直度或者對向孔的同心度能控制在 0.01mm 以內。

（五）市場可行性

隨著各種零組件精度要求提高，及各地缺地，缺電，缺工的情況，此次參賽的機型，能夠適當的解決以上問題，曙光本身是機械廠，需多機械上的零件需外協廠商加工，以此為市場調查，確實一立一臥的複合機型，是目前許多從事加工製造業者的需求，但苦於市場上沒有類似機型上市，或者目前市面上僅有少數的類似機型但設計上有許多缺失並不適用，依照我們評估，此次參賽機型需求一直都在，只是市場上還沒誕生，我們認為市場可行性將大有可為。

（六）審美性

本次參賽機台採用全罩式鈑金，外觀採用鑽石切割菱角分明意象設計，鑽石折射閃閃生輝，彷若早晨曙光照射，象徵著曙光不僅僅是一個改變的開始，更是一個對於機械信念的價值體現，只要有光的地方，就有曙光。

（七）其他

不管是標準三軸或者是高精的五軸機，目前在工具機市場可說是百花齊放，競爭相當的激烈，中國大陸削價競爭，日幣貶值導致台灣機械價格與日本機價差不大，台灣機械業近來可說是陷入苦戰當中，面對種種的困境，唯有把機械的價值提高，並且做出特殊性，才有競爭的優勢，此次參賽作品，是觀察市場需求，在務實的考量之下應運而生的產品，著重在功能性及實用性，是接近市場需求的一台機械，希望能夠幫客戶解決一些加工的問題，並且突破目前標準機的劣勢，能夠向晨曦的曙光一樣，為我們的工具機產業帶來些許的光亮。

DESCRIPTION IN ENGLISH:

(1)Innovation

Unlike typical vertical or horizontal machining centers on the market, this entry features a dual-column, dual-spindle structure with one vertical and one horizontal axis. It is equipped with its own servo slides and tool magazine to allow for vertical and horizontal machining. This design enables five-side machining without flipping the workpiece, completing all the process in one setup. By combining the functions of vertical machining center and horizontal machining center, it reduces the calibration time required when moving the workpiece. Additionally, the rigidity of the three-axis system is much higher than that of a five-axis machine, significantly improving both machining efficiency and accuracy.

(2)Intelligence and Practicality

The DN-600VH is paired with Siemens Create MyVirtual Machine software. This allows for the creation of a virtual machine before the physical

machine is assembled, enabling hardware stroke interference analysis, motion analysis, and simulation of customer operations. This avoids the previous situation where testing could only be done once the machine was fully assembled, greatly speeding up development efficiency and reducing costs related to potential collisions from motion errors. Furthermore, customers can use this model to simulate cutting processes on workpieces, enabling them to evaluate processing times, program paths, and other parameters in advance.

Remote Maintenance: By utilizing the built-in VNC server function of the Siemens 828D controller, the machine can be connected to the internet. This allows the controller to be accessed remotely from different locations. This feature is extremely useful for remote teaching or after-sales service. When customers cannot clearly describe a problem, service personnel can connect to the customer's controller and immediately understand the exact issue, improving training convenience and after-sales response time.

(3)Energy Saving Computation

The DN-600VH CNC vertical-horizontal machining center combines two machines into one, reducing the overall footprint and utilizing a shared X-axis, Y-axis, fourth-axis rotary table, and controller. This consolidation also lowers the power consumption originally required to operate two separate machines, achieving energy savings and carbon reduction. Additionally, the energy-saving monitoring system is equipped with Siemens smart meters. Power control: When the machine is idle and no motion is taking place for a certain period, it automatically shuts off the oil cooler, cutting fluid, lights, and air, contributing to energy conservation and carbon reduction. Energy-saving calculation: By integrating Siemens smart meters, the system can track power consumption during individual machining processes and calculate total energy usage throughout the day, facilitating analysis and comparisons to optimize energy savings.

(4)Structure, Precision and Quality

The DN-600VH CNC vertical-horizontal machining center features a dual vertical column, one vertical and one horizontal structure. It shares an X-axis, Z-axis, and a fourth-axis rotary table. For workpieces that require five-side machining, this machine allows the workpiece to remain fixed without the need to flip it, enabling easy completion of five-side machining. The three-axis structure ensures excellent rigidity. For mass production parts, it can combine a multi-station pallet changer, can perform long, unmanned machining operations. Because the workpiece does not need to be flipped for multi-sided machining, the verticality and concentricity of opposing holes within a 600mm square area can be controlled to within 0.01mm.

(5)Market Feasibility

With the increasing precision requirements for various components and the challenges of limited space, electricity, and labor shortages in many regions, the DN-600VH machining center offers a suitable solution to address these issues. Dawn Machinery as a machinery manufacturer, many of our machines' components require processing by external suppliers. Based on market research, it is clear that a combined vertical and horizontal machine is in high demand among many manufacturers in manufacturing industry. However, there are currently few similar models available in the market, and the few existing ones have significant design shortages that make them less suitable. According to our assessment, the demand for this type of machine has always been present, but it has not yet been fully addressed by the market. We believe that the market potential for this machine is significant and highly feasible.

(6)Aesthetics

The participating machine in this competition features a full-cover sheet metal design with a diamond-cut angular pattern. The diamond-like reflections sparkle brilliantly, reminiscent of the first light of dawn. This symbolizes that dawn is not just the beginning of a change, but also a reflection of the value of belief in machinery. Wherever there is light, there is dawn.

(7)Others

Whether it's standard three-axis machines or high-precision five-axis machines, the machine tools market is currently highly competitive, with a wide variety of options. Price competition driven by Chinese manufacturers and the depreciation of the Japanese yen have led to minimal price differences between Taiwanese and Japanese machines. The Taiwanese machinery industry has been facing tough challenges recently. In the face of these difficulties, the only way to gain a competitive edge is by increasing the value of machines and offering unique features. This entry was developed in response to market demand, combining practical consideration with functionality and usability. It closely aligns with the needs of the market, aiming to help customers solve machining problems while overcoming the disadvantages of standard machines. Like the first light of dawn, we hope this product will bring light to our machine tool industry.

發得科技工業股份有限公司（遠東機械集團）
FACTORY AUTOMATION TECH. CO., LTD. (FEMCO MACHINE TOOLS)

地　　址：621016 嘉義縣民雄鄉福樂村中山路 26 號
No.26, Zhongshan Rd., Fule Vil., Minxiong Township, Chiayi County 621016, Taiwan
電　　話：+886-5-2133166　　**傳　　真：**+886-5-2205293
網　　址：www.fatek.com.tw　　**E-mail：**global@femco.com.tw

攤位號碼：I0306

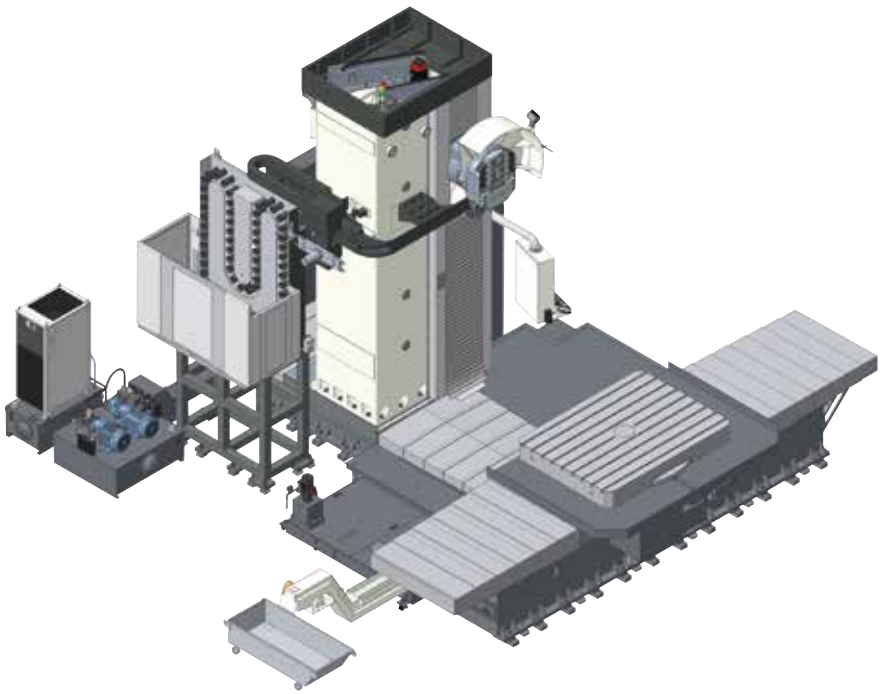
主要產品類別：

- CNC 臥式、立式車床
- CNC 臥式搪銑床
- 輪圈加工機
- 自動化與智能化服務
- 鋁輪圈鑽孔機

參賽作品名稱：

BMC-135FTS 高承載銑車複合搪孔機
BMC-135FTS Heavy Duty Mill-Turn and Boring complex Machine

作品圖片：



作品開發背景：

此次的參賽作品 BMC-135FTS，當初的開發動機為，以模組化設計為出發點，開發一台符合市場重切削需求，且工作台具高承載能力，容易組裝及維護保養的銑車複合搪孔機。參考國外知名的相關產品；如日本 KURAKI 的 KBT-13F、義大利 TREVISAN 的 DS900/300C 等。在排除以附件 (如 D'Andrea) 形式裝設於機台，及 KURAKI 的 Facing head 與主軸同中心設計方式後，決議以 TREVISAN 的設計理念，來進行 Facing head 及機台的開發工作。其主要原因，KURAKI 的 Facing head 與主軸同中心設計，在主軸部會無法再裝設延伸套筒，所以在主軸部的切削能力表現會顯得較弱。如果 Facing head 和主軸部能夠上下錯位，在機台有重切削需求，主軸部將可再裝設延伸套筒，防止切削震動產生。且如此設計更為簡潔，組裝及維修會更加容易，本機採用模組化設計的概念來進行設計，在完成各項技術驗證後，將可容易且快速的應用到其他機台，在營業的產品銷售將更具彈性，期望能提高產品的附加價值，且切入高階應用市場。

作品特點：

（一）創新性

高承載銑車複合搪孔機 BMC-135FTS，本機創新亮點為工作台高承載及配備具有旋削功能的面盤，以往大型零件加工工序複雜，易產生誤差，無法以單一機台完成加工，我司開發具有旋削功能面盤的搪孔機，以單一機台即可完成搪、銑、車等複雜加工，可降低不同工程產生的加工誤差，且為符合大型零件放置於工作台的高承載需求，我司自行開發油靜壓軸承技術來提升工作台承載能力，取代市面上造價高且交期長的轉台軸承。本機結合多個智慧元素，也讓機台更具備智慧化，均屬業界最創新的應用，為此也申請多項發明專利，詳述如下：

1. 工作台載重自動位移補償功能

因本機工作台為高承載，為克服工作台不同承載重量所帶來的位移誤差變化，我司以油靜壓技術為基礎，偵測油腔壓力，經計算轉換後，控制器自動取得工作台承載重量，經由控制器分析運算後，對位移誤差進行可變補償，從而提升加工精度。

2. 鏈條伸長檢測技術

為一種更換預測方法，對於關鍵零組件損壞前提供預知、預警功能，透過感測與分析裝置，可以偵測平衡機構鏈條因長時間受力產生的伸長量，經由控制器分析後，會依客戶不同的操作習慣，產生不同的預警伸長量，當鏈條剩餘伸長量低於預警伸長量時，機台會發出預警，提醒使用者在鏈條斷裂前進行更換，避免客戶的停機損失。

3. 防漏偵測系統

迴轉接頭為主軸中心出水的主要元件，在切削加工中，若元件有洩漏情形，會讓主軸箱內部受到汙染。為此我司開發出一種防漏偵測系統，可同時偵測迴轉接頭與主軸密封系統的切削液滲漏，不僅可偵測迴轉接頭正常與損壞時的滲漏現象，還能偵測密封系統因失效所造成的切削液滲漏，從而達到即時檢修或更換零件的目的，避免工具機內部的零件被切削液汙染而損壞，大幅提高偵測的靈敏度，確保工具機的順暢運作。

（二）智慧化與實用性

數位服務（AR 零件手冊、AR 問題排除指引）

發得自行研發擴增實境工具機管理系統，將各種工具機資訊以擴增實境建構在雲端伺服器，提供客戶端透過行動裝置連結系統，該系統包含有 AR 零件手冊、AR 問題排除指引…等，如客戶端設備問題發生時，由控制器畫面即時產生的二維碼，透過行動裝置連結至雲端，並應用雲端伺服器的擴增實境資訊指引，進行故障排除，此外發得開發的 AR 零件手冊，還提供機台專屬的二維碼查詢零件手冊，以擴增實境方式提供客戶查詢機台資訊，系統內亦可對損壞零件進行線上即時下單，協助客戶售後服務與維修，爭取在短時間內恢復機台運作。

數位雙生應用於加工前準備

透過 PC 軟體進行加工件效果的仿真，無需移動機台即可調整參數和加工條件，能夠大幅降低實際操作中的試錯成本，並提高整體生產效率，對加工零件進行碰撞干涉檢查，可降低機台干涉、避免加工程式錯誤導致工具機撞機與加工品質不良等問題。

ESG 人機介面

為使機台碳排計算更簡便，我司於機台入電端安裝比流計，透過電力監控模組，可以取得機台的三相電壓、電流、頻率、功率與總功耗等各項資訊，並清楚呈現在控制器畫面上，讓操作者可即時掌握機台的用電資訊，並且計算機台碳排放量。

（三）綠色、節能與永續

- ATC 節能降載功能開發
- 水箱泵浦外掛式變頻節能

（四）結構、精度與品質

- 機台溫升熱補償技術

由於本機台為主軸可伸出的搪孔機，W 軸行程更達到 800mm，為達更精確的精度要求，主軸採用機台溫升熱補償技術，減少熱溫升影響主軸伸長的尺寸誤差，可提高加工精度，呈現最佳補償效果達 ±18μm。

（五）市場可行性

目前全球市場上主要競爭對手為日本機械 KURAKI、NOMURA 與義大利 TREVISAN。我司新開發產品有銑車複合加工能力，可對應到各項加工需求，主要是以石化產業、大型幫浦、各項水、電網類管閥相關製品之組件加工。本機可對應大部分加工製程，機械本體面盤功能為我司全自製產品，已推廣至多個國家，目前針對主軸剛性、增加機台加工範圍、與操作便利性進行提升，並搭配智慧化 APP 數位服務，使此產品靈活對應市場需求，從各家競爭對手中脫穎而出。

（六）審美性

機械本體上方乳白色與亮灰色，展現出我司機台的專業性，底部機床為碳黑色，可明顯劃分移動與固定區域之辨識度，增加操作安全性，加上鈑金的襯托，使整體表現出搪銑床高穩定性、並可重切屑的出色外觀。

（七）其他

近年來，客戶逐漸要求機台產生的切屑及切削液須完全回收，提出機台外罩板金的需求，用來保持廠房乾淨與確保人員安全，我司也依需求開發機台半罩式及操作者防濺鈑金，用來防止切屑與切削液飛濺，並將其回收，於操作滑門裝設互鎖開關保護加工者安全。

DESCRIPTION IN ENGLISH:

(1)Innovation

The machine on exhibition this time is the BMC-135FTS, Heavy Duty Mill-Turn and Boring complex Machine. The innovative highlights of this machine are the high-loading capacity of the worktable and the facing head with mill-turn function. In the past, the processing procedures for large parts were complicated and prone to errors, making it impossible to finish machining process with a single machine. Thus, our company develops a boring machine with a mill-turn function facing head. It can complete boring, milling, turning and other complex processes, which can reduce the processing errors caused by different processes. This machine is also in line with the high loaded needs of large parts. Our company develops our own hydrostatic bearing technology to improve the high capacity of the worktable, replacing the high-cost and long-delivery turntable bearings on the current market. This machine combines multiple intelligent elements to make the machine more intelligent. Those are the most innovative applications in the industry. With this reason, we also apply for a number of invention patents, as detailed below:

A. Automatic displacement compensation function for loading of worktable (invention patent is applying)

Since the worktable is high loading, in order to overcome the displacement errors caused by different loading weights of the worktable, our company uses hydrostatic pressure technology as the basis to detect the oil chamber pressure. After calculation and conversion, the controller automatically obtains the loading weight. After analyzing and calculating, the controller can start compensation for the displacement error, thereby improving the machining accuracy.

B. Extending chain detection technology (invention patent has been approved)

It is a replacement prediction method that provides prediction and warning functions before key components are damaged. Through the sensing and analysis device, the elongation of the balancing mechanical chain due to long-term stress can be detected. After analysis by the controller, different warning elongations will be generated based on the customer's different operating habits. When the remaining elongation of the chain is lower than the pre-warning elongation, the machine will issue an early warning to remind the user to replace the chain before it breaks to avoid customer's downtime loss.

C. Anti-leak detection system (invention patent pending)

The rotary joint is the main component coolant through the center of the spindle. During machining process, if the component leaks, the inside of the spindle box will be polluted. To prevent this, our company has developed a leakproof detection system, it can detect cutting fluid leakage in the rotary joint and spindle sealing system at the same time. It can not only detect leakage when the rotary joint is normal and damaged, but also detect cutting fluid leakage in sealing system caused by losing function. It can achieve the purpose of immediate maintenance or replacement of parts. This can prevent the parts inside the machine tool from being damaged by cutting fluid contamination, greatly improving the detection sensitivity, and ensure the smooth operation of the machine tool.

(2)Intelligence and Practicality

A. Digital services (AR parts manual, AR problem troubleshooting guide)

FATEK develops our own augmented reality machine tool management system. A variety of machine tool information is constructed on a cloud server by using augmented reality, providing clients with access to the system via mobile devices. The system includes AR parts manuals, AR troubleshooting guides, etc. When a client's machine has problems, a QR code is generated in real time from the controller screen and is connected to the cloud through the mobile device and using AR information guidance in cloud server to solve problems. In addition, the AR parts manual developed by FATEK also provides a machine-specific QR code of the parts manual, allowing customers to search machine information in an augmented reality way. Damage can also be checked within the system. We can place instant online orders for parts, assist customers with after-sales service and maintenance, and strive to let machine operate in a short time.

B. Using Digital twins as preparation before processing.

In order to pursue the best processing procedure, FATEK uses advanced simulation technology on

real machines to optimize the production process. It uses PC software to simulate the effects of processed parts. Parameters and processing conditions can be adjusted without moving the machine, which can significantly reduce trial and error costs during operation and improve overall production efficiency. This machine applies digital twins technology to perform collision and interference checks on processed parts, which can reduce interference and avoid problems such as machine tool collisions and poor processing quality caused by errors in processing procedures.

C. ESG Human Machine Interface.

To make the carbon emission calculation of the machine easier, our company installs a specific current transformer at the part of power input on the machine. Through the power monitoring module, the info of three-phase electric voltage, electric current, frequency, power and total power consumption of the machine can be obtained. This information is clearly displayed on the controller screen, allowing the operator to instantly grasp the machine's power consumption information and calculate the machine's carbon emissions.

(3)Energy Saving Computation

- Development of ATC energy saving and load shedding function
- Water tank pump with frequency converter hang on back

(4)Structure, Precision and Quality

- Spindle thermal compensation technology

Since this is a boring machine with an extendable spindle, the W-axis can reach 800mm. In order to achieve better accuracy, the spindle adopts thermal compensation technology to reduce the dimensional errors caused by the increase of temperature when spindle is extending. It also can improve the processing accuracy and present the best compensation effect of ±18μm.

(5)Market Feasibility

At present, the main competitors in the global market are Japanese machinery KURAKI, NOMURA and Italian TREVISAN. Our company's newly developed products have milling and turning combined processing capabilities, which can correspond to various processing needs. They are mainly used for component processing of petrochemical industry, large pumps, various water and power grid pipe valve related products. This machine can cope with most machining processes. The mechanical facing head is a completely self-made product of our company. It has been promoted to many countries. Currently, the rigidity of the spindle increases the processing range of the machine and improves the convenience of operation. It is also equipped with a smart APP digital services, which makes the product meet the market needs and stand out from other competitors

(6)Aesthetics

The upper part of the machine body is milky white and bright gray, showcasing the professionalism of our machine tool. The bottom of the machine tool is carbon black, which can clearly distinguish the moving and fixed areas, increasing operational safety. The sheet metal lining further accentuates the overall appearance, demonstrating the high stability of the boring and milling machine, along with its excellent capability for heavy-cutting.

(7)Others

In recent years, customers have increasingly required that the chips and cutting fluid generated by the machine can be fully recycled and have requested sheet metal covers for the machine to keep the factory clean and ensure personnel safety. In response to these needs, our company has developed half-enclosed machine designs and splash-proof sheet metal for operators to prevent chips and cutting fluid from splashing, while also enabling their recycling. An interlock switch has been installed on the operating sliding door to protect the safety of the operator.

友嘉實業股份有限公司
FAIR FRIEND ENT. CO., LTD.

地　　址：40852 臺中市南屯區精科路 12 號
No.12, Jingke Rd., Nantun Dist., Taichung 40852, Taiwan
電　　話：+886-4-23594075　　**傳　　真：**+886-4-23594873
網　　址：www.feeler.com　　**E-mail：**sales@feeler.com

攤位號碼：J0330

主要產品類別：

- 臥式 / 立式 _ 車床
- 立式 / 臥式 / 五軸 _ 綜合加工中心機
- 龍門型加工中心機、臥式搪銑床
- 自動化生產線

參賽作品名稱：

VUX-300T 銑車複合綜合加工中心機
VUX-300T　Mill and Turn Machining Center

作品圖片：

作品開發背景：

本次參賽友嘉銑車複合加工中心機 VUX-300T，銑車複合加工中心在本質上是一種耦合的機床設備，它可以使用銑削的刀具旋轉和利用車削的工件旋轉進行金屬切削加工。可以讓使用者在不更換加工機台設備的情況下加工更複雜的零件，而且時間可以縮短很多，更符合目前市場上的需求。因此，本計畫將開發銑車複合加工中心，結合「刀具壽命評估技術」與「應用虛實整合於工件紋路解析」兩項智慧元素，增加設備之附加價值，以提升在全球市場的競爭力。研發策略市場 _ 電動車、模具、航天、…等市場是未來工具機產業的重點應用，響應政府「國機國造」政策所孕育而生，為廣大市場需求孕育開發而生，本機台具備有車 / 銑 _ 複合加工、可靠高精度且親民價位，特別注重在快速切削和各動作穩定位移速度，用以滿足複合型工藝分析條件，屬於高端市場智慧化機台，提供高精密且多元零件加工鏈市場需求為主。

作品特點：

（一）創新性

水箱擾流自體清潔：

新型專利 [水箱擾流 _ 移動式淤泥槽]

本新型的主要目的在於提供一種切削液過濾系統，其可以避免粉塵型態的切屑沉積在過濾水箱底部，並且可以有效地將粉塵型態的切屑與切削液分離。

直結主軸碟煞系統：

新型專利 [直結主軸煞車系統]

採用油壓卡鉗夾持煞車系統，最小輸出取得最佳制動力，可達成的功效：1. 降低成本、2. 簡化結構系統、3. 縮短物料製程期，使取得快速、4. 保養維修便利化

工具機機台開發採模組化設計，模組化設計涵蓋以下領域：1. 產品設計、2. 零部件設計、3. 製造工藝、4. 產品測試

（二）智慧化與實用性

友嘉實業在智慧化功能上，投入大量的研發資源，整合物聯網、大數據、以及 AI 人工智慧的技術資源，針對加工的節能減碳、維護的數位管理追蹤、以及生產的數據履歷整合提供智慧化的服務與方案，建構智慧機械的基礎與能量，提升本次 VUX-300T 銑車複合綜合加工中心機的智慧應用元素，提供客戶高品質、高價值、高回報的智慧加工設備，包含以下智慧化內容：

淨零碳排趨勢下，智慧節能的具體作為：

A. 整機電力統計：統計每日用電，瀏覽歷史能耗

B. ECO mode，開啟節能模式，計算節省能耗

機台智慧維修保養：

A. 診斷 / 健檢：開機自動巡檢、確保機台健康；運行中實時健檢，主動提示異常

B. 壽命管理：統計使用時間，預測主軸壽命

C. 系統架構功能設計規劃

D. 機電力統計（碳排監測）

E. 節能模式 (ECO Mode): 1. 手動模式 (Manual)、2. 自動模式 (Auto)、3. 遠端模式 (Remote)

應用虛實整合於工件紋路解析

本項技術與 FANUC 技術最大不同是除了模擬命令與伺服動態之外，會對機台進行鑑別建立其傳動與結構模型，可以模擬加工中傳動與結構的影響，改善工具機加工時所產生的紋路

FEELER HMI 優勢

整合了七大功能模組：a. 主畫面、b. 加工功能類、c. 加工程式類 d. 診斷類、e. 故障排除類、 f. 刀具表類、 g. 量測類、 h. 其他功能類

溫升熱補償

熱補償技術可有系統的、高效率的建立高精度熱誤差模型，減少熱變形及提升熱變形品質，提升機床精度及穩定性，主軸熱伸長穩態控制於軸伸長 0.012mm 以下

碳排監測：新型專利 [感測器數據識別系統]

智慧電錶感測器掛載在電器箱內的主電源。碳排資訊可視化：碳排量、用電度、用電金額…

（三）綠色、節能與永續

移載進給系統之潤滑系統主機改採環保油脂式潤滑，藉由油膜耐磨性提升降低零件磨耗使之拉長潤滑需求量來降低耗材，同時油脂潤滑的獨特凝固性可減低液化現象，造成機床周邊加工液混合而造成廢油量與切屑液性能惡化腐敗，可避免環境汙染

油水分離：採用國產圓盤式油水分離設備，主要的作用是把切屑液裡的油與雜質做分離避免加工液惡化，於此循環回收再利用的系統更具備環保功能。

（四）結構、精度與品質

工具機性能提升

本計畫運用這項技術是以目標導向式的進行機台設計，使其可以滿足目標的加速度 (Acc)、加加速度 (Jerk)。

刀具壽命評估技術

(1) 開發刀具壽命評估系統，以可視化介面呈現即時評估刀具壽命狀況。

(2) 利用切削力模型整合扭矩堆疊方法，僅需建立一次模型 (A 參數)，當加工參數變異 ±20% 內 (Fz) 無須重新建模，依舊能估測刀具壽命。

開發刀具壽命評估可視化介

(1) 取代人工經驗試誤法判斷刀具壽命的不確定性與耗時費工問題。

(2) 提供使用者判斷刀具更換時間，提早備刀準備，減少加工等待時間。

(3) 掌握刀具壽命，降低加工製造成本。

(4) 目的協助廠商，讓傳統工具機轉型為智慧製造解決方案供應商，提升產品附加價值

（五）市場可行性

VUX-300T 銑車複合立式加工中心機，可針對複合型及高精度工件，適用工件於一次性夾持條件下對工件進行銑 / 車複合加工，亦可應用於複材之工件對於不同屬性加工一次完成，本體同採 5 軸機延伸整合設計因考慮各區域市場，需求局部差異化設計，藉由不同行銷管道多品牌銷售擴大佔有率，於一次裝夾完成各種加工，避免重覆裝夾之時間浪費及精度漏失，特別適用於多工程複合，及有軸向干涉情況之加工件，因此 VUX-300T 特別適合於下述各種產業加工應用：半導體產業、3C 通訊產業、生技醫療產業、能源產業、精密模具、機械人產業、無人機…等

（六）審美性

形象美學設計採以數碼線條為基底同心圓繪製，豐富的線段意象如同 VUX-300T 機床萬能般並具有高度靈活的加工技術，更象徵友嘉豐富多式樣的機種設備，滿足加工的各式需求亦賦予強烈科技感的視覺觀，象徵友嘉機械邁進工業 4.0 的準備，呈現產業唯一的領先！

（七）其他

機能與實用性：

1. 智慧型加工機能可提供加工人員，事先預警加工程式是否發生顫振，並且能夠調整加工程式達到最高加工效益。
2. 並可搭配客需機外刀倉，規劃不同儲刀形態。
3. 加工區各種沖屑機能，能將加工出之切屑迅速帶

離加工區，除了維持加工區整潔，並避免殘餘切屑造成加工件表面與其他運動機能產生影響。
4. 主軸溫控防護裝置提供溫度監控功能，加上內部防護吹氣防屑及主軸油冷裝置達到主軸長期精度及壽命。
5. 使用者可趨近工作檯面（工作臺面中心處至操作員距離為 480mm），易更換刀具、安裝工件。
6. 特殊頂罩設計具備在切削過程中可防止油霧噴發加工區外面，及打開兩扇門時可輕易吊運工件。

DESCRIPTION IN ENGLISH:

(1)Innovation

Tank spoiler self-cleaning:

The purpose of the new design is to clean tiny dust chips by a coolant filter system, the dust type of chips are easy to deposit on the bottom of the water tank which is difficult to remove and will shorten the coolant using life, to avoid the dust chips deposited at the bottom of water tank and become a mud cleaning problem, we could add the fluid filtration system to separate the chips from coolant effectively.

Disc brake system for direct drive spindle:

The brake system is clamped by hydraulic calipers, the minimum output can obtain the best braking force.

Achievable effects:

1.Costs Reduce 2.Simplify the structural system
3.Shorten the material process lead-time
4.Easy maintenance and repairs

The development of machine tools adopts modular design, which covers the following areas:

1.Product design 2.Parts design
3.Manufacturing process 4.Product testing

(2)Intelligence and Practicality

Fair Friend Enterprise Co., Ltd invests a lot of R&D resources in intelligent functions, integrates the technical resources of the IoT, big data, and AI, also provides intelligence service and solution such as carbon reduction in processing for energy saving, digital management tracking for maintenance, and integration of production data history. To build the foundation and capability of smart machinery, is to improve the smart application elements of the VUX-300T Mill-Turn Machining Center, providing high-quality, high-value, high-return smart processing equipment, including the following contents:

Under the trend of net zero carbon emission,the specific actions of smart energy saving:

A. Whole Machine Electricity Usage Statistics: Statistics of daily power usage and browsing historical energy consumption

B. ECO mode, turn on the energy-saving mode,calculate the energy saving and consumption

Intelligent machine maintenance:

A. Diagnosis / health check: Automatic inspection at startup to ensure the health of the machine; Real-time health check during operation, Proactively prompting abnormalities.

B. Life management: Count the usage time and predict the spindle life:

C. System architecture and functional design planning

D. Machinery and electricity statistics (carbon emission monitoring)

E. Energy saving mode (ECO Mode):1.Manual mode (Manual) 2.Automatic mode (Auto) 3.Remote mode (Remote)

FEELER HMI Advantages

Integrates seven functional modules: a.Home screen b. Processing function class c. Processing program typed. d.Diagnostic e. Troubleshooting f. Tool table g. Measurement h.Other functional classes

Thermal compensation

Thermal compensation technology can systematically and efficiently establish a high-precision thermal error model, reduce thermal deformation and improve thermal deformation quality, improve machine tool accuracy and stability, and the steady-state control of the thermal elongation of the spindle is below 0.012mm.

Carbon emission monitoring: New patent [sensor data identification system]

The smart meter sensor is mounted on the main power supply in the electrical box.

Visualization of carbon emission information: carbon emissions, electricity consumption, and electricity consumption amount…

(3)Energy Saving Computation

Lubrication system:

The lubrication system of the transfer feeding system is replaced by environment-friendly grease lubrication Reduce the wear of parts by improving the wear resistance of oil film, so as to lengthen the lubrication demand to reduce consumables,At the same time, the unique solidification of grease

lubrication can reduce liquefaction, causing mixing of processing fluid around the machine tool, resulting in deterioration of waste oil and chip fluid performance, which can avoid environmental pollution.

(4)Structure, Precision and Quality

Improved machine tool performance

This technology is aimed at machine equipment that has not yet been assembled and pushes back the design specifications of the machine based on the target processing requirements. Because the acceleration (Acc) and jerk (Jerk) during feeding will induce structural vibration of the machine.

Tool life assessment technology

Under the multiple demands for new forms brought about by the development of new technologies (electric vehicles, aviation, green energy, etc.), in the field of tool machining, the most important task is to further innovate and evolve cutting tools so that users can Application performance can be improved.

(1) Develop a tool life evaluation system to present real-time assessment of tool life status through a visual interface.

(2) Using the cutting force model to integrate the torque stacking method, the model (A parameter) only needs to be established once. When the machining parameters vary within ±20% (Fz), there is no need to re-model, and the tool life can still be estimated.

Development of a visualization tool life assessment tool

(1) Replace the uncertainty and time-consuming and labor-consuming problems of manual trial and error method to judge tool life.

(2) Allow users to judge tool replacement time, prepare tools in advance, and reduce processing waiting time.

(3) Master tool life and reduce processing and manufacturing costs.

(4) Purpose: Assist manufacturers to transform traditional machine tools into smart manufacturing solution providers and enhance the added value of products.

(5)Market Feasibility

VUX-300T Milling and Turning machining center is suitable for turning and milling composite and high-precision workpieces under one-time clamping conditions. It can also be used for processing workpieces of composite materials with different attributes at one time. The extension and integration of this 5-axis machine body are designed based on the local differentiation of market demand in each region. Complete all kinds of processing in one clamping, avoiding time waste and loss of precision due to repeated clamping, especially suitable for multi-process composites and workpieces with axial interference.

(6)Aesthetics

The aesthetic design of the image is drawn in concentric circles based on digital lines, with diversify in thickness and graphics. The diversify line segment image is like the VUX-300T machine tool that is versatile and has highly flexible processing technology, which symbolizes the richness and diversity of FEELER.

(7)Others

Function and Practicability:

(1) The intelligent processing machine can provide the warning of chatter in the processing program, and can adjust the processing program to achieve the highest processing efficiency.

(2) It can also be matched with customers' needs to plan different tools storage forms.

(3) The spindle has a central water outlet function, which can meet the deep hole processing type, and can adjust different water outlet pressure requirements according to customer needs. It also has the function of temperature compensation, effectively improving the spindle efficiency.

(4) Various chip punching functions in the processing area can quickly take the processed chips away from the processing area. In addition to maintaining the cleanliness of the processing area, the residual chips can avoid the impact on the surface of the workpiece and other movement functions.

(5) The spindle temperature control protection device provides the function of temperature monitoring. In addition to the internal protection, air blowing and chip prevention, the spindle oil cooling device achieves the long-term accuracy and service life of the spindle.

(6) The special top cover design can prevent oil mist from erupting outside the processing area during the cutting process, and can easily lift large workpieces when opening two doors.

高明精機工業股份有限公司
KAO MING MACHINERY INDUSTRIAL CO., LTD.

地　　址：42152 台中市后里區中部科學園區后科南路 53 號
No.53, Houke S. Rd., Houli Dist, Taichung City 42152, Taiwan
電　　話：+886-4-25577650　　**傳　　真：**+886-4-25577630
網　　址：www.kaoming.com　　**E-mail：**km@kaoming.com.tw

攤位號碼：I0615

主要產品類別：

產品屬綜合加工機類、數值控制工具機類

參賽作品名稱：

KMC-436HAX.E 高剛性智慧五面龍門加工中心機
KMC-436HAX.E High-Rigidity Intelligent Five-Axis Gantry Machining Center

作品圖片：

作品開發背景：

本機的研發策略旨在打造一款具有航太行業難切削材料及大型工件加工能力的智慧五面龍門加工中心。主要改進有兩部分：一是提升主軸系統性能與機台剛性，二是搭載三項智慧化功能，專為航太零件切削需求提供高效能加工解決方案。

作品特點：

(一)創新性

本機的研發策略是打造一款智慧化五面龍門加工中心，能夠處理航太產業中大型難加工材料。其各項創新與優勢如下：

1. 標配 43/58HP 主軸馬達 (優於同級產品 40%).
2. 標配高強度齒輪組,齒面壓應力達負 700MPA (優於同級產品二倍壽命).
3. 快送能力 24m/min(優於同級產品 32%).
4. 臥式主軸 6000rpm(優於同級產品 71%).
5. 橫樑與立柱採用專利 M632767 號之十字封閉型 + 龍骨設計 (抗彎能力提升 42%; 抗扭能力提升 17%).
6. 節能油壓系統設計 (減少能耗 56%).
7. 可選配專利 M634822 號之傳動機構流道系統實現快速暖機與進給軸恆溫控制，其暖機時間從原本的 36 分鐘縮短至 11 分鐘，效率提升 70%。

(二)智慧化與實用性

本機搭載由高明精機智慧機械部與工研院合作發展之三項智慧功能。「智慧化輔助組裝監測技術；設備健康檢知技術；加工動態監測技術」等智慧化功能，其詳細分項如下：

◆智慧化輔助組裝監測技術：

主軸跑合監測系統：監控齒輪與軸承裝配狀態，量化確保品質一致性。

視覺化異常排除導引技術：基於 3D 模型數位化與可視化組裝，降低維護難度。

◆設備健康檢知技術：

關鍵部件狀態監控系統：結合人工智慧與感測器，監測部件老化情形。

潤滑系統全時監測技術：監控潤滑系統的溫度與振動，確保運作性能。

◆加工動態監測技術：

智慧溫控系統：結合模糊控制與人工智慧，自適應調節溫度，保持設備穩定。

切削動態管制系統：以振動與電流訊號即時監控加工狀態，提高生產良率。

本產品三項智慧化功能中,於實際應用上可解決來自公司內部組裝生產的瓶頸以及客戶端 回饋的實際加工需求.

(三)綠色、節能與永續

本產品採用節能油壓系統，將馬達功率從 10HP 降至 3HP，實現 56% 的能耗降低。全機使用 IE3 高效馬達，符合歐盟環保標準。關鍵零件的齒輪使用壽命提升兩倍，並有助於降低碳排放。公司也積極推動環保措施，包括 2019 年更換照明設備，每月節省 33,041.6 度電；2021 年完成太陽能發電板安裝，總面積達到 5,016 平方公尺，每月發電 98,328.2 度電；並於 2023 年完成碳盤查，設立減碳目標，實施綠能改革。

(四)結構、精度與品質

本產品三軸重複定位精度表現：

進給速度：5000 mm/min；

目標停留時間：4 sec；

重複定位精度：

X 軸 0.007mm / Y 軸 0.002mm / Z 軸 0.006mm。

(五)市場可行性

高明精機已超過 50 年專注於工具機市場，並在全球工具機展中持續亮相，與各國代理商建立長期合作關係。根據市場研究機構 ResearchAndMarkets.com，全球航太零件加工市場以 CAGR 4.0% 的年複合成長率穩定增長，促使對大型高精度、高效率加工需求上升。未來十年航太零件中的大型難切削工件是五面龍門加工中心機的一大市場。為應對航太產業需求，高明精機基於五面龍門加工中心技術，開發出專為航太大尺寸難切削材料設計的 KMC-HAX.E 系列，提供高精度、大行程、高剛性及多角度五面加工需求。

(六)審美性

整機融合高明企業識別色與知名車廠色調，外觀設計簡潔，無外露加固肋條與線材，邊角平滑。正面設有黑灰色透明門飾板，配淺藍邊條與機種編號，提升細膩感並解決透明板水漬問題。主軸頭及 CRT 上方雕刻高明 LOGO，並以鋁擠型材取代鋼材，實現輕量化與高質感。環繞式燈板取代傳統警示燈，增強機器科技感與可視化警示，輸送機飾板色彩與造型統一整體風格。

(七)其他

本產品採用完整 PLM 開發設計，國產化零組件比例達 74.5%，並符合 9 項 TMBA 產業規範。設計初期即考量零件標準化與模組化，各模組單元具備擴充功能。

DESCRIPTION IN ENGLISH:

(1)Innovation

The development strategy of this machine is to create an intelligent five-axis gantry machining center capable of processing large, difficult-to-machine materials in the aerospace industry. Its various innovations and advantages are as follows:

1. Standard 43/58HP spindle motor (40% better than similar products).
2. Equipped with high-strength gear sets, with surface pressure stress reaching -700MPa (twice the lifespan compared to similar products).

3. Rapid feed rate of 24m/min (32% better than similar products).
4. Horizontal spindle speed of 6000rpm (71% better than similar products).
5. The cross beam and column use patented cross-closed type and rib design (42% increase in bending resistance; 17% increase in torsional resistance).
6. Energy-saving hydraulic system design (reducing energy consumption by 56%).
7. Optional patented M634822 drive mechanism duct system for quick warm-up and constant temperature control of the feed axis, reducing warm-up time from 36 minutes to 11 minutes, improving efficiency by 70%.

(2)Intelligence and Practicality

This machine is equipped with three smart features developed in collaboration between KAO MING's Smart Machinery Division and the Industrial Technology Research Institute: "Smart Assembly Assistance Monitoring," "Equipment Health Monitoring," and "Machining Dynamics Monitoring." detailed in Table 1 below.

◆ **Intelligent Assembly Monitoring Technology:**
Spindle Run-in Monitoring System: Monitors the assembly status of gears and bearings, quantifying and ensuring consistent quality.
Visual Abnormality Detection Technology: Uses 3D digital models and visual assembly to reduce maintenance complexity.

◆ **Equipment Health Detection Technology:**
Critical Component Monitoring System: Combines AI and sensors to monitor component aging.
Lubrication System Monitoring Technology: Monitors temperature and vibration in the lubrication system to ensure operational performance.

◆ **Dynamic Processing Monitoring Technology:**
Smart Temperature Control System: Uses fuzzy control and AI to adaptively adjust temperature, maintaining equipment stability.
Cutting Dynamics Control System: Monitors machining status in real-time using vibration and current signals to improve production yield.

This product's three smart features address internal assembly production bottlenecks and meet actual machining needs based on customer feedback.

(3)Energy Saving Computation

This product uses an energy-saving hydraulic system, reducing the motor from 10HP to 3HP, cutting energy use by 56%. It also has IE3 high-efficiency motors that meet EU environmental standards. The gears in key parts have their lifespan improved by two times and help lower carbon emissions. The company has also taken steps to protect the environment, including changing lighting in 2019 to save 33,041.6 kWh per month, installing solar panels in 2021 with a total area of 5,016 square meters to generate 98,328.2 kWh per month, and completing a carbon audit in 2023. The company has set carbon reduction goals and is implementing green energy reforms.

(4)Structure, Precision and Quality

The product's three-axis repeatability accuracy is as follows: Feed rate: 5000 mm/min ; Target dwell time: 4 sec ; Repeatability accuracy: X-axis: 0.007 mm / Y-axis: 0.002 mm / Z-axis: 0.006 mm

(5)Market Feasibility

KAO MING has been dedicated to the machine tool market for over 50 years, consistently showcasing its products at global trade fairs and establishing long-term partnerships with international distributors. According to market research firm ResearchAndMarkets.com, the global aerospace parts machining market is steadily growing at a 4.0% CAGR, driving an increasing demand for large, high-precision, and high-efficiency machining. Over the next decade, large, hard-to-machine aerospace components will be a major market for five-axis gantry machining centers. To meet the demands of the aerospace industry, KAO MING developed the KMC-HAX.E series, based on five-axis gantry machining center technology, specifically designed for large, hard-to-machine aerospace materials, offering high precision, long travel, rigidity, and multi-angle machining capabilities.

(6)Aesthetics

The entire machine adopts KAO MING's brand identity colors, combined with the latest color schemes from renowned automotive manufacturers. The appearance is stylish and elegant, with no exposed ribs or wires, and smooth, rounded corners, presenting a clean, square design. The front features a black-gray transparent door with light blue trim and model identification, enhancing the premium feel while solving the issue of coolant water stains on traditional acrylic panels, improving cleanliness. The KAO MING logo is engraved above the spindle head

and CRT, and aluminum extrusion replaces steel for a lightweight, high-quality surface finish. A surround light panel replaces traditional three-color warning lights, enhancing the machine's technological appeal and improving the visibility of warning signals. The conveyor's decorative panels align with the overall design, creating a unified appearance.

(7)Others

This product features a complete PLM development design, with 74.5% domestically sourced components and compliance with 9 TMBA industry standards. The design prioritizes part standardization and modularization, with each module offering expandability.

偉詳工業股份有限公司
WAYSIA INDUSTRIAL CO., LTD.

地　　址：62159 嘉義縣民雄工業區中興一街 6 號
No.6, Ming Hsing 1 st St., Ming Hisung Industrial Area, Chiayi 62159, Taiwan
電　　話：+886-5-2210485　　**傳　　真：**+886-5-2210219
網　　址：www.waysia.com　　**E-mail：**sales@waysia.com

攤位號碼：N0114

主要產品類別：

- CNC 立式車床
- CNC 砂輪磨邊機
- CNC 櫛式車床
- CNC 綜合加工中心機
- Gantry Robot 桁架式機械手
- 夾具與治具
- 活塞環專用機
- 其他工具機週邊配件

參賽作品名稱：

WVM-410UT/UTR 銑車加工中心與智慧刀料倉系統
WVM-410UT/UTR Mill-Turn Machining Center with Intelligent Tool and Material Storage System

作品圖片：

作品開發背景：

本作品的開發動機源自於汽車零件生產工廠，因應人力資源短缺及土地資源有限等挑戰。在滿足產線自動化、智慧化和資訊化等需求的同時，縮小整體佔地面積，不僅能充分地利用土地資源，還能提升管理效率，減少操作人員的移動距離和工作疲勞。搭配複合式銑車加工機 WVM-410UT/UTR，不僅優化了製程中的搬運環節，亦實現了節能永續的理念，WVM-410UT/UTR 銑車加工中心與智慧刀料倉系統因此誕生。

作品特點：

（一）創新性

1. 智慧刀料倉系統內可混合儲存待加工件及製程用的刀具，搭配機械手進行換刀、換料，可實現連續自動生產。
2. 具備多元化的生產情境，此生產系統可靈活應用於以下模式。

全製程模式：左右手機台協同完成完整的加工工序，滿足全製程的生產需求。

單製程模式：用於單一工序製程，讓左右手機台執行相同的加工序，有效提升瓶頸工序的產能。

混合生產模式：左右手機台分別處理不同的工件加工製程，以應對多樣且彈性的製造需求。

離線操作模式：此生產系統甚至可將其中一側機台切換至離線模式，透過人工介入操作，以滿足返修加工或局部修改等特殊需求，充分展現其靈活性與適應性。

（二）智慧化與實用性

1. 智慧聯網

可透過互聯網傳遞生產訊息，包括刀具、工件與生產進度等資訊，供使用者進行管理應用，並提升生產監控與決策效率。

2. 智慧整刀

系統可透過預讀加工程式，智慧優化刀具在刀庫內的放置位置，最大限度地縮短刀庫在生產過程中的換刀移動距離，除了提高換刀效率，間接也引入了節能概念。當運用的刀具或生產數量越多時，效果越顯著。

（三）綠色、節能與永續

1. 減少機台的使用

選用複合式銑車加工機，根本融入綠色、節能與永續理念。原需兩台機具（車床與銑床）完成的工序，如今一台即可達成，不僅減少資源消耗，亦有效降低能源使用，實現節能環保目標。

2. 刀具利用率極大化

透過累積的經驗數據精準掌握刀具壽命，當刀具接近使用極限時，機械手臂會自動進行換刀操作，確保每支刀具在其壽命內達到最大利用率。這樣的刀具管理不僅提升生產效率，更在資源運用上實現了綠色節能的理念。

3. 緊湊的空間利用

整體面寬 4 米的緊湊設計，不僅大幅減少占地面積，還縮短自動化設備的搬運距離，進而降低生產材料和能源的消耗，體現綠色節能永續理念。

（四）結構、精度與品質

1. WVM-410UT/UTR 銑車加工中心結構設計

WVM-410UT/UTR 銑車加工中心，運用有限元素分析（FEA）結構分析，並進一步配合實驗模態分析驗證。依此，確保機台結構的穩定性。

2. 智慧刀料倉

智慧刀料倉採用鍊條式刀庫作為基礎架構，不僅確保刀料倉機構的成熟性與穩定性，還具備高重複精度之刀料取放位置。

（五）市場可行性

隨著全球市場的變遷、地緣政治的影響以及永續意識的提升，生產規模正逐漸趨向小型化與多樣化。在將加工機推向市場的過程中，除了追求高生產效率外，提升空間利用率也至關重要。這意味著在相同的空間內，能容納更多機台以應對多樣化的生產需求。

（六）審美性

WVM-410UT 榮獲 2024 金點設計獎的肯定，充分展現其在工業設計領域的卓越成就，更強化了其在國際市場的競爭優勢。

外觀結構方面，採用型隨機能 (Form Follows Function) 的設計原則，操作箱配合機身左側的梯形斜面設計，讓控制介面更貼近操作者並且與加工區域呈現 30 度的夾角，可便於觀測機身內部加工與操作箱，體現了人性化設計思維。特別設計的白色外框包覆操作箱主體融合取手功能，讓操作者能依個人需求靈活調整使用角度。

在色彩規劃上，採用多層次配色，主體採用深邃的工業灰色，搭配精細的捶紋表面處理。灰色不僅展現專業穩重的氣質，更能有效降低操作者在長時間工作中的視覺疲勞。深灰色調的選擇，特別契合歐洲市場對工業設備的審美偏好，同時也符合其注重細節處理的工藝要求。在重點功能區域，設計團隊採用了兼顧東西方審美的視覺策略。控制面板特別選用黑色與白色的雙色組合，創造出懸浮的視覺效果，這種現代感的設計特別吸引追求科技感的亞洲市場。在機台狀態燈周圍，巧妙地點綴了 WSI 標誌性的藍色飾條，不僅突顯了企業識別，更滿足了亞洲市場對於明亮色彩的偏好。

WVM-410UT/UTR 透過創新的雙機搭配智慧刀料倉整合設計，展現了突破性的空間運用概念。有別於傳統工具機與刀料倉各自獨立的配置方式，WVM-410UT 採用高度整合的設計思維，重新定義了智慧製造的空間效率。當雙機搭配智慧刀料倉時，整體空間規劃更顯巧妙，透過安全警戒區的重疊設計，有效降低整體占地面積需求。刀料倉外觀延續機台的設計語彙，採用相同的深邃工業灰色與表面處理，創造出整體性的視覺美學。

DESCRIPTION IN ENGLISH:

(1)Innovation

1. The intelligent tool and material storage system can store both workpieces and tools in a mixed configuration. Used with robot to change tools and materials, continuous automatic production can be achieved.
2. This system supports diversified production scenarios, which can be flexibly applied in the following modes:

Full-Process Mode

The symmetry machining center collaborate to complete the entire machining process, meeting the requirements of full-process production.

Single-Process Mode

Both machining center execute the same machining process, effectively increasing the capacity of bottleneck process.

Hybrid Production Mode

The left and right machining center handle different workpiece processes, accommodating diverse and flexible manufacturing demands.

Offline Operation Mode

Switching the left or right machining center to offline mode allows for manual processing operations, such as rework or partial modifications to meet specific requirements. This demonstrates exceptional flexibility and adaptability.

(2)Intelligence and Practicality

1. Smart Connectivity
   Production information, including details about tools, workpieces, and production progress, is transmitted through the Internet to support user management and applications, enhancing production monitoring and decision-making efficiency.
2. Smart Tool Arrangement
   The system can intelligently optimize the placement of tools within the tool magazine by pre-reading the machining program, minimizing tool change travel distance during production. This not only improves tool change efficiency but also indirectly introduces the concept of energy saving. The more tools or higher production quantities are utilized, the more significant the effect becomes.

(3)Energy Saving Computation

1. Reducing Machine Usage
   By adopting a mill-turn machine, the concept of environmental sustainability is integrated from the ground up. Tasks that previously required two separate types of machines (e.g., lathes and milling machines) can now be accomplished with a single mill-turn machine. This approach reduces resource consumption.
2. Maximizing Tool Utilization
   By leveraging accumulated experience data to precisely monitor tool life, the system ensures that when a tool achieves its life time, the robot automatically performs a tool change. This guarantees that each tool achieves maximum utilization within its life time. Such tool management not only enhances production efficiency but also embodies the concept of green and energy-saving practices.
3. Compact Space Utilization
   The compact design with an overall width of 4 meters significantly reduces the footprint and shortens the transport distance for automated equipment, thereby lowering material and energy consumption while embodying the concept of green, energy-efficient, and sustainable practices.

(4)Structure, Precision and Quality

1. WVM-410UT/UTR Mill-Turn Machining Center Structural Design

The WVM-410UT/UTR mill-turn machining center utilizes Finite Element Analysis (FEA) for structural analysis, further validated through Experimental Modal Analysis (EMA). This ensures the structural stability of the machine.

2. Smart Tool and Material Storage System

The smart tool and material storage system is built on chain type tool magazine as its foundational component. This ensures the maturity and stability of the storage system while providing highly repeatable precision in tool and material pick-and-place positions.

(5)Market Feasibility

With the shifting global market, the impact of geopolitical risks, and the growing emphasis on sustainability, production scales are gradually trending toward smaller and more diversified operations. Pursuing high production efficiency is essential, but enhancing spatial utilization is equally critical. This means accommodating more machines within a factory space to meet the diverse demands of production requirements.

(6)Aesthetics

The WVM-410UT mill-turn machining center has been

recognized with 2024 Golden Pin Design Award, showcasing its outstanding achievements in industrial design, further strengthening its competitive edge in the international market.

Its design embodies the "form follows function" principle, with a user-centric control box seamlessly integrated into the left-side slope, positioned at a 30-degree angle for better usability and visibility. The white-framed control box doubles as a handle, allowing angle adjustments for operator convenience, reflecting a human-centered philosophy.

The multi-layered color strategy balances global aesthetics. The main body's deep industrial gray minimizes glare and visual fatigue, appealing to European tastes. Key functional areas use black-and-white tones for a modern, high-tech look favored by Asian markets, while WSI's signature blue accents enhance brand identity.

The WVM-410UT/UTR introduces a groundbreaking concept in space utilization through its innovative dual-machine integration with the intelligent tool and material storage system, the overall space planning becomes even more sophisticated. By overlapping safety zones, the design significantly reduces the required footprint. The storage system's exterior extends the design language of the machine, featuring the same deep industrial gray color and surface finish, creating a cohesive and unified visual aesthetic.

崴立機電股份有限公司
WELE MECHATRONIC CO., LTD.

地　　址：305048 新竹縣新埔鎮義民路 1 段 520 號
No.520, Sec. 1, Yimin Rd., Xinpu Township , HsinChu County 305048, Taiwan
電　　話：+886-3-6960360　　傳　　真：+886-3-6960370
網　　址：www.welegroup.com　　E-mail：wele.cnc@msa.hinet.net

攤位號碼：K0816

主要產品類別：

- 龍門立式綜合加工中心機 (RB/SB/LB/VB/NB)
- 龍門五面綜合加工中心機 (MB/MS/ML/MVB)
- 天車式綜合加工中心機 (MG/FH)
- 臥式搪孔加工中心機 (HB/HR/HBM/HM)
- 臥式綜合加工中心機 (HMC)
- 立式綜合加工中心機 (AA/AQ/VQ)
- 五軸加工中心機 (UA/UG/UQ/UB/MG-U)
- 立式銑車複合加工中心機 (MT/MT-W)
- 立式車銑複合加工中心機 (VTC/VTM)
- 智慧化高效能彈性製造單元 (HMC500+PPS C5 , UG630+AWC)

參賽作品名稱：

UG630-AWC 智慧化彈性製造中心機
UG630-AWC Smart & flexible manufacturing Machining Center

作品圖片：

作品開發背景：

(1) 五軸加工機現已為每家工具機廠必備機種，而國外市場需求經代理商迫切期望崴立開發高性價比的五軸加工機，例如義大利、法國、土耳其等，許多國家都有市場需求，尤其在量產加工扮演重要角色，一次夾持可五軸多面加工，托盤自動交換節省交換工件停機與校正時間，並對應多托盤需求大容量刀庫與無人加工易於排屑特性。

(2) 然而目前國際市場變化多端，多樣少量加工之生產方式已經是趨勢，為滿足客戶需求：用最少的純熟技術人力，及最有效率簡便產出零件獲取最大的利潤，需要更高智慧彈性製造單元來達成。

(3) 本參賽產品機械研發方向追求最高可靠度長時間連續運轉加工產出，電控研發方向追求最高效率排程搭配，可實現無人化量產加工之市場趨勢，站在使用者角度去研發，有別於同業外購市售零組件，拼裝的結果只能堪用，外國製品雖可靠但昂貴交期長且售服速度慢。

作品特點：

(一)創新性

本參賽作品可實現高度無人化量產加工之市場趨勢需求，有別同業幾乎外購市售品，崴立為求掌握核心競爭力，大量自主研發製造堅固耐用之關鍵零組件。列舉如下：

1.1 15000 轉高速內藏主軸：具有最佳的體積重量性能比，可提升動態特性。

1.2 BC 軸旋轉工作台：採 Torque motor 直接驅動，旋轉定位 / 重複精度：10 弧秒 /5 弧秒。自製關鍵高扭矩強力煞車夾持系統，並使用國產高剛性交叉滾柱軸承，大幅提升產品耐用度

1.3 自動交換工作台：搭配托盤機械式原點夾持系統，採機械式彈簧夾持，以大幅降低油壓馬達做動而耗能。

1.4 AWC 彈性製造單元：相較市售品快速可靠，採用全電式伺服馬達搭配自製專利減速機，可縮小馬達規格。

1.5 120T 擴充式刀塔：模組化設計可擴充，並採用全電式伺服馬達搭配自製專利減速機驅動，可縮小馬達規格，節能又快速。

1.6 自主開發智慧排程軟體：滿足批量生產或急件插單等實際狀況。

(二)智慧化與實用性

2.1 智能與實用性操作畫面，共 7 大項客戶實用功能：刀庫管理，刀具量測，工件量測，計算器，I/O 列表，換刀復原，全機馬達資訊等。

2.2 智慧化主軸，內建溫度監控、智慧軸承可變預壓和類神經演算法溫度熱補償。

2.3 智慧化主機：托盤交換密合確認與切屑偵測排除，優化控制沖屑時機與部位，減少泵浦長時間作動耗能。

2.4 全自動刀長、刀徑量測與補償，全自動工件位置量測與補償。智慧化 AWC 彈性製造單元：

2.4.1 藉由智慧化感測與運算，能判斷運送機構上之承載情形並自動變速，以最佳速度及最短路徑定位後，再以最安全方式輸送托盤。

2.4.2 最佳化搬動順序：保持先進先出連續加工，無須人工判斷，無等待浪費時間。

2.4.3 急件插單：可簡便設定，急件進與出皆為最高優序，簡單應對突發狀況之急單需求離線維護與保養：應用 (不使用) 狀態，故障檢修與備料期間皆不需要停機。

2.4.4 模組化設計，單主機出廠後可容易擴充智慧化 AWC 彈性製造單元，且能裝貨櫃節省運費，好拆好裝，國外代理商能單人交機，搭配智慧軟體與機械精度復原介面可在交機兩天內快速校正復原上線。

2.4.5 人機介面 (HMI) 採用歐洲控制器大廠 :FAGOR，由崴立電控團隊縝密研發，直覺簡單容易操作，即時顯示畫面與實機動作完美同步。

2.5 智慧化刀庫：採全電伺服馬達驅動，模組化設計可容易擴充為 150 刀、亦可選購充刀庫內側自動斷刀檢知系統和刀庫數位觸控操作面板。

(三)綠色、節能與永續

3.1 自製內藏式主軸無皮帶或齒輪帶動，可更高效率榨出主軸馬達動力並減輕主軸頭移動重量。主軸軸承採油脂永久潤滑，無油氣汙染，且可縮減主軸空氣消耗量約 80%，大幅節約客戶廠房的氣壓耗能。

3.2 油壓單元使用最新高效率伺服馬達與蓄壓器。泵浦與切削液單元使用 IE3 高效率馬達與泵浦，符合節能趨勢。

3.3 智慧節能省電：所有備妥工件皆加工完成，主機與 AWC 即可自動斷電。

3.4 本機朝向聯合國永續發展目標包含 17 項目標 (Goals) 及 169 項細項目標 (Targets) 之中的三項目推進：(7-3): 2030 年前，使本機能源效率改善率成長一倍。(9-4) :2030 年前，通過提高資源利用效率和更多地採用清潔和無害環境的技術和工業流程，升級基礎設施和改造工業，使其更具可持續性。(12-5): 2030 年前，通過預防、減少、回收和再利用，大幅減少廢棄物產生。

(四)結構、精度與品質

4.1 透過拓樸幾何及 FEA 有限元素分析設計出：一體式高剛性底座，高動剛性輕量化的主軸頭與立柱，高速 DD motor 驅動旋轉工作台，可縮減驅動馬達耗能。

(五)市場可行性

5.1 目前台灣同業相同五軸加工中心機的開發，技術層次均有一定的水準，但就彈性製造系統與大容量刀庫擴充而言，大多是搭配市購品。崴立研發團隊以多年工具機設計經驗及貼近終端客戶的使用習慣，特為此開發此智能化高效能彈性製造系統及擴充刀庫來提供給台灣、歐美客戶有更友善及生產效益的智能系統。

5.2 此產品未來將著重於台灣、歐洲與北美洲市場的拓銷潛力，對於新產品的未來市場評估至 2027 年貢獻營收金額達 USD 9600 萬。

(六)審美性

6.1 本參賽作品外觀以簡約風格，結構緊湊為設計重點。符合人體工學的半圓弧工作站，操作員可在此輕鬆省力地裝卸與清潔工件，並為引入 TPS 豐田精實生產概念，實現機構模組化製程創新，簡化許多不必要的加工與板金，也大幅

提高組裝製程效率。塗裝配色則以銀、黑色薄紋漆為主，具有可局部修補之特性，環保又節省工時。

DESCRIPTION IN ENGLISH:

(1)Innovation

This entry addresses market demand for highly automated, unmanned mass production. Unlike competitors who rely heavily on commercially available components, WELE focuses on core competitiveness by independently developing and manufacturing robust, durable key components. Key innovations include:

1.1 15,000 rpm Built-in High-Speed Spindle

1.2 BC-Axis Rotary Table: Direct torque motor drive eliminates wear and backlash, with a high-torque brake ensuring stability. Cross-roller bearings enhance durability.

1.3 Automatic Pallet Changer: Spring clamping reduces energy use, while air cleaning and chip detection improve cleanliness.

1.4 AWC Flexible Manufacturing Unit: Servo motors with patented reducer provide compact, reliable, and fast operations.

1.5 120-Tool Magazine Module: Modular, servo-driven design with intelligent sensing for efficient and high-speed tool handling.

1.6 Proprietary Intelligent Scheduling Software: Supports batch and urgent orders with overnight unmanned production, enhancing productivity.

(2)Intelligence and Practicality

2.1 Intelligence and Friendly Control Software

2.1.1 Practical Customer Features: Includes tool magazine management, tool measurement, workpiece measurement, calculator, I/O list, entire motor information, and GUI integration.

2.2 Intelligent Spindle

2.2.1 Built-in Temperature Monitoring: Prevents unexpected downtime, providing users peace of mind during mass production.

2.2.2 Adaptive Bearing Preload: Offers high rigidity for low-speed heavy cutting and low heat generation for high-speed cutting, adapting to various machining conditions.

2.2.3 Neural Network Heat Compensation: Uses AI-based neural networks to model thermal deformation, reducing heat deformation by 65%, ensuring long-term machining precision.

2.3 Intelligent Machine Functions

2.3.1 Pallet Alignment and Chip Detection: Reduces manual cleaning and inspection time.

2.3.2 Smart Chip Flushing: Optimizes timing and positioning for coolant usage, reducing pump energy consumption.

2.3.3 Fully Automatic Tool and Workpiece Measurement and Compensation: Ensures machining accuracy with automated adjustments.

2.4 Intelligent AWC Flexible Manufacturing Unit

2.4.1 Load-Adaptive Transport: Adjusts speed and path for safe and efficient pallet delivery.

2.4.2 Optimized Workflow: Automates first-in-first-out machining, reducing idle time.

2.4.3 Urgent Order Handling: Seamlessly prioritizes urgent tasks to meet unexpected needs.

2.4.4 Modular Design: Expandable, compact, and supports fast setup with intuitive tools.

2.4.5 User-Friendly HMI: Intuitive interface synchronized with machine actions via FAGOR controllers.

2.5 Intelligent Tool Magazine

2.5.1 All-Electric Servo Drive: Reduces tool change time from 25s to 15s, enhancing efficiency.

2.5.2 Modular Expansion: Scalable from 30 to 150 tools after installation.

2.5.3 Broken Tool Detection: Optional feature to prevent machining defects.

2.5.4 Digital Touch Panel: Provides tool management info and quick positioning for convenience.

(3)Energy Saving Computation

3.1 Built-in Spindle Design: Belt-free and gear-free design efficiently transfers motor power, reduces spindle head weight, and saves about 80% of air consumption with permanent grease lubrication.

3.2 Energy-Efficient Units: Hydraulic and coolant systems use IE3 motors and pumps; pneumatic units with boosters and accumulators reduce air compressor load, supporting energy-saving trends.

3.3 Intelligent Power Saving: Machines and AWC automatically power off after processing, enhancing energy efficiency.

3.4 This machine is advancing towards three of the United Nations Sustainable Development Goals (Sustainable Development Goals, SDGs), including 17 goals (Goals) and 169 detailed goals (Targets):

(7-3):Before 2030, double the improvement rate of the energy efficiency of the machine.

(9-4):By 2030, upgrade infrastructure and transform industry to be more sustainable through greater resource use efficiency and increased adoption of clean and environmentally sound technologies and industrial processes.

(12-5):By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse.

(4)Structure, Precision and Quality

4.1 Robust Structural Design

Utilizing topological geometry and FEA (Finite Element Analysis), the machine features:

4.1.1 A high-rigidity and stability for the one piece design of Machine base.

4.1.2 A lightweight and high dynamically rigid spindle head and column design.

4.1.3 A high-speed DD motor-driven rotary table that reduces motor energy consumption.

4.2 Durability Testing

The machine has undergone rigorous endurance tests, simulating long-term continuous operation for 5,000 hours. Tests included maximum workpiece load during pallet changes, maximum tool weight during tool changes, use of cutting fluids, and actual cutting under substantial chip and coolant exposure, ensuring consistent performance.

4.3 Compliance with International Standards

Precision and quality meet the highest international standard, VDI3441, with certifications for CE and Taiwan TS, ensuring reliability and safety in global markets.

(5)Market Feasibility

5.1 This product is strategically positioned to expand into the Taiwanese, European, and North American markets. By 2027, it is projected to generate significant revenue, potentially contributing over $10 million globally. This estimate reflects strong growth potential driven by increasing demand in key regions, establishing a robust foundation for long-term success.

(6)Aesthetics

6.1 The appearance design is a simple style and compact structure.

6.2 Ergonomic semi-arc workstation, where the operator can load, unload, and clean the workpiece easily and effortlessly. In order to apply the concept of TPS (Toyota Production System), it realizes the innovation of mechanism modularization process and simplifies many unnecessary processing and sheet metal, and also greatly improve the efficiency of the assembly process.

6.3 Silver and black thin-grained paints are the main colors of the coating, which can be partially repaired, which is environmentally friendly and saves man-hours.

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CNC 車床及其加工單元類

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No.38, Keyuan Rd., Xitun Dist., Taichung, Taiwan
電　　話：+886-4-24636000　　**傳　　真：**+886-4-24636038
網　　址：www.goodwaycnc.com　　**E-mail：**info@goodwaycnc.com

攤位號碼：I0816

主要產品類別：

- 臥式車銑複合機
- 立式車銑複合機
- 走心式車銑複合機
- 多軸車銑複合機
- CNC 圓筒磨床

參賽作品名稱：

SK-38 多工高效綠色五軸走心式車銑複合機
SK-38 High-Efficiency, Multi-Tasking, Green 5-Axis Swiss-Type CNC Lathe

作品圖片：

作品開發背景：

近年因應 AI 人工智慧與淨零碳排的趨勢，電子、半導體、AI 伺服器、醫療生醫、航太產業對工具機需求增加，隨著 AI 伺服器規模日益增大及供應鏈成型，其相關零件加工需求如伺服器冷卻系統的快接頭、電子接頭端子等零件，零組件的加工過程愈來愈複雜，技術層面上的考量相對提高許多，在講求效率並維持精度品質，同時節省人力成本的條件下，必然需要複合型工具機來完成結合車削、銑削能夠高效率的完成各種形狀複雜的工件。智慧自動化量測生產系統結合機械手臂自動化上下料、高效率量測站串聯工具機，即時工件品質監控，即時自動刀具補償回饋，工具機及時修正，運用機械手臂重複精準供料和取料，可連續無人自動化生產節省人力成本。

綠色工具機設計，應用智慧功能減少工具機電力耗能、監控電力使用，落實節能減碳及永續發展的目標。

作品特點：

（一）創新性

(1) **主軸 / 副主軸：**主軸 / 副主軸使用內藏式馬達，以電磁能直接傳動為機械能，無傳遞功率損耗，高速切削能力較優。主軸側以迴轉油壓缸取代傳統開閉爪，動作反應更快、更即時，並提升工件夾持穩定性。

(2) **冷卻系統：**主軸 / 副主軸均搭配溫度控制的冷卻油循環至主軸軸承部分和驅動馬達，有效抑制主軸熱變位，進而防止加工精度劣化。

(3) **銑削單元：**機構搭配溫度控制的冷卻油循環，有效抑制銑削機構熱變位，以單銑削軸馬達驅動銑削單元大功率輸出有更佳加工效能。

(4) **主軸煞車：**採用全圓周碟式煞車，較以往的單點式煞車，可提供更平穩的煞車力。

(5) **高剛性龍門型刀具系統：**設計有利於均勻承受切削的力矩負荷，最大程度地增進刀具系統的結構剛性，提升加工效率。

彈性刀具系統：刀具數可安排高達 37 個刀位（刀位數提升 60%），可滿足高度複雜加工需求，側銑動力刀具座可加裝旋風銑削 / 多邊形銑削 / 滾齒 / 深孔等特殊設計動力刀具，背銑動力刀具座可加裝 90 度鑽孔 / 鋸片動力刀具，滿足跨產業之各式工件樣態。

(6) **B 軸動力刀座：**最大旋轉 135 度的 B 軸動力刀具座運動控制能夠自由編程，可依需求執行斜孔、斜面與多軸同動輪廓加工；旋轉軸兩端固定式設計提升 B 軸整體剛性和加工時動力刀座的穩定性，而有良好加工性能。

(7) **導套介面：**特殊設計的介面機構讓 SK-38 系列可依據需求即時拆卸或安裝導套，使用導套加工模式能提供工件穩固的支撐、避免懸垂，確保優異的加工精度與穩定度，適合加工細長型工件；使用無導套加工模式棒材無須精密研磨即可直接加工。

（二）智慧化與實用性

(1) **刀具壽命管理 & 刀具補償：**簡潔明瞭的用戶介面讓使用者的操作更加直覺式操作，即時監控紀錄刀具使用狀態，使刀具管理更加精確和便利性。

(2) **智慧機械 IIoT 模組：**於主軸及油水泵安裝感測器，可達到以下功能，並即時進行異常處理。

a. 主軸：監看功能、警告 / 警報閥值設定、主軸健檢、特定區間感測數據紀錄及比對。

b. 油水泵：監看功能、警告 / 警報閥值設定、補充與保養提醒、特定區間感測數據紀錄及比對。

c. 預知型保養：透過感測器和數據紀錄比對，當主軸、油水泵設備出現變化徵兆時，預先提供設備維護人員訊息，避免機器在非預期停機而延宕生產時程。

d. 遠端監控：機台連線而維護人員可以線上監控機台，減少人工現場巡視時間

(3) **OCR 擺動斷屑切削：**透過 OCR 控制功能可高速擺動刀具，在切削過程中交替產生實切與空切，進而利用空切的瞬間切碎細屑，能有效避免纏屑導致的工件表面精度不良或故障停機等問題，提升機械稼動率。

(4) **智能斷屑輔助系統：**透過我們這項功能，加工前利用圖形模擬，設定完數值系統會自行計算出波形並判斷是否可確實斷屑，不用盲目測試而浪費材料，就可以找出最穩定斷屑的加工條件。

(5) **自動化與量測系統：**走心車床後端整合協作型機器人，並搭載視覺辨識系統與工件量測儀設備。加工完成的工件自動下料後由輸送帶送出到暫放區，視覺辨識系統即可辨識工件位置與特徵，可依現況啟動做夾取對應，夾取後送入量測儀自動量測尺寸，提供即時工件品質監控，與聯動機台即時自動刀具補償回饋。

協作型機器人將檢測完成工件依序排放於粹盤上，配合走心車床刀具壽命管理，可連續無人自動化生產。

（三）綠色、節能與永續

(1) 即時監控電力使用狀態，統計消耗電量，圖形化介面讓使用者更輕易判讀監控資訊。並提供碳排量與電費換算以利達到能源監控。

(2) ECO mode 機台待機一段時間無使用自動進入節能模式，在節能模式下馬達會進入休眠模式，以達到節能省電的目的。

(3) 整合車、銑、旋風銑、滾齒、多邊形等高度複合化的加工能力，大幅減少夾治具的需求數量及調校時間，達成一機多用之特點，減少機器需求數量，提升廠房使用效率、減少電能用量。

(4) 使用高亮度 LED 工作燈、警示燈、指示燈等照明設備，降低機台電能用量又可以提高照明度。

(5) AES 節能伺服油壓單元，採用伺服馬達驅動，可依機器在不同工作需求時智慧控制伺服馬達輸出轉速，達到依機器實際需求供給壓力和流量，大大的降低機器在較低需求時電能消耗。

(6) 選配智慧變頻節能高壓切削冷卻系統，能夠能依照所需之輸出壓力精確地控制馬達轉速，進而產生適當的流量，大幅提高產能並延長刀具壽命，更解決了一般高壓冷卻系統高耗電的問題。

（四）結構、精度與品質

(1) 符合 ISO 230、ISO 13041、CNS 15660 標準

(2) 取得 CE 證書（驗證項目：MD、LVD、EMC）

和 TS 證書（識別號碼：TD0604CE）

（五）市場可行性

以自有品牌行銷全球，國內、大陸及美國等市場採直銷與代理商並行，全球市場的開拓則透過各地代理商的銷售，完善的銷售服務體系，行銷網路遍及 48 個國家或地區，超過 60 個專業代理商之規模。

（六）審美性

俐落的線條勾勒出簡約外型，外觀搭配經典黑白配色，機器顯露穩重而且協調的美感，精巧的機台外觀提升作業空間利用率，迴轉式操作面版搭配大尺寸耐衝擊視窗，兼具人員操作的便利性與安全性。

DESCRIPTION IN ENGLISH:

(1)Innovation

1. **Main Spindle / Sub-Spindle:** The main and sub-spindles use built-in motors that directly convert electromagnetic energy into mechanical energy, eliminating transmission power loss and offering superior high-speed cutting capabilities. The spindle employs a rotary hydraulic cylinder instead of a traditional toggle, ensuring faster, more responsive operation and enhanced workpiece clamping stability.
2. **Cooling system:** Both spindles feature a temperature-controlled coolant circulation system that cools the spindle bearings and drive motors, effectively suppressing thermal displacement and preventing degradation of machining accuracy.
3. **Milling Unit:** The milling unit incorporates a temperature-controlled coolant circulation system to effectively minimize thermal displacement. Powered by a single high-performance milling motor, the unit delivers exceptional output, enhancing machining efficiency.
4. **Spindle Braking:** A full-circumference disc brake replaces the conventional single-point brake, providing smoother and more stable braking force.
5. **High-Rigidity Gantry Tool System:** Designed to evenly distribute cutting torque loads, this system maximizes structural rigidity and improves machining efficiency.
   The flexible tool system accommodates up to 37 tool positions, a 60% increase in tool capacity. It meets the requirements for highly complex machining tasks. Cross milling live tool holders can be equipped with special tools for operations like whirling, polygon milling, gear hobbing, and deep-hole drilling. Back-milling live tool holders can be fitted with 90° drilling or sawing live tools, catering to a wide range of industrial applications.
6. **B-Axis Live Tool Holder:** Featuring a maximum rotation of 135°, the B-axis allows free programming for inclined holes, slanted surfaces, and multi-axis simultaneous contour machining. Its dual-end fixed design enhances overall rigidity and stability of the B-axis during operation, ensuring excellent machining performance.
7. **Guide Bushing Interface:** The specially designed interface allows SK-38 for on-demand installation or removal of the guide bushing. The guide-bushing mode provides stable support for workpieces, preventing deflection and ensuring superior machining precision and stability, particularly suitable for processing long, slender parts. In the non-guide-bushing mode, material bars can be machined directly without precision grinding.

(2)Intelligence and Practicality

1. **Tool Life Management & Tool Compensation**
   A user-friendly interface monitors tool usage in real time, enhancing precision and simplifying management.
2. **Smart Machinery IIoT Module**
   Sensors installed on the spindle and coolant pumps enable the following functions with real-time anomaly handling:
   a. Spindle: Monitoring functionality, warning/alarm threshold settings, spindle health checks, and data recording and comparison for specific intervals.
   b. Coolant Pump: Monitoring functionality, warning/alarm threshold settings, refill and maintenance reminders, and data recording and comparison for specific intervals.
   c. Predictive Maintenance: Using sensors and data analysis, signs of changes in the spindle and coolant pump are identified in advance, This minimizes unplanned downtime and optimizes production schedules.
   d. Remote Monitoring: Machine connectivity enables online monitoring by maintenance staff, reducing the need for on-site inspections.

3. OCR Oscillating Chip Removal

The OCR-controlled tool oscillation alternates between cutting and air cutting during the machining process. This effectively breaks chips into smaller pieces, preventing issues like entangled chips that can damage the workpiece surface or cause unexpected machine stoppages, thereby improving machine uptime.

4. Smart OCR Chip-Break Assist

Our system provides a solution through graphical simulation. Before machining, users can input the required values, and the system will automatically calculate the waveform and determine whether the parameters can effectively achieve chip breaking. This eliminates the need for trial-and-error testing, reducing material waste and allowing users to quickly identify the most stable conditions for chip breaking.

5. Automation and Measurement

The Swiss type lathe integrates a collaborative robot equipped with a vision system and parts measuring instruments. After machining, workpieces are automatically unloaded and transported to a temporary storage area. The vision system identifies the workpiece's position and features, enabling precise gripping and subsequent automatic measurement for quality control. Real-time data allows for automatic tool compensation feedback to the machine.

The collaborative robot sequentially places measured workpieces on trays, combined with tool life management, enables continuous unmanned automated production.

(3)Energy Saving Computation

1. Real-Time Power Usage Monitoring

Energy consumption is recorded and visualized with graphical interfaces for easy interpretation. Carbon emissions and electricity costs are also calculated to aid energy monitoring.

2. ECO Mode

The machine automatically enters energy-saving mode after a period of inactivity, putting the motor into sleep mode to conserve energy.

3. Multi-Tasking Machining Capabilities

Integrating turning, milling, thread whirling, gear hobbing, and polygon machining significantly reduces the need for fixtures and setting time. This multitasking design minimizes machine quantity requirements, enhances factory space efficiency, and reduces energy consumption.

4. High-Efficiency Lighting

High-brightness LED work lights, warning lights, and indicator lights reduce energy usage while providing better illumination.

5. AES Energy-Saving Servo Hydraulic Unit

Driven by a servo motor, the unit intelligently adjusts motor output speed based on operational needs. This ensures precise pressure and flow rates according to actual machine demands, significantly reducing power consumption during low-demand operations.

6. Optional High-Pressure Coolan System

The optional intelligent ECO high-pressure coolant system precisely adjusts the motor speed based on required pressure, ensuring optimal flow. It boosts productivity, extends tool life, and reduces energy consumption compared to traditional high-pressure coolant system.

(4)Structure, Precision and Quality

1. Compliance Standards: Conforms to ISO 230, ISO 13041, and CNS 15660 standards.

2. Certification: Certified for CE (MD, LVD, EMC) and TS (TD0604CE).

(5)Market Feasibility

Global marketing under our own brand, utilizing a combination of direct sales and distributors in domestic, Chinese, and U.S. markets. Expansion into global markets through local distributors, supported by a comprehensive sales and service network. A marketing network spanning 48 countries or regions, with a scale of over 60 professional distributors.

(6)Aesthetics

The sleek lines outline a minimalist design, complemented by a classic black-and-white color scheme that conveys a sense of stability and harmonious beauty. The compact machine design enhances workspace efficiency. The swivel control panel, paired with a large, impact-resistant viewing window, ensures both operator convenience and safety.

永詮機器工業股份有限公司
L & L MACHINERY INDUSTRY CO., LTD.

地　　址：41154- 臺中市太平區德隆里工業 20 路 73 號
No.73, Gongye 20th Rd., Taiping Dist., Taichung City 41154, Taiwan
電　　話：+886-4-22715727　　**傳　　真：**+886-4-22716561
網　　址：www.llcnctw.com/en-US/　　**E-mail：**service@llmachinery.com.tw

攤位號碼：I0602

主要產品類別：

長軸五軌式重型 CNC 車床及巨型車銑複合切削中心機、巨型銑車切削中心機、巨型多軸複合切削加工中心機。各種機械（車床、銑床、數 控工具機）設計製造買賣、機械零件製造買賣、前各項有關產品之進出口貿易業務。

參賽作品名稱：

LLB-M 高值智慧巨重型動柱臥式多軸車銑複合切削中心機
LLB-M High Value Smart Heavy Duty Column Moving Multi-Axis Complex Machine

作品圖片：

作品開發背景：

永詮公司瞄準先進產業的複合加工需求趨勢，針對離岸綠能風機大型零組件、國防工業及金屬材料重工業、應用航太產業零件等有複雜形狀精密加工需求之產業，開發大型金屬長軸件多軸加工應用機台。針對車銑複合車床普遍存在刀塔動力不足的劣勢，永詮公司也積極尋找可行方案，提升機台加工應用價值。

作品特點：

（一）創新性

聚焦於巨重型工件直徑 1600-2400mm 與重量 20-40 噸支撐結構體研發，新開發動柱式 X/Y/Z/C 軸同動結構體（台灣設計專利），配置大功率內藏主軸。動柱結構包括立式機柱及主軸滑座，Y 軸進給機構採用左右滾珠螺桿及線性滑軌驅動，可提供更佳的穩定性及加工精度。內藏式主軸及其滑動模組，開發六滑軌結構，為大直徑工件之切削行程，提供充足剛性支撐。搭配 HSK-A100 及可選配之 ATC20-60 把刀庫，滑座模組未來可整合 A、B 軸旋轉機構，提供多軸同動銑、車、磨、搪孔及滾齒等複合加工製程。

車銑複合車床普遍存在刀塔動力不足的情況，本機台設計為內藏式主軸，可確保切削行程所需動力，在滑枕結構有限的空間內，也能減少刀塔的干涉問題。

加工裝置安裝於床台支撐結構副軌道，設有線性導軌及支撐組件（台灣新型專利，發明專利審核中），可簡化並縮短再組裝時程，並保有良好之組裝精度。

（二）智慧化與實用性

開發診斷演算法及智慧化系統 (L&L Smart System)，協助操作者快速學習、輕鬆使用：

(1) 狀態自主檢測：

在工件主軸系統以及軸向螺桿配置感測器擷取相關數據，實現溫度、震動之自主檢測。操作者可直接透過控制器介面執行檢測程序，檢測程式亦可整合至客戶暖機程序中，對工件及軸向運動系統具備全面的故障預知保護。

(2) 加工輔助系統：

協助操作者制定加工程序異常警示值，自動記錄製程數據，完成加工履歷。可進一步應用於製程碳盤查，亦可透過共通格式連結至客戶 ERP、MES 系統。

(3) CPS 維修輔助系統：

專用虛擬人機介面，當機台出現異警時，可自動通知操作者、檢視維修步驟、快速排除異常。嚴重異常如撞機、加工錯誤等，則可回放異常發生過程，判斷異常原因並安排檢修。

（三）綠色、節能與永續

新型床台設計結構輕量化，利用 CAE 結構分析，在相同結構強度下，重量減少 14%，在運輸過程、原料、製造過程中約可減少相當於 4123 度電消耗的碳排量。

全行程油水分流回收：針對切削用水以及軌道潤滑油使用，採用油水分離機，搭配結構設計，從源頭減少油水混合的比例，提升循環使用時間。

實時監測機台中主要能源消耗元件：建立可視化監控畫面並根據加工耗能履歷抓出高耗能的配件，藉由改用節能機型以及優化待機設計後，最高可節省 20% 的配件電力消耗。

（四）結構、精度與品質

(1) 機柱結構採用 BOX-in-BOX 對稱式箱體結構，左右雙空心立柱構成矩型封閉箱體，透過加強肋板配置，提升結構本體抗彎曲與抗扭轉剛性。中間主軸頭座為矩型中空結構，其四面具有加強肋，可增加頭座剛性。結構材質為球狀石墨鑄鐵 (Spheroial graphite cast irons)，其機械性質符合 ISO 185/JL/300 規範，抗拉強度 (Tensile Strength) 為 600Mpa，彈性係數 (Modulus of elasticity) 為 174 GPa。

(2) 床鞍上裝置動柱臥式內藏主軸原型機台模型，立柱箱體主結構中間配置主軸頭座，搭配雙進給驅動機構，達到穩定精密上下定位。中間主軸滑座裝置在頭座內部，其進給導軌系統由滾珠導螺桿及六組平行滑軌所組成。

(3) 以整機動態分析，建立整機動態特性與個別部件模組特性之關係，藉此將連接面組裝工法標準化、提升機台品質。

(4) 針對關鍵零組件協力廠商進行全面品管，協助建立製程標準。開發組裝驗證數位化可靠度系統，以數位化振動量測及溫度紀錄，建立主軸組裝品質驗證平台，進行組裝品質履歷數位化。可協助操作者判斷異常原因、有效縮減進貨檢驗時間，並可將檢驗數據直接傳輸給供應商，促使其零件、零組件品質達到驗收標準，利於安排生產排程、如期交貨。

（五）市場可行性

目前國際主要競爭者為奧地利的 WFL 及 WEINGARTNER 兩家廠商，其專利技術以斜床身結構設計為主。國內並無臥式平床身之巨重型多軸車銑複合切削中心機同類產品。

本機台售價約為歐洲競爭產品價格的 1/3 至 1/2，且本標的目前技術層級可與奧地利商 WEINGARTNER 及西班牙商 GEMINIS 並列，具有高性價比的競爭優勢。

本機台開發之主軸箱體、尾座及連接部件皆已進入量產階段，預計 2025 年 2 月出貨。

（六）審美性

人性化與人因工程之考量：

(1) 以獨立控制操作箱，改變傳統操作箱與防濺門整合之不便利性。

(2) 獨立高壓沖屑裝置：前後鐵屑輸送機，減少除屑勞動工時。工業設計美學獨立的操作箱設計快速便捷移動，結構剛性的滿足重負載及高剛性材質的切削，外型簡約美觀。

（七）其他

本機台結合零組件廠商，建置國內產學研之工具機產業研發團隊，共同研究開發，由大專院校和國內廠商合作培育機械專業人力，不僅能使大學院校更加重視培養企業所需的人才，亦有機會將大學實驗室的研究成果轉化成擁有市場競爭力的新產品。

DESCRIPTION IN ENGLISH:

(1)Innovation

Focusing on the research and development of support structures for huge and heavy workpieces with diameters of 1600-2400mm and weights of 20-40 tons, we have newly developed a driving column-type X/Y/Z/C-axis co-moving structure (Taiwan design patent), equipped with a high-power built-in spindle.

The moving column structure includes a vertical machine column and a spindle slide. The Y-axis feed mechanism is driven by the left and right ball screws and linear slide rails, which can provide better stability and processing accuracy. The built-in spindle and its sliding module have developed a six-rail structure to provide sufficient rigid support for the cutting stroke of large-diameter workpieces. Paired with HSK-A100 and the optional ATC20-60 tool magazine, the slide module can integrate A and B-axis rotation mechanisms in the future to provide multi-axis simultaneous milling, turning, grinding, boring and gear hobbing and other composite processing processes.

It is common for turning-milling lathes to have insufficient turret power. This machine is designed with a built-in spindle to ensure the power required for the cutting stroke. It can also reduce the interference problem of the turret in the limited space of the ram structure.

The processing device is installed on the auxiliary track of the bed support structure and is equipped with linear guide rails and support components (Taiwan new patent, invention patent under review), which can simplify and shorten the reassembly process and maintain good assembly accuracy.

(2)Intelligence and Practicality

Develop diagnostic algorithms and smart systems (L&L Smart System) to assist operators in learning quickly and using them easily:

(1)Condition Self-detection:

Sensors are installed in the workpiece spindle system and axial screw to capture relevant data to realize independent detection of temperature and vibration. The operator can directly execute the inspection program through the controller interface, and the inspection program can also be integrated into the customer's warm-up program, providing comprehensive fault prediction protection for the workpiece and axial motion system.

(2)Machining Assistance System:

Assist operators to set abnormal warning values for processing procedures, automatically record process data, and complete processing history. It can be further applied to process carbon inventory and can also be linked to customer ERP and MES systems through a common format.

(3)CPS Maintenance Assistance System.

The dedicated virtual human-machine interface can automatically notify the operator when an abnormality occurs on the machine, review maintenance procedures, and quickly eliminate the abnormality. In case of serious abnormalities such as machine collision, processing errors, etc., the abnormal occurrence process can be played back to determine the cause of the abnormality and arrange maintenance.

(3)Energy Saving Computation

The new bed design has a lightweight structure. Using CAE structural analysis, the weight is reduced by 14% under the same structural strength, which can reduce carbon emissions equivalent to 4123 kilowatt hours of electricity consumption during transportation, raw materials, and manufacturing processes.

Full-stroke oil-water separation recovery: For the use of cutting water and orbital lubricating oil, an oil-water separator is used with structural design to reduce the ratio of oil-water mixing from the source and improve the cycle time.

Real-time monitoring of main energy-consuming components in the machine: Create a visual monitoring screen and identify high-energy-consuming accessories based on processing energy consumption history. By switching to energy-saving models and optimizing standby design, up to 20% of the power consumption of accessories can be saved.

(4)Structure, Precision and Quality

(1)The column structure of this entry adopts the BOX-in-BOX symmetric box structure, with the left and

right hollow columns forming a rectangular closed box, and through the reinforcement of ribs, the bending and torsional rigidity of the structure is improved. The intermediate spindle headstock is a rectangular hollow structure with reinforcement ribs on all sides to increase the rigidity of the headstock. The structure is made of Spheroial graphite cast irons with mechanical properties in accordance with ISO 185/JL/300, Tensile Strength of 600Mpa and Modulus of elasticity of 174 GPa.

(2) A moving column horizontal built-in spindle prototype machine model is installed on the bed saddle. The main structure of the column box is equipped with a spindle head seat in the middle and is matched with a dual-feed drive mechanism to achieve stable and precise up and down positioning. The intermediate spindle slide is installed inside the headstock, and its feed guide rail system consists of ball guide screws and six sets of parallel slide rails.

(3) Use the dynamic analysis of the whole machine to establish the relationship between the dynamic characteristics of the whole machine and the module characteristics of individual components, thereby standardizing the assembly method of the connection surface and improving the quality of the machine.

(4) Conduct comprehensive quality control for key component suppliers and assist in establishing process standards. Develop a digital reliability system for assembly verification, use digital vibration measurement and temperature records, establish a spindle assembly quality verification platform, and digitize assembly quality history. It can assist operators to determine the cause of abnormalities, effectively reduce incoming inspection time, and directly transmit inspection data to suppliers to ensure that the quality of their parts and components reaches acceptance standards, which is helpful for arranging production schedules and on-schedule delivery.

(5)Market Feasibility

At present, the main international competitors are European manufacturers, whose patented technology is mainly based on the design of inclined bed structure. There is no similar product in China that is a huge, heavy-duty, multi-axis turning and milling compound cutting center with a horizontal flat bed.

The price of this machine is about 1/3 to 1/2 of the price of competing products in Europe, and the current technology level of this machine is comparable to that of competitive international manufacturers, giving it a cost-effective competitive advantage.

The spindle box, tailstock and connecting parts developed for this machine have entered the mass production stage and are expected to be shipped in February 2025.

(6)Aesthetics

Humanization and human factors considerations:

(1) With controlling the operation box independently, we changed the inconvenience of the integration of the traditional operation box and the anti-splash door.

(2) Independent high-pressure chipping device: front and rear chip conveyors to reduce the labor hours. Industrial design aesthetics independent operation box design is fast and convenient to move, the structure is rigid to meet the heavy load and high rigidity material cutting, the appearance is simple and beautiful.

(7)Others

(1) This machine combines CNC and its suppliers to establish a domestic industry-academia-research team to jointly develop a smart machine and a product development and design management system (PDM), which can effectively manage production design and development documents and increase foreign exchange opportunities for the domestic market. The establishment of a domestic industry-academia cooperation mechanism, in which universities and domestic manufacturers cooperate to cultivate machinery professionals, will not only enable universities and colleges to pay more attention to cultivating the talents required by enterprises, but also provide opportunities to transform the research results of university laboratories into new products with market competitiveness.

名陽機械股份有限公司
MYLAS MACHINERY CO., LTD.

地　　址：42743 台中市潭子區興豐山莊東三巷 40 號
No.40, E.3rd Ln., Xingfeng Shsnzhuang, Tanzi Dist., Taichung City 427, Taiwan (R.O.C)
電　　話：+886-4-25377564　　**傳　　真**：+886-4-25394600
網　　址：www.mylascnc.com　　**E-mail**：sales@mym.com.tw

攤位號碼：Q0804

主要產品類別：

CNC 車床及嘉工單元類，台灣生產製造：

- **雙主軸雙刀塔系列**：三系統 雙刀塔 雙 Y 軸 CNC 車銑複合機
  雙主軸 雙 Y 軸 單刀塔 CNC 車銑複合機
  雙主軸 單 Y 軸 雙刀塔 CNC 車銑複合機
  雙主軸 雙刀塔 CNC 高性能車削中心
- **雙主軸單刀塔系列**：雙主軸 單 Y 軸 單刀塔 CNC 車銑複合機
- **高速精密自動車床**：高速精密自動車床

參賽作品名稱：

MYTURN MTY51/65 三系統 CNC 車銑複合機
MYTURN MTY51/65 CNC Multi-Tasking Turning Center
Maching : Double Spindle Double Turret With 3 Channels

作品圖片：

作品開發背景：

製造業對於高精度且複雜化的機製件日益增加，以往的三軸機械早已無法滿足加工製造業者的需求，再則自動化和智能化已然成為當前製造業的主流，而銑車複合加工機的購機成本又過高，所以多軸車床就是很好的選項。

國外機型以中村留 NTY3 與 DMG NZX 1500 較為常見，但其機型大多鎖定在汽車航太等行業別上，對於小軸件或是自動化零組件的加工彈性較欠缺，其問題點在於加工刀位數上擴充彈性較少 (32 刀位)，且第二主軸側通常沒有主軸與尾座共存的設計，在操作上各家都有針對雙控制系統作優化，比如 : 程式同期檢視、智慧操作，智慧監控、能耗管理。

綜觀以上條件進行開發適合 ψ51~ψ65 中型軸件與自動化…等產業，設計特殊刀具座讓最大加工刀具數可達 64 把刀，將副主軸單元設計成有副主軸與油壓尾座的共同體，操作上加入智慧操作、智慧監控、能耗管理等機能，讓操作者及時優化加工條件提高產能、穩定精度、控制能耗，並導入智慧雙生的概念進行加工前的模擬機能，滿足日益複雜加工所需。

作品特點：

(一) 創新性

64 個刀位與副主軸與油壓尾座的共同體、軸向伺服過載保護機能和智慧操作介面 (HMI) 的開發。

(二) 智慧化與實用性

智慧操作介面 (HMI)，計有負載監測、快速設定、加工總覽、維修模式、維護保養、刀具壽命、G/M 碼、同期檢查等八大項目。

(三) 綠色、節能與永續

導入智能電錶與智慧監控，油壓系統改採變頻式馬達，並以加工中實際量測電流直進而檢討改善能耗。

(四) 結構、精度與品質

以 ISO 13041-1 當成品機的檢驗基礎，開發階段利用有現元素進行床台、頭部、鞍座 .. 等鑄件的分析，一來增加剛性二來減少材料的過度使用。

(五) 市場可行性

油、氣壓元件在自動化設備中隨處可見，分布也極其廣泛如 : 台灣、歐美、中國大陸、日本 .. 等均有大、中、小型供應商的存在。

(六) 審美性

紅、黑配色、加上 LED 燈的點綴，讓機器有著神秘與期待感。

(七) 其他

內建自動化取料、排料機，單機就已經是部自動化機器。

DESCRIPTION IN ENGLISH:

(1)Innovation

Innovation of 64 tool positions, sub-spindle, and hydraulic tailstock, with axial servo overload protection function and smart operation interface.

(2)Intelligence and Practicality

Smart operation interface (HMI), which includes eight major functions: load monitoring,
quick setup, machining overview, maintenance mode, maintenance, tool life, G/M codes, and synchronous checking.

(3)Energy Saving Computation

Implementing smart meters and intelligent monitoring, the hydraulic system will adopt variable frequency motors, and actual current measurements during processing will be used to review and improve energy consumption.

(4)Structure, Precision and Quality

Using ISO 13041-1 as the inspection basis for finished machines, during the development stage, current elements will be utilized to analyze castings such as the bed, head, and saddle, to both increase rigidity and reduce excessive material usage.

(5)Market Feasibility

Pneumatic and hydraulic components are ubiquitous in automated equipment, with a wide distribution across regions such as Taiwan, Europe, America, mainland China, and Japan, where large, medium, and small suppliers can be found.

(6)Aesthetics

The combination of red and black colors, along with the accent of LED lights, gives the machine a sense of mystery and anticipation.

(7)Others

With built-in automated material handling and unloading systems, this machine is already an automated unit on its own.

東台精機股份有限公司
TONGTAI MACHINE & TOOL CO., LTD.

地　　址：821 高雄市路竹區路科三路 3 號
No.3, Luke 3rd Rd., Luzhu Dist., Kaohsiung City 821, Taiwan
電　　話：+886-7-9761588　　**傳　　真：**+886-7-9761589
網　　址：www.tongtai.com.tw　　**E-mail：**tongtai@tongtai.com.tw

攤位號碼：K0802

主要產品類別：

立式加工機、臥式五軸加工中心機、複合式車削中心機、立式五軸加工中心機、搪銑加工機、輪圈加工機、鑽孔攻牙機、臥式CNC車床、超音波輔助加工機、臥式加工機、立式CNC車床、專用機、數控電路板鑽孔機、數控電路板成型機、雷射鑽孔機、雷射雕刻機、雷射切割機、噴粉式積層製造複合加工設備、金屬粉床式積層製造設備、噴膠式砂模成型積層製造設備。

參賽作品名稱：

TMS-1800S 複合式車削中心機
TMS-1800S Multi-tasking Turning Center

作品圖片：

作品開發背景：

傳統生產加工模式為拆解加工程序，以數台加工機排列組合生產線，每當更換加工件，產線必需停機數小時或更久的時間來更換夾具與刀具，對於客製化產品與非量產型工件相當耗費時間與人力，基於這樣的原因開發 TMS-1800S 複合式車削中心機，一次裝夾就可將工件加工完成，減少客戶生產所需夾具，以及節省換線的人力與時間，滿足少量多樣的生產需求模式。

作品特點：

（一）創新性

TMS-1800S 是一款高度整合的車銑複合加工設備，專為現代製造業設計，能有效滿足對高效、自動化及高精度加工的需求。其採用先進的 Fanuc 控制器，具備多軸銑削及多角度車削功能，實現一次裝夾加工完成（工程集約），大幅縮短換線時間並減少人力投入，顯著提升生產效益。

此設備專注於處理複雜零件和少量多樣的加工任務，無論是加工高硬度工件還是提升中小型零件的精密度，TMS-1800S 均能提供穩定可靠的性能和經濟效益。整合式車銑技術確保高效處理複雜工件，同時可降低生產成本。

（二）智慧化與實用性

東台近年來積極推動智慧製造技術的研發與應用，TMS-1800S 藉由 NC 結合 PC 的架構平台與智能軟體平台 TIMS 的整合，為使用者帶來便捷的功能存取體驗。其友善的操作介面結合感測器與數據分析，實現高效加工與操作簡便化。

其中，東台自行開發的 3D 防碰撞功能是亮點之一。透過數位雙生技術，TMS-1800S 可預測機器運行位置，進行碰撞風險檢查，有效避免不當操作對機器或操作者造成損害。該功能在手動與自動模式下均能發揮作用，特別適用於少量多樣的加工場景，確保頻繁換線時的產品品質一致性。同時也支持人員在機器加工時於規劃下一件加工物，透過平行工程降低換線時間，提升整體設備效率 (OEE)。

此外，AI 助理 T-BOT 進一步提升操作便利性。操作員可通過語音或文字查詢機台狀態、刀具信息及異常排除指引，大幅提高操作效率與問題解決速度。這些智慧化設計不僅強化了設備的實用性，更為客戶帶來生產效能與加工精度的全面提升。

結合以上智慧化功能，TMS-1800S 不僅強化了設備的操作便利性與安全性，能夠為客戶帶來生產效能與加工精度的提升。

（三）綠色、節能與永續

工具機整體生命週期中，使用階段的能源消耗最為顯著，分為氣、水、油、電四大項目，透過選用高效節能馬達、結構輕量化及自動停止電源與氣源的供應，等設計手法來降低能耗，並減少運輸所需的一次性耗材，減輕環境衝擊。

（四）結構、精度與品質

TMS-1800S 在結構設計上充分考慮動態穩定性與高效運行。各軸向滑台採用大跨距及滾柱軌道設計，有效提高加工時的穩定性，減少振動並保持精度。B 軸傳動機構採用 Roller cam 設計，具備高剛性、高靈敏度及低背隙特性，確保精確的角度控制。內藏式馬達驅動主軸不僅高效穩定，還能有效提高整體運行表現，並配合圓盤式刀庫設計，減少占地面積，提升換刀效率。

在品質方面，透過嚴格的組立流程控制，確保每台機台的精度穩定性，為客戶提供可靠的加工性能，無論是在處理複雜工件還是進行高精度加工時，都能放心使用。

（五）市場可行性

TMS-1800S 具備車床與銑床的複合功能，實現多軸向和多角度的加工能力，並可一次裝夾完成加工，極大提升生產效率。其高度自動化設計能減少對技術人員的依賴，適用於少量多樣的生產模式，降低換線時間並提高加工精度。

在歐美市場，這款設備尤為符合當地需求。由於歐美地區人力成本較高，許多企業傾向選擇複合加工機來降低人力投入。TMS-1800S 的高效加工和自動化特性，使其成為企業減少技術人員需求、提升生產效益的理想選擇，具有很高的市場競爭力。

（六）審美性

TMS-1800S 在外觀設計上展現了東台精機的品牌識別，整體採用粉體塗裝，搭配東台新芽綠的鮮明配色，其 21.5” 觸控式面板提供直觀的操作介面，提升了使用便利性，並增強了整體的科技質感。無論在工廠環境或展示場，都能吸引目光，彰顯高端設備的精緻與現代化。

（七）其他

空間精度補償技術：TMS-1800S 依據 ISO230-1/230-2 檢驗各項幾何精度與定位精度，透過精密的檢測與數據分析，有效地補正線性軸誤差和旋轉軸誤差，確保機台在運行過程中保持穩定精度。

DESCRIPTION IN ENGLISH:

(1)Innovation

The TMS-1800S is a highly integrated turning-milling machine, designed specifically for modern manufacturing industries. It effectively meets the demands for high efficiency, automation, and precision machining. The advanced Fanuc controller is used, featuring multi-axis milling and multi-angle turning capabilities, enabling complete machining in one setup (engineering integration). This significantly reduces changeover times and minimizes labor input, enhancing production efficiency.

The machine is designed to handle complex parts and small-batch, diverse machining tasks. Whether machining high-hardness materials or enhancing the precision of small to medium-sized components, the

TMS-1800S offers stable and reliable performance with cost-effective results. The integrated turning-milling technology ensures efficient handling of complex workpieces while reducing production costs.

(2)Intelligence and Practicality

In recent years, Tongtai has actively promoted the development and application of smart manufacturing technologies. The TMS-1800S, with its NC-PC platform architecture and the integration of the smart software platform TIMS, offers users a convenient and efficient access experience. Its user-friendly interface, combined with sensors and data analysis, ensures efficient machining and simplified operation.

One of the highlights is Tongtai's self-developed 3D anti-collision feature. Through digital twin technology, the TMS-1800S can predict the machine's operational position, perform collision risk checks, and effectively prevent damage to the machine or operator due to improper operations. This function works in both manual and automatic modes, making it particularly suitable for small-batch, diverse machining scenarios, ensuring consistent product quality during frequent changeovers. It also supports operators in planning the next workpiece while machining, using parallel processes to reduce changeover times and improve overall machine efficiency (OEE).

Additionally, the AI assistant T-BOT further enhances operational convenience. Operators can query machine status, tool information, and troubleshooting guidance via voice or text, significantly improving operational efficiency and problem-solving speed.

These smart features not only enhance the machine's practicality but also bring overall improvements in production efficiency and machining precision.

(3)Energy Saving Computation

Energy consumption during the usage phase is the most significant aspect of the overall lifecycle of machine tools, covering pneumatic supply, coolant systems, hydraulic and lubrication system, and electricity supply. By utilizing high-efficiency energy-saving motors, lightweight structural designs, and automatic shutdown of power and Pneumatic supply sources, the TMS-1800S reduces energy consumption. Furthermore, the use of fewer consumables for transportation helps reduce environmental impact.

(4)Structure, Precision and Quality

The TMS-1800S's structural design fully considers dynamic stability and efficient operation. The linear guides for each axis adopt a large span and roller guide design, which effectively improves machining stability, reduces vibrations, and maintains accuracy. The B-axis drive mechanism uses a roller cam design, offering high rigidity, high sensitivity, and low backlash characteristics, ensuring precise angle control. The integrated motor-driven spindle not only operates efficiently and stably but also improves overall performance. Coupled with the disc-type tool magazine design, the machine reduces its footprint and enhances tool change efficiency.

Regarding quality, strict assembly processes ensure stable accuracy for each machine, providing reliable machining performance. Whether handling complex parts or performing high-precision machining, customers can trust the machine's stability.

(5)Market Feasibility

The TMS-1800S combines the functionality of both a lathe and a milling machine, providing multi-axis and multi-angle machining capabilities, allowing complete machining in a single setup. This greatly enhances production efficiency. Its highly automated design reduces dependence on skilled technician, making it suitable for small-batch, diverse production models. It reduces changeover times and improves machining accuracy.

In the European and American markets, this machine is particularly in demand. With higher labor costs in these regions, many companies prefer composite machining machines to reduce labor inputs. The TMS-1800S's efficient machining and automation features make it an ideal choice for businesses seeking to reduce personnel requirements and enhance production efficiency, giving it a strong competitive edge in the market.

(6)Aesthetics

The TMS-1800S's exterior design reflects Tongtai's brand identity. It features a powder-coated finish with Tongtai's signature "New Sprout Green" color, while the 21.5-inch touchscreen provides an intuitive interface, enhancing user convenience and giving the equipment a high-tech appearance. Whether in a factory or showroom, its design captures attention and highlights the sophistication and modernity of the equipment.

(7)Others

Volumetric Compensation Technology: The TMS-1800S adheres to ISO 230-1/230-2 standards for testing geometric accuracy and positioning accuracy. Through precise testing and data analysis, the system effectively compensates for linear and rotary axis errors, ensuring stable precision during operation.

崴立機電股份有限公司
WELE MECHATRONIC CO., LTD.

地　　址：305048 新竹縣新埔鎮義民路 1 段 520 號
No.520, Sec. 1, Yimin Rd., Xinpu Township , HsinChu County 305048, Taiwan
電　　話：+886-3-6960360　　**傳　　真**：+886-3-6960370
網　　址：www.welegroup.com　　**E-mail**：wele.cnc@msa.hinet.net

攤位號碼：K0816

主要產品類別：

- 龍門立式綜合加工中心機 (RB/SB/LB/VB/NB)
- 龍門五面綜合加工中心機 (MB/MS/ML/MVB)
- 天車式綜合加工中心機 (MG/FH)
- 臥式搪孔加工中心機 (HB/HR/HBM/HM)
- 臥式綜合加工中心機 (HMC)
- 立式綜合加工中心機 (AA/AQ/VQ)
- 五軸加工中心機 (UA/UG/UQ/UB/MG-U)
- 立式銑車複合加工中心機 (MT/MT-W)
- 立式車銑複合加工中心機 (VTC/VTM)
- 智慧化高效能彈性製造單元
  (HMC500+PPS C5 , UG630+AWC)

參賽作品名稱：

VTC1612-CW　立式車銑複合機
VTC1612-CW　Vertical Turning and Milling Machining Center

作品圖片：

作品開發背景：

(1) 回應市場需求：蒐集歐美的客戶對此產品的期望，提出了對中型立式車銑複合中心的迫切要求及價格具競爭的高性價比產品。

(2) 目標應用領域：致力於為能源產業與航太工業提供高可靠性、價格具競爭力的國產化產品，滿足嚴苛的加工需求。

(3) 提升國際競爭力：進入大型車銑複合加工領域，挑戰歐美及中國市場中的德國和日本品牌，助力本公司營收與獲利成長。

作品特點：

（一）創新性

1.1 車銑複合 Cs 軸控制：本產品在車銑複合傳動的 Cs 軸控制上，突破性地由傳統雙齒輪箱雙馬達控制，改為自有專利的減速機組裝而成的零背隙系統。此創新設計僅需一顆協力的 α 2 馬達來輔助主軸馬達消除背隙，且零背隙的離合機構可以在車床模式下使齒輪完全脫離，可減少不必要的能源耗損，提升運行效率。

1.2 伺服驅動橫樑：橫樑採用伺服馬達連接減速機控制，可於 W 軸行程中任意點停止，滿足各類高度工件的切削剛性需求。

1.3 專利夾持系統：橫樑停止時啟用的夾持系統提供卓越的切削抗震性，保障切削穩定性。

1.4 掛樑式刀庫設計：掛樑式刀庫隨 W 軸橫樑同步移動，實現無盲區換刀，克服傳統落地式刀庫的換刀局限，大幅提升換刀效率。

1.5 重切削刀具系統：WELE type 重切削刀具系統具備齒盤抗震自鎖功能、中心軸線對正流體接頭等設計，支持重型加工刀具的穩定性。

1.6 高效油壓夾爪：油壓夾爪提供穩定且可調整的夾持力，確保加工穩固，提升工件穩定性與加工精度，展示了高強度夾持技術的創新。

（二）智慧化與實用性

2.1 智能彈性化掛樑 ATC 刀庫：掛樑式刀庫驅動由伺服馬達控制，取代傳統油壓系統，降低能耗並精確換刀。拼盤組合式刀庫搭配崴立自我開發的友善及視覺化的刀具設置操作畫面，允許用戶靈活改變刀具組合以應對不同工件需求。

2.2 崴立 iSmarTune 電控軟體
包含 4 大項客戶實用功能：計算器，全機馬達資訊，稼動率資訊，維護資訊，eDNC... 等，不斷推陳出新，讓客戶除了套裝控制器外亦能享有崴立專屬控制介面。

2.3 自動油壓夾爪調整：油壓夾爪具自動調整功能，能隨工件形狀變化進行精確夾持，或體現快速換模的目的，提升加工便捷性。

2.4 新穎獨特的加工應用：搭載本機的零背隙機構及 Cs 軸控制功能，藉此達到進行螺牙加工時，可適應及抑制”銑”削螺牙震動的進給調適機制，一般的同業的立式車床所謂能及的機構及軟體應用。

（三）綠色、節能與永續

3.1 刀庫伺服驅動系統：刀庫採用伺服馬達替代傳統油壓系統，顯著降低能耗，並減少油壓設備產生的廢油，符合綠色生產要求。

3.2 精密金屬軸承應用：採用精密金屬軸承取代液靜壓軸承，降低系統用油量，大幅減少潤滑油的消耗量，進一步減少環境負擔。

3.3 精簡化潤滑和冷卻系統：潤滑油和冷卻油用量減少，降低運營成本並減少環境負擔。電氣箱內部優化的隔熱及對流設計不需額外安裝冷氣，進一步節約能源。

3.4 節能減碳：整體設計符合國際綠色生產標準，顯著降低碳足跡，支持可持續發展。

3.5 機台耗電量監控：客戶可以由崴立自製畫面獲取機台耗電量資訊，進一步擬　定節能計畫。

（四）結構、精度與品質

4.1 高精密金屬軸承：產品結構中使用精密金屬軸承，提供卓越的加工穩定性和超高精度，確保長時間加工仍具優異的可靠性。

4.2 掛樑式刀庫結構：刀庫隨 W 軸同步移動，避免傳統落地式刀庫的換刀盲區，實現換刀過程中的穩定性與無縫銜接，並提高生產靈活性。

4.3 線硬複合軌設計：W 軸採用線硬複合軌設計，減少組裝工時又保有硬軌的高剛性，增強機台耐用性和運行效率。此設計還能提升機械加工的平穩度及精確度，符合高端加工需求。

4.4 高精密油壓夾爪：油壓夾爪設計提供穩定且高效的夾持力，確保工件穩定性，減少震動並提升加工精度，保障在各類重型加工條件下的出色表現。

4.5 國際標準認證：本產品經過嚴格的質量管控，並通過歐盟 CE 及台灣 TS 安全認證，確保符合國際標準，為客戶提供高標準的安全性和可靠性，進一步增強產品在全球市場的信賴度。

（五）市場可行性

5.1 歐美亞市場導向：針對歐、美及亞地區的風能與航太市場設計，滿足市場對高精度、大型工件加工的需求。

5.2 突破國際市場壟斷：開發針對風力發電主體及航太發動機零件的加工方案，突破歐美日壟斷市場。

5.3 強化市場競爭力：高精度與多功能加工優勢，降低生產和運營成本，在內外銷市場中具備吸引力。

5.4 油壓夾爪強化市場定位：油壓夾爪的高穩定性和強夾持力，讓產品在大型工件加工市場中更具競爭優勢。

（六）審美性

本機採用精簡的現代化設計風格，整體佔地面積減少 40%，結構簡潔緊湊，提升空間利用率。操控介面符合人體工學，提供操作便捷性與安全性。外觀選用低調優雅的銀灰色調，搭配環保且耐用的表面塗層，易於日常清潔與維護，延長產品使用壽命。此設計不僅展現出產品的專業質感，亦滿足實用性與視覺美感的雙重需求。

(七) 其他

此產品將於國際機械展中亮相，重點展示其智能化管理與全自動加工性能，特別適合大量生產需求。產品設計著重於穩定的切削過程與友好的操作介面，確保用戶使用體驗最佳化。該產品已榮獲多項國內外專利及節能認證，並具備參與國際競賽如台灣精品獎的潛力，有助於提升品牌在高端市場的知名度與競爭力

DESCRIPTION IN ENGLISH:

(1)Innovation

1.1 Cs-Axis Control for Turning-Milling application: This product achieves a breakthrough in Cs-axis control by replacing traditional dual gearboxes and dual motor systems with a patented zero-backlash system using a custom-built reducer. Supported by a single ∂2 servo motor, this design eliminates backlash and decouples the gear system in lathe mode, reducing energy consumption and improving efficiency.

1.2 Servo-Driven Crossrail: The crossrail, controlled by a servo motor connected to a reducer, can stop at any point along the W-axis, ensuring cutting rigidity for various workpiece heights.

1.3 Patented Clamping System: The clamping system activates when the crossrail stops, providing excellent anti-vibration performance and ensuring cutting stability.

1.4 Overhead Tool Magazine Design: The overhead tool magazine moves synchronously with the W-axis crossrail, allowing seamless tool changes without blind spots, overcoming the limitations of traditional floor-mounted tool magazines and significantly improving efficiency.

1.5 Heavy-Duty Tool System: The WELE own-design heavy-duty tool system features a self-locking anti-vibration gear disk and a coaxial fluid coupling, ensuring the stability of heavy machining tools.

1.6 High-Efficiency Hydraulic Chuck: The hydraulic chuck offers stable and adjustable clamping forces, ensuring workpiece stability and machining precision, showcasing an innovation in high-strength clamping technology.

(2)Intelligence and Practicality

2.1 Intelligent Overhead ATC Tool Magazine: Powered by a servo motor instead of a traditional hydraulic system, the overhead tool magazine reduces energy consumption while improving tool change accuracy. Its modular platter design, combined with WELE's proprietary visualized tool setup interface, allows users to flexibly adjust tool configurations to meet diverse workpiece requirements.

2.2 WELE iSmartune control software: Includes the calculator, I/O list, tool change recovery, entire motor information, productivity insights, maintenance information, and eDNC. Continuous updates ensure customers enjoy WELE's unique control interface beyond standard controllers.

2.3 Automatic Hydraulic Chuck: The hydraulic chuck features automatic adjustment to accommodate varying workpiece shapes, enabling precise clamping and supporting quick mold changes for enhanced processing flexibility.

2.4 Innovative Machining Applications: Equipped with a zero-backlash mechanism and Cs-axis control, the system delivers superior threading capabilities with adaptive feed vibration suppression, outperforming standard vertical lathes in this class.

(3)Energy Saving Computation

3.1 Servo-Driven Tool Magazine System: Replacing traditional hydraulic systems with servo motors, the tool magazine significantly reduces energy consumption and eliminates hydraulic waste oil, aligning with green production standards.

3.2 Precision Metal Bearing Application: Utilizing precision metal bearings instead of hydrostatic bearings, the design decreases lubricant usage, further reducing environmental impact.

3.3 Simplified Lubrication and Cooling System: Optimized lubrication and cooling systems reduce oil consumption and operational costs. The electrical cabinet's enhanced thermal insulation and convection design eliminate the need for additional cooling, saving energy.

3.4 Energy-Saving and Carbon Reduction Design: The machine meets international green production standards, dramatically reducing its carbon footprint and supporting sustainable development.

3.5 Equipment Power Consumption Monitoring: Friendly and useful design of visible interface to shows the power consumption information and customer available to make the energy saving plan in advance.

(4)Structure, Precision and Quality

4.1 High-Precision Metal Bearings: The structure incorporates high-precision metal bearings to deliver outstanding machining stability and ensure exceptional accuracy even under extended operation and heavy load conditions.

4.2 Overhead Tool Magazine Structure: The tool magazine synchronizes with the W-axis motion, eliminating blind spots in traditional designs, ensuring smooth and stable tool changes while enhancing operational flexibility and productivity.

4.3 Hybrid Linear-Hard Rail Design: The W-axis adopts a hybrid linear-hard rail design, combining the rigidity of hard rails with the efficiency of linear rails, reducing assembly time and significantly improving machining stability and precision.

4.4 High-Precision Hydraulic Chuck: The hydraulic chuck design provides robust and accurate clamping, effectively minimizing vibration during machining and ensuring stability and precision in heavy-duty applications.

4.5 International Standard Certification: Certified by CE and TS standards, the product meets international quality and safety requirements, demonstrating superior manufacturing quality and reliability.

(5)Market Feasibility

5.1 Targeting European, American, and Asian Markets: Designed to meet the specific demands of the wind energy and aerospace sectors in Europe, America, and Asia, focusing on high-precision and large-scale workpiece processing.

5.2 Breaking International Market Monopoly: Provides innovative machining solutions for wind turbine components and aerospace engine parts, challenging the dominance of European, American, and Japanese manufacturers.

5.3 Enhancing Market Competitiveness: Combines high precision and multifunctional capabilities to significantly reduce production and operational costs, boosting appeal in both domestic and international markets.

5.4 Hydraulic Chuck Advantage: The stable and powerful hydraulic chuck ensures superior clamping strength, strengthening the product's competitive edge in the large workpiece machining market.

(6)Aesthetics

The machine showcases a sleek, modern design with a compact structure, reducing its overall footprint by 40%. Its ergonomic control interface enhances operator convenience and safety. The exterior features an understated silver-gray color scheme combined with an eco-friendly and durable surface coating, ensuring easy maintenance and longevity. This design seamlessly blends functionality with aesthetic appeal, highlighting the machine's professional quality and visual elegance.

(7)Others

This product will debut at an international machinery exhibition, showcasing its intelligent management and fully automated machining capabilities, which are ideal for mass production. Its design emphasizes stable cutting processes and a user-friendly interface, ensuring an optimal user experience. Having received multiple domestic and international patents and energy-saving certifications, the product holds strong potential for recognition in global competitions like the Taiwan Excellence Awards, enhancing brand visibility and competitiveness in the premium market segment.

奕達精機股份有限公司
YIDA PRECISION MACHINERY CO., LTD.

地　　址：41465 台中市烏日區溪南路 1 段 357 巷 68 弄 41 號
NO.41, Aly 68, Ln 357, Sec. 1, Xinan Rd., Wuri Dist., Taichung 41465, Taiwan.
電　　話：+886-4-23358368　　**傳　　真：**+886-4-23356681
網　　址：www.YidaCNC.com　　**E-mail：**yida.cnc@msa.hinet.net

攤位號碼：I1329

主要產品類別：

- CNC 車床
- 立式綜合加工中心機
- 臥式綜合加工中心機、
- 車銑複合工具機之設計與製造

參賽作品名稱：

MT-210 小型多軸複合加工單元之低碳創新應用
MT-210 Innovative, Low-Carbon a Small, Multi-Axis, Compound Machining Unit.

作品圖片：

作品開發背景：

鑒於當前工具機行業不斷向複合化發展，並逐漸將智慧化與高效能理念融入機台設計，市場上功能齊全的複合加工設備售價通常高達數百萬台幣，且機台體積龐大。對於中小企業及學術機構而言，性價比高、功能全面且佔地面積小的複合加工設備仍然是主要需求。

基於此，我們自主研發了 8 軸車銑複合加工中心機 MT-210，從核心軟體到機構均由內部開發，結合車床、銑床、ATC 自動換刀系統及刀塔等功能，能夠滿足多樣化加工需求，實現「一次加工完成」的作業模式。

該產品售價約為 6 萬美元（約新台幣 200 萬元），以「綠色低碳」為核心設計理念，結合機構創新應用與智慧功能，全面提升能源使用效率及環保價值。產品應用周邊設備，包括機構創新設計、智慧照明系統、冷卻裝置、水箱偵測與能源監測技術，實現更優質的使用體驗，進一步邁向低碳與永續發展的目標。

作品特點：

（一）創新性

- **多功能整合：**
  MT-210 集成車床、銑床功能及自動換刀系統（ATC），一次裝夾即可完成多工序加工，顯著提升生產效率。
- **Harmonic Gears 技術：**
  運用於 B 軸、CF 軸及刀塔設計，減少 70%-80% 重量與潤滑油使用量，提升能源效率並降低維護成本。
- **結構創新：**
  採用正交式結構設計，配置 ±105° B 軸旋轉銑削主軸與主副主軸的 C 軸功能，滿足多方向複雜加工需求。
- **高效刀具系統：**
  配備 18 支刀塔與 16 支圓盤式刀庫，縮短換刀時間，顯著提升生產靈活性。

（二）智慧化與實用性

- **智慧節能模式：**
  智慧化技術中的節能模式，能根據加工需求靈活調整設備運行狀態，以最大限度降低能源消耗，同時保持加工效率。這個模式的設計旨在兼顧能源效率與生產效益，特別適合需要長時間運行的中小型工件加工。根據加工需求靈活調整設備運行狀態，實現最多可達 24.1% 的節能效果。
- **智慧冷卻與監測：**
  專利水箱偵測系統提供冷卻液容量、溫度及管路流量異常的實時監測，提前預警異常，保障加工穩定性並延長設備壽命。

（三）綠色、節能與永續

- **結構輕量化與材料優化：**
  - 機台底座採用輕量化設計，以鐵件材質替代全鑄鐵底座，在確保結構穩定的前提下，減少約 30% 的材料使用量，降低生產成本並減少材料碳足跡。
  - 旋轉運動軸使用上銀 Harmonic Gears 諧波減速機取代傳統傳動結構，減少約 80% 的重量與潤滑油使用量，有效減少能源消耗並降低潤滑油對環境的潛在污染。
- **能源監控系統：**
  實時記錄設備能耗，幫助用戶優化能源使用，降低長期運營成本。

（四）結構、精度與品質

- **結構設計：**
  採用正交動柱式設計，減輕移動部件重量 20%，降低移動能源消耗 15%。
- **加工精度：**
  符合 ISO 13041 標準，線性軸定位精度＜ 10μm，重複定位精度＜ 8μm，各旋轉軸精度穩定達標。
- **品質管理：**
  建立標準化組裝與檢驗規範，結合數位化履歷系統，確保一致性並降低人為錯誤。

（五）市場可行性

- **價格優勢：**
  售價僅為國外進口機台的六分之一，性價比極高，適合中小企業及教育市場。
- **行銷策略：**
  - 積極參加國內外展覽，展示創新設計與應用，建立品牌知名度。
  - 線上品牌推廣與精準數位廣告，提升市場滲透率。
- **市場定位：**
  瞄準機械加工、教育、創客等多元市場，滿足多樣化需求。

（六）審美性

- **外觀設計：**
  採用人體工學與八角形設計，突破傳統工具機外觀，提升操作便利性與空間效率。
- **操作便利：**
  配備可翻轉操作箱與前置鐵屑槽，方便清理與維護，增強用戶體驗。
- **現代感與科技感：**
  精簡線條設計，展現工業美學與高科技特性，吸引重視效率與美觀的客戶群。

（七）其他

- **高度便利性：**
  支援單相 AC220 電壓輸入，靈活移動設計，操作如家電般便利。
- **數位雙生技術應用及永續發展**
  廣泛應用於產品開發、品質控管與售後服務，實現數位化管理與 ESG 目標。落實環保與節能減碳理念，將永續精神融入企業經營與產品設計。

DESCRIPTION IN ENGLISH:

(1)Innovation

- **Multi-functional Integration:**
  The MT-210 integrates lathe, milling, and an automatic tool-changing system (ATC), enabling multi-process machining in a single setup, significantly enhancing production efficiency.
- **Harmonic Gears Technology:**
  Applied to the B-axis, CF-axis, and turret design, reducing weight by 70%-80% and minimizing

lubrication usage, improving energy efficiency and lowering maintenance costs.

- **Structural Innovation:**
  Features an orthogonal structure design with a ±105° B-axis rotary milling spindle and C-axis functionality on both main and sub-spindles, accommodating multi-directional complex machining needs.
- **High-Efficiency Tool System:**
  Equipped with an 18-tool turret and a 16-tool disk magazine, significantly reducing tool change time and enhancing production flexibility.

(2)Intelligence and Practicality

- **Smart Energy-saving Mode:**
  Intelligent control technology adjusts the equipment's operation dynamically based on machining requirements, achieving energy savings of 5.5%-24.1%, ideal for prolonged machining operations.
- **Smart Cooling and Monitoring:**
  A patented coolant tank detection system provides real-time monitoring of coolant capacity, temperature, and pipeline flow abnormalities, enabling early warnings to ensure stable operation and extend machine life.

(3)Energy Saving Computation

- **Lightweight Structure and Material Optimization:**
  - o The machine base adopts a lightweight design, replacing fully cast iron bases with iron materials, reducing material usage by 30% while ensuring structural stability, lowering production costs, and reducing carbon footprints.
  - o Rotary motion axes utilize Hiwin Harmonic Gears to replace traditional transmission structures, reducing weight by approximately 80% and minimizing lubrication usage, effectively lowering energy consumption and environmental impact.
- **Energy Monitoring System:**
  Real-time energy consumption monitoring helps users optimize energy usage, reducing long-term operating costs.

(4)Structure, Precision and Quality

- **Structural Design:**
  Features an orthogonal column design, reducing moving parts' weight by 20% and cutting energy consumption for movement by 15%.
- **Machining Precision:**
  Complies with ISO 13041 standards, achieving linear axis positioning accuracy $<10\mu m$ and repeatability $<8\mu m$. Rotary axis precision is stable and meets international standards.

(5)Market Feasibility

- **Price Advantage:**
  Priced at only one-sixth of imported machines, offering exceptional cost-performance value, suitable for SMEs and educational institutions.
- **Marketing Strategy:**
  - o Actively participate in domestic and international exhibitions to showcase innovative designs and applications, enhancing brand recognition.
  - o Promote the brand online and leverage targeted digital advertising to expand market reach.
- **Market Positioning:**
  Target diverse markets such as machining, education, and makerspaces to meet varying customer needs.

(6)Aesthetics

- **Exterior Design:**
  Combines ergonomics with an octagonal design, enhancing operational convenience and space efficiency.
- **Modern and High-tech Look:**
  Clean lines reflect industrial aesthetics and advanced technology, attracting customers who value efficiency and aesthetics.

(7)Others

- **High Convenience:**
  Supports single-phase AC220 voltage input with flexible mobility, offering plug-and-play convenience similar to household appliances.
- **Digital Twin Technology Application:**
  Extensively applied in product development, quality control, and after-sales services, achieving digital management and ESG goals.
- **Sustainable Development:**
  Emphasizes environmental protection and carbon reduction, incorporating sustainability into corporate operations and product design.

www.timtos.com.tw

其他數控工具機及其加工單元類

Other CNC Machine Tool and Manufacturing Cell

金豐機器工業股份有限公司
CHIN FONG MACHINE INDUSTRIAL CO., LTD.

慶鴻機電工業股份有限公司
CHING HUNG MACHINERY & ELECTRIC INDUSTRIAL CO., LTD.

曙光機械有限公司
DAWN MACHINERY CO., LTD.

精呈科技股份有限公司
EXCETEK TECHNOLOGIES CO., LTD.

新虎將機械工業股份有限公司
GENTIGER MACHINERY INDUSTRIAL CO., LTD.

全鑫精密工業股份有限公司
GRINTIMATE PRECISION INDUSTRY CO., LTD.

鍵和機械股份有限公司
JAINNHER MACHINE CO., LTD.

和和機械股份有限公司
SOCO MACHINERY CO., LTD.

金豐機器工業股份有限公司
CHIN FONG MACHINE INDUSTRIAL CO., LTD.

地　　址：50071 彰化市彰水路 186 號
No.186, Chang Shui Road, Chang Hua City 50071
電　　話：+886-4-7524131　　**傳　　真：**+886-4-7611920
網　　址：www.chinfong.com.tw　　**E-mail：**joanchen@chinfong.com.tw

攤位號碼：P0814

主要產品類別：

本公司為專業之沖鍛壓機械製造商，主要營業內容及範圍為各項沖鍛壓機械及零件之生產製造、研究開發、工程設計、營業銷售、週邊設備買賣及維護修理等業務。主要產品與服務：

(1) 重型縱列式鈑金沖壓生產線。
(2) 超大型多工位自動移送沖壓生產線。
(3) 大型冷熱間精密鍛造自動化生產線。
(4) 板材衝鍛複合成形壓力機。
(5) 大公稱力行程冷鍛壓力機。
(6) 單、雙點伺服沖床。
(7) 精密衝鍛自動壓力機。

參賽作品名稱：

OCP-110EW 智慧單曲軸沖床
OCP-110EW Intelligent Single Crank Power Press

作品圖片：

作品開發背景：

金豐公司對社會責任、綠色、節能與永續，一直視為研究發展理念最重要的一部分，持續創新產品及優化，來滿足客戶因應 ESG 時代所需的生產設備變遷需求。此次開發以下列四點來做為努力方向的實踐與永續發展。

一．**行星減速機模組化：**透過自製行星減速機的應用，取代原本的傳動機構，減少因客戶需求而改變的齒輪模組，行星減速機皆採模組化生產，生產週期縮短，在異常狀況下可快速更換，避免等待時間的浪費。

二．**潤滑油量減少化：**透過免潤滑導襯應用，免除原本需要潤滑的作動部位，同時也減少潤滑配管作業，進一步降低能源及潤滑油品消耗。

三．**機構精實化：**台身重量占比沖床整體重量約 50% 以上，此次的台身配合傳動結構的優化，台身重量降低約 170kg，台身重量減幅約為 3.5%，整體機器高度方面降低了約 150mm，以整體機器高來說約減少了 5%，整體的外觀經過此次的改造設計，更顯精實穩重。

四．**智慧綠色節能化：**以高效低耗能電磁阻馬達 (IE4) 來替代傳統感應馬達，並選用節能元作件，並有能源回收裝置，可回收沖壓時的能量回升，搭配自行開發的 iForming 智慧成形生產管理系統與故障預測及健康管理 (PHM) 技術，減少生產過程中的能源消耗。始終秉持金豐的經營理念 - 創新、服務、回饋，期待與客戶攜手走在世界的前沿，共創未來。

作品特點：

（一）創新性

本產品以行星減速機取代傳統的傳動機構及採用自潤材質於作動部位，提升傳動效率和環保效能。iForming 智慧成形生產管理系統搭配故障預測及健康管理（PHM）技術，配合高效馬達及能源管理的使用，降低設備能耗及壽命管理。

本產品具備以下設計理念：

1. **節能減排：**改進傳動方案及無摩擦傳動部件減少摩擦損失，降低能源及油品消耗。
2. **模組化傳動系統：**模組化設計讓傳動系統可更靈活地調整和配置。不僅可降低生產成本，亦可縮短維修和保養時間，從而延長設備使用壽命。
3. **再生能量回收：**將減速運行過程中能量回收，轉為電能重新使用，達到能源再利用。
4. **自適應能源管理系統：**使用智能控制技術迅速應對設備異常，提升能源使用效率，降低生產過程中的能源消耗。

（二）智慧化與實用性

結合各類感測器、PHM 技術、iForming 即時可視化監控及大數據分析提供維修與診斷依據，迅速排除設備異常；能源管理升能源使用效率，減少製程能耗。iForming 系統支援與上位系統或異質系統串接，實現資料共享與協同運作；結合 IT、AIoT、物聯網技術、感測器、RFID 及大數據等系統整合，助客戶低成本邁向智慧工廠。

（三）綠色、節能與永續

金豐公司之企業社會責任，將綠色、節能與永續列為公司研究發展的重要理念，持續創新的產品優化及改善，設計差異說明如下：

1. **產品結構輕量化：**台身本體及傳動部件的重量降低 3.5%。
2. **潤滑油量改善：**選用高效潤滑材料，縮減傳動部油箱容量，整體減少潤滑油用量約 54%；減少約 70% 潤滑配管作業時間及檢修項目。
3. **再生能量回收：**搭配節能裝置將作業中回升電流回收再利用，取代傳統以剎車電阻熱排設計，降低設備功率損失約 30%。
4. **自適應能源管理系統：**設備可視化管理、大數據分析即時掌握設備健康狀態及能源消耗、進行預防維護提示與故障預警，提升設備有效稼動及延長設備壽命。

（四）結構、精度與品質

透過有限元素分析軟體 (FEM)，持續以 3R(Recycle、Reuse、Reduce) 思維融入設計規劃，讓設計產品結構最佳化、生產製造合理化及能源循環利用等，減少冗餘設計達到減化物料，使產品更加節能及環保。以大數據分析機器常產生的異狀、客訴資料完整檢核重點與要求內容進行製品檢驗工程規劃，並進行設計驗證測試，確認設計規劃與實務產品之差異。

成機檢驗根據客戶要求與安全規定進行 100% 檢驗，產品符合 CNS3157 B7045、JIS B6402、歐盟 EN692 及國內型式檢定等相關法規要求。

（五）市場可行性

OCP 系列以創新優化結構設計，以行星減速機設計替代傳統齒輪組、進階版智能化管理系統 (iForming) 以及故障預測與健康管理 (PHM)，以低成本協助客戶將傳統管理邁向智慧製造及數位轉型。

金豐以「創新研發、布局全球」為發展策略思維，貼近市場需求及協助中小企業智能規劃，創新優化結構設計減少潤滑油量，可廣泛運用於下料、引伸、彎曲、刻印、壓平及切邊等沖壓製程。親和式觸控螢幕操作介面大幅提升操作便利性，螢幕顯示機台運轉參數可即時監控機台運轉狀況。因應不同類型產業工廠，整合自動化周邊設備實現關燈工廠的整體解決方案，以迎合並掌握市場需求。

金豐縱橫七十餘年品牌是高優質、高可靠及服務佳的象徵，此為金豐品牌特性。行銷採直營及經銷雙模式。全球銷售服務通路達 60 之多，涵蓋全球五大洲都有金豐產品服務的觸角。客戶超過 3600 家及銷售突破 5 萬台，成功將金豐品牌行銷於國際。

（六）審美性

寬底座保持沖壓穩定性，簡潔且線條粗曠整體架構，提供沉穩、簡單、耐久的視覺。天然、可回收或低耗能材料等讓設計更具永續性語言，讓生態價值有更多的共鳴。

（七）其他

產品發展以多面相符合市場、ESG 需求，從鋼材降低用量、高效驅動馬達及免潤滑材料等方案，提供客戶永續發展的契機起點，與客戶共同增進經濟發展及繁榮，貢獻企業對這世界的責任與關懷，為這片土地的人們提供一個前進的典範。

DESCRIPTION IN ENGLISH:

(1)Innovation

This product incorporates a self-developed planetary reducer as a replacement for traditional transmission mechanisms.

The iForming intelligent forming production management system, in combination with Prognostics and Health Management (PHM) technology, high-efficiency motors, and energy recovery, is designed to reduce energy consumption.

This product is designed based on the following principles:

1. **Energy Efficiency and Emission Reduction:** Improves transmission efficiency to reduce energy waste. Frictionless transmission components minimize friction losses, thereby decreasing the consumption of energy and lubricants.
2. **Modular Transmission System:** A modular design enables more flexible adjustments and configurations of the transmission system. This approach not only lowers production costs but also shortens maintenance time, prolongs equipment lifespan, and reduces the environmental burden of equipment replacement.
3. **Energy Recovery:** The design allows energy generated during deceleration to be recovered and converted into electricity for reuse, achieving energy recycling.
4. **Adaptive Energy Management System:** Utilizes intelligent control technology to quickly respond to equipment anomalies, enhancing energy efficiency and reducing energy consumption during production.

(2)Intelligence and Practicality

This product integrates various sensors with PHM technology, paired with the iForming intelligent forming production management system, to achieve real-time visual monitoring. Big data analysis provides maintenance and diagnostic insights, enabling swift responses to equipment anomalies. Additionally, the system incorporates smart meters for press energy management, improving energy usage efficiency and reducing production energy consumption.

In terms of open integration, the iForming system supports connections with higher-level systems or heterogeneous systems (e.g., ERP, MES), facilitating data sharing and collaborative operations. With AIoT-based equipment management services, the system integrates IoT technologies, sensors, communication devices, RFID, PHM, and big data analysis to monitor production conditions in real time, helping customers gradually transition to smart factories at a low cost and improving market competitiveness.

(3)Energy Saving Computation

Chin Fong's commitment to corporate social responsibility emphasizes green, energy-efficient, and sustainable product development as core principles. Continuous innovation optimizes and improves product designs with notable features:

1. **Lightweight Design:** Reduces the weight of the machine base and transmission components by 3.5%.
2. **Lubricant Reduction:** Utilizes efficient lubricating materials, reducing the oil tank capacity and overall lubricant demand by approximately 54%, along with a 70% reduction in lubrication pipeline operations, significantly lowering maintenance requirements.
3. **Energy Recovery:** Equipped with energy-saving devices that recover and reuse reverse current during operations, replacing traditional heat discharge via brake resistors and reducing equipment power loss by about 30%.
4. **Adaptive Energy Management System:** Offers visualized equipment management while leveraging big data analysis to monitor equipment health and energy consumption in real time, provide preventative maintenance alerts, and extend equipment lifespan.

(4)Structure, Precision and Quality

Using finite element analysis (FEM), the product incorporates the 3R principles (Recycle, Reuse, Reduce) in its design planning. This ensures structural optimization, rationalized manufacturing, and energy recycling, minimizing redundant design and simplifying materials for more energy-efficient and environmentally friendly products.

The internal quality control system leverages big data analysis to identify common anomalies and customer complaints, planning inspection processes accordingly.

Post-assembly, rigorous design verification tests ensure the product meets original specifications. Final inspections adhere to customer requirements and safety standards, meeting regulations such as CNS3157 B7045, JIS B 6402, and EU EN 692, fulfilling the demands of global customers.

(5)Market Feasibility

The OCP series features innovative structural optimization, integrating planetary reducers to replace traditional gear assemblies. With Chin Fong's latest generation of intelligent management systems (iForming) and PHM, it transforms traditional stamping presses into smart manufacturing solutions, guiding customers toward digital transformation.

Chin Fong's strategic vision, "Innovative R&D, Global Deployment," aligns with market needs and supports Small-Medium Enterprises (SMEs) in planning smart factories.

The product drastically reduces lubricant requirements and is versatile for various stamping processes, such as blanking, drawing, bending, embossing, flattening, and trimming.

The user-friendly touch screen interface enhances operational convenience by displaying machine parameters and enabling real-time operation monitoring. For diverse industries, customized automation peripherals provide comprehensive solutions for "lights-out" factories, aligning with market trends.

With over 70 years of experience, Chin Fong is synonymous with high quality, precision, stability, and efficiency. Its dual sales model (direct sales and dealerships) spans 60 locations worldwide, including China, the Americas, Southeast Asia, Europe, the Middle East, Oceania, and Africa. Chin Fong products are available in over 50 countries, serving more than 3,600 clients, with over 50,000 units shipped globally, firmly establishing its international brand presence.

(6)Aesthetics

The machine's height is reduced while maintaining a wide base for stability during stamping. Its clean, rugged structural design conveys a sense of durability and simplicity. By incorporating natural, recyclable, or low-energy materials, the design emphasizes sustainability, resonating with the ecological value of the product.

(7)Others

Chin Fong's product development aims to meet market and ESG demands from multiple perspectives. By reducing steel usage, upgrading motor systems, and adopting lubrication-free materials, it provides customers with opportunities for sustainable development. Chin Fong collaborates with clients to promote economic growth and prosperity, reflecting its corporate responsibility and care for the planet, setting a forward-thinking example for the industry.

慶鴻機電工業股份有限公司
CHING HUNG MACHINERY & ELECTRIC INDUSTRIAL CO., LTD.

地　　址：408 台中市南屯區精科一路 3 號
No.3, Jing-Ke 1 Road, Nantun District, Taichung City 408, Taiwan
電　　話：+886-4-23509188　　**傳　　真**：+886-4-23509199
網　　址：www.chmer.com　　**E-mail**：overseas@mail.chmer.com

攤位號碼：M0810

主要產品類別：

- CNC 雕模放電加工機
- CNC 線切割放電加工機
- CNC 深孔放電加工機
- CNC 高速加工中心機
- CNC 雷射加工機

參賽作品名稱：

UA432L　綠能三機一體線馬驅動線切割機
UA432L　Green and Compact Linear Driven Wire Cut EDM

作品圖片：

作品開發背景：

臺灣已成為全球高科技產業的主要生產地區，並且在有限的國家資源下，節能減碳的綠色設計與製造變得尤為重要。在 3C、IT、汽車、醫療、航太等產業中，許多模具與零件加工產品對精度和表面粗糙度的要求日益提高，尤其是在特殊材料之模具與零件加工。慶鴻機電秉持「創新、科技、綠能、效益」的理念，致力於提供精密、高效、環保的加工解決方案。慶鴻機電是臺灣首家、全球第二家配備線性馬達線切割機的製造廠。

慶鴻機電是少數能夠自行開發工具機核心技術（如電腦控制器）的臺灣廠商，其產品透過自有品牌「CHMER」行銷全球。產品線涵蓋 CNC 放電加工機、線切割機、高速加工機及深孔機、雷射加工機等。作為全台放電加工機及線切割機的龍頭企業，慶鴻機電同時也是全球前五大放電加工機製造商。

慶鴻機電擁有豐富的研發設計經驗，並且具有與歐洲、日本並駕齊驅的實力，致力於生產高精密線切割機。公司目前專注於研發新一代具自動穿線系統的 UA432L 智能化線性馬達驅動線切割機，產品功能主要訴求為提升目標客群最關注的「高精度、高精細表面、節能環保」的加工效益。

在新產品開發上，慶鴻機電參考終端客戶需求及瑞士、日本品牌優點，並結合內部研發團隊的創新構想，成功開發智慧化自動穿線系統（AWT）的系統。這款機台的自動穿線系統 (AWT) 系統不僅可媲美瑞士和日本品牌產品，零件設計更精簡，並具備斷線點穿線的高速自動穿線系統。相信這款新機型的開發，將在國際線切割機市場上大放異彩，進一步鞏固慶鴻機電在全球的競爭力。

作品特點：

（一）創新性

1.「線切割機水箱自動補離子水系統」[發明專利第 I643689 號]
2.「線切割機水槽液面自動控制系統及水循環控制」[發明專利第 I632969 號]
3.「金屬加工機之回收液處理設備」[發明專利第 I606884 號]
4.「線切割機應用於將加工廢料銲固在工件的電路結構」[發明專利第 I731333 號]
5. 搭載自行研發的線性馬達 [新型第 M532690 號]
6. 張力控制器採用可變定電流技術，提升加工穩定性與精度。[新型第 M530198 號]
7. 創新荷重檢知機構，提升生產效率並實現智能管理 。[新型第 M527360 號] [新型第 M525809 號]
8. 雙自耦變壓器和快速電壓判斷電路，提升電力系統穩定性與可靠性。[新型第 M578042 號]
9. 輸入訊號自動轉換電路，提升訊號轉換的自動化與效率。[新型第 M616247 號]
10.「整合視覺檢測裝置」，即時量測工件尺寸或特徵。[新型第 M627309 號]
11.「磁控平衡錘裝置」，確保感測裝置與磁鐵同步運動並穩定供線。[新型第 M556188 號]

（二）智慧化與實用性

1.UA432L 控制器結合慶鴻自製 GenOS 系統與 EtherCAT 自動控制技術，實現高速反應與高擴充性的多軸同步運動控制。
2. 支援符合國際工控標準 IEC61131-3 的 IL 指令語法，能直接在線上修改機台的程式與 IO 點設定，提高系統操作的便利性。
3. 控制器內建 Database 功能，儲存加工參數與資料，即時掌握資訊，實現智慧製造目標。
4. 支援 OPC UA Server，實現機台與工廠的資訊整合，提升資料處理的即時性與共享能力。
5. iConnected 實時顯示機台運行狀況、加工影像及稼動率。
6. 管理者可通過手機或平板遠端監控機台運行狀況與稼動分析。ChmerApp 功能包括三色燈狀態、即時資訊、稼動率、訊息履歷及耗材資訊等。
7. 根據工件厚度精準控制放電能量，確保加工速度、表面粗糙度及尺寸精度符合需求。

（三）綠色、節能與永續

1. 本機基於臺灣 MIT 材料設計，所有關鍵組件由慶鴻集團自主研發、設計與製造，包括 CNC 控制器、線性馬達及模組化電路等。
2. 全新 Linux - N 型控制器：支援雙作業系統 GenOS 與 DOS。
3. 創新 i8+ 電控系統：採用革新放電迴路設計，相比舊款在處理 150mm 以上工件時，加工速度提升 15%，節能 20%。
4. 節能變頻冷卻器：採用自主溫度偵測技術，比傳統定頻冷卻機節省 45% 電力。
5. HEMS 系統，透過電路和水系統整合優化，獲得 ISO 14955 綠色工具機認證。
6. HEMS 系統的控制及電路優化，除節省電力費用，ECO Cut 模式還能減少 42% 銅線用量，幫助使用者降低成本。

（四）結構、精度與品質

1. 機器採高剛性動柱設計，搭配線性馬達驅動與固定工作台，專為大型工件高荷重、高效率加工設計。經 3D 模擬與有限元素分析，結構有效分佈應力，保持精度穩定，提升加工穩定性與可靠性。
2. UA432L 採用三機一體以及模組化設計，大幅縮小佔地面積 20%，提高客戶廠房空間利用率，縮短人員安機時間。
3. 定位精度：± 3μm。

（五）市場可行性

國內市場：

線切割放電加工機專為高精度金屬模具與複雜零件設計，能精確處理各類導電材料，突破傳統技術限制，實現更高精度與穩定性。廣泛應用於機械、3C、航太與車用電子等領域，並獲得長榮航宇、鴻海、華碩等企業肯定。

國際市場：

1. 市場展望與競爭策略

未來，慶鴻將專注拓展國際市場，尤其是中國、美國、韓國及其他亞洲國家。儘管中國市場競爭激烈，我們在高精度 CNC 線切割機及線性馬達技術上具優勢，將主攻高端市場並擴展歐美市場，採取薄利多銷策略提高市場佔有率。我們提供優質銷售保障和完善的售後服務，定期進行海外巡回服務，確保客戶滿意。

2. 客製化與產品定價策略

客製化機台是慶鴻的核心業務，我們專注於根據客戶需求提供設計與設備整合解決方案。對於國際市場，我們採取薄利多銷策略，提升市場佔有率和品牌影響力。

（六）審美性

1. UA432L 以耀眼的白色為主體，搭配內斂灰色和搶眼橘色 CHMER 識別，配合科技感的機台狀態燈，無論遠近皆可輕易辨識。
2. 機台配備 LED 燈光系統，通過三種顏色顯示加工狀態，讓使用者快速識別工作情況。此設計不僅提升外觀，還增強操作可視化，體現人性化設計理念。
3. 控制器操作面板符合人體工學，依自然操作習慣設計，提供直觀舒適的操作體驗。搭配觸控式彩

色液晶顯示屏，操作簡單易懂。

4. 機台本體、電源箱和水箱經精心設計，有效縮小佔地面積，減少約 20% 面寬，此設計提升空間利用率，與機台本體色調協調，展現現代時尚外觀，完美結合功能與美學。

DESCRIPTION IN ENGLISH:

(1)Innovation

1. "Automatic Ionized Water Replenishment System for Wire Cut EDM Tank" [Invention Patent No. I643689]
2. "Automatic Liquid Level Control System for Wire Cut EDM Tank and Water Circulation Control" [Invention Patent No. I632969]
3. "Recycling Liquid Treatment Equipment for Metal Processing Machines" [Invention Patent No. I606884]
4. "Wire Cut EDM Applied to Soldering Processing Waste onto the Workpiece's Circuit Structure" [Invention Patent No. I731333]
5. Equipped with a self-developed linear motor [Utility Model No. M532690]
6. The tension controller adopts variable constant current technology, improving processing stability and accuracy. [Utility Model No. M530198]
7. Innovative load detection mechanism, enhancing production efficiency and achieving intelligent management. [Utility Model No. M527360 and M525809]
8. Dual autotransformers and a fast voltage detection circuit, improving power system stability and reliability. [Utility Model No. M578042]
9. Automatic signal conversion circuit, increasing automation and efficiency in signal conversion. [Utility Model No. M616247]
10. "Integrated Vision Detection Device," enabling real-time measurement of workpiece dimensions or features. [Utility Model No. M627309]
11. "Magnetic Control Balance Device," ensuring synchronized movement of the sensor and magnet while maintaining stable wire supply. [Utility Model No. M556188]

(2)Intelligence and Practicality

1. The UA432L controller integrates Chmer's self-developed GenOS system with EtherCAT automatic control technology, achieving high-speed response and highly scalable multi-axis synchronous motion control.
2. Supports IL instruction syntax compliant with the international industrial control standard IEC61131-3, allowing real-time online editing of machine programs and IO point settings, enhancing system operation convenience.
3. The controller has a built-in database function to store processing parameters and data, providing real-time information management and realizing smart manufacturing goals.
4. Supports OPC UA Server, enabling information integration between machines and factories, improving real-time data processing and sharing capabilities.
5. i-Connected provides real-time display of machine operation status, processing images, and utilization rates.
6. Managers can remotely monitor machine operation and utilization analysis through smartphones or tablets. The ChmerApp functions include status lights, real-time information, utilization rates, message history, and consumables information.
7. Precisely controls discharge energy based on workpiece thickness, ensuring that processing speed, surface roughness, and dimensional accuracy meet requirements.

(3)Energy Saving Computation

1. The machine is designed with MIT materials from Taiwan, with all key components, including the CNC controller, linear motors, and modular circuits, independently developed, designed, and manufactured by the Chmer Group.
2. The brand new Linux-N type controller supports dual operating systems: GenOS and DOS.
3. The innovative i8+ electrical control system, using a revolutionary discharge circuit design, increases processing speed by 15% and reduces energy consumption by 20% compared to older models when handling workpieces over 150mm.
4. Energy-saving variable frequency chiller, utilizing self-developed temperature detection technology, saves 45% of power compared to traditional fixed-frequency cooling systems.
5. HEMS system, optimized through circuit and water system integration, has obtained ISO 14955 certification for green machine tools.
6. HEMS system's control and circuit optimization not only saves electricity costs but also reduces copper wire consumption by 42% with the ECO Cut mode, helping users reduce costs.

(4)Structure, Precision and Quality

1. The machine adopts a high-rigidity moving column design, driven by linear motors and a fixed worktable, specifically designed for high-load, high-efficiency processing of large workpieces. Through 3D simulation and finite element analysis, the structure effectively distributes stress, maintaining precision stability and improving processing reliability.
2. The UA432L features an all-in-one and modular design, significantly reducing the footprint by 20%, improving space utilization in customer workshops, and shortening installation time.
3. Positioning accuracy: ± 3μm.

(5)Market Feasibility

Domestic Market:

Chmer's wire-cut EDM machine is designed for high-precision metal molds and complex parts, capable of processing conductive materials with precision and stability. It is widely used in machinery, 3C, aerospace, and automotive electronics industries, earning recognition from companies like EVA Air, Foxconn, and ASUS.

International Market:

Chmer will focus on expanding into China, the U.S., South Korea, and other Asian countries, leveraging its strengths in high-precision CNC wire-cut EDM and linear motor technology. The company aims to target the high-end market and expand in Europe and the U.S. by adopting a low-margin, high-volume strategy to increase market share. Comprehensive after-sales service and regular overseas tours ensure customer satisfaction.

(6)Aesthetics

1. The UA432L features a sleek white body with gray and orange CHMER accents, and status lights that enhance visibility from a distance.
2. Its LED system uses three colors to indicate processing status, improving both appearance and operational clarity.
3. The ergonomically designed control panel, with a touch-sensitive color LCD, offers intuitive and comfortable operation.
4. The compact design of the machine body, power box, and water tank reduces the width by 20%, optimizing space while maintaining a modern, functional aesthetic

曙光機械有限公司
DAWN MACHINERY CO., LTD.

地　　址：516022 台灣彰化縣埔鹽鄉員鹿路一段 179 號
No.179, Sec. 1, Yuanlu Rd., Puyan Township, Changhua County 516022, Taiwan
電　　話：+886-4-8659610　　傳　　真：+886-4-8653980
網　　址：www.dawn-machinery.com.tw　　E-mail：dawn.machine@msa.hinet.net

攤位號碼：M0610

主要產品類別：

- 立式圓筒磨床
- 客製化磨床
- 數控圓台平面磨床 (轉盤平面磨床)
- 立臥兩用綜合加工機
- 滾子凸輪蝸桿銑床
- 滾子凸輪蝸桿磨床

參賽作品名稱：

DN-808F 數控複合立式圓筒磨床
DN-808F CNC Universal Vertical Cylindrical Grinder

作品圖片：

作品開發背景：

立式圓筒磨床屬於比較精密的工具機，長期以來日歐獨佔市場，但自從曙光機械於 2017 推出第一台立式圓筒磨床後，至今已經累計銷售超過 150 台立式圓筒磨床於世界各地，我們的主要競爭對手是日系廠商，比如 DMG 旗下的太陽工機，近幾年日比貶值，間接的削弱了台廠的競爭力，故我們思考除了價格之外，我們必須推出更高性價比，功能更多的機型來對應，一立一臥的複合機型因此而生，以往 2 台立磨必須搭配一台臥式轉盤磨床來研磨基準平面，現在使用我們的立臥複合機型，把兩台機床的功能合而為一，可以有效率的一次性完成基準面及各加工面加工，保證基準面的平面度及和內外徑垂直度，圓筒度等幾何精度，減少因為更換製程移動工件而造成的安裝誤差。並且減少兩台機器的佔地面積，共用轉盤驅動以及一套控制器即可實現兩台機器的功能，也能達到節能減碳的目的，提高機台的價值，與國際大廠競爭。

作品特點：

（一）創新性

有別一般市場上的單主軸立磨，此參賽作品為雙主軸一立一臥結構，既往單主軸立磨對於較大平面的研磨必須增加主軸擺頭結構來研磨，擺頭結構會降低機械剛性影響加工精度，且單主軸為求效能通用性，通常主軸設定為高轉速，因此剛性相對比較低，用小砂輪擺角度研磨平面，表面粗糙度及效率沒有臥式磨頭用大砂輪來的好。一立一臥雙主軸複合磨床，立軸主軸用於內外徑研磨，搭載較小砂輪可以達到高轉速高精度的效果。臥式主軸頭水平擺放，搭載外徑 355mm 以上的大砂輪，低轉速高剛性，可取代轉盤平面磨床，工件可一次性地在機台上完成基準平面及內外徑研磨，達到較高幾何的精度（平面度及垂直度）。

（二）智慧化與實用性

此次參賽的 DN-808F 數控複合立式圓筒磨床，採用西門子的 828D 搭配 15” 觸控螢幕，內建全功能的對話畫面，操作者不用撰寫加工程式，只要點選人機上的圖式即會引導操作者輸入各項所需之加工參數。對話畫面內已包含本公司多年的研磨加工經驗及工法，讓操作者面對不同的加工工件，可以選擇適合的加工工法及路徑，以確保加工效率及精度。且搭配西門子原廠 Create MyVirtual Machine 軟體，在機台還未組裝完成時，事先將虛擬機械建構起來，可以事先進行硬體行程干涉分析，加工動作分析，並模擬客戶的操作應用等。與過往機械完成後再整合測試的作法，大大加速了開發的效率，以及節省動作錯誤時導致機械碰撞等成本。後期，客戶也能利用此模型，先進行工件的模擬切削，以便事先評估加工時間，程式路徑等等。遠端維護，利用西門子 828D 控制器內建的 VNC 伺服器功能，只需將機械連上網際網路，則透過網路可在不同地點連接上機械的控制器。此功能非常方便遠距教學或是售後服務，有時候客戶無法完全清楚的描述問題，此時，只要售服人員連線上客戶的控制器，可以即時並實際了解客戶所要表達的正確問題，增進了教育訓練的便利性，以及售服的時效性。

（三）綠色、節能與永續

此次參賽的 DN-808F 數控複合立式圓筒磨床，包含台身及橋架約佔整機重量的 70% 部件，採用礦物鑄件澆鑄而成，捨棄傳統的鑄造方式，礦物鑄件是常溫鑄造，避免因為鑄造產生的高溫高熱消耗能源以及溫室氣體的破壞環境。另外節能監控部分，控制系統上安裝西門子智慧錶，在電源控制方面，當機台閒置，一段時間內都沒有運動動作時，會自動將油冷機 / 切削液 / 電燈 / 空氣關閉，以達成節能減碳的作用。在節能計算面，可統計單一加工耗電量、整日耗電量，用於分析以利節能計算。

（四）結構、精度與品質

此次參賽的 DN-808F 數控複合立式圓筒磨床結構採用龍門結構，雙 Z 軸雙主軸對稱結構，Y 方向主軸懸伸短，剛性好，變形量小，台身及橋架採用礦物鑄件澆鑄而成，礦物鑄件阻尼是鑄鐵的 6 倍以上，有出色的減震性和熱穩定性，轉盤採用液靜壓結構，承載剛性大於軸承，且沒有軸承接觸問題，壽命長，盤面直徑 800mm，旋轉精度能長期控制在 1u 之內，是立磨工件研磨後真圓度主要控制來源，另外研磨平面精度及圓筒度及垂直度，主要控制來源在於 X 軸及 Z 軸滑台的直線度及垂直度，本公司組立 X 軸及 Z 軸滑台除用花崗石標準直規檢驗外，另外採用 Renishaw XK10 雷射直準儀複驗各線軌直線度及平行度及 X/Z 垂直度，加上西門子直線度補償功能，我們能夠將各軸直線度及垂直度全行程控制在 2u 之內。因為以上組合因素，機台結構剛性好，每條線軌組裝平行度及直線度全行程控制在 2u 內，造就了我們的機台可以做到 0.1u 的微小量進給，除了幾何精度可以做到 2u 範圍，尺寸公差也可以得到很好的控制。

（五）市場可行性

因為立磨的精度門檻比較高一點，在曙光之前，生產立磨的廠商並不多，一立一臥的複合機型甚至沒有廠商製造，但需求一直存在，而且面對日本的競爭，唯有把機器精度壽命做到同樣跟日本製造等級之外，在功能面甚至要超越日本，客戶才有買單的可能，再搭配交鑰匙工程，客製化解決方案，建立口碑，曙光機械除了製造標準的立磨外，之後又推出的雙主軸（雙立軸）立式圓筒磨床，也是以此理念為基礎而生的產品，目前也成為暢銷機種，這次報名參賽的一立一臥機型，發佈後也獲得客戶青睞，目前已收到訂單已經超過 10 台，大部分客戶都拿太陽工機立磨跟我司比較，最終選擇我司，主要是複合機型功能性遠勝日本單主軸機型，以此推論，此機型市場將大有可為。

（六）審美性

本次參賽機台採用全罩式鈑金，外觀採用鑽石切割菱角分明意象設計，鑽石折射閃閃生輝，彷若早晨曙光照射，象徵著曙光不僅僅是一個改變的開始，更是一個對於機械信念的價值體現，只要有光的地方，就有曙光。

（七）其他

磨床幾乎是所有加工的最後一道工序，把關產品的最終精度，而其困難之處，在於精度的控制因素不只是機台本身精度，還必須考慮到加工工法，砂輪的應用，夾治具，切削水選用等等的配套措施，（對於磨床而言，機器準，不一定研磨出來的東西就很準），曙光機械長期專研各式研磨機械的開發生產，深知客戶要的不僅是台精度很高的機械，而是台能夠生產出高品質產品的機器，我們一直以這個方向去製造出客戶要的機械，此次參賽作品便是以此理念而設計的產品，把需要多台機器才能夠完成的工作，在一台機器上一次性完成，減少客戶在轉換工程中造成的安裝誤差，並且提供多年的研磨工法，植入對話畫面，加上交鑰匙工程，客戶收到機器後在最短的時間就能夠量產出合格的產品，體現出機台真正的價值。

DESCRIPTION IN ENGLISH:

(1)Innovation

Unlike traditional single-spindle vertical grinders available on the market, our entry features a dual-spindle design with one vertical and one horizontal spindle. Traditional single-spindle vertical grinders require an additional spindle swing mechanism to grind larger flat surfaces. However, this swing mechanism reduces mechanical rigidity and compromises machining accuracy. Furthermore, to achieve versatility and efficiency, single spindles are typically set for high-speed, resulting in lower rigidity. Using small grinding wheels with a swinging angle to grind flat surfaces often cause poorer surface roughness and low efficiency compared to larger grinding wheels on horizontal grinding heads.

The complex vertical grinder, with one vertical and one horizontal spindle, overcomes these limitations. The vertical spindle is designed for internal and external diameter grinding, equipped with a smaller grinding wheel capable of achieving high-speed and high-precision results. The horizontal spindle head, mounted a large grinding wheel with diameter 355mm or more, operating at low speed with high rigidity. This setup effectively replaces rotary surface grinders, allowing the workpiece to be processed in one installation and complete base surface grinding, internal and external diameter grinding, achieving superior geometric precision in flatness and verticality.

(2)Intelligence and Practicality

The DN-808F CNC complex vertical grinder features Siemens 828D with a 15” touchscreen. It is equipped with a fully dialog interface, which eliminates the need for operators to write CNC programs. Instead, operators can simply select icons on the human-machine interface, which will guide them to input the required processing parameters. The dialog interface incorporates the company’s years of grinding experience and techniques, allowing operators to choose the appropriate processing methods and paths for different workpieces, ensuring efficiency and precision.

Additionally, it is paired with Siemens Create MyVirtual Machine software. This allows for the creation of a virtual machine before the physical machine is assembled, enabling hardware stroke interference analysis, motion analysis, and simulation of customer operations. This avoids the previous situation where testing could only be done once the machine was fully assembled, greatly speeding up development efficiency and reducing costs related to potential collisions from motion errors. Furthermore, customers can use this model to simulate cutting processes on workpieces, enabling them to evaluate processing times, program paths, and other parameters in advance.

Remote Maintenance: By utilizing the built-in VNC server function of the Siemens 828D controller, the machine can be connected to the internet. This allows the controller to be accessed remotely from different locations. This feature is extremely useful for remote teaching or after-sales service. When customers cannot clearly describe a problem, service personnel can connect to the customer's controller and immediately understand the exact issue, improving training convenience and after-sales response time.

(3)Energy Saving Computation

The DN-808F CNC complex vertical grinder features a base and bridge frame that make up approximately 70% of the total machine weight, which are made by mineral castings. This method replaces traditional casting processes, as mineral casting is a room temperature casting technique that avoids the high temperatures and energy consumption associated with traditional casting, as well as the environmental harm caused by greenhouse gas emissions.

In terms of energy-saving monitoring, the control system is equipped with Siemens smart meters. Power control: When the machine is idle and not in motion for a certain period, it automatically turns off the oil cooler, cutting fluid, lights, and air supply to save energy and carbon reduction. Energy consumption calculation: By integrating Siemens smart meters, the system can monitor and calculate the power consumption of individual machining processes as well as the total energy consumption throughout the day, allowing for analysis and comparison to support energy-saving strategies.

(4)Structure, Precision and Quality

The DN-808F CNC complex vertical grinder features a gantry structure with a symmetrical dual-Z axis and dual-spindle design. The Y-axis spindle is short and suspended, providing excellent rigidity with minimal deformation. The base and bridge frame are made by mineral castings, which have a damping capacity more than six times that of cast iron, offering excellent vibration absorption and thermal stability. The rotary table adopts a hydrostatic structure, providing a

load rigidity greater than that of bearings, without bearing contact issues, ensuring long lifespan. The table has a diameter of 800mm, and the rotation accuracy can be maintained within 1 micrometer, ensuring true roundness control for the workpieces after grinding.

Moreover, the flatness, cylindricity, and verticality of the ground surfaces are primarily controlled by the straightness and verticality of the X and Z-axis slides. In addition to using granite gauges to inspect the X and Z-axis slides during assembly, the company also employs a Renishaw XK10 laser alignment system to recheck the linearity, parallelism, and X/Z verticality of the guide ways. With the Siemens linear compensation function, we can control the straightness and verticality of all axes within 2 micrometers across the entire travel.

Owing to these combined factors, the machine structure has excellent rigidity, and the parallelism and straightness of each guide way assembly are controlled within 2 micrometers across the full range. This enables the machine to achieve feed increments as small as 0.1 micrometers. In addition to geometric accuracy within a 2-micrometer range, dimensional tolerances can also be precisely controlled.

(5)Market Feasibility

Due to the higher precision requirements for vertical grinding machines, there were relatively few manufacturers producing vertical grinder before Dawn Machinery. For a complex model with both vertical and horizontal spindles were even not being manufactured by any company. However, the demand has always existed. In the face of competition from Japan, the only way to succeed was to ensure the machine's precision and lifespan were on par with Japan-made machines, while also surpassing them in functionality. Only then would customers choose Dawn Machinery over Japan. Coupled with turnkey solutions, customized applications, and building a solid reputation, Dawn Machinery not only manufactures standard vertical grinder but also introduced the dual-spindle (dual vertical axis) vertical grinder to the market based on same faith. This product has since become a best-seller.

The one-vertical-one-horizontal complex modle entered in this competition has also highly catch customer's attention after its launch. To date, over 10 sets orders have been received. Most customers initially compared our machine with Taiyo Koki vertical grinders, but ultimately chose our product. The reason for their decision was the superior functionality of our complex machine compared to Japan's single-spindle models. Based on this trend, it can be concluded that this machine model has great potential in the market.

(6)Aesthetics

The participating machine in this competition features a full-cover sheet metal design with a diamond-cut angular pattern. The diamond-like reflections sparkle brilliantly, reminiscent of the first light of dawn. This symbolizes that dawn is not just the beginning of a change, but also a reflection of the value of belief in machinery. Wherever there is light, there is dawn.

(7)Others

The grinding is often the final step in the manufacturing process, ensuring the ultimate precision of the product. The challenge lies not only in the machine's own precision but also in factors such as the machining methods, the application of grinding wheels, fixtures, the selection of cutting fluids and so on. (For a grinding machine, a precise machine does not mean that the ground workpiece will be precise too.) Dawn Machinery has long specialized in the development and production of various grinding machines, fully understanding that customers seek not just a machine with high precision, but one capable of producing high-quality products. We have continuously manufactured machines based on this understanding. The product submitted for this competition is designed with this philosophy in mind, completing tasks that would normally require multiple machines in one, reducing installation errors caused by process changes, and providing years of grinding expertise inside. By integrating a dialogue interface and turnkey solutions, the customer can begin mass production of qualified products in the shortest possible time after receiving the machine, truly reflecting the value of the machine.

精呈科技股份有限公司
EXCETEK TECHNOLOGIES CO., LTD.

地　址：429 台中市神岡區豐工三路 10 號
No.10 Fenggong 3rd Rd., Shengang Dist., Taichung City, Taiwan
電　話：+886-4-25200688　　傳　真：+886-4-2520-0111
網　址：www.excetek.com　　E-mail：Sales.dp@excetek.com.tw

攤位號碼：N0806

主要產品類別：

CNC 線切割放電加工機

參賽作品名稱：

NP600Plus 節能智慧化線馬線切割加工機
NP600Plus Energy-saving Intelligent Linear Motor Wire EDM Machine

作品圖片：

作品開發背景：

精呈科技因應全球製造業向智慧化與綠色化轉型，特別是歐美市場對碳排放與節能要求日益嚴格，推出了 NP600plus 智慧高精度線馬線切割機。這款機台專為降低能耗與碳排放設計，符合 ISO 14955 國際環保認證，能幫助企業減少碳稅負擔並提升市場競爭力。同時，NP600plus 滿足現代製造對高效能與環保的雙重需求，同時針對半導體晶圓等材料加工提供特殊的放電技術與噴流控制，為客戶帶來更多機會。此外針對少子化與技術人力短缺問題，機台可搭載線上量測、智能倉儲交換系統、遠端監控等智能化系統與廢料自動排除裝置等，大幅提升生產效率並減少故障停機，助力製造業實現數位化與自動化升級。NP600plus 展現了精呈科技對製造業未來趨勢的前瞻，為企業提供環保高效的創新解決方案，推動未來持續發展。

作品特點：

（一）創新性

1. 高效率節能放電能量回收技術

精呈科技針對高速加工研發出全新的節能放電迴路，搭載主動式能量回收模組，在進行高速加工時能有效減少 33% 的耗電量，同時將加工速度提升 25%。此技術將最大加工速度提升至每分鐘 320 平方毫米，達到日系同級機種的技術水準，為用戶提供高效且具成本效益的加工解決方案。

2. 晶圓加工放電電流可變模組

新技術採用 T 型波放電技術（專利 I839195），能在切割晶圓時顯著提升切割速度 50%，並有效減少熱損傷及裂紋的產生，提高晶圓完整性。該模組在降低耗材成本的同時，保持加工精度與品質，未來將更進一步擴展技術應用場景。

3. 智慧化加工預測功能

為確保長時間運作的穩定性，NP600plus 配備加工時間預估、銅線壽命檢測、水質狀態監控及加工條件自動搜尋功能。此技術可有效防止因加工中斷造成的時間與成本浪費，並大幅提升協同加工效率，適應現代化生產需求。

4. 自動化廢料捕抓裝置

加工後廢料處理是線切割機要達到無人化操作必要要素之一，以往線切割加工完後，需人工將廢料或沖子輕敲落入工作槽中，往往造成人力時間成本及撿取不易之情況發生。本次透過磁吸式的自動化沖取廢料裝置並改良內部緩衝機構，並可運用在不貼面加工情況下仍可順利將廢料吸取，並集中收納廢料，提升廢料磁吸可用性並大幅節省客戶人力需求。

（二）智慧化與實用性

1. 智慧製造遠端監控系統

整合 Dz-Connect 智慧平台，採用標準化的 OPCUA 及 UMATI 通訊協定，提供即時數據監控與分析功能，用戶可透過手持設備掌握生產狀態並進行操作。此系統不僅提升管理靈活性，還加速工廠智慧化轉型，助力客戶邁向工業 4.0 目標。

2. EtherCAT 高速傳輸控制器

採用 PC-base 架構的控制器，計算效能較上一代提升 6 倍，並實現更高精度的運算及快速繪圖能力。同時新增智慧轉角功能與自動段差偵測技術，可自動調整加工路徑，確保穩定性與加工精度。

3. 智能轉角與段差控制技術

根據工件的形狀與厚度，該技術能精準調整能量輸出，減少崩蝕現象 50% 與形狀誤差 40%。圓弧加工的尺寸誤差控制在 2μm 內，適合高精度需求的製造場景，提升成品品質。

4. 智能防撞感測系統

配備全新防撞技術，傳輸速度提高 10 倍，可在機械運動中快速判斷異常並即時停止，避免損害機械元件，延長設備使用壽命。

5. 高速自動穿線系統升級

穿線速度提升 30%，並支援最小線徑達 0.07mm 的細線操作。結合機械手臂應用，可進行全自動化生產，進一步滿足工業 4.0 的需求，提升生產效率與自動化程度。

（三）綠色、節能與永續

1. 整機節能策略

為響應全球環保趨勢，NP600plus 搭載主動式放電能量回收模組，實現整機耗電量下降 33%。冷卻與濾水系統分別優化節能 75% 與 44%。新增的待機模式將待機耗電量降低 95%，全年節電約 10961 度，減少碳排放 5425kg CO2e，符合歐洲嚴格碳稅法規要求。

2. 自動化節能管理策略

引入智慧電錶系統，精確調整加工功率，並提供詳細能耗數據。此外，新銲接模式減少廢料處理的停機時間達 97%，顯著提升加工效率與設備利用率，進一步助力用戶降低碳足跡與營運成本。

（四）結構、精度與品質

線性滑軌與驅動軸線設計同平面，結合高效平板線性馬達與光學尺，將運動誤差降至最低，實現 ±2μm 的高精度。透過有限元素分析技術（FEA）對結構進行最佳化設計，不僅提高整體穩定性，還縮短組裝與調校時間，為用戶提供更加可靠的生產設備。

（五）市場可行性

NP600plus 專為歐美市場設計，具備應對碳稅法規的能力，能有效降低使用者在碳稅方面的成本支出。同時，該機台以高精度、低碳排的特性，適用於航太、電子等對精度與效率有極高需求的產業。精呈科技在全球設有 36 個售後服務據點，提供即時遠端支援，滿足歐美市場的嚴格需求。

（六）審美性

NP600plus 的外觀設計靈感來自水的流動，主色調以深藍和科技白為主，搭配橘色點綴，營造出現代化與科技感兼具的視覺效果。新增的 LED 燈條進一步增強外觀吸引力。人機介面採直觀設計，搭載 19 吋大尺寸觸控螢幕，簡化操作流程並降低培訓成本，用戶可快速熟悉設備操作，提升使用體驗。

DESCRIPTION IN ENGLISH:

(1)Innovation

1. High-Efficiency Energy Recovery Technology

EXCETEK's energy-efficient discharge circuit reduces power consumption by 33% and increases machining speed by 25%, achieving a maximum speed of 320 mm²/min. This innovation meets high-speed machining needs with efficiency and cost-effectiveness.

2. Variable Wafer Processing Module

The patented T-wave discharge technology (I839195) improves wafer cutting speed by 50% and reduces heat damage, ensuring better material integrity and lower costs.

3. Smart Machining Prediction

The NP600plus predicts machining time, monitors wire lifespan and water quality, and automates condition searches. These features reduce downtime and improve collaborative efficiency.

4. Automated Waste Capture Device

Post-processing scrap handling is essential for achieving unmanned operation of wire-cut EDM machines. Traditionally, scrap or punch-outs required manual tapping into the work tank, incurring labor costs and difficulties in retrieval. The newly introduced magnetic automated scrap collection device, enhanced with an internal cushioning mechanism, ensures smooth scrap collection even in non-surface-contact machining conditions.

(2)Intelligence and Practicality

1. Smart Remote Monitoring System

Integrated with the Dz-Connect platform and standardized protocols (OPCUA, UMATI), this system allows real-time monitoring and remote operation via handheld devices, accelerating Industry 4.0 transformation.

2. EtherCAT High-Speed Controller

The upgraded controller enhances computing performance sixfold, improving precision and graphics rendering. Smart cornering and segment detection features ensure stable machining paths and accuracy.

3. Intelligent Control for Precision

Energy output adjusts based on workpiece shape and thickness, reducing chipping by 50% and maintaining dimensional errors within 2 μm, ideal for high-precision manufacturing.

4. Smart Anti-Collision System

New anti-collision technology detects anomalies 10 times faster, preventing component damage and extending machine lifespan.

5. Upgraded Wire Threading System

Threading speed is increased by 30%, supporting ultra-fine wires (0.07 mm). It enables fully automated production with robotic integration for enhanced efficiency.

(3)Energy Saving Computation

1. Comprehensive Energy-Saving Strategy

The NP600plus reduces power consumption by 33% and improves cooling and filtration efficiency by 75% and 44%, respectively. Standby power consumption is reduced by 95%, saving 10,961 kWh annually and cutting CO2 emissions by 5,425 kg CO2e.

2. Automated Energy Management

The smart electricity meter adjusts power usage and provides energy data. A new welding mode reduces waste processing downtime by 97%, enhancing efficiency and lowering operational costs.

(4)Structure, Precision and Quality

Linear guides and drive axes are designed on the same plane and combined with high-efficiency flat linear motors and optical encoders to minimize motion errors, achieving a precision of ±2 μm. Using Finite Element Analysis (FEA) for structural optimization not only enhances overall stability but also shortens assembly and calibration times, offering users a more reliable production tool.

(5)Market Feasibility

Specifically designed for European and American markets, the NP600plus addresses carbon tax regulations, effectively reducing user costs related to carbon taxes. With its high precision and low-carbon characteristics, it is well-suited for industries such as aerospace and electronics that demand high efficiency and precision. Jing Cheng Technology has 36 global after-sales service locations, providing real-time remote support to meet the stringent demands of the European and American markets.

(6)Aesthetics

The design of the NP600plus is inspired by the flow of water, featuring a color scheme of deep blue and technological white with orange accents to create a modern and technological visual effect. The addition of LED light strips further enhances its appearance. The human-machine interface adopts an intuitive design with a 19-inch touchscreen, simplifying operation and reducing training costs. Users can quickly familiarize themselves with the equipment, improving the overall experience.

GENTIGER

新虎將機械工業股份有限公司
GENTIGER MACHINERY INDUSTRIAL CO., LTD.

地　　址：438016 台中市外埔區水頭一路 100 巷 66 號
No.66, Lane 100, Shuitou 1st Road, Waipu Dist, Taichuang City 438016, Taiwan.
電　　話：+886-4-26836919　　**傳　　真：**+886-4-26839900
網　　址：www.gen-tiger.com　　**E-mail：**GT@gentiger.com.tw

攤位號碼：J0802

主要產品類別：

- 高速三軸加工中心機
- 高速五軸加工中心機
- CNC 銑車複合機
- 砲塔式傳統銑床
- CNC 高速帶鋸機

參賽作品名稱：

GT-A4H 龍門型自動高速帶鋸機
GT-A4H CNC High-Speed Horizontal Band Saw Machine

作品圖片：

作品開發背景：

開發頂級帶鋸床的目標為

「快」: 加工時間短、「準」: 成品材料尺寸精確、「省」: 加工的餘料少。

「鋸切」係為所有零件加工前之胚料所需歷經的第一道工序，隨著科技的進步與日益增多的高端材料應用，如何縮短材料鋸切時間，以及在鋸切過程預留最少加工餘料，，是目前帶鋸床所需的最大技術突破點。

帶鋸床是以鋸帶連續單向運行，使鋸帶上的鋸齒對材料進行拉削方式來移除材料，鋸切過程機器便會產生震動與熱量，而機器產生震動越大，鋸切精度便會變差，導致效率的降低，以及金屬鋸帶所產生的熱度越高亦會使其鋸齒壽命越短。

為了快、準、省的需要，選擇使用鎢鋼鋸帶鋸切材料更有優勢，但鎢鋼鋸帶相比於傳統雙金屬鋸帶，其鋸切過程對於震動與發熱的控制要求更為嚴苛，否則會產生不可預期的鋸齒毀損，因此對於機器運行中所要求的條件將更為艱難。　而有高剛性結構的帶鋸床，才能使鋸帶在鋸切過程中維持穩定一致的張力與剛度，以利使用鎢鋼鋸帶來對材料進行鋸切，從而獲得超越傳統帶鋸床 100% 以上的鋸切效率。

上述因素與目的即係研發 - 新虎將 GT-A4H 龍門型自動高速帶鋸床之動機。

舉凡如日本 AMADA、德國 BEHRINGER、德國 KASTO 等高速鋸床，一直是國內帶鋸床參考學習目標；新虎將機械工業股份有限公司發跡於 1995 年，為國內生產製造 CNC 高速銑床先驅，30 年來自有其高於市場的組裝標準與精度要求，才能達到滿足低運行震動、高機台剛性、最後得到機器稼動率高的條件。

現時新虎將 GT-A4H 是國內唯一可以與國外高速鋸床所競爭的產品，不但具有高效能、亦有高效率、高節能、低碳排等特點，並具備機器後端自動化應用與遠端連線售服維修功能，亦符合歐盟 CE 安全規範設計，自民國 112 年 3 月亮相以來，已成功外銷至英國進行特殊金屬鋸切應用與高階發動機製造商之採用肯定。

作品特點：

(一) 創新性

GT-A4H 有別於傳統帶鋸床，除了高剛性的底座與雙立柱設計、採雙邊雙點支撐固定鋸帶輪心軸，在進口機也不常見的高強度機構硬體外，更搭載高性能的電控系統來做運行配置，GT-A4H 為業界首創使用了 Sinumerik 828D 作為其控制核心，真正將數值控制器的技術置入 GT-A4H 高速帶鋸床之中，其優勢不但為處理速度上的革新，得益於全電式伺服控制與易操作易辯讀的人機介面，GT-A4H 能以傳統帶鋸床所達不到的效率進行鋸切，並且在此效率之中獲得無與倫比的節電性能，為科技與永續之間達到完美的融合。

(二) 智慧化與實用性

GT-A4H 亦搭載了全燈號顯示按鍵面板，並可透過畫面上的文字進行交替式引導，機床可自動辨認目前所處在的步驟、程式運行的階段、材料與機床間的相對狀態，智慧式的給予不同鋸切方式指令引導，並閃爍其按鍵面板上對應之按鍵，來提示指引使用者需要如何動作方能執行下一步，完成材料鋸切預備執行，此能力不但能大幅縮短新用戶的學習時間，亦能有效防止各種誤操作的發生，係 GT-A4H 獲得海外代理商高度青睞的特色之一，該機能亦已於 112 年 10 月取得中華民國新型專利 M646605，獲得國家認可。

(三) 綠色、節能與永續

GT-A4H 所搭載超高效率的 Sinamics S120 Combi 伺服驅動系統，將所有運動軸都採用編碼器速度控制，包含鋸切馬達、鋸弓升降、送料前後、鋸帶清潔鋼刷等四只主要馬達皆以超高效率運行，其中驅動器與鋸弓升降、送料前後、鋸帶清潔鋼刷馬達之等級係相同於模具精雕級高速銑床所用之規格，為帶鋸床中前所未見的最高規格。 其中驅動系統，以 GT-A4H 所採用的 16kw 型號為例，其在額定功率下的雜散損失僅 0.8kw，其有效轉換效率高達 95%，且採無回生電阻設計，可將馬達制動的機械能轉換為電能再回送電網，大大降低了無用功率以及省去電氣箱內所需的額外散熱設計，最終顯現的結果是市場中其他對手難以匹敵的。

(四) 結構、精度與品質

GT-A4H 擁有雙立柱設計，寬大的剛性底座，採雙邊雙點支撐固定鋸帶輪心軸，重達 7 噸的整機重量皆表明了新虎將機器一貫以來的強勢作風：超高剛性結構。 並得益於新虎將 30 年來在高速銑床的專業深耕，高速鋸床亦有新虎將銑床的核心精神，透過嚴格的品管檢驗與組裝程序，使得 GT-A4H 得以宣稱鋸切精度可達鋸切實心材料厚度之四周精度誤差於 0.03mm/100mm 圓徑之內，遠勝於 CNS 4897-1982 國家標準的 0.10mm/100mm 數據，皆非一般帶鋸床可達到之程度。

得益於高剛性結構的優勢， GT-A4H 可搭配並發揮鎢鋼鋸帶之所有性能，經新虎將廠內自身測試，鋸切直徑 400mm SKD61 工具鋼於穩健條件可達 18 分 40 秒，直徑 300mm SUS304 不鏽鋼於穩健條件可達 11 分，皆能達到 0.03mm/100mm 的高精度標準。

（五）市場可行性

GT-A4H研發策略為「高速加工、耐重切削」，其龍門型雙立柱鋸框結構，全機滾柱式線軌滑塊，以高速銑床為基底的組裝公差，使得 GT-A4H 運作更低阻更順暢。 堅固的結構與設計，強效高速精準鋸切，可達到均勻平整的切斷面，高效率的同時不失最終品質，搭配圖形式對話操作畫面，全引導式操作，安全易學效率高。以上數點皆為新虎將 GT-A4H 不同於市場上待鋸床之特色，可將我國帶鋸床之鋸切性能與操作友好度提升到能與進口機種匹敵之高度，目標為促進國有產業升級發展，並最終達成外銷目的。

（六）審美性

GT-A4H 防護罩採用白色塗裝為主並搭配局部綠色面積的色調表現，厚實鈑金與傾斜角度，展現力與美視覺設計，外觀視覺上顯得俐落。

美學面板採用企業識別色，與機體底座一致色系設計，並在線條上特定角度之折線來讓飾板圖形與機身鈑件相互呼應，強化整機的一體性，凸顯出穩定感受並由銳利的摺線來營造科技感，令人第一眼不會認為這是一部帶鋸床，大大提升整體美學表現。

DESCRIPTION IN ENGLISH:

(1)Innovation

The GT-A4H features a high-rigidity base and double-column design, with a double-sided, dual-point support for the bandsaw wheel shaft. This high-strength structural hardware, rarely seen even in imported machines, is complemented by a high-performance control system. The GT-A4H is the industry's first to use the Sinumerik 828D controller, truly integrating CNC technology into the GT-A4H high-speed bandsaw. This advancement not only revolutionizes processing speed but, with its fully servo control and user-friendly HMI, enables cutting efficiency far beyond that of traditional bandsaws. Moreover, it achieves unparalleled energy-saving performance, representing the perfect fusion of technology and sustainability.

(2)Intelligence and Practicality

The GT-A4H also has a full indicator light button panel, providing alternate guidance through on-screen text. The machine can intelligently recognize the current step, the program execution phase, and the relative status between the material and the machine. It then gives instructions for different sawing methods. It highlights the corresponding buttons on the panel to guide the user through the next steps, completing the preparation for material sawing. This feature shortens the learning time for new users and effectively prevents operational errors. It is one of the features highly favored by overseas distributors. This function was granted a utility model patent (M646605) in Taiwan in October 2023, receiving national recognition.

(3)Energy Saving Computation

The GT-A4H is not only equipped with a high-performance Sinumerik controller but also features the ultra-efficient Sinamics S120 Combi servo drive system. All motion axes are controlled with encoder-based speed control, including the main motors for sawing, saw frame lifting, material feeding, and the saw blade cleaning brush. These four key motors are precisely controlled by the high-efficiency Sinamics S120 drive, which offers the same level of precision as those used in high-speed milling machines for mold engraving, setting an unprecedented standard of positioning accuracy for bandsaws.

Taking the 20 kW model used in the GT-A4H as an example, it has a stray loss of only 0.83 kW under-rated power, with an effective conversion efficiency of up to 95%. Additionally, it features a regenerative design that converts mechanical energy generated during motor braking into electrical energy and feeds it back into the grid. This significantly reduces wasted power and eliminates the need for additional cooling in the electrical cabinet, resulting in a performance level that is difficult for competitors to match.

(4)Structure, Precision and Quality

The GT-A4H features a double-column design and a wide, rigid base with double-sided, dual-point support for securing the band wheel shaft, contributing to its total weight of 9 tons. This robust structure exemplifies Gentiger's commitment to ultra-high rigidity in its machinery. Drawing from Gentiger's 30 years of expertise in high-speed milling machines, the GT-A4H embodies the core principles of Gentiger milling machines. Through rigorous quality control inspections and assembly procedures, the GT-A4H can achieve a cutting accuracy of less than 0.03mm per 100mm diameter for the four sides of solid materials, significantly outperforming the national CNS 4897-1982 standard of 0.10mm per 100mm.

(5)Market Feasibility

The GT-A4H focuses on "high-speed processing and heavy-duty cutting," with three key features: mechanical and electronic control integration, variable frequency drive, and easy operation.These features make the GT-A4H stand out in the market, enhancing the performance and user-friendliness of domestic band saws to a level that rivals imported models. The goal is to promote the upgrading of local industries and export success.

(6)Aesthetics

The GT-A4H's protective cover features a predominantly white design with subtle green accents. Its robust sheet metal construction and sharp, angled contours perfectly blend strength with aesthetics, creating a bold yet refined appearance that exudes elegance and clean lines. The panel incorporates the company's signature color scheme, harmonizing with the machine's base. Sharp, angular folds in the panel's design mirror the body's metalwork, reinforcing the overall unity of the machine and enhancing its stability. Additionally, these sharp folds create a strong technological feel, elevating the first impression of the machine beyond that of a traditional band saw, significantly enhancing its aesthetic appeal and visual impact.

GRINTIMATE
全鑫精密工業股份有限公司

全鑫精密工業股份有限公司
GRINTIMATE PRECISION INDUSTRY CO., LTD.

地　　址：40768 台中市西屯區工業區三十六路 23 號
No.23, Gongyequ 36th Rd., Xitun Dist., Taichung City 407, Taiwan
電　　話：+886-4-23591486　　**傳　　真：**+886-4-23597158
網　　址：www.grintimate.com/　　**E-mail：**sales@grintimate.com

攤位號碼：M0303

主要產品類別：

- 液靜壓外圓磨床專用機
- 液靜壓直進式外圓磨床
- 液靜壓斜進式外圓磨床
- 液靜壓臥式轉台平面磨床
- 液靜壓立式晶圓研磨機

參賽作品名稱：

GTR-1215　半導體專用液靜壓立式晶圓研磨機
GTR-1215　Semiconductor Dedicated of Hydrostatic Wafer Grinder

作品圖片：

作品開發背景：

全鑫精密多年研究「液靜壓」技術，自研自製無軸承磨耗、高抗阻尼及制震特色的液靜壓核心關鍵零組件，包含液靜壓主軸、液靜壓滑軌與液靜壓旋轉工作台，其特點可滿足半導體產業針對碳化矽 (SiC) 等硬脆材料高精度研磨加工的嚴苛要求，特別是針對超薄型工件的研磨，能夠克服加工過程中的不穩定性、震動、溫升所導致加工物破損、變形、精度不良、粗糙度過大等問題。

作品特點：

（一）創新性

全鑫精密研發具備高度創新技術的晶圓薄化設備 GTR 系列，為業界首創將液靜壓技術導入晶圓研磨製程，本參賽作品具備以下特點：

1. 導入液靜壓軸承技術投入高速液靜壓研磨主軸與液靜壓旋轉平台之設備開發。
2. v 結合多種機構、擁有多項專利設計，包含：高壓噴水排屑系統、自動修砂機構、自動量測系統採用跟監式 2 探針方式量測等。
3. 超音波液靜壓主軸開發，並投入粗 / 細研磨之鑽石砂輪特徵齒設計開發提升壽命及運用智慧監診技術掌握研磨狀態，提升減薄製程良率。
4. 製程智慧監診與 AI 特徵模型萃取：利用聲射頻感測器 AE Sensor 及上主軸馬達電流變化 Power Sensor 作為訊號的來源，達到監測製程狀態的變化。
5. 瞄準日本國際大廠 DISCO，現階段已著手開發「超音波雙主軸全液靜壓 AI 自動化連續雙站式研磨設備」，為本參賽作品之延伸 / 升級機型。

（二）智慧化與實用性

全鑫精密首創開發全液靜壓碳化矽 (SiC) 晶圓薄化設備，並導入「高速液靜壓主軸模組」，開發晶圓研磨機專用立式主軸，配合中空軸設計含超音波振動頻率機構，提升高硬度高脆性材料加工之可行性。

1. 研磨盤高壓排屑清潔冷卻裝置，提高砂輪使用效率與降溫排削。
2. 側邊自動修砂系統：可減少人工置放與時間損耗及避免重覆對刀失誤。
3. 粗 / 細研磨製程技術開發：針對砂輪抗折強度進行設計，完成超音波專用鑽石研磨盤砂輪生產。
4. 智慧型人機介面控制：客戶可輕易完成研磨過程中的砂輪自動修整、自動補償、自動加工，實現超高精密減薄研磨加工。
5. AI 智能模型：將超音波專用鑽石研磨盤與研磨製程狀態監控系統導入本參賽作品，達到減薄製程中砂輪狀態變化監控。
6. 國產客製 12 吋砂輪與真空吸盤：Chuck Table 可依照終端客戶需求進行客製，可滿足 4”-12” 不同尺寸半導體材料的研削薄化工藝。
7. 本參賽作品可結合 EFEM 滿足自動化生產。

（三）綠色、節能與永續

1. 搭配自製內藏式液靜壓主軸，動態迴轉精度高、無傳遞功率損耗、轉動慣性小、低噪音、低環境污染，符合經久耐用、可維修、可升級，實現循環經濟標準。
2. 本參賽作品採用模組化設計，並保（預）留產品擴充性，除能降低客戶因維修或更新設備的停機成本外，亦能僅針對損壞部位進行維修或更換，在成本管控、獲利與環境保護三方面中取得平衡。
3. 本參賽作品之液靜壓系統皆採用封閉式油路，可完全隔絕外部汙染，達到綠色製程中「預防汙染」、「減廢技術」與「廢料最少化」的目標。
4. 公司亦將著手規劃導入機台能耗紀錄（分析）可視化系統，達到需量管理、減少超約用電、智慧節能目的。

（四）結構、精度與品質

1. 符合 ISO 9001:2015（證書編號：93Q21653）
2. 取得 CE 證書：2006 / 42 / EC (Machinery) 與 2014/35/EU (Low Voltage)
3. 取得 SEMI S2 證書（證書編號：112R0279）
4. 取得 TS 認證（識別號碼：TD060045I）

（五）市場可行性

全鑫精密自 2019 年開始佈局半導體市場，不僅是本參賽作品，產品線包含外圓磨床、轉台平面磨床，均有半導體客戶實蹟。本參賽作品 - 液靜壓立式晶圓研磨機 GTR-1215，強攻晶圓製造、先進封裝等領域，目標鎖定第三代半導體碳化矽 (SiC) 晶圓及其他硬脆材質的薄化研磨，藉由全鑫獨特的液靜壓軸承技術，採用先進的液靜壓潤滑 / 冷卻系統和流量控制器，保持磨削品質、穩定壓力、進而提升進給精確性和定位精度，可因應碳化矽 (SiC) 製程薄化面臨研磨負載阻力大、碳化矽 (SiC) 晶圓薄化製程易破裂之挑戰，為客戶提供革命性晶圓研磨薄化解決方案、提升減薄製程良率，不僅縮短晶圓製程時間，還能降低使用化學機械拋光研磨 (CMP) 製程的成本。

（六）審美性

1. 創新美學設計，結合企業 CI 鮮明的配色打破以往機械冷硬的形象，上方採用圓弧形鈑金設計，傳達簡潔、靈活與高精密的美學感受。
2. 符合人因工程設計，操作箱體符合人體工程學可依據操作習慣移動位置，達到可視性及易於工件的裝卸及易於維護。
3. 底座一體式設計，對於防屑性及防水性較佳，與密閉式全罩鈑金搭配容易，減少組裝誤差值，並提升耐用度。
4. 手動入料上開自動門採用大面積的壓克力飾板，降低光影折射干擾操作者確認機台內部狀況。
5. 本參賽作品亦可靈活搭配機器人手臂的智慧控制整合優化生產製程。
6. 美學、空間、節省等元素提升企業產品辨識度及產品價值。

（七）其他

本參賽作品榮獲 2023 年台灣精品獎。

DESCRIPTION IN ENGLISH:

(1)Innovation

GRINTIMATE has developed the innovative GTR series wafer grinding machine. The key features are as follows:

1. By incorporating hydrostatic bearings into the high-speed hydrostatic bearing spindle and hydrostatic rotary worktable, ensuring high-quality wafer grinding & thinning processes.
2. Multi-Mechanism Integration with Patented Designs- The machine is equipped with a high-pressure water flushing system, automatic dresser mechanism, automatic measurement system using dual-probe monitoring for real-time corrections and etc.
3. Ultrasonic Hydrostatic Spindle Development- Combined with the design and development of characteristic teeth for diamond grinding wheels tailored for coarse and fine grinding.
4. Intelligent Process Monitoring and AI Feature Modeling- Using an acoustic emission (AE) sensor and the power sensor monitoring changes in the upper spindle motor current to detect and monitor process condition variations.
5. Targeting Japan's DISCO, we are currently developing the "Ultrasonic Dual-Spindle Fully Hydrostatic AI-Automated Dual-Station Grinding Equipment," which serves as an upgraded version of this product.

(2)Intelligence and Practicality

GRINTIMATE has pioneered the development of fully hydrostatic silicon carbide (SiC) wafer grinding machine, the design incorporates a "high-speed hydrostatic spindle module" and a dedicated vertical spindle.

1. High-Pressure Grinding Disc Cleaning and Cooling System, improving grinding wheel efficiency and providing effective cooling and chip removal.
2. Side-Mounted Automatic Wheel Dressing System, to reduce manual placement errors and time consumption while preventing tool alignment mistakes.
3. Development of Rough/Fine Grinding Processes- The grinding wheels are designed with varying fracture strength levels (soft, medium, hard) to meet specific application needs.
4. Intelligent Human-Machine Interface (HMI) Control, including wheel dressing, compensation, and adjustments to ensure ultra-precise wafer thinning and grinding.
5. AI Intelligent Model- Ultrasonic diamond grinding wheels and process monitoring systems are integrated into this product to optimize long-term grinding process monitoring.
6. Customized Domestic 12-Inch Grinding Wheels and Vacuum Chucks.
7. This product can be combined with an EFEM system to support automated production workflows.

(3)Energy Saving Computation

1. Equipped with a self-developed built-in hydrostatic spindle, featuring excellent dynamic rotation accuracy, no power transmission loss, low rotational inertia, low noise, and minimal environmental impact.
2. The modular design of this product reduces R&D and maintenance costs while preserving expandability. This not only minimizes customer downtime during repairs or upgrades but also allows for repairing or replacing only the damaged parts, significantly reducing resource waste and environmental impact. It achieves a balance between cost control, profitability, and environmental protection.
3. The hydrostatic system uses a sealed oil circuit that completely isolates external contaminants, significantly reducing the frequency of oil changes. This lowers production costs and downtime for customers while minimizing environmental pollution, achieving green manufacturing goals of "pollution prevention," "waste reduction," and "waste minimization."
4. GRINTIMATE also plans to implement an energy monitoring and analysis system for its machines to achieve demand management, reduce excess energy usage, and promote intelligent energy-saving.

(4)Structure, Precision and Quality

1. Conforms to ISO 9001:2015 (Registration Number:93Q21653)
2. CE certificate: 2006 / 42 / EC (Machinery) & 2014 / 35 / EU (Low Voltage)
3. SEMI S2 certificate (Certificate:112R0279)
4. TS certificate (identification number:TD06045I)

(5)Market Feasibility

Since 2019, GRINTIMATE has strategically positioned itself in the semiconductor market. This product, the hydrostatic vertical wafer grinding machine GTR-

1215, targets wafer manufacturing and advanced packaging fields, focusing on thinning and grinding third-generation semiconductor silicon carbide (SiC) wafers and other hard and brittle materials. Our solution addresses the challenges of high grinding resistance and the risk of wafer breakage during SiC wafer thinning processes. By providing a revolutionary wafer thinning and grinding solution, the GTR-1215 improves process yield, shortens wafer manufacturing times, and reduces costs associated with Chemical-Mechanical Polishing (CMP).

(6)Aesthetics

1. The machine incorporates the company's CI with a distinctive color scheme to redefine the rigid and mechanical image.
2. The control box is ergonomically designed and can be adjusted according to operational preferences, making it more user-friendly.
3. The one-piece base offers superior chip and water resistance.
4. Manual Loading with Top-Opening Automatic Door.
5. This product is designed for flexible integration with robotic arms.
6. The integration of aesthetic, spatial, and efficiency elements improves the brand identity and value of the company's products.

(7)Others

This product was honored with the 2023 Taiwan Excellence Award.

鍵和機械股份有限公司
JAINNHER MACHINE CO., LTD.

地　　址：407 台中市西屯區台中工業區 28 路 333 號
No.333, 28th Rd., Taichung, Industrial Park, Taichung 407, Taiwan
電　　話：+886-4-23585299　　**傳　　真**：+886-4-23594803
網　　址：www.jainnher.com　　**E-mail**：saledep@jainnher.com

攤位號碼：M0701

主要產品類別：

- CNC 無心磨床
- CNC 內圓磨床
- CNC 圓筒磨床
- CNC 直進式 / 斜進式外圓磨床
- CNC 雙主軸內外圓磨床
- NC 中心孔研磨機
- CNC 立式磨床

參賽作品名稱：

DN-808F 數控複合立式圓筒磨床
DN-808F CNC Universal Vertical Cylindrical Grinder

作品圖片：

作品開發背景：

磨床作為加工的最後一道工序，其精密研磨工藝複雜且加工時間長，導致成本極高。然而，傳統磨床操作高度依賴人工經驗，容易因設定錯誤或操作不當發生撞機事故。儘管業界已將事故發生率控制在 5% 以下，但每次事故仍可能造成平均約 50,000 元新台幣的維修損失，並導致平均 2-3 天的停機時間。

為進一步降低事故風險並提升加工效率，鍵和機械公司研發了這款創新的智慧平台。該平台藉由獨特的結構設計和高靈敏度感知器，即時監控磨床機台主軸運轉動態和砂輪間隙。透過 AI 演算法分析振動數據，智慧平台能夠：

- 預防撞機：在發生碰撞前發出警報並自動停止進給，預計可將事故發生率降低至 1% 以下。
- 縮短進刀時程：預測最佳的進刀參數，預計可提升 15% 的產能。
- 快速診斷機台異常：根據振動特徵判斷異常原因，預計可縮短 30% 的維修時間。
- 提升研磨加工附加價值：優化研磨參數，提高加工精度和表面品質，延長刀具壽命，預計可提升 5% 的良品率。

與市面上現有的磨床相比，本產品首創將 AI 技術應用於磨床振動分析，實現了更精準的預警和診斷，有效提升了磨床的安全性、效率和加工品質。

作品特點：

（一）創新性

- 獨特的 LSTM 演算法，融合老師傅經驗開發出獨特的預測模型。此模型可根據加工條件預測最佳的進刀參數，安全的提高加工效率，預計可提升 15% 的產能。
- 創新的感測器佈局，採用聲發射感測器和電流計，並結合控制器提供的資訊，包含加工軸的座標位置、工件轉速等，以獲取更精準的數據。與傳統加速規不同，聲發射感測器能夠檢測高頻細微振動，能捕捉到切削條件的變化，進而進行預防性維護或即時調整加工參數，有效提升加工精度和穩定性。
- 解決業界缺工和技術傳承難題：面對業界日益嚴重的缺工問題和技術傳承的挑戰，透過 AI 技術，將老師傅的經驗轉化為可量化的數據模型，不僅可以降低對人工經驗的依賴，還可以將珍貴的技藝傳承下去，確保加工品質的穩定性。
- 智慧平台不僅可以預測最佳的進刀參數，還可以優化研磨參數，提高加工精度和表面品質，延長刀具壽命，預計可提升 5% 的良品率。

（二）智慧化與實用性

- **砂輪動平衡校正技術**：使用者可以依據動平衡等級需求設定，當偵測超過動平衡等級設定時則警示使用者。使用者可以選擇執行手動或自動動平衡校正，避免主軸損壞與加工不良品。
- **異音檢測**：機械運轉過程中若發生異音時，以主軸健康診斷程式判斷是否損壞的前兆，避免產生不良品。當加工中產生異常撞擊信號，程式自動退刀減少損害，以確保機械壽命。
- **機台運轉紀錄**：透過執行暖機程式，智慧平台可以收集並記錄每天的機械健康狀況，並且評估壽命作為預防保養的參考依據。當機械發生損壞時，智慧磨床紀錄歷史異常訊息，包含時間、異常狀態與數值，供後端工程人員檢視，作為設計變更的重要參考依據。除了常規的稼動率（循環時間 / 上班時間）紀錄，另外依照研磨強度計算出不同加工強度下的研磨稼動率（研磨時間 / 循環時間），可以此評估加工程式執行效率。
- **空行程減量**：快速進給到最接近材料的位置才轉換為切削模式，可以減少空行程時間，提高加工效率。
- **自動對刀**：在軸移動時用感測器訊號判斷砂輪與工件是否接觸，當產生接觸時紀錄軸位置作為對刀點。如此可在對刀位置後指定固定的研磨量，或是做多點對刀後計算出適合的研磨起點。
- **製程參數優化**：加工研磨數據配合目標品質結果，帶入類神經網路訓練。訓練完畢後生成可符合目的的速度曲線。藉由控制加工時的進給速度來讓加工完畢的品質結果朝目標品質靠近，或是縮減加工工時。

（三）綠色、節能與永續

- **智慧化控制系統**：透過智慧化控制系統，例如：變頻馬達控制、變頻冷卻系統等，實現按需輸出，避免能源浪費。相較於傳統磨床，預計可節省 15% 的能源消耗，有效降低碳排放量。
- **加工效率提升**：透過智慧化功能，例如：自動對刀、加工參數優化等，縮短加工時間，提高生產效率，進而降低單位產品的能源消耗。
- **快速加熱系統**：主軸溫度控制增加加熱器，可在低溫環境下快速加熱主軸，縮短機台預熱時間，提高生產效率，同時降低能源消耗。
- **結構優化**：透過有限元素分析和拓撲優化等方法，對機台結構進行優化設計，在保證剛性和穩定性的前提下，減少材料使用量，實現輕量化設計，預計可減輕機台重量 8%。
- **可回收材料**：機台外殼和部分零件採用可回收材料，例如：再生塑料、可回收金屬等，減少對環境的影響。
- **低污染材料**：所有材料均符合環保標準，不含有害物質，確保生產過程和產品的環保性。

（四）結構、精度與品質

- **機電一體化分析**：在設計過程中，導入機電一體化分析，將機械結構、控制迴路和智慧化功能整合考慮，優化整體設計，確保機台的動態性能和穩定性。
- **靜壓滑軌**：採用靜壓滑軌設計，降低摩擦力，均化軌道誤差，提高機台的反應速度和運動精度。
- **熱變形控制**：採用中空螺桿有效帶走熱能，並在床身上採用特殊設計，將切削水的熱量與床身有效隔離，降低熱變形對加工精度的影響。
- **精密加工工藝**：採用精密加工工藝，例如：精密研磨、超精密加工等，確保關鍵零組件的加工精度，進而提升整機的精度。
- **高精度量測**：在加工過程中，採用高精度量測儀器，例如：雷射干涉儀、三次元量床等，對關鍵尺寸進行嚴格檢測，確保加工精度符合設計要求。
- **耐久性測試**：對關鍵零組件和整機進行耐久性測試，例如：疲勞測試、壽命測試等，確保機台的長期穩定性和可靠性。
- **品質檢測**：對所有零組件和整機進行嚴格的品質檢測，例如：尺寸檢測、性能測試等，確保產品品質符合國際標準。

DESCRIPTION IN ENGLISH:

(1)Innovation

- **Unique LSTM algorithm combined with the experience of master craftsmen:** This product innovatively combines the LSTM algorithm with the grinding experience of master craftsmen to develop a unique prediction model. This model can forecast the optimal feed parameters according to the processing conditions, such as the machining feed rate, workpiece speed, size, and accuracy requirements, to improve processing efficiency under the premise of safety. It is expected to increase production capacity by 15%.
- **Innovative sensor layout to accurately capture high-frequency vibration:** This product utilizes an acoustic emission sensors (AE sensor) and an ammeter, combined with the information provided by the controller, including the coordinate position of the machining axis and the workpiece speed. The sensors are installed in key positions such as the main shaft, grinding wheel, and worktable to obtain more accurate data. Different from the traditional three-axis sensor, the ultrasonic sensor can detect high-frequency and subtle vibrations, which is especially suitable for precision machining, ultra-high-speed machine tools, and micro-machining processes. During high-speed cutting and ultra-precision machining, small vibration changes have a great impact on machining quality. This type of sensor can capture changes in cutting conditions and then perform preventive maintenance or adjust machining parameters in real-time, effectively improving machining accuracy and stability.
- **Solve the industry's labor shortage and technical inheritance problems:** Facing the industry's increasingly serious labor shortage and the challenge of technical inheritance, this product provides an effective solution. By leveraging AI technology, the experience of master craftsmen is transformed into a quantifiable data model, which not only reduces the dependence on manual experience but also inherits valuable skills and ensures the stability of processing quality.
- **Improve processing efficiency and yield rate:** The intelligent platform not only predicts the optimal feed parameters but also optimizes grinding parameters, improves machining accuracy and surface quality, and extends tool life. It is expected to increase the yield rate by 5%.

(2)Intelligence and Practicality

- **Grinding wheel dynamic balance correction technology:** User can set according to the dynamic balance level requirements. When the detection exceeds the dynamic balance level setting, the user will be alerted to avoid damage to the spindle and defective products.
- **Abnormal sound detection:** If an abnormal sound occurs during the operation of the machine, it is usually a precursor to a defect or damage. Therefore, the abnormal sound is detected and an emergency retraction program is executed to ensure the service life of the machine.
- **Impact detection:** When an abnormal impact signal is generated during processing, the program will automatically retract the tool to reduce damage.
- **Spindle health diagnosis:** Check whether the spindle status is abnormal, and issue an alarm prompt when the spindle is abnormal.
- **Machine operation record:** By executing the warm-up program, the intelligent platform can collect and record the daily health status of the machine and evaluate the service life as a reference for preventive maintenance. When the machine is damaged, the intelligent grinding machine records historical abnormal messages, including time, abnormal status, and values, for back-end engineers to review as an important reference for design changes.
- **Utilization rate monitoring:** Record the daily startup and processing cycle time, and the conventional utilization rate (cycle time/work time) can be calculated. In addition, the grinding utilization rate (grinding time/cycle time) under different processing intensities is calculated according to the grinding intensity, which can be used to evaluate the execution efficiency of the machining program.
- **Air travel reduction:** Fast feed to the closest position to the material before switching to cutting mode, which can reduce air travel time and improve processing efficiency.
- **Automatic tool setting:** When the axis is moving, the sensor signal is used to judge whether the grinding wheel is in contact with the workpiece.

When contact occurs, a signal is immediately returned to the CNC to record the axis position as the tool setting point, and the grinding can be performed after the tool setting position is confirmed. In this way, a fixed grinding amount can be specified after the tool setting position, or multiple tool setting points can be used to calculate a suitable grinding starting point.

- **Process parameter optimization:** The processing and grinding data is matched with the target quality results and brought into the neural network training. After the training is completed, a speed curve that can meet the purpose is generated. By controlling the feed speed during processing, the quality results after processing can be close to the target quality, or the processing time can be reduced.

(3)Energy Saving Computation

- **Intelligent control system:** Through the intelligent control system, such as: variable frequency motor control, variable frequency cooling system, etc., on-demand output is realized, avoiding energy waste. Compared with traditional grinding machine, it is expected to save 15% of energy consumption and effectively reduce carbon emissions.
- **Improved processing efficiency**: Through intelligent functions, such as: automatic tool setting, optimization of processing parameters, etc., shorten processing time, improve production efficiency, and thereby reduce energy consumption per unit of product.
- **Rapid heating system:** The spindle temperature control adds a heater, which can quickly heat the spindle in a low-temperature environment, shorten the machine warm-up time, improve production efficiency, and reduce energy consumption at the same time.
- **Structural optimization:** Through finite element analysis and topology optimization methods, the machine structure is optimized and designed to reduce material usage under the premise of ensuring rigidity and stability, and to achieve lightweight design. It is expected to reduce the weight of the machine by 8%.
- **Recyclable materials:** The machine casing and some parts are made of recyclable materials, such as recycled plastics and recyclable metals, to reduce the impact on the environment.
- **Low-pollution materials:** All materials meet environmental protection standards and do not contain harmful substances, ensuring the environmental protection of the production process and products

(4)Structure, Precision and Quality

- **Mechatronic analysis:** In the design process, mechatronic analysis is introduced to integrate mechanical structure, control loops, and intelligent functions into consideration, optimizing the overall design and ensuring the dynamic performance and stability of the machine.
- **Hydrostatic slideways:** The hydrostatic slideway design reduces friction, equalizes track errors, and improves the machine's response speed and motion accuracy.
- **Thermal deformation control:** The use of a hollow screw effectively removes heat, and a special design is adopted on the bed to effectively isolate the heat of the cutting fluid from the bed, reducing the impact of thermal deformation on machining accuracy.
- **Precision machining process:** Precision machining processes, such as precision grinding and ultra-precision machining, are used to ensure the machining accuracy of key components, thereby improving the accuracy of the entire machine.
- **High-precision measurement:** During the machining process, high-precision measuring instruments, such as laser interferometers and three-coordinate measuring machines, are used to strictly inspect key dimensions to ensure that the machining accuracy meets the design requirements.
- **Durability test:** Durability tests, such as fatigue tests and life tests, are conducted on key components and the complete machine to ensure the long-term stability and reliability of the machine.
- **Quality inspection:** Strict quality inspections, such as dimensional inspection and performance testing, are carried out on all components and the complete machine to ensure that the product quality meets international standards.

和和機械股份有限公司
SOCO MACHINERY CO., LTD.

地　　址：40852 台中市南屯區精科東路 3 號
No.3, Jingke E. Rd., Nantun Dist., Taichung City 40852, Taiwan
電　　話：+886-4-23591888　　**傳　　真：**+886-4-23592386
網　　址：www.soco.com.tw　　**E-mail：**sales@soco.com.tw

攤位號碼：D0628

主要產品類別：

雷射切管機

參賽作品名稱：

SLT-80-FIBER Cell 雷射切管機 (10 軸) + 管端倒角除屑
SLT-80-FIBER Cell Tube Laser (10Axis) + End Finishing

作品圖片：

作品開發背景：

・ 雷射產業市場龐大：

根據全球雷射權威 Laser Focus World 的研究，2020 年全球雷射源產業大約有 151 億美元，其中材料加工 (Materials Processing & Lithography) 佔了 40% (約 61 億美元)。

・ 同時專精在雷射切管 + 管端除屑的領域，發展自動化技術：

雷射切管機廠商中，少數同時專精在雷射切管技術及管端除屑技術的領域。大部分公司就只有專精在雷射加工領域。我們了解廠商在雷射切管加工後，需要去管端毛邊這項需求，所以我們結合了雷射加工 + 管端倒角 (或是鋼刷除屑)，自動化生產甚至到最後的打包，一貫化的自動作業。

作品特點：

（一）創新性

(A) 世界首創，多製程雷射加工技術：雷射切管加工 + 管端倒角（鋼刷除屑）+ 長度量測 + 堆疊打包

(B) 同時專精在雷射切管及管端除屑的技術領域：這是和和機械的優勢。所以和和可以開發出多製程自動化的雷射加工設備。例如德國 TRUMPH 公司就只有專精在雷射加工領域。

(C) 自動化生產，減低人力成本 100% 以上：以往的單機製程需要 1 機 1 人，如雷射切管機自動上料 + 鋼刷除屑 + 自動堆疊下料。以上 3 個製程就需要 2~3 個人力操作。整合後的雷射切管自動化設備，自動化生產只需要 1 個人力。

（二）智慧化與實用性

(A) 全球 24 小時的技術支援服務：好的後勤支援，才能發揮銷售綜效。

- 30 個在地代理商及和和原廠 20 位服務工程師
- SOCO IRMS（Internet Remote Monitoring System）運用遠端監控，可即時線上進行 Trouble Shooting。

(B) i2（intelligent interface）直覺式圖形化操作介面，60 分鐘訓練上手：

以往機台的操作介面艱澀難懂，學習時間很長，操作不當，也易發生工安意外。

(C) 省下 80% 的定位調整時間：

全自動 10 軸電機伺服控制。只需設定管徑之後，不用人工調整，全機自動定位。

（三）綠色、節能與永續

(A) 廢料減量 40%，實現綠色生產：和和機械的雷射切管機採用最先進的斷點續切和最佳排版技術，將廢料降至最低，僅 60mm ！相較於競品 100mm 以上的廢料率，我們為您節省了大量的材料成本。此外，我們的機器還支援單件共邊排版，最大程度地利用材料，實現綠色生產。

(B) ISO 14001 認證。

（四）結構、精度與品質

(A) 符合 CE 認證

(B) 2014 年 ISO14001 認證

(C) 2023 年 數位化精實管理 TPS 計畫

(D) 推展全面品質管理（Total Quality Management，TQM）。員工都要檢定內部 3 級人力評鑑制度考核（A,B,C），至少須通過 C 級基本職能檢定。

（五）市場可行性

(A) 和和機械看見家具產業的市場缺口：在家具產業中使用的金屬管件，大多是 OD 80mm 以下，但是市場上沒有針對此市場的主打產品。SLT-80-FIBER 雷射機的開發是針對這個市場缺口，對於客人而言具有低投資成本，高效率，操作簡易，保養及維護費用低，CP 值高。

(B) 國產化程度高。國產化零件成本佔總成本的 72%。

(C) 多語言操作介面：可以擴充多種語言操作介面，如日文、俄文、土耳其文等等

(D) 網路廣告宣傳 + 全球每年 30 個展覽活動

（六）審美性

(A) 多層次板金流線型機械外觀設計。

(B) 品牌 LOGO 清楚標示於機身。

（七）其他

(A) 全區域安全護罩：全機外圍由鈑金隔絕，避免人員誤入運作區域導致工安事故。

(B) 關鍵零組件國產化程度高。

品牌願景：

成為亞洲金屬加工的領導品牌 TO BECOME THE ASIAN LEADER OF METAL PROCESSING。

SOCO：以市場為導向，顧客為中心的企業

SOCO 深知市場競爭的激烈和客戶需求的多樣化，因此建立了以市場為導向、顧客為中心的運營模式，透過業務行銷部門及客服部門的密切合作，持續收集市場資訊、調查客戶滿意度，並將結果轉化為產品研發、市場拓展和客戶服務的改進方向，不斷提升 SOCO 的競爭力，滿足客戶需求。

貫徹「Sawing & Cutting 精準切割」理念，成就卓越品牌

SOCO 不僅僅只是一家提供管材切割機器的公司，更是一個注重品牌形象和客戶體驗的企業。通過完善的全球行銷網絡和強大的運營團隊，SOCO 將「Sawing & Cutting」的核心理念傳遞至全球，贏得了廣大客戶的信賴，成就卓越的品牌地位。

以市場為導向、顧客為中心的運營模式是企業成功的關鍵。

SOCO 堅信，通過持續的市場資訊收集、分析和客戶滿意度調查，SOCO 能夠準確把握市場需求，不斷提升產品和服務的競爭力，為客戶提供卓越的體驗，贏得客戶的信賴和支持。SOCO 的顧客服務系統從「客戶需求收集」、「需求分析」、「產品發展方向」到「售後服務」有一連貫性的、系統性的組織運作。針對客戶機器問題，由總經理不定時召開「臨時品委會」，參與人員有總經理、業務、技術支援、研發、品保及成品部門等主管人員。採用 CRM 客戶關係管理系統，整合客戶銷售資料及維修需求。

DESCRIPTION IN ENGLISH:

(1)Innovation

(A)World's First Multi-Process Tube Laser Technology: Combines laser tube cutting, tube end finishing, length measurement, and stacking and packaging in a single machine.

(B)SOCO specializes in both Laser Tube Cutting and Tube End Finishing: This is SOCO Machinery's advantage. Therefore, SOCO can develop multi-process automated laser processing equipment. For example, TRUMPH of Germany specializes only in laser processing.

(C)Automated production, reducing labor costs by over 100%: In the past, a single machine process required one person per machine, such as automatic loading of laser cutting machines + steel brush deburring + automatic stacking and unloading. The above 3 processes required 2-3 people to operate. With the integrated laser tube cutting automation equipment, automated production only requires one person.

(2)Intelligence and Practicality

(A)Global 24-hour technical support service: Excellent after-sales support is essential to maximize sales effectiveness.

I. A network of 30 local agents and 20 in-house service engineers.

II. SOCO IRMS (Internet Remote Monitoring System) enables real-time online troubleshooting.

(B)i2 (intelligent interface) intuitive graphical user interface, 60-minute training for proficiency: Traditional machine interfaces were often complex and time-consuming to learn, leading to operational errors and safety hazards.

(C)Saves 80% of positioning adjustment time: The 10-axis control system automates various functions, making the machine highly efficient and reducing the risk of human error.

(3)Energy Saving Computation

(A)Waste material is reduced by 40%: The shortest waste material is only 60mm, while most competing products produce more than 100mm of waste.

(B)Avoids a large amount of waste, environmentally friendly and cost-saving: Supports mid-process stop and break point resumption, preventing the same pipe material from being unable to continue production and becoming waste.

(C)Materials Saving: Supports single-piece co-edge layout, outputs the optimal cutting path, and saves materials.

(D)ISO 14001 certified.

(4)Structure, Precision and Quality

(A)CE certified.

(B)ISO 14001 certified.

(C)Digital Lean Management TPS project since 2023.

(D)Implementing Total Quality Management (TQM). All employees must pass the Internal.

(E)3-level human resource assessment (A, B, C), and at least pass the C-level basic skill assessment.

(5)Market Feasibility

(A)SOCO Machinery identifies a market gap in the furniture industry: Most metal fittings used in the furniture industry are under OD 80mm, but there is no dominant product specifically targeting this market. The development of the SLT-80-FIBER laser machine is aimed at filling this market gap. For customers, it offers low investment costs, high efficiency, easy operation, and low maintenance costs, providing a high cost-performance ratio.

(B)Resulting in 72% of costs sourced locally: A high degree of localization for critical components.

(C)Multilingual user interface: The machine supports multiple language interfaces, including Japanese, Russian, Turkish, and more.

(D)Online advertising and participation in 30 global exhibitions annually.

(6)Aesthetics

(A)The machine boasts a streamlined multi-layer sheet metal design for a visually appealing exterior.

(B)The brand LOGO is clearly displayed on the machine body.

(7)Others

(A)The machine is equipped with a full-area safety guard, featuring a sheet metal enclosure to prevent personnel from entering the operation area and causing safety accidents.

(B)Additionally, a high degree of localization has been achieved for critical components.

www.timtos.com.tw

數值控制工具機

關鍵零組件類

Components for CNC Machine Tools and Other NC Machine Tools

億川鐵工所股份有限公司
DI CHUN IRON WORK CO., LTD.

吉輔企業有限公司
GIFU ENTERPRISE CO., LTD.

霄特國際股份有限公司
GPM CO., LTD.

漢鼎智慧科技股份有限公司
HANTOP INTELLIGENCE TECHNOLOGY CO., LTD.

上銀科技股份有限公司
HIWIN TECHNOLOGIES CORP.

鉦通工業股份有限公司
JHEN TONG PRECISION CO., LTD.

鍵君工業股份有限公司
JIAN JUN INDUSTRIAL CO., LTD.

台灣引興股份有限公司
KEYARROW (TAIWAN) CO., LTD.

百德機械股份有限公司
QUASER MACHINE TOOLS, INC.

先鎰企業廠股份有限公司
SPINDLEX TECHNOLOGIES CO., LTD.

新代科技股份有限公司
SYNTEC TECHNOLOGY CO., LTD.

威士頓精密工業股份有限公司
WEXTEN PRECISE INDUSTRIES CO., LTD.

億川鐵工所股份有限公司
DI CHUN IRON WORK CO., LTD.

地　　址：台中市南屯區精科一路 7 號
No.7, Jingke 1st Rd., Nantun Dist., Taichung City 408, Taiwan
電　　話：+886-4-23585879　　**傳　　真**：+886-4-23583695
網　　址：www.auto-strong.com　　**E-mail**：sales@mail.auto-strong.com

攤位號碼：S1216

主要產品類別：

- CNC 車床零配件
- 油壓夾頭
- 超高速迴轉油壓缸
- 普通高速車床用之三爪連動夾頭
- 氣壓式動力夾頭
- 機床行業用之特殊夾治具

參賽作品名稱：

MB2091　薄型中空迴轉油壓缸
MB2091　Compact High Speed Through-Hole Rotary Hydraulic Cylinder

作品圖片：

作品開發背景：

新產品開發是為了迎合自動化加工市場需求及彰顯企業價值所採取之重要策略之一。公司在傳統標準型油壓夾頭與迴轉油壓缸市佔率高達 80%，在市場龐大需求下，全新打造薄型中空迴轉油壓缸產品 MB2091，以「更輕、更薄、更易安裝」輕量化小材積及前後鎖安裝設計，不僅節省機台內部空間，安裝更簡易便利。MB2091 比改良前 M 系列產品長度縮短 30%，除了高速旋轉時的性能更穩定外，重量減少超過 10 公斤大幅降低主軸負載，節省用電量達到環保節能效益。MB2091 薄型中空迴轉油壓缸搭配新型式專利，專利逆止閥安全機構設計，確保異常斷電時壓力立即保持，此新產品開發已獲得全球專利產品，為億川創造更高的效益，以維持國內外市場競爭優勢。

作品特點：

（一）創新性

全新打造中空迴轉油壓缸「更輕、更薄、更易安裝」，輕量化小材積及前後所安裝設計不僅節省機台內部空間，安裝更簡易便利。MB2091 比改良前 M 系列產品長度縮短 30%，除了高速旋轉時的性能更穩定外，重量減少超過 10 公斤大幅降低主軸負載，可使機械的能力更加充分活用。公司依據物質旋轉慣性量的物質特性，在確保應有之性能要求無慮之下， 有效的降低鋼鐵金屬的使用量約 33%，減少對大自然資源需求，又可在使用階段主軸能源消耗。

（二）智慧化與實用性

中空通孔可讓棒材自動送料及裝在雙主軸之副主軸上，減輕主軸負載，使高速旋轉切削加工時性能更穩定，並於安全構造內附逆止閥機構，確保異常斷電時壓力立即保持，此新產品開發已獲得全球專利產品。

- 輕量化設計，長度縮短 30% 高速旋轉性能更穩定，重量減輕大幅降低主軸負載。
- 前後鎖共用設計，便利客戶選用前鎖或後鎖安裝，提高組裝機台效率，使用者可更加靈活運用。
- 億川取得歐洲共同體機械安全標準檢定「CE」標誌認證，我們得以確保產品使用之安全性，保障客戶之安全。

（三）綠色、節能與永續

研發產品設計時，同時考慮到產品使用的安全、環保與節能減碳。

※ 億川設計理念：輕量化、高速化，所有產品均依此準則。

- 產品的設計與節能減碳方面，公司依據物質旋轉慣性量的物質特性，在確保應有之性能要求無慮之下，有效的降低鋼鐵金屬的使用量約 33%，減少對大自然資源需求，又可在使用階段減少主軸能源消耗。
- 公司落實 QC080000 及減少對環保有害物質，可大幅降低環境污染。
- 製程履歷智慧化 - 將生產製程中的紙本記錄轉化為數位化資訊，透過數位化管理可縮短資料傳達時間，快速回饋製程資訊、機台稼動率等，以達製程資料可追朔、可數據分析，提取有價值的資訊作為決策和優化流程，促動精實管理，落實減碳生產。

※ 億川環保政策：資源再生；節能減碳

※ 資源再生：公司產品與包裝皆使用可再生之材料，如金屬鋼鐵、EPE 板節能減碳 : 公司之物流作業，配合成品與再製品之運送，全程統合規劃，已滿載 9 成為理貨下限，減少空車疏運，耗費能源。

（四）結構、精度與品質

公司研發設計理念為：輕量化、高速化，比起傳統製品，產品結構設計實現精短型，輕量化，高速迴轉切削加工時性能更佳穩定，更減輕機械的負擔。

- 結構設計分析零件模型上的應力及流體力學之運用，產品安裝於機台運轉測試，符合規格之耐久性及精度標準，品質及安全皆符合 ISO9001 及歐 盟 CE 認證，億川得以確保產品使用之安全性，保障客戶之安全。
- 精確的製程，需要嚴謹的品保守護，並透過 TESA 二次元高度規及英國 IMPACT 三次元量床、精密真圓儀等品保利器，億川徹底落實品質穩定要求，提供客戶頂級卓越的機具產品。
- 億川不僅屢獲國內獎項肯定，也取得歐洲共同體機械安全標準檢定「CE」標誌認證，品質高度已遠超越 ISO-9001 的規格。

（五）市場可行性

億川不分國內外，採代理及經銷之銷售模式，以中國市場為例，將其劃分為四大區 (華中、華北、華東、華南)，各區設置億川授權代理商，透過代理商地緣優勢，讓 AUTO-STRONG 品牌觸及中國各地，為中國工具機夾頭使用第一品牌。 現除了外銷中國市場外，更因近期中美貿易戰影響加速億川南向佈局，億川於 2019 年與越南 SHIOGAI SEIKI VIETNAM CO.,LTD 進行代理商簽約儀式，取得國際代理商，拓展億川鐵工所國際版圖。億川也於東盟與歐、美市場皆有銷售代理商，讓億川邁向 全球、讓世界認識台灣。

此外在行銷力與形象力的建立上，億川更致力於推展自有品牌 "STRONG" 及其識別體系的規劃應用，從品牌命名、商標設計、企業整體識別規劃到實施應用等各方面，莫不竭盡心力。其中以 "STRONG" 名取其強壯之意，目的在於彰顯億川產品的品質與性能好比鷹爪般精準有力之優異特性。因此綜合了產品力、行銷力與形象力。

億川所銷售之產品均投保「全球產品責任險」，客戶能安心購買使用，以及完善的售後服務及技術指導，完整展現億川產品的無形價值。

（六）審美性

產品材質選用特殊鋁合金，並搭配特殊無電解鎳之表面處理方式，使得 整體色調呈現出銀灰色光澤，富有未來科技的質感，外觀看似簡單，內涵卻隱藏著複雜且細膩的機構設計。

（七）其他

【溫室氣體盤查及減碳作業】

歐盟課徵碳稅在即，億川積極落實企業永續發展目標，自主推動溫室氣體盤查及減碳作業，

於 2023 年 10 月通過第三方艾法諾國際 (AFNOR ASIA) 查證，取得 ISO 14064-1 查證證書。

【MB2091 產品榮耀】

- 薄型中空迴轉油壓缸 MB2091 已獲得全球專利產品，目前只有億川有此產品。
- 榮獲 2024 TMBA 工具機產業節能標章評鑑「金色標章」。
- 榮獲 2025 台灣精品獎。

DESCRIPTION IN ENGLISH:

(1)Innovation

The newly developed MB2091 hydraulic cylinder features a "lighter, thinner, and easier-to-install" design. Its lightweight, compact build and front-rear mounting design not only save space within the machine but also make installation easier and more convenient. Compared to the previous M-series products, the MB2091's length is reduced by 30%. MB2091 not only in enhanced stability during high-speed rotation and the weight reduction of over 10 kilograms. It is significantly decreasing spindle loading and allowing optimal use of the machine's capacity.

Based on the physical properties of rotational inertia, the company reduces steel usage by approximately 33% while maintaining performance standards, minimizing reliance on natural resources and reducing spindle energy consumption during use.

(2)Intelligence and Practicality

The through-hole allows for automatic bar feeding and attachment to the sub-spindle of dual-spindle which reduces spindle loading and enhances stability during high-speed rotary cutting operations. The design includes a built-in check valve within the safety structure to maintain pressure immediately in the event of a power failure. This new product development has obtained global patents.

- The light weight design makes the length is reduced by 30% also greater stability at high speeds and the weight significantly lowers the spindle load.
- Front and back mounting design makes this feature allows customers to choose between front or back mounting installation, enhancing assembly efficiency and offering greater flexibility for users.
- DI CHUN has obtained the European Community Machinery Safety Standard "CE" certificatiom, guaranteeing the product and customer's safety.

(3)Energy Saving Computation

Cost-saving and innovative in production process with an environmental protection and green energy process. Product development considers safety, environmental impact, and energy savings and reduce carbon emissions.

DI CHUN's design principles: lightweight and high speed. All products are designed based on these principles.

- Under energy-saving and carbon reduction in product design, the company is leveraging the material properties of rotational inertia and reduces steel usage by approximately 33% under performance requirements. This reduction conserves natural resources and decreases spindle energy consumption during operating.
- Under QC080000 standards, the company significantly reduces the use of environmentally harmful substances and lower environmental pollution levels.
- Production process records Intelligent - convert paper records in the production process into digital information. Through digital management, data transmission time can be shortened, fed back process information, machine utilization rate, etc. Moreover, the process data can be traced, analyze, and extract valuable information as a decision-making and optimization process alsdo promote lean management, and implement carbon reduction production.

DI CHUN's environmental policy: Resource regeneration and energy savings and reduce carbon emissions.

Resource Regeneration: products and packing of company made from recyclable materials, such as steel, metal, and EPE foam.

Energy savings and reduce carbon emissions: For logistics operations, the company integrates planning for both finished and in-process products, maintaining a minimum 90% load capacity to reduce empty runs and energy waste.

(4)Structure, Precision and Quality

The company's R&D design philosophy emphasizes lightweight and high speed. Compared to traditional products, this compact, lightweight structural design achieves better stability during high speed rotational cutting also reduces mechanical loading.

- Structural Design and analysis stress testing and fluid dynamics modeling on component models. Products are mounted on machinery for operational testing to meet durability and precision standards. Quality and safety compliance with ISO9001 and EU CE certification. DI CHUN guarantees product safety and provides secure usage for customers.
- Precision manufacturing needs strict quality guardians. DI CHUN uses advanced tools such as TESA 2D height gauges, IMPACT 3D coordinate measuring machines, and precision roundness instruments. DI CHUN ensures exceptional quality and stability, delivering premium machinery products to customers.
- DI CHUN has received multiple domestic awards and has earned the CE certification for EU machinery safety standards, exceeding the requirements of ISO9001.

(5)Market Feasibility

DI Chun Iron Work Co., LTD adopts a sales model of agency and distribution, both domestically and internationally. Taking the Chinese market as an example, it is divided into four major regions (Central China, North China, East China, and South China), with authorized DI Chun Iron Work Co., LTD agents in each region. Through the geographic advantages of these agents, the AUTO-STRONG brand is able to reach all parts of China, becoming the top brand for machine tool chucks in the country.

In addition to exporting to the Chinese market, the recent impact of the China-US trade war has accelerated DI Chun Iron Work Co., LTD 's Southward expansion. In 2019, DI Chun Iron Work Co., LTD signed an agency agreement with SHIOGAI SEIKI VIETNAM CO., LTD in Vietnam, securing an international agent and expanding its global footprint. DI Chun Iron Work Co., LTD also has sales agents in ASEAN, Europe, and the U.S. markets, advancing the company's global presence and introducing Taiwan to the world.

In addition, in terms of building marketing strength and brand image, DI Chun Iron Work Co., LTD is dedicated to promoting its own brand "STRONG" and the planning and application of its identity system. This includes everything from brand naming, logo design, and overall corporate identity planning to implementation. The brand name "STRONG" was chosen to symbolize strength, aiming to highlight the quality and performance of DI Chun Iron Work Co., LTD products, which are characterized by precision and power, much like the claws of an eagle. As a result, it integrates product strength, marketing power, and brand image to create a comprehensive presence.

All products sold by DI Chun Iron Work Co., LTD are covered by "Global Product Liability Insurance," ensuring that customers can purchase and use them with confidence. Additionally, DI Chun Iron Work Co., LTD provides comprehensive after-sales service and technical support, fully showcasing the intangible value of its products.

(6)Aesthetics

The product is made from a special aluminum alloy, paired with a unique non-electrolytic nickel surface treatment. This gives the overall color a silver-gray sheen, exuding a futuristic and technological feel. The exterior appears simple, yet it hides a complex and intricate mechanical design within.

(7)Others

【Greenhouse Gas Inventory and Carbon Reduction Operations】

With the European Union's carbon tax implementation approaching, DI Chun Iron Work Co., LTD is actively pursuing its corporate sustainability goals. The company has independently implemented greenhouse gas inventory and carbon reduction operations. In October 2023, DI Chun Iron Work Co., LTD successfully passed third-party verification by AFNOR Asia and obtained the ISO 14064-1 verification certificate.

【The Honor of Product MB2091】

- The slim hollow rotary hydraulic cylinder MB2091 has received a global patent, and currently, only DI Chun Iron Work Co., Ltd offers this product.
- The MB2091 has been awarded the "Gold Label" in the TMBA Machine Tool Industry Energy-Saving Certification.
- The MB2091 has been awarded the "2025 Taiwan Excellence" award.

吉輔企業有限公司
GIFU ENTERPRISE CO., LTD.

地　　址：42741 台中市潭子區祥和路 133 巷 33 號
42741 No. 33., Ln.133., Xianghe Rd., Tanzih Dist., Taichung City
電　　話：+886-4-25334244　　**傳　　真：**+886-4-25334224
網　　址：www.atcgifu.com.tw　　**E-mail：**Domestic.sales@atcgifu.com.tw

攤位號碼：R0413

主要產品類別：

立式綜合加工中心機刀庫、臥式綜合加工中心機刀庫、各式龍門加工中心機刀庫、
立臥式專用加工中心機刀庫、臥式搪銑床加工中心機刀庫、立車刀庫、車銑複合刀庫、
頭倉設備、附件銑削頭及凸輪換刀機構…等。

參賽作品名稱：

BT5036HSS5 智能低碳全伺服搖擺刀庫
BT5036HSS5 Intelligent Low-Carbon Servo Drives Type with Swinging Tool changing Magazine

作品圖片：

作品開發背景：

隨著中美貿易戰的加劇、地緣政治因素和匯率差的影響，在面對工具機市場低迷的危機下，如何去研發創新具有智慧化、低碳節能、高競爭力又符合客戶需求的產品，即是目前市場契機。因此，進而開發出此低能耗、智慧化、高速化與具有 AI 賦能運用的『BT5036HSS5 智能低碳全伺服搖擺刀庫』。

作品特點：

(一) 創新性

擁有一項台灣新型專利：

(1) M657015 換刀機構之刀具活動結構。

(2) 一項台灣發明

專利案號：113101371 換刀機構之刀具活動結構 (申請中)。

(二) 智慧化與實用性

除了有 RFID 可視化的刀具管理系統外，此產品也搭載刀把自動旋轉式吹氣刷洗裝置，以確保換刀時刀具的清潔度，延長主軸的加工使用壽命；另外也導入 AI 賦能領域型刀庫故障診斷分析助手，協助客戶對於售服原因的提造確認與排除。

(三) 綠色、節能與永續

此產品，以節能減碳為創新研發目標，並積極導入節能模組化設計、提高低碳材料使用，降低了 72.51% 的年碳排放；並導入同規共軌產業規範應用，降低 5% 採購成本； 目前已完成 ISO 14064-1 類別 1 到類別 4 的組織碳盤查，且積極參與低碳供應鏈以及產品的淨零碳排目標努力 , 以符合企業永續經營的理念。

(四) 結構、精度與品質

全伺服驅動的搖擺臥式刀庫，將原本的 10sec 換刀時間縮短為 7sec 完成，可提高加工效率。

(五) 市場可行性

此刀庫可配置於臥式加工中心機或臥式五軸加工中心機上使用，在市場上具有穩定的需求量。

(六) 審美性

以漸層式簡約造型設計並且搭配公司形象視覺美學配色，讓整體的產品更加的突出亮眼。

DESCRIPTION IN ENGLISH:

(1)Innovation

One utility model patent:

(1)M657015 tool changing of tool magazine mechanism and 113101371 tool changing mechanism with movable tool mechanism. (Invention patent pending)

(2)Intelligence and Practicality

Apart from the RFID-enabled visualized tool management system, This product also features an automatic rotating air blowing and brushing device that ensures tool cleanliness during tool changing and extends the spindle's operational lifespan. In addition, we have integrated an AI-powered diagnostic system for tool changer fault analysis, which assists customers in quickly identifying and troubleshooting service issues.

(3)Energy Saving Computation

This product is developed with energy efficiency and carbon reduction as key innovation goals. It incorporates modular energy-saving design and use low-carbon materials, resulting in a 72.51% reduction in annual carbon emissions. The product also implements to industry-standard regulations, reducing procurement costs by 5%. We have completed carbon footprint verification according to ISO 14064-1 (Categories 1-4) and are actively participating in low-carbon supply chains and pursuing Net Zero Emissions, in line with our commitment to sustainable business practices.

(4)Structure, Precision and Quality

Fully servo-driven swing tool changer reduces the tool changing time from 10 seconds to 7 seconds, significantly improving machining efficiency.

(5)Market Feasibility

The tool changer is applicable with horizontal machining centers and horizontal 5-axis machining centers, and is in steady demand in the market.

(6)Aesthetics

The minimalist design and company-branded color scheme make the product much more outstanding.

霄特國際股份有限公司
GPM CO., LTD.

地　　址：40869 台中市南屯區環中路 4 段 368 號
No.368, Sec. 4, Huanzhong Rd., Nantun District, Taichung, Taiwan
電　　話：+886-4-23805836　　**傳　　真：**+886-4-23805832
網　　址：www.GPMcnc.com　　**E-mail：**info@GPMcnc.com

攤位號碼：S1004

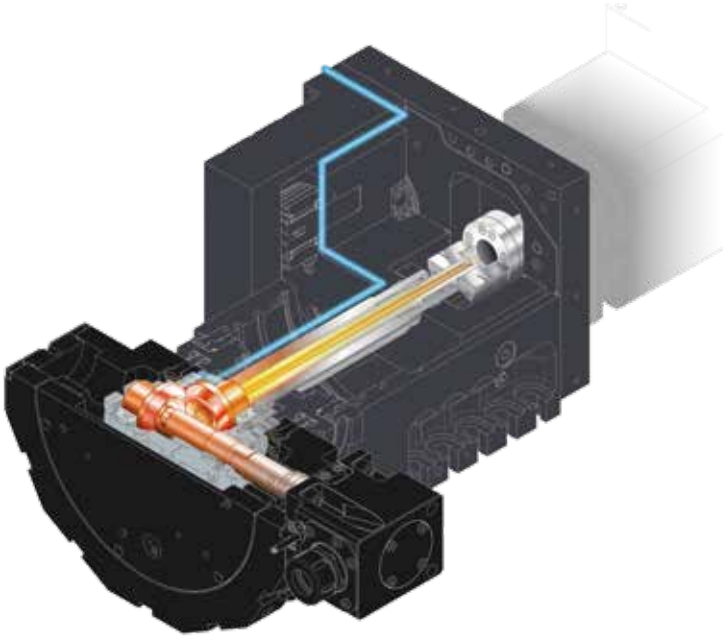
主要產品類別：

刀塔、刀座

參賽作品名稱：

434.420 BMT 升級版動力刀塔
434.420 BMT Turret Premier Series

作品圖片：



作品開發背景：

市面上的 BMT 動力刀塔，原有設計都為以車削功能為主，動力軸部份只能短時間銑削，如鑽孔、攻牙等。以 BMT65 動力刀塔為例，6000rpm 轉速下只能連續加工 2.5 分鐘，需停止 7.5 分鐘，降溫後再進行下次銑削。

近年來車床發展趨勢走向車銑複合機為主，且很多需求以高速化且須長時間銑削，而市場上只有 DD 內藏動力刀塔能達成此需求，但此刀塔價格為原有動力刀塔 2~3 倍，導致此類機床無法普及。我司考量市場需求，將原有 BMT 動力刀塔進行設計改良，推出 BMT 升級版刀塔新產品。透過特殊冷卻設計及功能提升，可實現動力刀長時間銑削，達成刀塔性能、智能雙重升級。

作品特點：

（一）創新性

具備適切的功能，符合市場需求：

A. 性能升級：

- 原有 BMT 刀塔設計只能短時間銑削，提升為可長時連續運轉：
  原本 BMT 刀具轉速 6000rpm 限制為 25%DC (=Duty Cycle 可運轉週期）
- 透過內建特殊冷卻迴路，將內部軸承、齒輪發熱快速帶走，從而拉長動力刀連續運轉時間，新設計可提升為：
  a) 6000rpm 下，可運轉時間提升為 100% DC
  b) 最高轉速提升：6000rpm --> 8000rpm (85%DC)

B. 刀塔內部冷卻迴路設計方案：

- 刀塔設計特殊冷卻迴路，採用空壓氣體作為冷卻介質，冷空氣從刀塔後端進入，經過刀塔齒輪頭外壁，通過溫度最高的傘齒傳動及軸承、密封件區域，最終從刀塔前端刀盤往外將熱空氣排出。

C. 內建熱導管，快速散熱：

- 刀塔齒輪頭心軸內建熱導管 (Heatpipe)，其導熱速度為一般鐵合金約為百倍以上，能將傘齒運轉時產生的高溫快速往後端帶走，並搭配氣冷迴路，將刀塔內部快速散熱，以達到內部維持低溫，故刀塔才能時間長時間銑削運轉。

（二）智慧化與實用性

A. 智能升級：

- 刀塔內建溫度感測器，也可選配振動感測器，可即時監控刀塔狀態，異常時可即時預警，減少維修成本。

B. 實用性：

- 此產品散熱方式採用氣冷，絕大部分 CNC 加工機都有現成管線，客戶不需要額外採購水冷機 (or 油冷機），減少機床及額外設備維護成本。

（三）綠能、節能與永續

A. 低碳排放設計：

- 僅需外接一路壓縮空氣，即可利用強制氣冷來冷卻動力齒輪、軸承及油封。
- 此產品散熱方式採用氣冷，而非水冷 or 油冷，機床可減少一台水冷機 (or 油冷機）的採購成本以及能耗。
- 搭配內建的溫度感測器，客戶可在 PLC 編寫智慧溫控功能，在溫度高於閥值時才開啟強制冷卻系統 (forced air cooling system)，可有效降低碳排量。
- 所有產品零組件用料與表面處理皆符合 ISO14001 規範及 RoHS 無鉛製程要求。

（四）結構、精度與品質

本產品在設計上採用與原有 BMT 動力刀塔共用零件為主，盡量減少新零件數量，來降低成本。

透過專利散熱設計、特殊氣冷迴路及心軸內建熱導管，將原有短時間銑削提升至 24hr 連續銑削，齒輪頭溫度可控制在 70℃ 以下，刀盤熱變形可控制在 0.01mm 以內。

同時動力刀轉速上限提升至 8000rpm, 可穩定連續精密加工。

此產品創新設計已通過兩項新型專利申請。

（五）市場可行性

以市場需求來看，車床使用銑削功能已經非常普遍。原本 BMT 動力刀塔設計只能短時間銑削的功能已經不敷使用，而導致刀塔異常狀況增加，客戶維修成本提高。為解決此客戶痛點，故開發此新產品：434.420 BMT 升級版動力刀塔 (可選擇帶 Y 軸)。

（六）審美性

刀盤刀號標示採用雷雕方式加工，字體大氣且清楚明瞭。

刀塔銘牌上增加新型產品識別 QRCode，客戶可快速掃描並取得產品生產履歷，以提供快速服務。

DESCRIPTION IN ENGLISH:

(1)Innovation

Performance Upgrade :

- Continuous operation: elongate operation time compared with standard 434/BMT turret (25% Duty cycle when tool drive at 6000rpm)
- Special cooling channel inside turret that can take away heat quickly that is generated from internal bearings, and gears; and makes continuous operation possible.

8000RPM premier series can achieve :

a) Tool drive at 6000rpm : 100% DC
b) Tool drive increase from 6000rpm to 8000rpm (85% DC)

(2)Intelligence and Practicality

Intelligence upgrade:

- Embedded temperature sensor, while vibration sensor is optional, may monitor the status of the turret in real time, and an early warning can be given when an abnormality occurs, reducing maintenance costs in advance.

Practicality :

- Air cooling method is adopted for heat dissipation as most CNC processing machines already have existing pipelines available, hence, there is no extra investment on either water cooler or oil cooler for customers. Money investment and machine maintenance can be reduced.

(3)Energy Saving Computation

Low carbon emission design

- Only one tube for compressed air is needed to provide forced cold air to cool down gears, bearings and oil seals.
- The heat dissipation method is by using air cooling, instead of water cooling or oil cooling. Therefore, no need for additional water cooler nor oil cooler; hence less purchase cost and energy consumption. With built-in temperature sensor, users may include programming of smart temperature control functions into PLC, and only trigger forced air cooling system when the temperature is higher than the setting value, which can effectively reduce carbon emissions.
- The materials and surface treatments of all product components comply with ISO14001 specifications and RoHS lead-free process requirements.

(4)Structure, Precision and Quality

The design of this premier series mainly uses parts shared with the existing 434/BMT driven turret, minimizing new parts to reduce costs.

Through patented heat dissipation design, special air cooling channel, and built-in heat pipe, the original short-time machining time is now upgraded to 24hr continuous motion. The temperature of the gear head can be controlled below 70 ˚C, and the thermal deformation of the tool disc can be controlled within 0.01mm.

At the same time, the max speed of driven tool is increased to 8000rpm, which can ensure stable and continuous precision machining.

The innovative design of this premier series has passed two (2) new patent applications.

(5)Market Feasibility

Nowadays, it is very common for lathes to supply milling functions. The existing 434/BMT driven turret was designed to only perform milling for a rather short period of time, which no longer satisfies today's market demand. This has led to an increase in turret abnormalities and increased customer maintenance costs. This is main cause that the new series product 434.420 BMT upgraded version (optional with Y axis) was developed.

(6)Aesthetics

The tool station numbers on the tool disc are processed by laser engraving, making the appearance clear and noticeable.

A new product identification QR Code is added to the turret nameplate. Customers can quickly scan and obtain traceable product production history provide instant after-sales service.

漢鼎智慧科技股份有限公司
HANTOP INTELLIGENCE TECHNOLOGY CO., LTD.

地　　址：40817 台中市南屯區工業區二十一路 41 號
No. 41, Gongyequ 21st Rd., Nantun Dist., Taichung City 40817, Taiwan
電　　話：+886-4-22850838　　**傳　　真：**+886-4-22850836
網　　址：www.hit-tw.com/　　**E-mail：**sales@hit-tw.com

攤位號碼：Q0113

主要產品類別：

- 超音波加工模組
- 超音波刀把
- 超音波驅動器
- 超音波主軸

參賽作品名稱：

UTD30 非接觸傳輸供電高速主軸
UTD30 Wireless Power Transmission High-Speed Spindle

作品圖片：

作品開發背景：

漢鼎公司以非接觸式電能傳輸、機電整合和軟硬整合技術所開發出來智慧超音波刀把模組，完全相容於傳統的 CNC 工具機主軸與其自動換刀系統，可在 6 小時內，將傳統金屬加工的 CNC 工具機，立即升級為先進材料的精密加工裝備，並證實在切削陶瓷、Inconel 與 CMC 材料時，可以有效提昇刀具壽命數倍、降低切削力 40% 以上、以及降低加工件破損機率。

本產品將非接觸電能傳輸系統整合入主軸內，目標為提供非接觸電能進入高速旋轉中的刀把，除了可以供電給予超音波刀把之外，亦可供電給予 IOT 智慧化刀把；可協助將傳統的 CNC 工具機快速轉化為可加工半導體硬脆先進材料的加工機台，大幅提升工具機的附加價值與可銷售市場。

近幾年，隨著漢鼎超音波刀把模組產品銷售至國內外客戶，也逐漸從客戶端接收到各種的反應與期

望，主要分為兩大方面：

一、整合型超音波主軸

目前漢鼎的超音波刀把模組是採外掛式安裝，所以在機台主軸上需安裝電能非接觸傳輸所需的功率傳輸器，客戶主要是擔心機台操作人員的誤動作容易造成碰撞而損傷功率傳輸器，且因外掛式安裝的模式，電線與管路無法完美整合至機台板金內；所以希望漢鼎能夠提供整合性更佳的超音波整合方案。

二、IOT 與 AOI 刀把

漢鼎的主要客戶群集中在半導體相關零件加工業者，加工件多為石英、單晶矽、氧化鋁陶瓷、碳化矽等難切削硬脆材料，加工耗時長且對於加工品質要求極高，例如 shower-head 的加工，往往需要 5~7 天的加工時間，在這期間內必須定時的檢查刀具與工件的狀態來確保產品的加工品質，頗為耗費時間與人力。因此，希望能有適合的技術整合方案，能夠機上即時監測切削狀態及加工品質。

IOT 智慧化刀把與與 AOI 刀把將會是最佳的解決方案，但現有市面上具有類似功能的刀把大多採電池作為電源供應，難以滿足長時間加工與大電流供應的需求，而漢鼎的非接觸電能傳輸技術可以完美的解決此一問題。

綜合上述的客戶需求及漢鼎公司的非接觸電能傳輸技術，投入開發非接觸傳輸供電高速主軸，可在不更動主軸的外觀尺寸下，將非接觸供電供電傳輸模組整合入主軸設計，可相容於現有主軸產品，使得高速主軸不僅能提供加工的能力外，也能進行即時監測加工狀態與工件加工品質。

作品特點：

（一）創新性

本創作已於 113 年 9 月 11 日 獲得中華民國專利 TWM 660347U。

現有工具機如果要做到線上監測，需要使用 IOT 智慧化刀把來即時監測加工狀態或是使用 AOI 檢測設備來檢測工件加工品質；IOT 智慧化刀把採電池供電為主，電池蓄電量有限，難以長時間運作，所以大多作為製程測試用，無法應用在量產加工使用；AOI 檢測設備以外部接線供電為主，僅能安裝在固定結構件上，且規格單一無法任意改變。

本產品是將漢鼎公司非接觸式電能傳輸模組整合入高速主軸設計，可在主軸高速旋轉的狀態下提供穩定的電源至心軸及刀把，可以提供超音波刀把、IOT 智慧刀把及 AOI 影像量測刀把所需的電源，使得主軸的功能性增加與附加價值提高，可有效並快速協助機台操作人員了解加工狀態與加工品質。

本作品的創新性特點如下：

1. 非接觸供電傳輸模組技術，可將電源從固定元件傳輸至高速運轉中的元件，且無磨耗問題。
2. 緊湊式供電傳輸模組設計，可高度整合入高速主軸，不會改變現有主軸的安裝尺寸，現有量產中機台可快速無痛導入。
3. 應用範圍廣泛，除超音波刀把、IOT 智慧刀把、AOI 刀把，亦可依據客戶端應用需求來開發設計新刀把。

（二）智慧化與實用性

本產品除了非接觸供電模組與高速主軸整合設計技術外，也需要良好的機電整合及軟硬整合技術，才能將穩定的電源提供至高速運轉中的刀把；例如在超音波輔助加工的應用場合，漢鼎所開發的驅動器除了能提供電源外，也能即時監測超音波的振動，隨時進行智慧化追頻的動作，以確保加工過程中超音波振動的穩定輸出。

（三）綠色、節能與永續

本主軸的材料以使用可回收的金屬材料為主，材料可回收率達 95% 以上。

本公司自主開發的非接觸式電能傳輸系統的傳輸效率可達 93% 以上，優於市售的普遍在 90% 以下高頻電能轉換裝置。

（四）結構、精度與品質

高速主軸在國內是技術相當成熟且穩定的精密模組，所以本主軸產品的精度、剛性、運轉品質是符合國內外主軸檢驗標準。此外，漢鼎已銷售外掛式超音波刀把至國內外市場，經過客戶多年的應用回饋與漢鼎持續的改善精進，非接觸式供電技術已是漢鼎主要成熟核心技術之一，產品品質更是毋庸置疑的。

（五）市場可行性

因為少子化的影響，工廠欠缺人員的狀況將會惡化，所以如何將生產人力降到最低，甚至做到無人化工廠，這都是未來的趨勢。所以，工具機在加工過程中如何即時的監測加工狀態與加工品質檢測就變得相當重要了；非接觸傳輸供電主軸搭配各種不同功能的刀把模組便可以達到前述的功能，且主軸安裝尺寸與現有尺寸相符，不需更改機台的結構設計，可在最短的時間完成導入量產。

DESCRIPTION IN ENGLISH:

(1)Innovation

This product was granted a patent in the Republic of China (Taiwan) on September 11th, 2024, under the Patent Number TWM 660347U.

In current machine tools, achieving online monitoring typically requires the use of IoT-enabled smart tool holders for real-time monitoring of machining conditions or AOI (Automated Optical Inspection) equipment for inspecting workpiece quality. IoT smart tool holders are primarily battery-powered, but their limited battery capacity makes long-term operation difficult, confining their use to process testing rather than large-scale, mass production. On the other hand, AOI inspection equipment relies on external wired power supply, which can only be installed on fixed structural components, and its specifications are standardized and cannot be easily modified.

This product integrates HIT's non-contact power transmission technology into the high-speed spindle design, providing stable power to the spindle and tool holder during high-speed rotation. It supports the power requirements of ultrasonic tool holders, IoT smart tool holders, and AOI imaging measurement tool holders. This integration enhances spindle functionality and added value, effectively and efficiently assisting machinists in understanding machining conditions and quality.

The innovative features of this product are as follows:

(a) Non-Contact Power Transmission Module Technology: It enables the transfer of power from stationary components to components in high-speed operation without wear and tear issues.

(b) Compact Deisgn of Power Transmission Module: It is highly integrable into high-speed spindles without altering the existing spindle installation dimensions, allowing seamless and rapid adoption in current mass production machinery.

(c) Wide Applicability: Beyond ultrasonic tool holders, IoT smart tool holders, and AOI tool holders, it can also be tailored and developed for new tool holders based on specific application needs from the clients.

(2)Intelligence and Practicality

In addition to the integration of non-contact power transmission module and high-speed spindle design, the product requires advanced electro-mechanical and software-hardware integration technologies to deliver stable power to tool holders under high-speed operation. For instance, the ultrasonic driver developed by HIT not only supplies ultrasonic power but also monitors ultrasonic vibrations in real-time ultrasonic-assisted machining applications. It performs intelligent frequency detecting and tracking to ensure the stable output of ultrasonic vibrations throughout the machining process.

(3)Energy Saving Computation

The spindle is primarily made of recyclable metal materials, with over 95% recyclability rate. The non-contact power transmission system achieves over 93% transmission efficiency, surpassing the market standard of high-frequency power conversion devices, which typically remain below 90%.

(4)Structure, Precision and Quality

High-speed spindles are a well-established and stable precision module in the domestic market. As such, this spindle product meets both domestic and international spindle inspection standards in terms of precision, rigidity, and operational quality. Additionally, HIT has successfully marketed additive ultrasonic tool holders domestically and internationally throughout the past 6 years. Through years of customer feedback and continuous improvement, the non-contact power transmission technology has become one of HIT's mature core technologies, ensuring unquestionable product quality.

(5)Market Feasibility

With the challenges posed by declining birth rates, labor shortages in factories are expected to worsen, emphasizing the need to minimize production manpower or even achieve fully automated process. As a result, the ability to monitor machining conditions and inspect machining quality in real-time is becoming increasingly crucial. By integrating the non-contact power transmission spindle with various tool holder modules, these functionalities can be achieved. Furthermore, the installation dimensions of the spindle are consistent with existing configurations, requiring no structural modifications, thereby enabling rapid deployment for mass production in the shortest possible time.

上銀科技股份有限公司
HIWIN TECHNOLOGIES CORP.

地　　址：408-208 台中市南屯區精科路 7 號
No. 7, Jingke Road, Precision Machinery Park, Taichung 408208, Taiwan
電　　話：+886-4-23594510　　**傳　　真：**+886-4-23594420
網　　址：www.hiwin.tw/　　**E-mail：**business@hiwin.tw

攤位號碼：Q0514

主要產品類別：

滾珠螺桿 / 滾珠花鍵 / 線性滑軌 / 單軸機器人 / 軸承 / DATORKER® 諧波減速機 / 多軸機器人 / 末端效應器 / Torque Motor 迴轉工作台 /EFEM 晶圓移載系統 / 晶圓裝卸機 / 晶圓機器人 / 晶圓尋邊器

參賽作品名稱：

RCH-100E　高速放電銑削頭
RCH-100E　High-Speed EDM Milling Head

作品圖片：

作品開發背景：

隨著航空、汽車及半導體產業的快速發展，相關產業對超硬材料的加工需求日益增加，這些材料如工業鑽石、鎳基合金和碳化鎢等，通常需要依賴放電加工（Electrical Discharge Machining, EDM）來進行製程。然而，傳統的放電加工方式存在諸多限制，例如需要大量消耗銅電極（刀具），頻繁更換電極不僅增加了銅電極的成本，還導致了加工效率的降低。此外，傳統放電加工中的電極消耗不均勻也會對加工件的精度產生影響。

基於這些痛點，上銀科技投入研發，推出了高速放電銑削頭（RCH-100E），創造出“放電銑削”這項創新技術。這項技術旨在解決傳統放電加工面臨的瓶頸，不僅提升了加工速度，還有效降低了電極的消耗頻率，進而縮短了加工時間，確保加工件的精度。通過這項技術，上銀科技希望幫助客戶提升市場競爭力，並實現可持續發展。

在研發過程中，上銀科技參考了市場上放電加工設備的相關技術與瓶頸需求，包括在提高精度和高效率放電加工技術上的發展動向，以確保高速放電銑削頭（RCH-100E）該產品能夠符合市場需求並具有競爭力。高速放電銑削頭（RCH-100E）已榮獲 2025 台灣精品獎銀質獎。

作品特點：

HIWIN 高速放電銑削頭 RCH-100E，是世界首創，專為高階放電加工設計的高速精密銑削複合式直驅迴轉工作台，具備分度、同動、主軸多功能之特點，為航空、半導體、車用等精密且高硬度之零組件的生產提供卓越解決方案。

1. 創新加值方案：整合 HIWIN 力矩馬達直驅傳動技術，精度為傳統機械式的 3 倍，轉速高達 300 rpm，是機械式放電 C 軸的 15 倍，具備高速長時間高精度運轉的加值功能。
2. 製程技術革命：傳統放電加工以 Z 軸上下移動，電極靠近，透過放電來移除工件材料。HIWIN 高速放電銑削頭 RCH-100E 將傳統放電加工升級為多功能的「放電銑削」，使加工效率提高 5 倍，加工精度達 2 微米，為航空、半導體等高加工難度精密零件提供創新解決方案。
3. 智慧診斷能力：整合漏液、溫度、電流感測系統，賦予轉台「智能化感知」，能主動回饋使用狀況，讓使用者能有計畫性地進行設備維護。
4. 節能減碳設計：採用特殊合金材質，在相同剛性下減少 30% 的重量，為放電機帶來節能的附加價值。同時，放電銑削技術大幅降低銅電極的消耗量達 70%，銅電極相當於銑床的銑刀，不僅節省了刀具材料，也降低了生產成本。
5. HIWIN 高速放電銑削頭 RCH-100E 的 90% 零件由 HIWIN 自製零組件組成，材質多為鋁合金，因此 HIWIN 可針對轉台進行重新設計，將原有的迴轉工作台升級或修復，延續生命週期。若迴轉工作台壽命已至，零件可進行回收、熔解、再鑄造，使其能夠用於製造新的產品或組件，減少對自然資源的需求，同時降低環境影響。內部關鍵零件如力矩馬達可進行拆解，其金屬外殼、銅線、鐵芯皆可進行回收再利用，減少廢棄物的產生。
6. HIWIN 高速放電銑削頭 RCH-100E 的內部關鍵零組件軸承、Torque Motor 力矩馬達，均為 HIWIN 自製，掌握關鍵技術；HIWIN 為台灣唯一可以同時大量生產力矩馬達和迴轉工作台的企業，可以降低成本且縮短交期，讓使用者獲得高品質及交期穩定之高附加價值產品。
7. 產品視覺設計，表現工業設計美學

   HIWIN 高速放電銑削頭 RCH-100E 產品以微型緊湊 (compact) 結構，結合簡潔的工業設計，陶瓷黑化表面，展現沉著穩重的專業水準；方正及去銳化的外型設計，適合各類型的放電加工設備，表現 MIT 精品級的質感。

加工應用產業案例：

航空零件 / 模具加工

特 色：

- 直驅式傳動，高精度、高轉速、零背隙
- 適用 EROWA 或 3R 夾頭
- 專利絕緣設計，安裝不須微調校正
- 額定轉速 200rpm；定位精度 ±15 arc-sec；重複精度 ±5 arc-sec
- 可夾持最大電極重量 35kg
- 支援通訊格式 Pulse, V-command, EtherCAT®, MECHATROLINK-III, PROFINET

DESCRIPTION IN ENGLISH:

HIWIN High-Speed EDM Milling Head (RCH-100E) equipped with a high-speed Torque motor is designed for high precision application to produce parts for aviation, semiconductor & automotive.

1. Innovative Value: Equipped with high-speed Torque Motor and built-in absolute encoder to achieve precise indexing of 0.0005° and rotation speed of 300 RPM, HIWIN Direct Drive Rotary Table offers 15 times higher productivity and better surface finishing than the mechanical type Rotary Tables.
2. Process Technology: RCH-100E "EDM Milling" is a new processing technology with capability to process complex precision parts. With this technology, efficiency is increased by 5 times and accuracy is maintained within 2 microns.
3. Intelligent Diagnostic: Built-in Sensor systems with "intelligent detection and conditions feeback" allowing users to schedule maintenance and reduce downtime.
4. Energy-saving and Carbon Reduction: Special Aluminum Alloy is being used to reduce weight by 30%, maintaining the same rigidity. The new EDM Milling technology reduces production costs by saving copper electrodes consumption by 70%.
5. HIWIN High-Speed EDM Milling Head (RCH-100E) is composed of 90% in-house manufactured components, primarily made of aluminum alloy. This allows HIWIN to redesign rotary tables, upgrading or refurbishing existing ones to extend their lifecycle. When a rotary table reaches the end of its service life, its parts can be recycled, melted down, and re-cast to produce new products or components. This process reduces reliance on

natural resources while minimizing environmental impact.

Key internal components, such as torque motors, can also be disassembled, with their metal casings, copper wires, and iron cores being recycled and reused, thereby reducing waste generation.

6. HIWIN High-Speed EDM Milling Head (RCH-100E) features key internal components, including bearings and torque motors, all independently manufactured by HIWIN, ensuring full control over core technologies. As the only company in Taiwan capable of mass-producing both torque motors and rotary tables simultaneously, HIWIN offers cost-effective solutions with shorter lead times, providing users with high-value products that ensure superior quality and reliable delivery.
7. Product Visual Design Showcasing Industrial Aesthetics

   HIWIN High-Speed EDM Milling Head (RCH-100E) features a compact structure combined with a sleek industrial design. Its ceramic blackened surface exudes a sense of professionalism and reliability. The squared yet smooth-edged shape design ensures compatibility with various EDM machines, showcasing premium MIT quality.

Electrical Discharge Machining:

Aircraft / Mold

Features:

- Direct drive motor, High accuracy, High rotation speed, Zero backlash.
- Compatible with EROWA and 3R chuck.
- Patented insulation design, fine-tuning-free and calibration-free during installation.
- Continuous rotation speed is up to 200rpm ; Positioning accuracy: ±15 arc-sec ; Repeatability:±5 arc-sec.
- The maximum electrode weight that can be clamped is 35kg.
- Supports for different protocols such as Pulse, V-command, EtherCAT®, MECHATROLINK-III, PROFINET.

鉦通工業股份有限公司
JHEN TONG PRECISION CO., LTD.

地　　址：桃園市八德區長安街 29 號
No. 29, Chang'an Street, Bade District, Taoyuan City
電　　話：+886-3-3627056　　**傳　　真：**+886-3-3627055
網　　址：www.jtp.com.tw/　　**E-mail：**david.lin@jtp.com.tw

攤位號碼：R1226

主要產品類別：

- 伺服刀塔 動力刀塔 龍門式 Y 軸動力刀塔
- 車床相關零配件
- 各式刀座

參賽作品名稱：

BMT-55MYW　龍門式 Y 軸偏置刀塔
BMT-55MYW　Y-axis Turret

作品圖片：

作品開發背景：

隨鉦通工業於 2019 年發表第一代的 Y 軸刀塔後，全球至今已累積銷售超過 500 台的實績。在收到各方客戶的寶貴回饋和使用建議後，(例如：希望可延伸應用於多刀塔，多主軸應用) 於今年再次推出 Y 軸偏置刀塔，可用於副主軸，或是雙刀塔，雙主軸應用，因此也立即獲得國內外客戶好評和選購，並即將於 2025 年台北和印度工具機展中展出。

作品特點：

(一) 創新性

鉦通於是全球第一家廠商將 Y 軸功能於 2019 年整合在 BMT 動力刀塔上，後於 2024 年再次發表 Y 軸偏置刀塔，可用於副主軸或是雙 (三) 刀塔，雙 (三) 主軸應用。

(二) 智慧化與實用性

相較於車床 Y 軸功能設計，鉦通將 Y 軸功能直接整合在刀塔上，可有效節省車床內部空間，減少干涉，並方便維修保養。

(三) 綠色、節能與永續

設計產品使用年限為 20 年。

刀盤或是銑銷主軸可重新透過維修人員架錶將精度重新調校回出廠規範 (3~5um)，若是客戶端使用時不慎發生撞車 (無須更換整台刀塔)。

(四) 結構，精度與品質

結構採一體龍門式設計，箱體跨距增加，有效提升剛 性，易於重切削應用，Y 軸行程 +/-60mm，精度可控制在 3um 內，銑銷主軸轉速 6,000rpm，可長時間運轉而無異音。

(五) 市場可行性

第一代 Y 軸刀塔市場銷售實績，已超過 500 台數量，而新發表的 Y 軸偏置刀塔，今年已獲國內外主要工具機大廠採用，即將於 IMTEX 2025，和 TIMTOS 2025 展出。

(六) 審美性

刀塔箱體配置近黃金比例設計 (高度 / 寬度，或是長度 / 寬度)

(七) 其它

業於 2024 6 月 1 日取得中華民國新型專利 M656268

DESCRIPTION IN ENGLISH:

(1)Innovation

JTPMAK is the 1st company to introduce Integrated Y-axis turret in 2019, then Y-axis turret for sub-spindle, multi-spindles, multi-turrets applications is further launched in year 2024 to respond to the customers' feedback and demands.

(2)Intelligence and Practicality

In comparison with the typical turning machine design with Y-axis Function,JTPMAK integrate the Y-axis function on its BMT turret where the interior space of the turning machine is effectively reduced, and the maintenance and after service is easily accessed.

(3)Energy Saving Computation

Designed service life of 20 Years.

In case of the crash of tool disc by work piece during the turning operation, the tool disc or spindle can be re-aligned at least within 3 ~ 5 microns. (No need to repalce the whole tool turret)

(4)Structure, Precision and Quality

The tool disc and housing of the turret is with gantry design and its rigidity is greatly increased. The precision class of Y-axis stoke is +/-60mm(120mm) is managed within 3um, and the speed of milling spindle runs up to 6,000rpm with no abnormal noise.

(5)Market Feasibility

The 1st generation have been sold with +500units, and the 2nd generation of Y-axis turret have been ordered by domestic and foreign customers for TIMTOS 2025, and
IMTEX 2025.

(6)Aesthetics

The whole turret housing is design close to a golden ratio in terms of height against its width or length against its width

(7)Others

The utility model patent #M656268 has been obtained in TAIWAN dated 2024-06-01

鍵君工業（股）有限公司
JIAN JUN INDUSTRIAL CO., LTD.

地　　址：台中市神岡區堤南路 210 巷 7-1 號
N0.7-1, Lane 210, Tinan Road, Shengang District Tuchung City.
電　　話：+886-4-25610678　　**傳　　真：**+886-4-25610679
網　　址：facebook.com/profile.php?id=61560916412426&mibextid=LQQJ4d
E-mail：Jianjun.industrial@gmail.com

攤位號碼：C0334

主要產品類別：

- CNC 電腦車床
- CNC 電腦銑床
- 零件製造
- 精密加工
- 專業聯軸器客製化製造

參賽作品名稱：

JJ-110-1　梅花型彈性聯軸器（花式）
JJ-110-1　FLEXIBLE COUPLING （花式）

作品圖片：

作品開發背景：

鍵君工業（股）有限公司董事長廖宏輝先生，原先本業是在做 CNC 傳統及電腦加工、車床，將近有 35 年的時間，因自身經驗及身邊親友反映有關聯軸器的問題後而突發奇想，自行研發能精密傳動並且準確能快速定位及能高載重，接近零背隙的「梅花型彈性聯軸器」。而中間墊圈為服貼接面式且除墊圈外皆可客製化，董事長希望能藉由產品的改良，使更多廠商使用時更加方便，也將產品改良為鎖兩顆螺絲減少金屬疲乏，也更好更換中間墊圈，增加使用年限，最大重點為中間墊圈破損時也能不傷害聯軸器外部及原接馬達機台，只需要更換墊圈，但除年限使用長以外能定期更換減少破損發生更是重要。

作品特點：

（一）創新性

本產品為今年申請專利，為新興產品，本公司董事長依過往經驗及各聯軸器的問題省思，所自行研發出的，絕無抄襲「梅花型彈性聯軸器」也經由董事長構想所設計程式製造，梅花型彈性聯軸器墊圈以外和中間墊圈為服貼並非市面所見的接點式產品。

（二）智慧化與實用性

董事長會研發此產品原因為身邊朋友也些都是工具機台的製造商，有反映過聯軸器使用壽命很短，常常爆開也影響馬達的壽命！雖說聯軸器為非常小的東西，卻在機台中佔有重要的地位。

之後董事長也開使專注研究如何讓聯軸器更耐用、使用壽命更久，透過寫程式及使用 3D 列印的方式增加密合，減少聯軸器跟聯軸器的皮圈相撞產生損壞，也接受較大的公差尺寸，將聯軸器設置成對剖式，減少更換麻煩程度也減少金屬疲乏，設計的更加實用也能把自己的想發加入在聯軸器中呈現出鍵君的獨特。

（三）綠色、節能與永續

經過鍵君董事長研發設計，我們聯軸器中的墊圈是使用 Hytrel®6356 一體成形的無參雜其他東西，是可以通過科學的加工改變形狀，是種可以再生資源產品，降低對環境的污染及過多的環境損失！已達到環保及永續利用聯軸器是用 6061 一體成型的，能增加產品壽命，由於無參雜任何雜質，如果壞掉整體都可以經過處理將鋁渣進行重複再利用，盡量把對地球的傷害降到最低！

（四）結構、精度與品質

結構外體都由鋁合金 6061 一體成型所製造出，中間墊圈也由 Hytrel®6356 所製造並無參雜其它材料，符合大部分工具機、物料移送機械、發電機及工程機械等所有使用，且只要尺寸為外徑 84mm 長度 106mm 以內的皆可客製化，精準度則在本產品所製造後使用十萬次以上，公差一樣在 2 度內，品質 & 安全都已請廠商測試及請代理廠商辦理 SGS 測試報告。

（五）市場可行性

董事長在研發聯軸器時，在網路上調查許多廠商的資料！發現有些廠商以便宜來換取量，有的廠商則是佔據市場無法有價格或有人抗衡的空間，所以他才想研發自己的產品，價格中等，但品質保證的聯軸器。

雖說現在還很少人知道我們，但我們有陸續跟工具機的廠商接洽，去推銷我們的聯軸器，有許多聯軸器跟著工具機一起銷售到巴西、日本等地區！希望未來台灣市場也能看看見我們，也能用品質闖出一片天！

（六）審美性

因應董事長設計理念及美觀，在產品上保留加工下來的磨面已表示每顆聯軸器，都是經由人工檢查及加工的，色彩則經由陽極後的霧灰所展示，選擇霧灰原因為增加產品質感也能不失工業風格，以及外觀設計為圓柱體，打破市場原既定的風格，展現鍵君對產品的求新及用心。

DESCRIPTION IN ENGLISH:

(1)Innovation

The product was patented this year. The chairman of the company developed it by himself through experience and reference to various coupling. There is no plagiarism. The “FLEXIBLE COUPLING” is also manufactured though the design program conceived by the chairman. The coupling is externally connected and The middle gasket is a conformable joint rather than a contact type.

(2)Intelligence and Practicality

The chairman developed this product because some of his friends, who are manufacturers of machine tools, have reported that the service life of the coupling is very short and often explodes, which also affects the life of the motor!

Although the coupling is a very small thing, it occupies an important position in the machine.

Afterwards, the chairman also began to focus on research on how to make the coupling more durable and have a longer service life. He wrote programs and used 3D printing to increase the tightness, reduce damage caused by the collision between the coupling and the coupling's apron, and also accepted larger tolerance dimensions.

Setting the coupling into a half-section type reduces the trouble of replacement and reduces metal fatigue. The design is more practical and you can add your own ideas to the coupling to show the uniqueness of Keyjun.

(3)Energy Saving Computation

After R&D and design by Chairman Jianjun, the washers in our couplings are made of Hytrel® 6356 and are made of Hytrel®6356 without any other components. The shape can be changed through scientific processing and it is a renewable resource product.

Reduce environmental pollution and excessive environmental losses! Environmental protection and

sustainable use have been achieved.
The coupling is made of 6061 in one piece, which can increase the product life. Since it does not contain any impurities, if the whole part is broken, the aluminum slag can be processed and reused, minimizing the damage to the earth!

(4)Structure, Precision and Quality

The outer body of the structure is integrally made of aluminum alloy by 6061, and the middle gasket is also integrally made of Hytrel®6356 without inclusion of other things. It's suitable for use in most machine, tools, material transfer machinery, generators and construction machinery, etc. The outer diameter of the structure is. The length can be customized to 84mm*106mm. The accuracy is within 2 degrees after this product has been used for more than 100,000 times. The quality and safety have been tested by the manufacturer. The SGS report is handled by the agent.

(5)Market Feasibility

When the chairman was developing couplings, he researched information from many manufacturers on the Internet! He found that some manufacturers were cheap in exchange for volume, while others were occupying a space in the market where there was no price or competition, so he wanted to develop his own product, a coupling with a mid-range price but guaranteed quality.
Although few people know about us yet, we have successively contacted machine tool manufacturers to promote our couplings. If necessary, multi-couplings will be sold to Brazil, Japan and other regions together with the machine tools! I hope that the Taiwanese market will also see us in the future and that we can make a mark with quality!

(6)Aesthetics

In response to the chairman's design concept and aesthetics, the process grinding surface is retained to indicate that each piece has been manually inspected and processed. The color is displayed by the foggy gray behind the electrode. The reason for choosing the foggy gray is to increase the texture for the product without losing the industrial style, the appearance is designed as a cylinder, breaking the original established style of the market and showing JianJun's Innovation and dedication to products.

台灣引興股份有限公司
KEYARROW (TAIWAN) CO., LTD.

地　　址：40768 台中市西屯區工業區 39 路 52 號
No. 52, Road 39, Taichung Industrial Park, Taichung 40768 Taiwan
電　　話：+886-4-23581239　　**傳　　真：**+886-4-23581358
網　　址：www.keyarrow.com　　**E-mail：**keyarrow@keyarrow.com

攤位號碼：R1014

主要產品類別：

- 伸縮護罩
- 風琴護罩
- 排屑機
- 精密鈑金

參賽作品名稱：

KA-WTS　智慧節能切削液水箱
KA-WTS　Smart energy saving coolant tank

作品圖片：

作品開發背景：

鑒於「2030 永續發展目標」及國際標準組織 (ISO) 發布「工具機專用之能耗量測及設計改善標準 ISO 14955 系列」，台灣引興以智慧聯網、環保節能、強效抑菌為三大主軸，開發出 "智慧節能切削液水箱" 來因應綠色浪潮，協助工具機降低能源、資源的消耗， 減少溫室氣體排放。

以往切削液水箱的功能只有用來裝盛切削液，最困擾使用者的是切削液劣化後，導致加工零件的表面光澤度不佳、刀具潤滑性下降並伴隨難聞的氣味飄盪在空氣中。因此本產品著重在維持切削液性能，降低厭氧菌分解切削液帶來的危害。

作品特點：

（一）創新性

1. 水箱不淤積設計

1.1 梳狀噴流口：應用鈑金工藝，在水箱底部製作微噴流口，製造循環水流，減少厭氧菌孳生。

1.2 傾斜式底部：應用康達效應，讓切削液貼底流動，避免切屑淤積，去除無氧區。

2. UVC 抑菌光

2.1 動能回充：白天利用低壓泵浦的管道進行水力發電，並儲存電能。

2.2 紫光抑菌：晚上使用電池電能讓紫外燈發出紫外光 (265nm 波長) 進行抑菌。

（二）智慧化與實用性

1. AIoT 可視化診斷系統：即時偵測各項感測器之數據，並提供異常告警。
2. 智慧聯網：透過 MQTT、UMATI 通訊格式，將泵浦電流、水箱液位高度、切削液 PH 值、切削液溫度的資訊傳輸到工具機的 IPC 電腦，提供使用者有用的決策訊息。

（三）綠色、節能與永續

1. 變頻節能沖屑：鑒於粗加工與精加工的切削液需求量不同，以往工具機皆是提供機械閥門讓使用者控制啟閉，而供水泵浦仍是 100% 全速運轉，造成用電浪費。本案透過壓力感測器與變頻器進行智能 PID 恆壓控制。當冷卻液使用量減少時，自動降轉節能，年減約 20% 碳排放。
2. 鐵屑車切削液回收：應用文丘里效應，使用壓縮空氣產生真空吸力，將鐵屑車底部的切削液吸回水箱。一般加工廠平均回收量「1 公升 / 車」，每個月約可回收 52 公升的切削液。稀釋的切削液單價約 9.6 元 / 公升，一個月約可節省 500 元的切削液支出。

（四）結構、精度與品質

1. 結構特色：以鈑金工藝與雷射切割工法製成水道與梳狀噴流口，相較於使用市售鋼管與噴嘴，有更高的性價比。
2. 品質：導入數位化成品履歷紀錄平台，提供溯源管理，讓品質更有保障。

（五）市場可行性

1. 鑒於未來工具機紛紛朝向智能化、節能化…等方向發展，智慧節能切削液水箱可提供此領域的加值服務，同時也適用於各式金屬切削工具機。

（六）審美性

1. 市場上銷售殺菌燈、臭氧殺菌都有應用實績，但是該產品屬於額外加裝，會額外佔據空間及影響美觀，「智慧節能切削液水箱」提供完整的方案同時，也兼具美感。

DESCRIPTION IN ENGLISH:

(1)Innovation

1. Coolant tank design

1.1 Comb-shaped jet nozzle: Laser cut micro-jet nozzles at the bottom of the water tank to create water flow circulation and reduce Anaerobic bacteria.

1.2 Inclined bottom: Apply the Coanda effect to allow the cutting fluid to flow against the Bottom to avoid chip deposition and remove oxygen-free zones.

2. UVC antibacterial light

2.1 Kinetic energy recharge: During the day, low-pressure pumped pipes are used to generate hydropower and store electrical energy.

2.2 Purple light antibacterial: At night, it uses battery to power ultraviolet lamp to release ultraviolet light (265nm wavelength) inhibiting bacteria.

(2)Intelligence and Practicality

1. AIoT visual diagnosis system: Real-time detection from various sensors and provides abnormal alarms.
2. Smart networking: Through MQTT and UMATI communication formats, the pump current, water tank level, cutting fluid ,pH value and cutting fluid temperature is transmitted to the IPC computer of the machine tool, providing the user with useful decision-making information.

(3)Energy Saving Computation

1. Frequency convertible energy-saving chip flushing: Due to different cutting fluid requirements for rough machining and finishing machining, in the past, Machine tools provide mechanical valves allowing users to control, while the fluid supply pump still runs at maximum speed, resulting in a waste of electricity. We provide constant PID voltage control through pressure sensors and frequency converters. When coolant usage decreases, it reduces the energy consumption automatically, and approximately 20% of carbon emissions has been reduced .
2. Recycling of cutting fluid from chip cart: Applying the Venturi effect, compressed air is used to generate vacuum suction to suck the cutting fluid from the bottom of the chip car back to the water tank. The average recycling volume of a general processing plant is 1 liter per cart, and about 52 liters of cutting fluid can be recycled every month. The unit price of diluted cutting fluid is about 9.6

yuan/liter, which equals to about 500 NTD per month of cutting fluid expenses being saved.

(4)Structure, Precision and Quality

1. Structural features: The water channels and comb-shaped jet nozzles are laser cutted, which is much more cost-effective compared with commercial steel nozzles.
2. Quality: Introducing digital finished product record platform, which provides traceability management and ensure quality.

(5)Market Feasibility

1. The future development of machine tools being intelligence and energy saving, smart energy-saving cutting fluid water tanks can provide extra value and is also suitable for various metal cutting machine tools.

(6)Aesthetics

1. Germicidal lamps and ozone sterilization are commercial goods which has been in the market for a while, yet the installation will occupy additional space. The "Smart Energy-Saving Cutting Fluid Water Tank" provides a complete solution that is both functional and aesthetically.

百德機械股份有限公司
QUASER MACHINE TOOLS, INC.

地　　址：43768 台中市大甲區幼獅工業區工六路 3 號
No.3, Gong 6th Rd., Youshih Industrial Park, Dajia Dist., Taichung City 43768, Taiwan
電　　話：+886-4-2682-1277　　傳　　真：+886-4-2682-2045
網　　址：www.quaser.com　　E-mail：sales@qmt.com.tw

攤位號碼：J0830

主要產品類別：

- 立式加工中心機
- 銑車複合加工中心機
- 工作台交換加工中心機
- 臥式加工中心機
- 多面 / 5 軸加工中心機
- 彈性交換系列單元

參賽作品名稱：

MF700 MR.Q (CNC + 生成式 AI)
MF700 MR.Q (CNC + Generative AI)

作品圖片：

作品開發背景：

可提醒沒有經驗的使用者，該如何在加工前準備，縮短新手學習時間並在加工中檢查機器即時狀態（Search）、預警（Book），減少因為人為疏忽浪費成本進而計算、記錄、查詢碳排放數據（Carbon-footprint），提醒降低無效的等待工時（Reminder）AI 孿生技術能快速應對，供精準的解答與建議，提升使用者的操作體驗。

作品特點：

（一）創新性

MR.Q 是一款嵌入式生成式 AI 控制模組，將智慧技術導入工具機操作中提供聲控與觸控雙介面，讓用戶可以更加直覺地與機器互動。智能診斷與建議功能，能模擬專家指導，幫助新手快速適應機器操作。加工前的準備指引，縮短用戶學習時間，顯著提升使用效率。AI 孿生技術能快速應對，供精準的解答與建議，提升使用者的操作體驗。

（二）智慧化與實用性

在加工過程中進行實時機器狀態檢查，提前預警，避免人為疏忽造成損失。支援加工參數記錄、分析與優化，降低因設定不當導致的加工問題。能整合碳排放數據，幫助客戶進行環保決策。

（三）綠色、節能與永續

百德機械以 ESG 為目標，MR.Q 系統支援智能化流程，減少重複作業對資源的耗損。計算、記錄加工過程的碳排放量，協助用戶降低能源浪費與環境負荷。在系統層面減少無效等待工時，提升整體能源使用效率。

（四）結構、精度與品質

MR.Q 模組的監控功能保證機器性能穩定，並適應高複雜度加工場景。

（五）市場可行性

適用於中小型企業與大型製造企業的智慧升級需求。支援多語系操作，滿足國際市場需求。

（六）審美性

系統介面設計人性化，操作簡單且美觀，符合工業設計的現代化趨勢。

（七）其他

可支援遠端維護功能，減少人工干預成本，提升用戶體驗。在 2023 年獲得多項工具機創新獎，證明了其在技術創新與實際應用中的市場價值

DESCRIPTION IN ENGLISH:

(1)Innovation

MR.Q is an embedded generative AI control module that integrates intelligent technology into machine tool operations.

It provides dual interfaces—voice control and touch control—allowing users to interact with the machine more intuitively.

The intelligent diagnosis and recommendation functions simulate expert guidance, helping beginners quickly adapt to machine operations.

Pre-machining preparation guidance shortens the user learning curve and significantly enhances operational efficiency.

AI twin technology enables quick responses, providing precise solutions and recommendations to improve the user experience.

(2)Intelligence and Practicality

Real-time machine status checks during machining provide early warnings to prevent losses caused by human error.

Supports machining parameter recording, analysis, and optimization to reduce issues caused by improper settings.

Integrates carbon emission data, helping customers make environmentally conscious decisions.

(3)Energy Saving Computation

Buffalo Machinery focuses on ESG goals, and the MR.Q system supports intelligent processes to reduce resource waste from repetitive tasks.

Calculates and records carbon emissions during machining, assisting users in reducing energy waste and environmental impact.

Minimizes idle waiting time at the system level, improving overall energy efficiency.

(4)Structure, Precision and Quality

The monitoring features of the MR.Q module ensure stable machine performance and adaptability to highly complex machining scenarios.

(5)Market Feasibility

Designed to meet the smart upgrading needs of both small and medium-sized enterprises (SMEs) and large manufacturing companies.

Supports multilingual operation to cater to international market demands.

(6)Aesthetics

The system interface is user-friendly, simple, and visually appealing, aligning with modern industrial design trends.

(7)Others

Supports remote maintenance functions, reducing manual intervention costs and enhancing user experience.

Won multiple machine tool innovation awards in 2023, showcasing its market value in both technological innovation and practical applications.

先鎰企業廠股份有限公司
SPINDLEX TECHNOLOGIES CO., LTD.

地　　址：新北市三重區中興北街 204 巷 21 號
No. 21, Ln. 204, Zhongxing N. St., Sanchong Dist., New Taipei City 241, Taiwan (R.O.C.)
電　　話：+886-2-2995-0267　　**傳　　真：**+886-2-2995-8334
網　　址：www.spindlex.com.tw　　**E-mail：**spindlex@spindlex.com.tw

攤位號碼：Q1424

主要產品類別：

- 內藏式高速主軸
- 客製化精密主軸
- 主軸周邊配件（油氣潤滑系統及客製化刀桿）
- 歐美日進口主軸維修

參賽作品名稱：

SYE-220DC 智慧化外圓研磨主軸
SYE-220DC Intelligent External Grinding Spindle

作品圖片：

作品開發背景：

研磨加工是精密製造的核心工序之一，但傳統研磨技術仍面臨多重挑戰。砂輪因不均質性帶來的震動，對加工穩定性與精度造成影響；軸承損壞則多源於潤滑油脂劣化後的金屬接觸，導致主軸壽命縮短。此外，砂輪整修過程中的多餘修整雖能確保品質，但卻犧牲了砂輪的使用壽命。而在高性能加工設備中，熱伸長問題會進一步限制加工精度，隨著幾何加工的複雜性提高，加工過程中撞機的風險也隨之上升。

針對以上挑戰，本公司推出了創新的智慧化外圓研磨主軸，致力於解決傳統加工的核心問題。該產品整合多項智慧化技術，包括線上動平衡系統以降低砂輪震動、油脂潤滑系統以延長軸承壽命、音頻防撞檢知以減少停機損失，並結合即時監控的修砂技術，實現加工的最佳化。同時，產品設計兼顧環境永續，採用高效能永磁馬達，減少能量損耗，並透過熱伸長補償系統提升加工精度，為現代精密製造提供了高效能與高可靠性的解決方案。

作品特點：

（一）創新性

設計理念：

本產品專注於解決研磨製程的痛點，特別是在震動、熱伸長與潤滑系統等關鍵問題上，提出創新的智慧化解決方案。以下這些專利技術的應用，確保了智慧化外圓研磨主軸在設計上具備突破性與實用性，適應多樣化加工需求。

（二）智慧化與實用性

1. 線上動平衡：動態校正砂輪的不平衡量，消除震動，減少人工操作的需求，提高加工品質與效率。
2. 音頻防撞檢知：即時監控修砂與加工過程，降低因過負載或撞擊導致的停機風險；縮短空行程，提高加工速度。
3. 熱伸長補償：渦電流感應即時偵測軸心熱伸長，透過即時補償系統保持加工精度，避免熱效應影響工件品質。

（三）綠色、節能與永續

1. 永磁馬達：能量密度高使主軸輕量化，且效能優異，節能效益相較於感應馬達提升約 15%。
2. 油脂潤滑系統：持續供應新鮮潤滑油脂，有效延長軸承壽命 50%，減少主軸維修頻率。
3. 音頻防撞檢知：延長砂輪壽命 25%，降低砂輪更換頻率，節省資源並提升環保效益。
4. 編碼器應用：提供精準動態響應，避免不必要的能源損耗，提高系統整體效率 12%。

（四）結構、精度與品質

1. 熱伸長補償：運行穩定性顯著提升，確保加工精度在微米級（1μm 以內）。
2. 震動：主軸震動性能達到國際最高標準 ISO 1940-1 G0.4 等級。
3. 陶珠軸承：主軸固定端配置四顆陶珠軸承，提高剛性與耐用性，滿足高強度加工需求。
4. 錐度：主軸軸心錐度介面符合 ISO 1119 規範，角度 5° 44’ 10,550 0” 。
5. 偏擺精度：控制在 1μm 以內，確保加工品質穩定。
6. 編碼器技術：提供精準的轉速控制，讓主軸運轉平穩順暢。

（五）市場可行性

智慧化外圓研磨主軸以其高精密化與智慧化特性，契合台灣企業轉型需求，同時符合全球對綠色製造的重視，具備顯著市場競爭力。

（六）審美性

主軸採用簡約乾淨的方形外觀設計，整體線條流暢且極具現代感，搭配高品質的金屬材質，不僅突顯精密工業的高端質感，還展現了沉穩、可靠的特質。

DESCRIPTION IN ENGLISH:

(1)Innovation

Design Concept:

This product addresses critical issues in the grinding process, such as vibration, thermal expansion, and lubrication failures, with innovative intelligent solutions.

(2)Intelligence and Practicality

1. Online Dynamic Balancing: Automatically corrects wheel imbalance, reduces vibrations, and improves machining quality and efficiency.
2. Touch Detector: Real-time monitoring of grinding and dressing processes, reducing downtime risks caused by overload or collisions, and optimizing idle movement speed.
3. Thermal Expansion Monitoring System: Detects spindle shaft thermal expansion with eddy current sensors, ensuring machining precision and dimensional stability.

(3)Energy Saving Computation

1. Permanent Magnet Motor: High energy density enables spindle lightweighting and with a 15% energy-saving advantage over asynchronous motors.
2. Grease Lubrication System: Supplies fresh grease continuously, extending bearing lifespan and reducing resource wastage.
3. Touch Detector: Prolongs wheel lifespan by 25%, reducing replacement frequency and enhancing environmental benefits.

4. Encoder: Provides precise dynamic response, reducing unnecessary energy consumption and improving overall efficiency by 12%.

(4)Structure, Precision and Quality

1. Thermal Expansion Compensation: Improves operational stability, maintaining precision within one micron-level tolerance.
2. Vibration: Achieves ISO 1940-1 G0.4 standards for spindle vibration performance.
3. Ceramic Ball Bearings: Four ceramic bearings arrangement at the fixed end of the spindle enhance rigidity and durability, supporting high-strength machining.
4. Taper: Complies with ISO 1119 standards, with a taper angle of 5°44'10.550".
5. Runout Precision: Controlled within 1μm, ensuring machining quality.
6. Encoder Technology: Provides precise speed control, ensuring smooth spindle operation.

(5)Market Feasibility

The intelligent external grinding spindle aligns with Taiwan's machinery industry shift toward high-precision, intelligent, and green manufacturing, demonstrating strong market competitiveness.

(6)Aesthetics

The spindle features a minimalist, clean square design with a highly modern appearance. Made from high-quality metal materials, it not only highlights the high quality of precision engineering but also conveys a sense of stability and reliability.

SYNTEC 新代科技

新代科技股份有限公司
SYNTEC TECHNOLOGY CO., LTD.

地　　址：30076 新竹科學園區研發二路 25 號
No. 25, Yanfa 2nd Rd., Hsinchu Secience Park, Hsinchu City 30076, Taiwan
電　　話：+886-3-666-3553　　**傳　　真：**+886-3-366-3505
網　　址：www.syntecclub.com.tw　　**E-mail：**syntecmarketing@syntecmail.com

攤位號碼：P0528

主要產品類別：

機床產品 Machine Tool Products

參賽作品名稱：

22PLUS 新世代智慧節能控制器 - 新代 22PLUS 系列控制器
22PLUS New Generation Open Platform Controller-Syntec 22 PLUS CNC Controller

作品圖片：

作品開發背景：

面向生產高精密工具機的機械廠客戶，加工過程中發生非預期性的撞擊，可能造成主軸或軸向機構嚴重損傷，除產生高額的維修費用外，機台停機無法生產降低稼動率。基於上述原因，設計智慧撞機保護功能，當系統判斷機台發生撞擊現象時，控制器在動程規劃時提早剎車，達預防造成機構嚴重損傷之目的。

面向量產高附加價值產品的終端客戶，加工過程中發生斷刀現象時，若無人立刻察覺或系統無立刻提醒，可能造成產品品質批量異常，成非必要的生產成本支出。基於上述原因，設計智慧斷刀檢測功能，當系統判斷刀具發生斷刀現象時，系統立刻跳出提示或警報，令機台停機，達預防機台生產出批量不良品之目的。

作品特點：

（一）創新性

1. 撞機保護及斷刀檢測智慧功能目標提供無傳感器及搭配傳感器方案。特色一為搭配新代伺服，不需外加感測器，標配提供撞機保護及斷刀檢測功能。特色二為支援多廠牌加速規感測器，應用於微小刀具（<3mm）的斷刀檢測。目前加速規可支援的方案有：甲、中光電；乙、G-Tech
2. 此技術為台灣控制器產業的重大突破，該技術對齊 Fanuc、Siemens、Mitsubishi 等國際控制器品牌的最新規格，讓新代科技成為首家能做到不外加感測器，以標配實現這兩項功能的台灣廠商。這項創新技術不僅能有效保護機台，提升生產效率，更能降低生產成本。我們期許新代做為台灣控制器品牌的領航者，能將台灣的智慧製造技術推向國際舞台，實現媲美世界一流品質的願景。

（二）智慧化與實用性

1. **易於擴充：**提供完整系統 API，易與工廠管理系統或視覺等擴充功能整合。開放的資料擷取方式，可透過控制器從網路傳輸資料或是利用資料擷取模組透過通訊方式傳輸。另外，提供 APP 架構，便於第三方開發功能與使用者安裝移除功能 APP。
2. **應用彈性：**模組化軟體設計，終端用戶根據加工產品需求，啟用標配或選配軟體功能。針對人機畫面，根據不同情境需求，彈性開放給客戶自行調整。
3. **使用操作：**針對設定學習及監控的順序安排按鍵列，提高操作流暢性。採全平面設計，可選配觸控螢幕進行操作。

（三）綠色、節能與永續

1. 綠色環保 - Less is More：

新代科技的產品具備綠色環保的設計理念，透過新代控制器搭配伺服產品，無需外裝感測器，即可實現智慧斷刀檢測與智能撞機保護功能。我們專注於使用最精簡的設備，提供最先進的智慧機械解決方案，並達到節能減碳的目標。我們堅信「Less is More」， 不推銷不必要的配件，我們的使命是將最環保、最簡約的產品交付給客戶，才能創造出真正為客戶帶來價值的解決方案。

2. 節能減碳 - 預防性節能理念：

新代科技的智慧撞機保護功能，能夠做到預防加工過程中發生非預期性的撞擊。當系統判斷機台發生撞擊現象時，控制器在動程規劃時提早剎車，達到預防造成機構嚴重損傷之目的。此功能不僅能延長機構件的使用年限，更有效降低機構損傷，從而減少重複料件的採購，避免浪費。我們相信智慧機械的演進，不僅在生產效率提升上體現，更應該在友善環境中彰顯。

新代科技的智慧斷刀檢測功能，能精準偵測加工過程中刀具的斷裂，並立即停止機台運轉，有效避免不良品的產生。透過及時預警，能減少因產品瑕疵而造成的批量報廢，大幅降低材料浪費。此外，智慧斷刀檢測還能延長刀具使用壽命，減少更換頻率，進而降低生產成本。新代科技致力將「預防勝於治療」的理念融入生產流程，協助客戶從源頭把關品質，為客戶實現節能與增效雙贏的效果。

3. 永續生產 - 高效節能智慧自動化生產線：

新代科技 22PLUS 系列控制器設計，可搭配自動化手臂單元，建構高效節能的無人化生產線。機器人可長時間不間斷運作，取代人力進行上下料，大幅提升生產效率。相較於人工，機器人能確保每次裝夾的精準度，並能勝任高負載、高風險的工作環境。根據工研院《淨零碳排趨勢下，對成型機械業及供應鏈之影響及因應建議》報告指出，機器人的碳排量僅為人類的一半，且在「待機狀態」下的耗能約為 0.192 千瓦，相較於研究中的「人類工作」平均 0.5 千瓦，更有耗能效率上的優勢，有助於實現企業的節能減碳目標。透過自動化生產，企業不僅能降低成本，還能提升品質，並為環境做出貢獻。

（四）結構、精度與品質

新代致力於提高控制器的品質，所有產品均通過以下測試：

1. **電磁相容性（EMC）：**ESD（靜電放電耐受測試）、EFT（電性快速突波耐受測試）、Surge（雷擊耐受測試）等。
2. **環境驗證：**高溫乾熱測試、高溫高濕測試、低溫開機測試、低溫運作測試、高低溫循環測試、摔落測試、振動測試。

（五）市場可行性

1. 佈局與服務政策：

台灣地區：台灣地區共計有，經銷商 3 家，分公司兩家。提供客戶 24 小時內到客戶現場的服務保證。

中國地區：東南沿海各省均有新代經銷商或分公司，分公司加上經銷有 61 個據點，即便機台跨省銷售依然能得到新代完整的售後與支援服務，在有分公司的省份也提供 24 小時內派工出發的服務保證。

海外地區：陸續於東南亞、歐洲、美洲成立分公司，目前在九個國家擁有直營或經銷的服務據點，除積極拓展海外工控市場外，也提供台灣工具機客戶外銷後的技術與服務支援。

2. 預估新產品之拓銷潛力：

目標市場：兩岸智慧機械領域

新代 22 PLUS 系列特色為開放式的電控平台，能應用於附加價值較高的智慧機械領域，需要完整的智慧組件供應鏈與具研究開發能力的第三方支持，因此第一階段的目標鎖定在兩岸的智慧機械市場。

產品優勢：智慧組件的應用平台

一方面經由 APP 開發的推廣與機械組件之產官學研結盟，一方面結合台灣強大的電子與 IT 產業，全力促成智慧組件應用平台的建立，藉此與日系控制器產生差異化，凸顯台灣科技島與精密機械

產業鏈的優勢。

(六)審美性

1. 22 PLUS 系列硬體設計：

控制器採用全平面設計，配以高雅的灰黑色外框，外觀簡約而不失經典風格。此款設計不僅具有現代感，還帶有穩重、大方的工業美學質感。灰黑色的色調精心搭配，讓產品在多種應用環境下顯得格外和諧。

塑料部分經過精心設計，採用咬花工藝處理，不僅賦予了表面極佳的耐磨性，還有效防止刮傷、灰塵、污漬對外觀的影響。這種設計提升控制器的質感，使其堅固耐用，維護持久的美觀，強化了整體的高級感。

控制器上的 8 鍵按鍵編排遵循人體工學原則，排列均勻且符合自然操作習慣。此編排不僅在視覺上為井然有序的美感，還提供舒適、直覺的使用體驗。按鍵質感與控制器的典雅風格相得益彰，突顯了產品的精緻與專業性。

2. 單機智慧功能軟體設計：

畫面採用了黑底白字的主視覺設計風格，這種高對比的配色不僅在視覺上顯得簡潔大方，還能有效提升訊息的可讀性。透過明顯的色彩反差，使用者能夠快速辨識和理解畫面中的資訊，減少眼部疲勞，並確保即使長時間操作也能保持良好的視覺舒適感，體現了設計的直觀與清晰性。

按鍵的排列是根據智慧機械軟體的使用者流程精心設計，最大程度提升操作的友善性和簡易性。使用者在操作過程中能夠自然地依循流程進行操作，無需經過繁瑣的學習便能輕鬆上手。這種直觀的排列不僅簡化了複雜的操作步驟，還確保每個功能都能在需要時即時觸及，讓整體使用體驗更加流暢和高效。

DESCRIPTION IN ENGLISH:

(1)Innovation

Syntec systems offer flexible solutions for collision prevention and tool breakage monitoring, including both sensor-less and sensor-based options. By integrating with Syntec's servo products, we eliminate the need for external sensors to provide standard collision prevention and tool breakage monitoring. Additionally, we support multiple brands of accelerometers, such as Coretronic Corporation and G-Tech, for highly precise tool breakage monitoring of micro-tools (<3mm).

This technology marks a major breakthrough for the Taiwanese controller industry, positioning Syntec Technology at the forefront of innovation. By aligning with the latest specifications of international brands like Fanuc, Siemens, and Mitsubishi, Syntec has become the first Taiwanese company to offer sensor-less collision prevention and tool breakage monitoring as standard features, without the need for additional sensors. These advancements not only protect machinery and boost productivity but also reduce production costs, showcasing Taiwan's advanced manufacturing capabilities on the global stage and achieving world-class quality.

(2)Intelligence and Practicality

Easy Expansion: The system provides a comprehensive API for seamless integration with factory management systems or additional visual features. Its open data retrieval methods enable data transmission via the network through the controller or communication modules. Additionally, the app-based architecture supports third-party function development, allowing users to install or remove functional apps as needed.

Application Flexibility: The modular software design enables end users to activate standard or optional features based on product processing needs, while the human-machine interface can be flexibly adjusted to accommodate different situational requirements.

User Operation: The key sequences are arranged for setting, learning, and monitoring to enhance operational fluidity, while the full-flat design, with an optional touch screen, provides an intuitive user experience.

(3)Energy Saving Computation

Less is More:

Syntec Technology's products are designed with a green and eco-friendly mindset. By pairing new generation controllers with servo products, we've eliminated the need for external sensors to achieve Tool Breakage Monitor and Collision Prevention System. Our focus on minimal equipment provides cutting-edge smart machinery solutions that not only reduce costs for customers but also minimize hardware requirements, saving materials and energy. Embracing the philosophy of "Less is More," we avoid unnecessary accessories and are committed to delivering the most environmentally friendly and streamlined products to create solutions that truly add value.

Preventive Energy-Saving Concept:

1. Syntec's Collision Prevention System actively prevents unexpected collisions in machining by initiating early braking to protect machine components from damage. This approach extends part lifespan, reduces costly replacements, and minimizes waste. We believe smart machinery should contribute to a greener environment by reducing resource waste.
2. Syntec's Tool Breakage Monitor detects tool breakage during machining, stopping the machine immediately to prevent defects. This system

minimizes material waste, extends tool life, and lowers replacement costs. Syntec is committed to a “prevention is better than cure” approach in production processes, helping customers adopt preventive, energy-saving measures from the beginning.

3. Highly Efficient and Energy-Saving Smart Automated Production Line : Syntec's 22 PLUS series controllers are designed to be paired with robotic arm units, creating highly efficient and energy-saving production lines. Robots replace manual loading/unloading tasks, enhancing precision and productivity while handling high-risk environments. According to ITRI’s report, robots generate half the carbon emissions of humans and use only 0.192 kilowatts in idle mode, compared to 0.5 kilowatts for humans, underscoring their energy efficiency. Automated production with Syntec reduces costs, improves product quality, and supports sustainability goals.

(4)Structure, Precision and Quality

Syntec Technology is dedicated to enhancing the quality of its controllers, and all products undergo the following tests:

Electromagnetic Compatibility: Electrostatic Discharge Immunity Test, Electrical Fast Transient Immunity Test, Surge Tes, etc.

Environmental Verification: High-temperature dry heat testing, high-temperature and high-humidity testing, low-temperature startup testing, low-temperature operation testing, high-low temperature cycling tests, drop tests, and vibration tests.

(5)Market Feasibility

Global Market and Service Policy:

1. Taiwan Region: There are a total of three distributors and two branches in Taiwan, ensuring a service guarantee that provides customer on-site service within 24 hours.
2. Mainland China: There are Syntec distributors or branches in every province along the southeastern coast, totaling 61 locations when combining branches and distributors. Even when machines are sold across provinces, comprehensive after-sales and support services from Syntec Technology are available. Provinces with branches also offer a service guarantee with dispatch within 24 hours.
3. Overseas Regions: Syntec has branches in Southeast Asia, Europe, and the Americas, and having service points in 9 countries through direct operations or distributors. In addition to actively expanding the overseas industrial control market, support for technology and services is also provided to Taiwan's machine tool customers after export.

Estimated Sales Potential for New Products:

1. Target Market: Intelligent Machinery Field in China and Taiwan
2. The Syntec Technology 22 PLUS series features an open electric control platform suitable for the high- value-added intelligent machinery sector, requiring a complete supply chain of smart components and third-party support capable of research and development. Therefore, the initial goal is to focus on the intelligent machinery market in China and Taiwan.
3. Product Advantages: Application Platform for Smart Components. The promotion of APP development and collaboration among industry, government, and academia in mechanical components, combined with Taiwan's electronics and IT industries, will facilitate the establishment of an application platform for smart components. This aims to differentiate Taiwan from Japanese controllers while highlighting its strengths as a technology-driven nation.

(6)Aesthetics

22 PLUS Series Hardware Design:

1. The all-plane design and elegant gray-black finish create a simple yet classic look. This design improves the overall appearance, and provides a solid, reliable foundation for industrial applications.
2. The plastic parts are designed with a textured finish, ensuring durability and resistance to wear and tear. This design contributes to the controller's long-lasting performance and maintains its appearance over time.
3. The controller's eight buttons layout is designed for comfortable and easy use. With well-spaced, accessible buttons, it offers a smooth user experience that boosts productivity and reduces operator fatigue.

Machine Intelligence Software Design:

1. The interface features a black background with white text, creating a high-contrast design that is both visually appealing and easy to read. This thoughtful choice ensures clear communication, allowing users to quickly absorb on-screen information, reducing eye strain, and providing visual comfort even during extended use.
2. The software button layout is crafted to align with the user flow of intelligent machinery software, maximizing simplicity and ease of use. Users can intuitively follow the workflow and operate the system effortlessly, without extensive training. By minimizing the learning curve, this design enables users to navigate the system with confidence and efficiency.

威士頓精密工業股份有限公司
WEXTEN PRECISE INDUSTRIES CO., LTD.

地　　址：412024 台中市大里區國中路 495 巷 2 號
No. 2, Ln. 495, Guozhong Rd., Dali Dist., Taichung City 412024, Taiwan
電　　話：+886-4-2418-0799　　**傳　　真：**+886-4-2418-0699
網　　址：www.wexten.com.tw　　**E-mail：**service@wexten.com.tw

攤位號碼：R1307

主要產品類別：

工業用複合式冷卻系統

參賽作品名稱：

COIDA-24PTS 複合式恆溫冷卻系統
COIDA-24PTS COMPOSITE THERMOSTATIC COOLING SYSTEM

作品圖片：

作品開發背景：

市場需求與背景

全球對 ESG 的關注及科技發展加速，高精密加工、AI 設備與儲能系統對高效冷卻技術需求增加。然而，傳統冷卻系統無法同時處理多熱源，難以應對複雜場景，影響效率與穩定性。

傳統冷卻系統的限制

傳統冷卻系統面對多發熱源環境時表現乏力，尤其是在高精密加工行業，主軸、電控箱等多熱源的冷卻需求超出其處理範圍，難以應對複雜的應用，導致效率低下及設備異常。

創新的解決方案

此複合式恆溫冷卻系統，可同時冷卻主軸與電控箱熱源，透過精密冷卻迴路實現協同運行，滿足多場景需求。

技術優勢

- **複合設計：**協同冷卻主軸與電控箱，效果穩定。
- **熱交換媒調節：**第三管線精準控溫，確保穩定運行。
- **節能低碳：**減少能源浪費與碳排放，推進環保目標。

作品特點：

（一）創新性

1-1 複合式恆溫設計：採用單一冷凍迴路設計，主迴路負責冷卻主要熱源（如主軸液冷），副迴路冷卻次要負載（如電控箱空調）。此外，第三管線迴路精確調節熱交換媒溫度，確保系統在各種工況下穩定運行，並可將冷卻液體應用於液冷空調系統，實現高效與穩定的冷卻方案。

1-2 節能減碳：液冷空調系統的耗電量與碳排放僅為傳統定頻空調的 33%-35%，降低能源消耗和碳排放。

1-3 減少廠房熱負擔：系統設計有效降低冷凝熱風對廠房的影響，減輕中央空調的負荷，顯著提升整體能效並降低運營成本。

1-4 專利技術：本產品 2024/2 獲得台灣發明專利，在冷卻系統整合與效能提升方面具技術領先性，適用於多領域場景。

1-5 解決方案：系統整合多種冷卻需求於單一冷凍迴路，實現高效、節能的多重冷卻功能，提升空間與能源使用效率，展現強勁的市場競爭力與應用潛能。

（二）智慧化與實用性

2-1 智慧化監控與數據收集：配備 RS-485 介面，連接工具機實現數據監控與遠端操作，記錄溫度、開關機狀態及故障警報等，讓使用者快速排除異常，避免停機並提升生產穩定性與精度。

2-2 複合式恆溫冷卻系統：主副迴路溫度靈活調節，支援與工具機聯動，自動優化冷卻參數，有效提升冷卻效果，降低能耗並延長設備壽命。

（三）綠色、節能與永續

3-1 CO_2e 每年降低 46% 並節省用電成本：在 40°C 環境下、每日運行 12 小時、全年 365 天的條件下，複合式冷卻單元採用變頻技術，有效降低能耗與碳排放。

- 個別冷卻單元（定頻）：年耗電 12,626 度，碳排放 6.237 噸 CO_2e
- 複合式冷卻單元（變頻 + 液冷）：年耗電 5,826 度，碳排放 2.878 噸 CO_2e 相比之下，複合式冷卻單元每年減少碳排放 46%（約 3.36 噸 CO_2e），並顯著降低用電成本。

3-2 冷媒填充量減少，降低 5.43% 溫室氣體排放量：透過優化冷媒選擇與填充量，複合式冷卻單元 進一步降低溫室氣體排放。

- 個別冷卻單元（R-407C + R-134a）：年排放 3.8169 噸 CO2e
- 複合式冷卻單元（R-410A）：年排放 3.6096 噸 CO2e

冷媒排放量減少 5.43%，有助於降低環境影響。（依據 IPCC 2021 第六次評估報告 GWP 值計算）

（四）結構、精度與品質

4-1 高環溫測試：本產品在 40℃ ～ 50℃ 環境下經過全面測試，驗證了高溫環境中的冷卻能力、恆溫精度、散熱效益及保護機制，確保穩定性。

4-2 高精度：主迴路溫控精度達 ±0.2℃ ～ 1.5℃，液冷空調系統溫控精度為 ±1.0℃ ～ 2.0℃，適用於高精度需求的冷卻場景，有效提升系統運行效率。

4-3 結構與穩定性：結構充分考慮冷卻系統的流體動力學與熱交換效率。關鍵元件均經嚴格選材與測試，確保高負載運行下的長期穩定性與高效能。

4-4 符合 CE 設計：設計符合 CE 規範（EN 60204-1:2018），確保產品在市場的合規性、安全性及可靠性。

4-5 品質保證：ISO 9001：2015 品質管理體系進行管控，設計到出廠的每個環節均經過嚴格檢控，確保產品穩定性、耐用性及品質。

（五）市場可行性

市場需求與策略

台灣市場：

台灣對冷卻系統需求隨工具機、半導體設備和數據中心需求增長而增加。複合式恆溫冷卻系統能提高加工精度、降低能耗及環境污染，符合市場需求。2020 年台灣工具機全球占 13.8%，預估 2026 年市場規模可達 105.96 億至 158.94 億美元，計劃與工具機及設備製造商合作，整合產品並提供技術服務。

國際市場：

- **北美：**美國與墨西哥對高精度冷卻技術需求強烈，與當地代理商合作並參加國際展會。
- **亞太：**中國儲能市場快速成長，複合冷卻技術可提升電池性能；泰國和印度製造業發展迅速，對工具機與冷卻需求增長，通過當地合作夥伴推廣。

（六）審美性

本產品配備液晶螢幕與直覺式圖形介面，快速判讀異常，簡化操作並降低停機時間。外觀採白灰烤漆設計，結合板金工藝與象徵熱忱的美學元素，提升辨識度與品牌價值。

DESCRIPTION IN ENGLISH:

(1)Innovation

1-1 Composite Constant-Temp. Design: A single refrigeration circuit cools the main shaft via the main circuit and the control box via the secondary circuit. A third pipeline regulates heat exchanger temperature, ensuring stable operation and supporting liquid-cooled air conditioning for efficient cooling.

1-2 Energy Efficiency and Carbon Reduction: Liquid-cooled air systems use 33%-35% less energy and emit less carbon than traditional constant-frequency air conditioners.

1-3 Reduction of Facility Heat Load: System design effectively reduces impact of condensing hot air on the factory, lightens the load on the central air conditioning system, significantly improves overall energy efficiency, and lowers operational costs.

1-4 Patented Technology and Carbon Emission Reduction: Patented in Taiwan (2024/2), the product excels in cooling integration and efficiency, fitting diverse applications.

1-5 Innovative Solutions: The system uses a single refrigeration loop for efficient, energy-saving cooling, maximizing space and energy use with strong market potential.

(2)Intelligence and Practicality

2-1 Smart Monitoring and Data Collection: With an RS-485 interface, it enables real-time monitoring, remote control, and quick issue resolution, improving stability and accuracy.

2-2 Composite Constant-Temperature Cooling System: The main and auxiliary circuits adjust temperatures flexibly, optimizing cooling, saving energy, and extending equipment lifespan.

(3)Energy Saving Computation

3-1 46% Reduction in Annual CO_2e Emissions and Significant Savings in Electricity Costs

Under conditions of 40°C ambient temperature, 12 hours of daily operation, and 365 days per year, the hybrid cooling unit utilizes inverter technology to effectively reduce energy consumption and carbon emissions.

- Standalone cooling unit (fixed-speed): Annual power consumption 12,626 kWh, carbon emissions 6.237 tons CO_2e
- Hybrid cooling unit (inverter + liquid cooling): Annual power consumption 5,826 kWh, carbon emissions 2.878 tons CO2e

In comparison, the hybrid cooling unit reduces carbon emissions by 46% annually (approximately 3.36 tons CO2e) while significantly lowering electricity costs.

3-2 Reduced Refrigerant Charge, Lowering Greenhouse Gas Emissions by 5.43%

By optimizing refrigerant selection and charge levels, the hybrid cooling unit further reduces greenhouse gas emissions.

- Standalone cooling unit (R-407C + R-134a): Annual emissions 3.8169 tons CO2e
- Hybrid cooling unit (R-410A): Annual emissions 3.6096 tons CO2e

This results in a 5.43% reduction in refrigerant-related emissions, contributing to environmental sustainability.

(Based on GWP values from the IPCC Sixth Assessment Report, 2021.)

(4)Structure, Precision and Quality

4-1 High-Temp. Environment Testing: Tested at 40°C to 50°C , the product ensures cooling efficiency, temperature accuracy, heat dissipation, and stability in high temperatures.

4-2 High-Precision: Main circuit achieves ±0.2°C to 1.5°C accuracy, and liquid-cooled air systems ±1.0°C to 2.0°C, ideal for high-precision cooling and efficiency.

4-3 Structural Design and Stability: The structure optimizes fluid dynamics and heat exchange, with rigorously tested components ensuring stability and performance under high loads.

4-4 CE-Compliant Design: Designed to CE standards (EN 60204-1:2018) for compliance, safety, and reliability.

4-5 Quality Assurance: ISO 9001:2015 ensures rigorous quality control, guaranteeing stability, durability, and quality from design to release.

(5)Market Feasibility

Market Demand and Strategies:

Taiwan Market: Taiwan's demand for cooling systems grows with tooling, semiconductor, and data center expansion. Composite cooling systems boost accuracy, cut energy use, and reduce pollution. Taiwan's machine tool market held 13.8% globally in 2020, projected at $105.96–$158.94 billion by 2026. Plans include collaborating with manufacturers to integrate products and offer technical services.

International market:

- **North America:** High demand for precision cooling in the U.S. and Mexico, supported by local agents and international exhibitions.
- **Asia-Pacific:** China's energy storage growth boosts battery cooling needs; Thailand and India's thriving manufacturing sectors drive tooling and cooling demand via local partners.

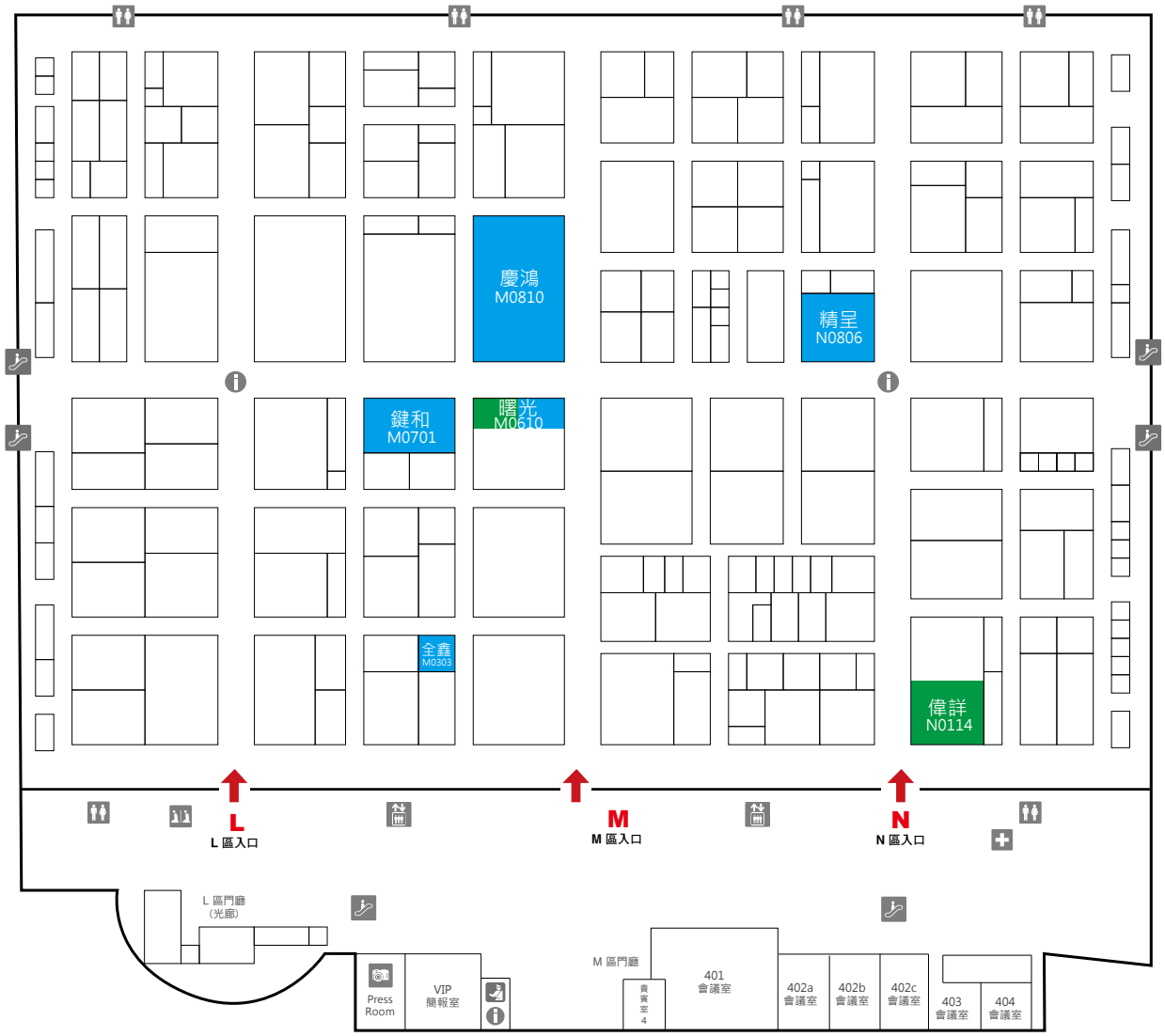
(6)Aesthetics

The product has an intuitive LCD interface for quick issue detection and a white-gray design with aesthetic elements, boosting recognition and brand value.

南港展覽1館
1樓展場平面圖

- 綜合加工機及其加工單元類 Machining Center and Manufacturing Cell
- CNC 車床及其加工單元類 CNC Lathe and Manufacturing Cell
- 其他數控工具機及其加工單元類 Other CNC Machine Tool and Manufacturing Cell
- 數值控制工具機關鍵零組件類 Components for CNC Machine Tools and Other NC Machine Tools

南港展覽1館
4樓展場平面圖



綜合加工機及其加工單元類 Machining Center and Manufacturing Cell

其他數控工具機及其加工單元類 Other CNC Machine Tool and Manufacturing Cell

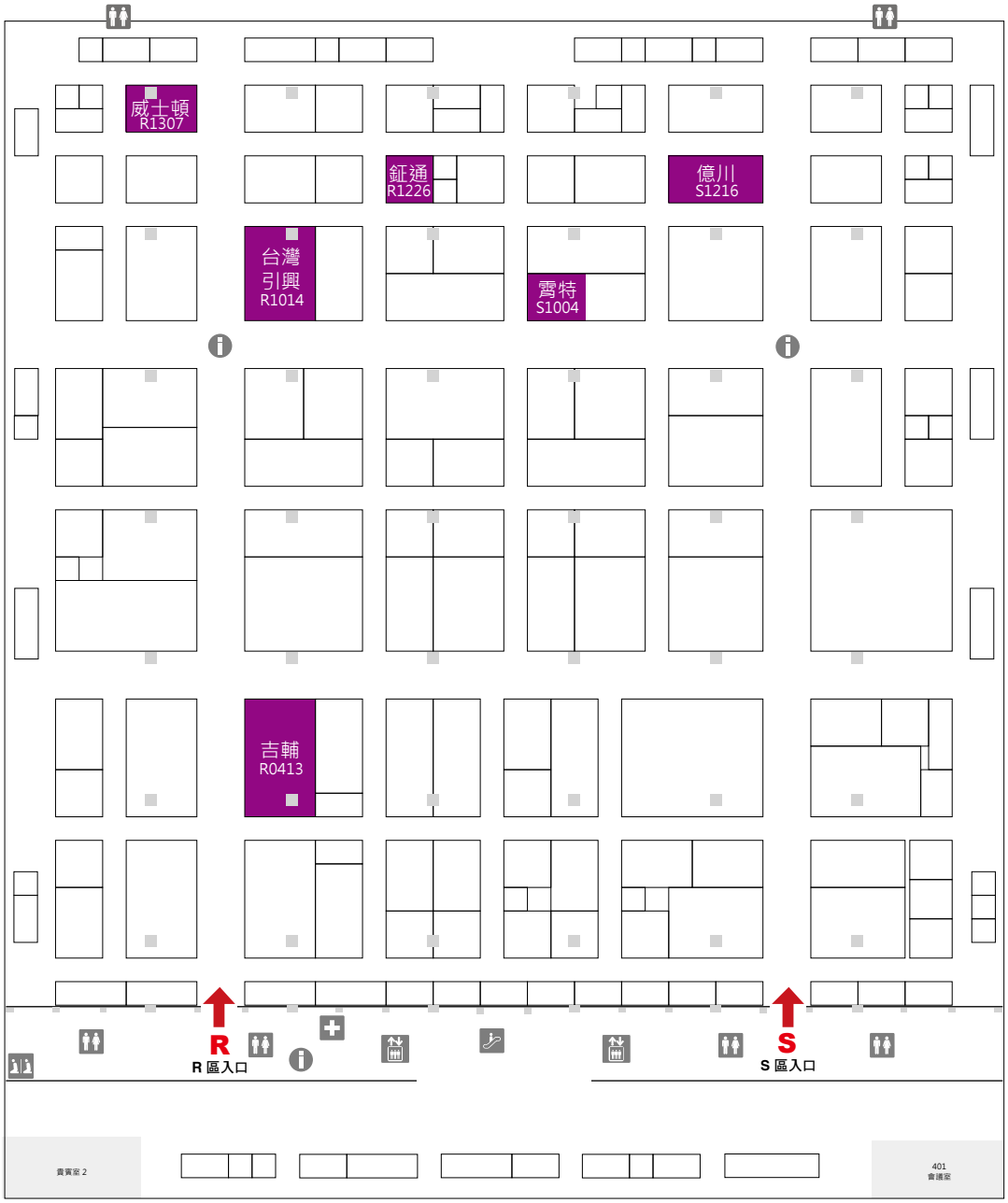
南港展覽2館
1樓展場平面圖

CNC 車床及其加工單元類 CNC Lathe and Manufacturing Cell

其他數控工具機及其加工單元類 Other CNC Machine Tool and Manufacturing Cell

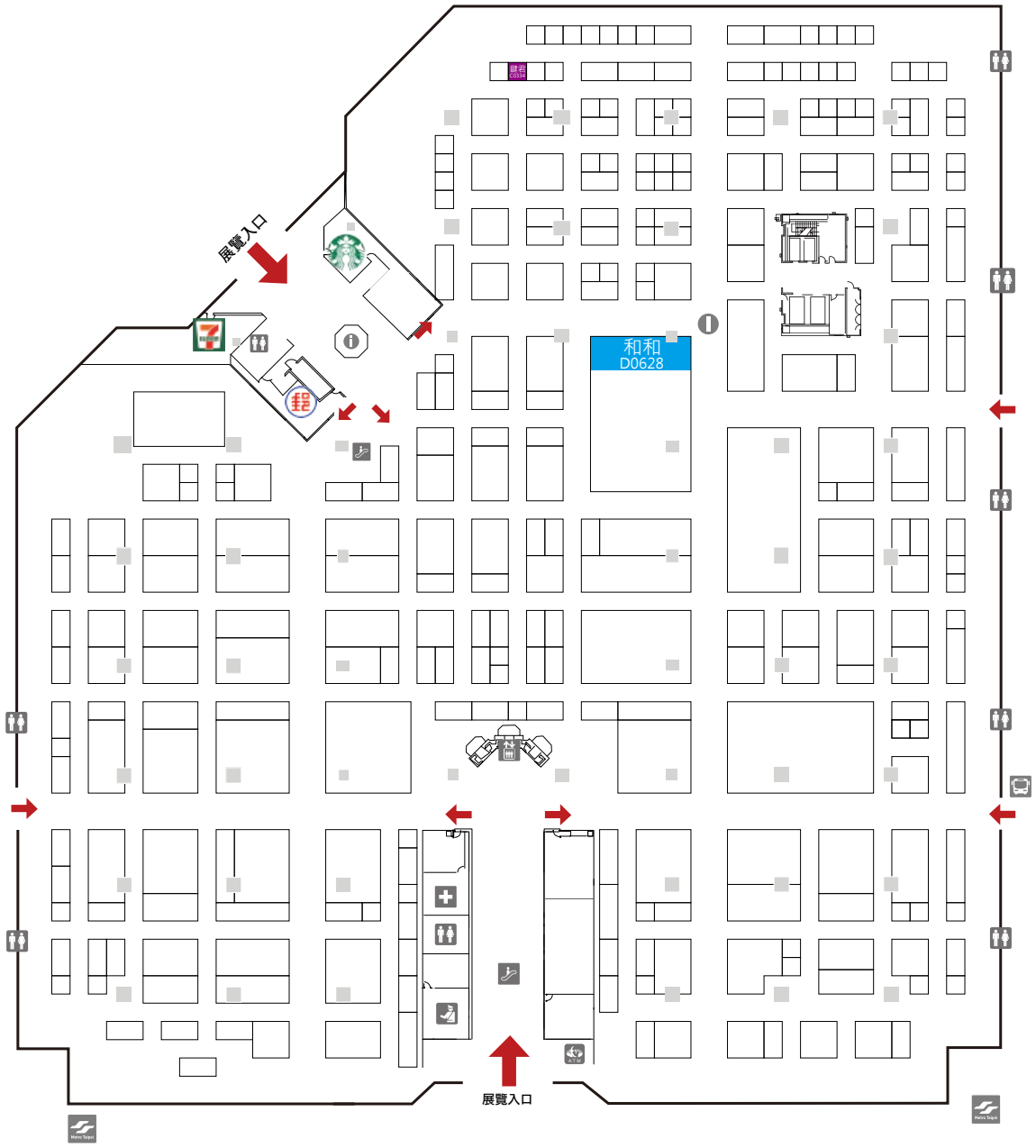
數值控制工具機關鍵零組件類 Components for CNC Machine Tools and Other NC Machine Tools

南港展覽2館
4樓展場平面圖



數值控制工具機關鍵零組件類 Components for CNC Machine Tools and Other NC Machine Tools

台北世貿1館
1樓展場平面圖



信義路五段

其他數控工具機及其加工單元類 Other CNC Machine Tool and Manufacturing Cell

Memo