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市場成功的營運模式很多，有人靠掌握通路取得市場領先的優勢，有人靠精湛的技術研發團隊，取得市場第一頭銜，但也有人靠量產製造，囊括市場獨占鰲頭。舉凡這些方式，在不同產業都有其可成功的機會。環顧現今整個製造產業，不難找到為數不少領導市場的優秀公司，都是同時具備兩個以上的成功特質。

恩德身為精密設備專業的製造者，一向自許技術領先為核心競爭力，但在面對今日更嚴峻的競爭環境，需要創造更多的成功特質，以維繫恩德在市場洪流的競爭力，這是公司管理階層乃至於所有同仁應有的共識。今年恩德在精密機械市場有機會再發展成更完整的通路，新的通路將遍及整個中國大陸、亞洲、歐洲和整個美洲市場；換言之，恩德在市場的拓展，將因此取得更多的優勢。另外在電子機械市場，為因應此產業的管理效能要求，將考量提升整個研、產、銷的整合性為主軸，並以品質優勢和高效能管理來拓展市場版圖。

There are numerous successful operational models in the market: some enterprises become market leaders by controlling the channels, while others climb to the top with skilled technical ability in research and development. Some win the market by mastering mass production. All the aforementioned strategies have the opportunity to succeed in various industries. In the manufacturing industry today, it is easy to find excellent market-leading firms which have more than two of the aforementioned characteristics for success.

As a professional manufacturer of precision equipment, Anderson thrives on technological leadership as its core competitiveness. Facing an increasingly competitive market environment, we have to create more successful characteristics to maintain the competitive power of Anderson in the market. It is the consensus at the managerial level and all colleagues in the company. This year, Anderson has the opportunity to develop more complete channels in the precision machinery market. The new channels extend all over the mainland China market, Asia market, Europe market and the Americas market. In other words, Anderson will gain more advantages in market development. In the electronic machinery market, the integration of research, production and sales is considered as required for achieving competitive advantage. Quality advantages and highly efficient management are drivers for increasing market share.

總經理 王元男
General manager
Jason Wang

CNC 方形榫孔機

•文 / 鍾善珍

CNC Square Mortising Machine

—By Jung Shan Jen

現今市場為求速成，皆大量使用鐵釘、釘片或者角鐵接合木材，其優點就是方便快速，但缺點是破壞木材本身的紋理影響美觀。而單價較高的家具市場中，有一部份的消費者為求美觀、整體性，會選擇如圖一所示設計簡約且不使用五金材料固定的實木家具。此種方式即使用榫頭及榫孔互相接合，而圖二所示的方榫又是特別能夠凸顯手工質感的榫接方式。因為方榫較容易手工加工，且強度較好，是手工製作中最常見的榫接方式。

Introduction

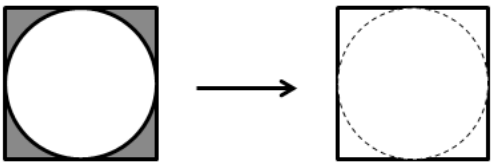
In the current market, a large quantity of iron nails, picker points and angle iron are used for wood joining. The advantage of these parts is that they make the joining process convenient and fast. Meanwhile, their disadvantage is that it damages the texture as well as the appearance of the lumber. In the high-end furniture market, customers who value beauty and integrity will choose solid wood furniture, which employs simple design and uses no hardware materials in its assembly, as shown in Fig.1. By this method, the tenon and the mortise are connected to each other. The mortise-and-tenon jointing method shown in Fig.2 specially highlights the handcrafted texture of the furniture. As this jointing method is easy for finishing by hand and provides good strength, it is the most commonly used mortise jointing method in hand-made manufacturing.

< 圖一：方榫接合的家具〔1〕
Fig.1 Furniture with mortise jointing [1]

> 圖二：方形榫頭與榫孔對接〔2〕
Fig.2: Jointing the square tenon and mortise hole [2]

方形榫孔的做法

因爲刀具形狀的限制，一般加工機無法製作方形榫孔，若以主軸銑削僅能切削出邊緣爲圓弧狀的榫孔。目前最常見的方形榫孔加工方式如圖三、四所示。以方孔鑽頭鑽削出正方形的榫孔，其原理是先以鑽頭移除中心大部分的材料，緊接著再以鑽頭前端的刀刃刨除四個角落的材料，再重疊數個即可得到長形的榫孔。此方式的缺點是加工速度較慢。另一種爲鑿刀往復鑿削的加工方式，其原理如圖五所示，經由往復的機構使得刀刃前端以橢圓型的路徑對材料進行鑿削，速度快、榫孔尺寸精確是其優點。恩德開發的方形榫孔機 MorTek 即整合了前述兩種加工模式，可同時滿足正方形及長方形榫孔的需求。



圖三：正方形榫孔加工示意圖
Fig.3 Square mortise hole processing diagram

How to make the square mortise holes

Due to the restriction of tool shapes, the general processing machines cannot make square mortise holes. Mortise holes with arc-shaped edges can only be cut by spindle milling operation. Currently, the most commonly used method to process square mortise holes is shown in Fig.3 and Fig.4. Mortise holes are created with a square drill. The principle is to remove most of the material in the center with a drill before removing the material at the four corners with the cutting edge on the front of the drill. A rectangular mortise hole is created by overlapping several square mortise holes. The disadvantage of this method is that the processing speed is very slow. Another processing method is chisel reciprocating cutting as shown in Fig.5. The reciprocating mechanism allows the front of the tool to cut the material in an elliptical path. The advantages are that it is fast and that the dimensions of the mortise hole are precise. The square mortising machine MorTek developed by Anderson integrates the above mentioned processing methods and, at the same time, meets the requirements for square and rectangle mortise holes.

CNC 方形榫孔機 MorTek

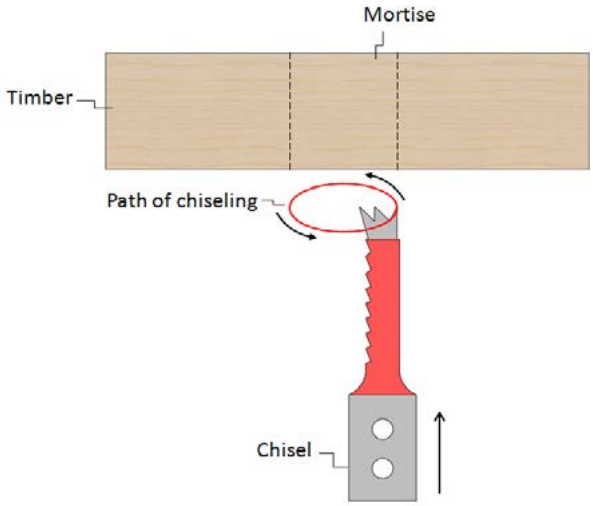
恩德開發之 CNC 方形榫孔機爲頭組移動式，此種型式可有效地使用機器行程且體積較小。並且整合了自動化的生產模式，搭配了拖料的夾爪。機器的配置如圖六所示，操作者從上料區推入材料進到工作區，壓持氣缸組會自動將材料推抵在承靠面上將材料固定，然後進行鑿孔加工。在工作區加工完成後，拖料夾爪會將材料拖離加工區，此時加工區淨空即可快速地進行下一個循環的工作。

加工頭組如圖七、八所示爲鑿刀模組及方孔鑽模組的組合。可使用鑿刀鑿削出長方形的榫眼，方形榫眼即使用方孔鑽，完成的特徵如圖九所示。目前機構的設定，鑿刀單次可加工的榫孔爲 40 mm(W) x8 mm(H)。如圖十的示意圖，若有其他尺寸特徵的需求時則可重疊數次以達到設定的榫孔尺寸，方孔鑽亦同。如此即可符合客戶更多樣化的使用範圍。

圖四：重疊數個正方形孔形成一個長方形的榫孔〔3〕
Fig.4 Overlapping several square holes to make a rectangle mortise hole [3]

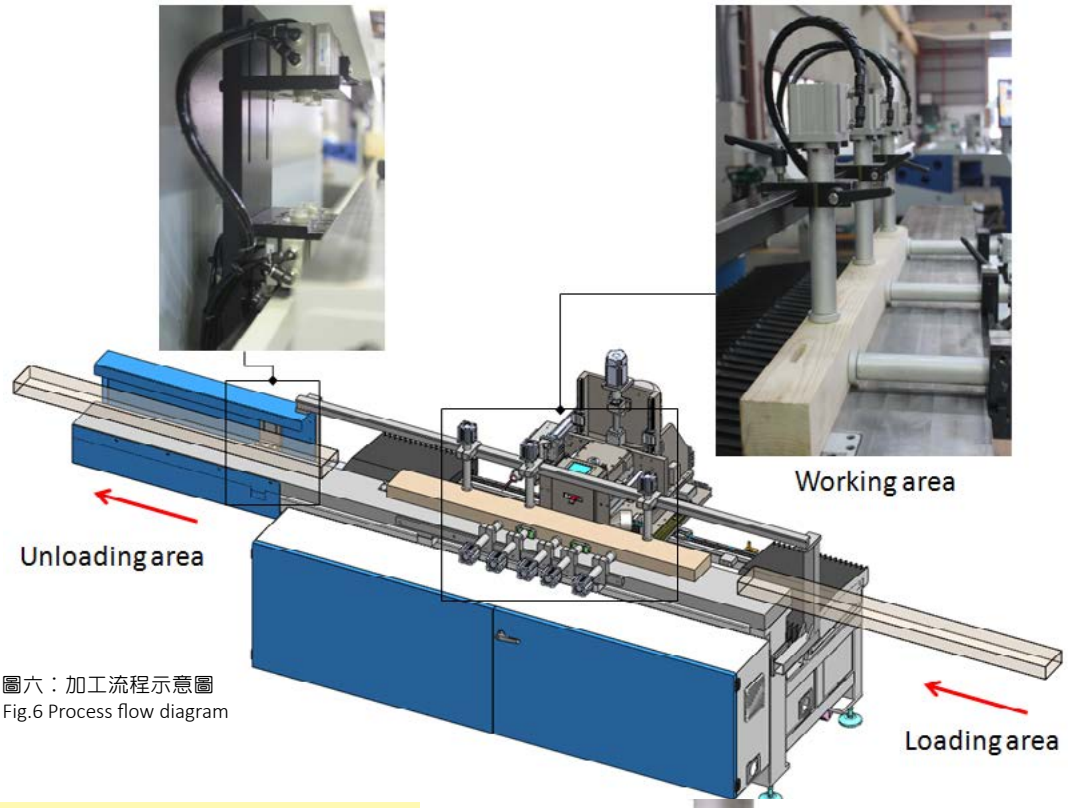
CNC square mortising machine MorTek

The CNC square mortising machine features a movable head. A machine of this type can effectively utilize the machine stroke, and it is small in size. Moreover, it integrates an automatic production mode and is equipped with clamping jaws for pulling materials. The configuration of the machine is shown in Fig.6. The operator pulls the materials from the loading area to the working area. The cylinder pressure group will automatically pull and fix the materials on the supporting surface for drilling processing. After being processed on the working area, the materials are pulled off of the working area with the clamping jaws. At this moment, the working area is cleared, ready for the work in the next cycle.



圖五：鑿刀往復鑿削路徑
Fig.5 Chisel reciprocating cutting path

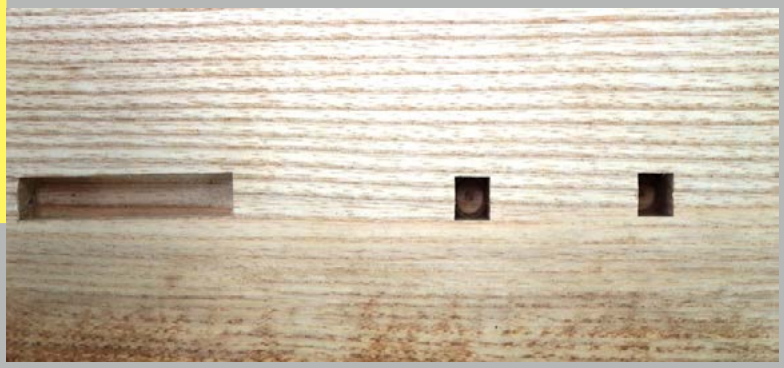
The processing head group is the combination of the chisel module and square drill module as shown in Fig.7 and Fig.8. Rectangle mortises can be cut with a chisel, and square mortises can be cut with a square drill. The characteristics of the finished mortises are shown in Fig. 9. In accordance with the current setting of the machine, the dimensions of a mortise made by single chisel processing are 40mm (W) x 8mm(H). As shown in Fig.10, overlap several times to reach the desired mortise dimensions if other dimensions are required. The same applies for the square drills. This satisfies users with more diversified usable ranges.



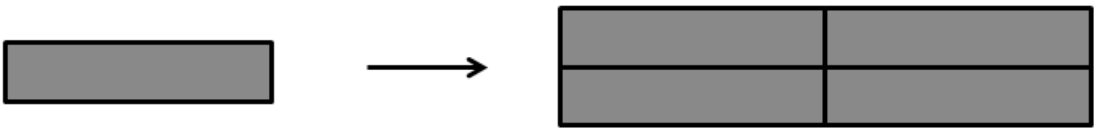
圖六：加工流程示意圖
Fig.6 Process flow diagram

> 圖七：鑿刀模組
Fig. 7: Chisel module

圖八：方孔鑽模組
Fig.8: Square drill module



圖九：方形榫眼
Fig. 9: Square mortise



圖十：重疊四個榫孔以加大特徵的尺寸
Fig.10: Overlap four mortise to enlarge to special dimensions

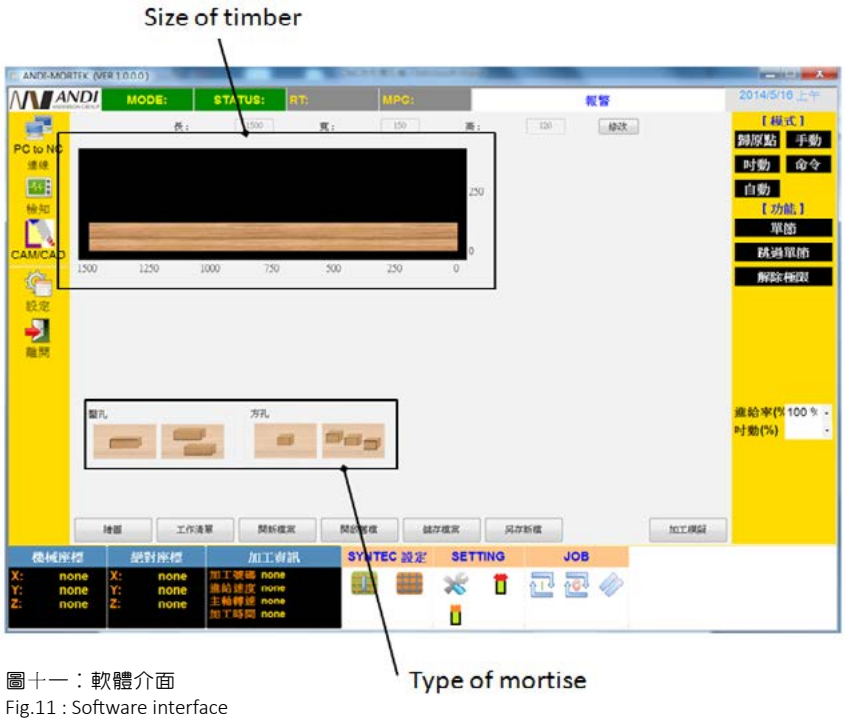
恩德除了硬體方面，亦開發一套此榫孔機專用的軟體。此軟體具備直覺式的視窗，加工選項亦以圖示區分，人性化的軟體介面讓操作者能夠快速地學習。操作上，主要的輸入步驟有三個：1. 輸入材料尺寸；2. 選擇特徵的形式；3. 輸入特徵的尺寸、間距。軟體操作介面如圖十一所示，材料尺寸輸入後可先預覽，然後再依需求選擇鑿刀或方孔鑽加工以及輸入陣列的個數。排列形式選擇後，如圖十二所示，即可列出預先設定的資料欄，輸入完成後會依設定的值在上方欄顯示出圖形，讓使用者可先確認孔位是否正確。輸入確認後即可進行加工，當特徵位置超過機械行程時，經由程式的計算後，拖料夾爪會做一次拖料移動材料到可加工的位置進行加工。

流程上，開始加工到完成並移送材料到下料區完全自動化，操作者不需要裝卸夾具，僅需要在下料區將材料取走即完成整個加工循環。

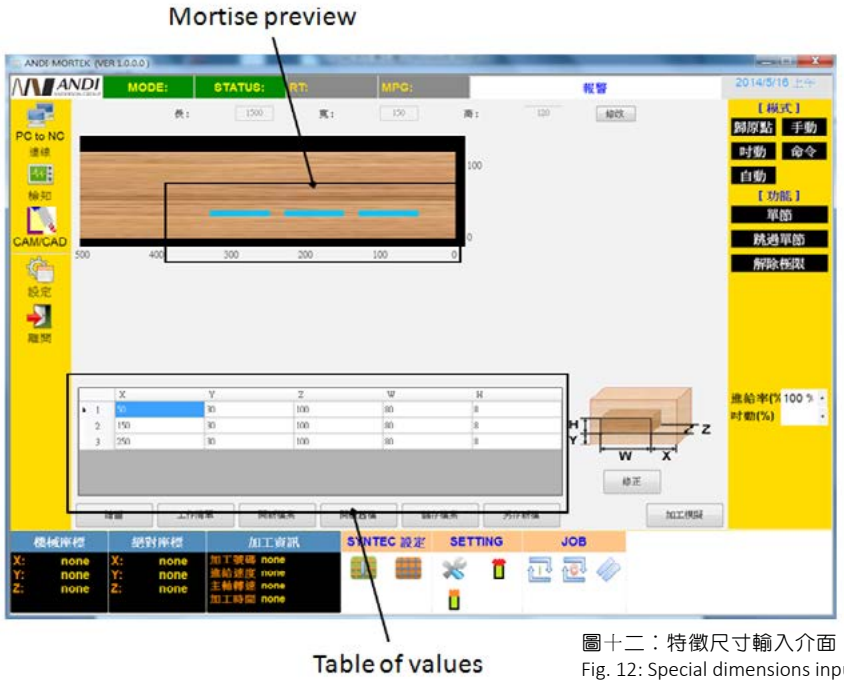
In addition to hardware, Anderson has also developed specialized software for this mortising machine. This software has an intuitive window and the processing options are graphically distinguished. The intuitive software interface enables operators to quickly learn the system.

In terms of operation, there are three main input steps: 1. Input material dimensions; 2 select characteristics; and 3. Input characteristic dimensions and separation distance. The software interface is shown in Fig. 11. Firstly, preview results after inputting material dimensions. Then select the chisel or square drill as required for processing and the number of arrays. After selecting the mortise spread pattern, as shown in Fig.12, the preset data field is listed. Images are displayed according to the user-inputted values. Processing can be started after confirming inputs. When the position of a characteristic is aligned with the stroke of the machine, the clamping jaw pulls material for processing.

In terms of flow, full automation is enabled from the beginning to the end of the processing until the transmission of materials to the cutting area. The operators do not need to assemble and disassemble the fixtures. All they need to do is to remove materials. This completes the whole processing cycle.



圖十一：軟體介面
Fig.11 : Software interface



圖十二：特徵尺寸輸入介面
Fig. 12: Special dimensions input interface

結論

此方形榫孔機的加工頭組亦可以加裝鏤銑模組增加其應用範圍，如此除了方形的榫孔，客戶若有其他型式榫孔的需求，此機器也能夠滿足。另外，減少加工程序及人力需求，可以因應人事成本不斷升高的趨勢。此方形榫孔機可規畫成自動上下料的加工流程，且人性化的操作介面亦能夠縮短使用者的學習時間。總而言之，此設備正如同恩德所秉持的理念，提供有品質、精度，也能夠同時符合市場價位的優異產品。

Conclusion

A routing module can also be added to the processing head group of this square mortising machine to enlarge its application range. Thus, this machine can also meet the requirements for other types of mortise holes except for square mortise holes. Besides, it also reduces the processing procedures and manpower requirement, effectively responding to the increasingly rising trend in personnel cost. This square mortising machine can be set as part of the process flow in the automatic loading and unloading of materials. Moreover, the intuitive operation interface can shorten the user's learning process. In conclusion, this machine, produced according to the philosophy of Anderson, produces superior results with high quality and precision, while making products competitive at the market price.

[1] Dezeen magazine, http://www.dezeen.com/
[2] J Black Design, http://www.jblackdesign.com/
[3] American woodworker, http://www.americanwoodworker.com/default.aspx

DI 技術在 PCB 的運用

Application of DI Technology in PCB

— By Fang Six un /Chen Yong yu/ Liu Zhi xi

文・方思巽／陳永裕／劉致奚

前言 Introduction

印刷電路板（Printed Circuit Board 簡稱 PCB）是依電路設計，將連接電路零件的電氣佈線滙製成佈線圖形，然後再以設計所指定的機械加工，表面處理等方式，在絕緣體上使電氣導體重現所構成的電路板而言；換言之，印刷電路板是搭配電子零件之前的基板。該類產品的作用是將各項電子零件以電路板所形成的電子電路，發揮各項電子零組件的功能，以達到信號處理的目的。由於印刷電路板設計品質的良莠，不但直接影響電子產品的可靠度，亦可左右系統產品整體的性能及競爭力。

Printed circuit board (hereinafter referred to as PCB) is the circuit board formed by electrical conductor recurrence on the insulator by means of machinery processing and surface treatment specified in the design, in which the electrical wiring of the circuit components are connected to form the wiring diagram. In other words, the PCB is the baseplate on which electronic components are collocated. The function of these products is signal treatment, enabling the various electronic components to perform their respective functions. The difference in design quality of PCBs not only directly influences the reliability of electronic products but also affects the whole performance and competitiveness of the system products.

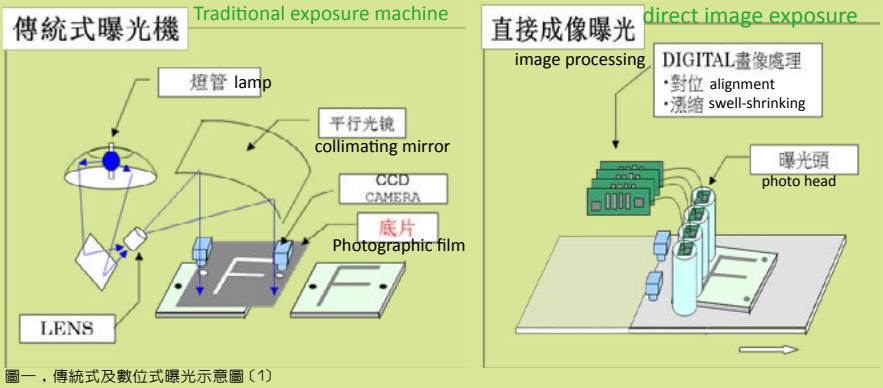
何謂直接成像曝光
What is direct image exposure? (Direct Image, DI)

隨著電子設備越來越複雜，需要的零件越來越多，且越輕薄短小，PCB 上頭的線路與零件也越來越密集。所以在 PCB 板上導線與導線間的線寬及線徑也就越來越小，而印刷電路板 (PCB) 朝向高密度連接 HDI 板，多層板等趨勢對於 PCB 電路線寬及對位精度要求愈來愈高，因此有鑑於電子產品生命週期循環快及有些產品需要小量多樣化，甚至於要客製化時，傳統的光罩 (Mask) 曝光微影製程 (Lithography) 面臨生產技術瓶頸，已不符合目前製程的要求，為了解決良率與產出率 (Throughput) 的問題，新興的「無光罩」微影技術，愈來愈受到 PCB 產業的重視，所以直接成像曝光 (DI) 技術的發展，已衍然形成一股新趨勢。

As electronic equipment is becoming more complicated, components are becoming lighter and smaller. The lines and parts on the PCB are becoming increasingly concentrated. Line widths and diameters between the wires on PCB board are smaller. As the PCB faces competition with high-density interconnection (HDI) boards and multi-layer boards, there are higher requirements for the line width of the PCB circuit and the alignment accuracy. Since the life cycle of electronic products are fast, and these products are diversified and small in quantity, traditional mask exposure lithography is faced with production technology bottleneck in customized production. Moreover, it does not meet the requirements for current production processes. In order to solve the problems of pass yield and throughput, the newly emerging maskless lithography is generating more attention from PCB industry. Therefore, the development of direct image exposure technology has formed a new trend.

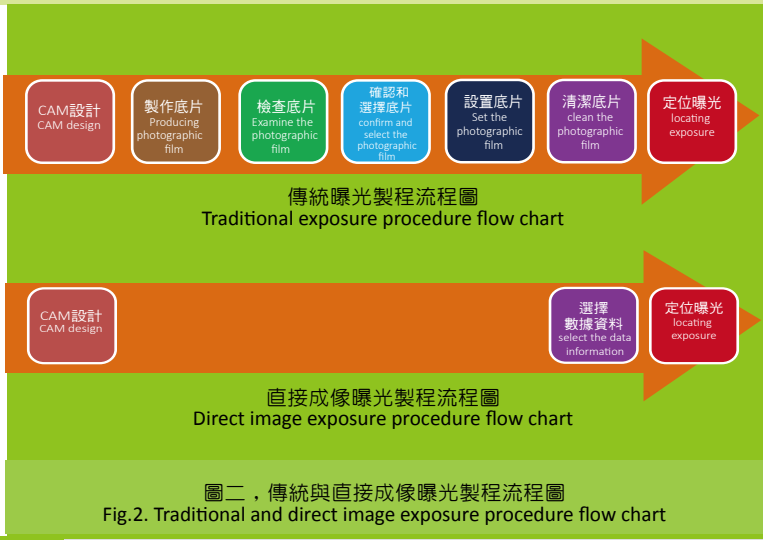
所謂 Direct image Exposure，是泛指在 PCB 曝光製程中，無須使用光罩 (MASK) 下，利用 CCD 影像對位及軟體加工程式直接進行曝光動作。可避免傳統曝光製程中底片有脹縮，定位精度不良的問題，且板子越大誤差越大，能大幅減少開發成本並加快推入新市場的時間差，使用上也更具彈性。針對研究開發，試作及小量生產外，具備高精準度對位及載台移動。可對應的材料廣泛外，亦可設定其對應焦距深度，並針對客戶需求提供客製化服務。PCB 產業及觸控面板產業發展到現今，用途愈來愈廣，電子產品因中央處理器的運算能力增強，附加功能愈來愈多，使得未來的電路板市場無光罩直接成像曝光機，將逐漸取代傳統接觸式底片光罩式曝光機，成為 PCB 及觸控面板業界的關鍵生產設備。如圖一所示：

Direct image exposure is a PCB exposure process taking advantage of CCD image alignment and software, using no mask. It avoids the problem of swell-shrinking on the photographic film in the traditional exposure procedure and the problem of poor positioning accuracy. The larger the board is, the greater the error will be. Direct image exposure greatly reduces the development cost



圖一，傳統式及數位式曝光示意圖〔1〕
Fig.1 Traditional and digital exposure schematic diagram [1]

and accelerates the product go-to-market process. Moreover, it is more flexible in use. Except for the research and development, trial run and short run production, it delivers high accuracy alignment and worktable movement ability. In addition to a diverse set of corresponding materials, the corresponding focal depth can also be manually set. Besides, it provides customized service according to the requirements of the customers. With the development of the PCB industry and the touch panel industry, its application is becoming wider. As the operational ability of the central processing unit increases, additional functions of electronic products are increasing. As a result, the mask-less direct image exposure machine in the circuit board market will gradually replace traditional exposure machines. It will become a key piece of production equipment in the PCB and contact control panel industries, as shown in Fig. 1.



圖二，傳統與直接成像曝光製程流程圖
Fig.2. Traditional and direct image exposure procedure flow chart

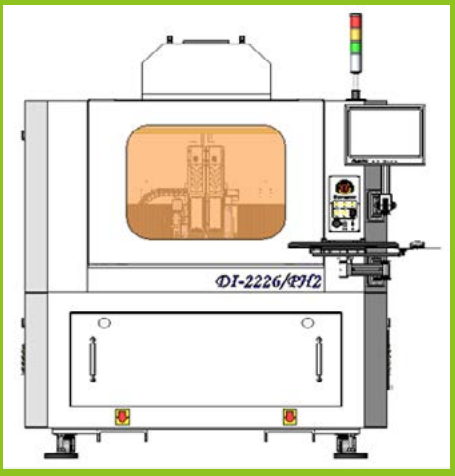
傳統曝光和直接成像曝光製程比較
Comparison between traditional exposure and direct image exposure procedures

如圖二所示，傳統曝光製程，除了加工軟體的 CAM 設計外，還需要製作底片（光罩）使圖像在光阻上成像，但曝光製程中還必需要經由檢查底片，確認及選擇底片，然後設置底片及清潔底片等過程，才能進行對位曝光。而直接成像曝光，因爲是無需使用光罩（底片），只需要選擇相對應板子的曝光參數及加工程式，即可進行對位曝光。因此直接成像曝光大大降低人力的需求及簡化生產製程，縮短準備工作時間，減少因粉塵所引起的斷線問題，也因爲無需使用光罩而大幅減少開發成本，提高生產效率及品質。

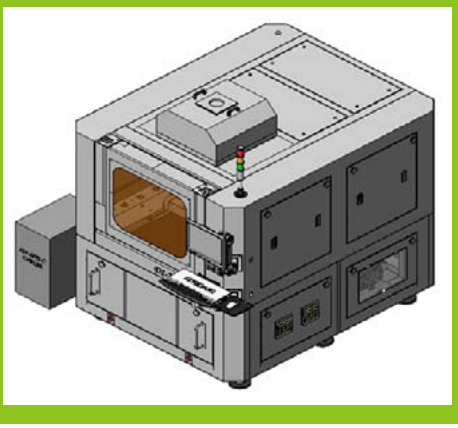
As shown in Fig.2, the traditional exposure procedure also requires for producing photographic film (mask) to form the image on the photoresist (except for the CAM design of the processing software). The exposure procedure also includes several procedures such as photographic film examination, confirmation and selection, as well as photographic film setting and cleaning. It is only after finishing these procedures that alignment and exposure can be done. However, as direct image exposure uses no mask (photographic film), alignment and exposure can be done by selecting the exposure parameters and the processing program of the corresponding board. Therefore, direct image exposure greatly reduces the need for human input and simplifies the production procedure. It shortens preparation time and mitigates the broken line problem. As it uses no mask, the development cost is also greatly reduced, and production efficiency and quality are improved.

DI 機台功能規格要求
Functional specifications and requirements

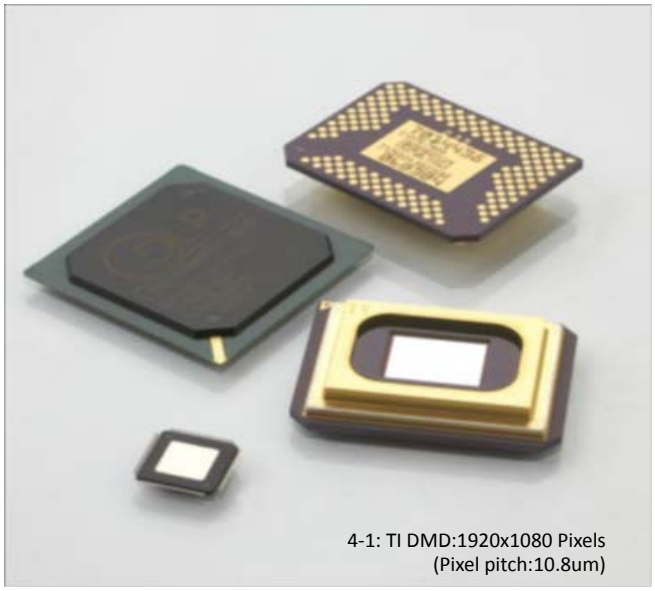
目前恩德開發的直接成像（DI）曝光機設備屬第一代產品（如圖三所示），雛型機已開發完成，許多的功能規格，都陸續測試修改及建構中，未來還會針對客戶製程需求，開發多頭組新功能及搭配整合性的上下料系統 (Roll to roll, Sheet to sheet)，此設備目前採雙曝光頭組設計（未來會視產能及效率增加多頭組），頭組間距爲 83mm（如圖五所示），搭載 355~405nm 曝光波長由 LED 驅動的紫外線（UV）光源，利用 DLP(Digital Light Process) 技術及數位微鏡裝置 (Digital Micro mirror Device；DMD) 如圖四所示，不需要藉由光罩，而是透過灰階影像 (Grey Level Imaging；GLI) 技術，將紫外光以數位方式投影在光阻劑上成像。目前單一頭組成像尺寸 (Image Size) 爲 20.73x10.66mm（如圖四所示），台面有效曝光尺寸爲 22x26 英吋，板厚尺寸範圍可達 20mm，曝光線寬及線距爲 30um，資料讀取採 Gerber 格式，並配有 CCD 輔助對位系統，真空台面及壓板機構等，適用於 PCB 製程中的線路及防焊 (Solder Mask) 曝光製程。由於直接成像技術可快速切換料帶來產量倍增，同時節省底片光罩的成本，提高生產速度，協助 PCB 業界快速大量生產應用，是爲生產成本最具效益的直接成像設備。



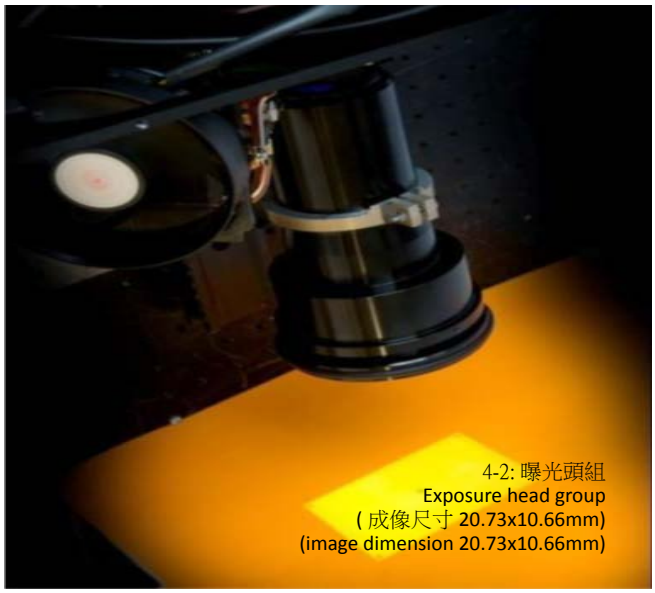
圖三，直接成像曝光機 (DI-2226/PH2) 外觀圖
Fig.3. Outside view of the direct image exposure machine (DI-2226/PH2)



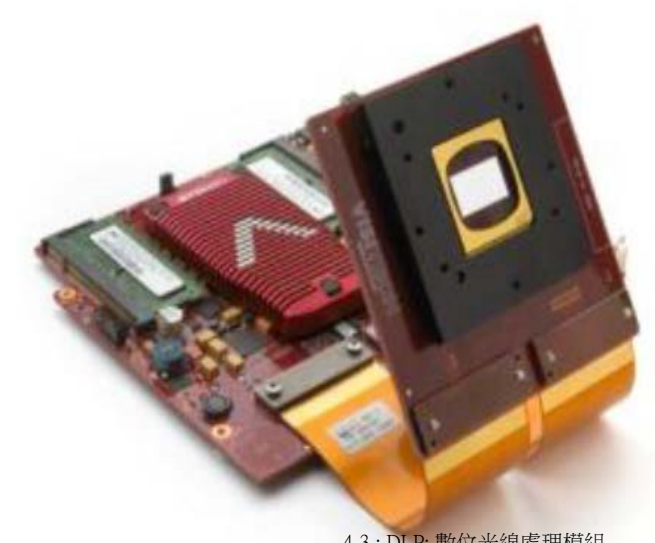
The direct image (DI) exposure machine is the first generation of such products (as shown in Fig.3) developed by Anderson. The prototype of the machine has been finished and the functions and specifications are gradually tested, modified and constructed. New functions of multi-head group with integrated loading and unloading systems (roll to roll, sheet to sheet) are being developed. Currently, this machine adopts the double exposure head group design (multiple-head groups might be adopted in the future depending on capacity and efficiency). The space between heads is 83mm (as shown in Fig.5). UV light source with 355~405nm exposure wave length is driven by LED and using DLP(Digital Light Process) technology and digital micro mirror device; DMD) as shown in Fig.4. The ultraviolet light is projected on the photoresist to form the image digitally with grey level imaging (GLI) technology rather than through the mask. At present, the image size of the single head group is 20.73x10.66mm (as shown in Fig.4). The effective exposure size on the tabletop is 22x26 inches. The board thickness dimension range is 20mm and the exposure line width and line distance is 30 um. Information is read using the Gerber format. In addition, the machine is equipped with CCD auxiliary alignment system, vacuum worktable and pressing plate mechanism, which are applicable for the line and solder mask exposure procedures in the PCB production process. As direct image technology can quickly switch between materials and allow production to increase exponentially, it saves the cost of the film mask and improves the production speed. Applied in mass production, it is the most efficient direct image equipment in production.



4-1: TI DMD:1920x1080 Pixels
(Pixel pitch:10.8um)

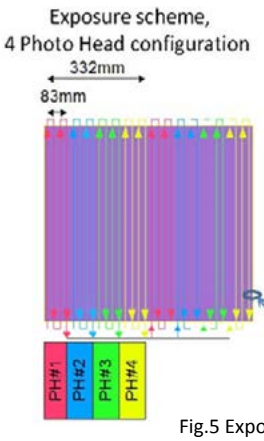


4-2: 曝光頭組
Exposure head group
(成像尺寸 20.73x10.66mm)
(image dimension 20.73x10.66mm)



4-3 : DLP: 數位光線處理模組
DLP: Digital line processing module

圖四 ,DLP 及 DMD 組成之曝光頭組圖 [2]
Fig.4. Exposure head group made of DLP and DMD [2]



Number of exposure strips

No. of Photo Heads	2	4	6
Panel width: 16"(406mm)	10	5	4
Panel width: 18" (460mm)	12	6	4
Panel width: 21"(533mm)	13	7	5
Panel width: 24"(610mm)	15	8	5

圖五 , 曝光頭組循環曝光說明 [2]
Fig.5 Exposure head group cyclic exposure description [2]

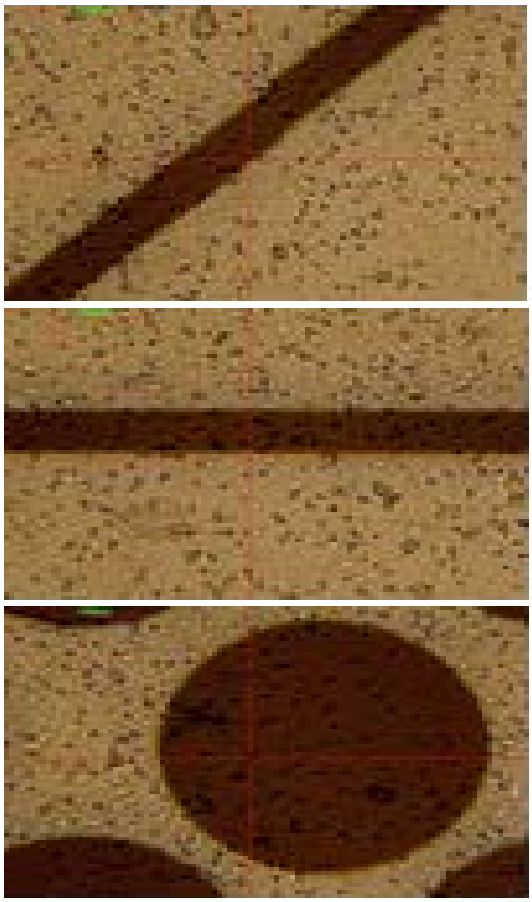
註：什麼是 DLP ？
數位光線處理 (Digital Light Processing，DLP) 是一項使用在投影機和背投電視中的顯示技術。DLP 技術最早是由德州儀器所開發，德州儀器至今仍然是此項技術的主要供應商。在 DLP 投影機中，影像是由 DMD(Digital Micromirror Device，數位微鏡裝置）產生的。DMD 是在半導體晶片上佈置一個由微鏡片（精密，微型的反射鏡）所組成的矩陣，每一個微鏡片控制投影畫面中的一個像素。微鏡片的數量與投影畫面的解析度相符，800×600,1024×768,1280×720 和 1920x1080 (HDTV) 是一些常見的 DMD 的尺寸。〔4〕

Note: what is DLP?
Digital light processing, DLP, is a display technology used in the projection machine and rear projection television. DLP technology was developed by Texas Instruments, the main supplier of this technology. In a DLP projection machine, images are produced by the digital micromirror device (DMD). DMD is the matrix consisting of a micromirror (precise and micro mirror) on the semiconductor chip. Each micro lens controls one pixel on the projected picture. The number of the micromirrors agrees with the resolution of the picture. Common DMD dimensions include 800×600, 1024×768, 1280×720 and 1920x1080 (HDTV). [4]

直接成像曝光機應用及推廣
Application and promotion of direct image exposure machine

目前開發的直接成像曝光機，最小曝光線寬及線距爲 30um，採用愛克發 CDF 照相感光軟片做底片曝光，厚度 4mil，如圖六所示，斜線部份爲 30um，直線部份爲 30um，圓直徑爲 200um，允許誤差爲尺寸的 10%，目前所量測線寬及線距誤差都在 3um 以內，符合精度誤差的要求。另硬板乾膜測試所使用的是長興化工 (ETERTEC)HT-9615 乾膜用光阻劑 (PHOTORESIST)，此光阻劑的解析度較好，相對的需要較高曝光能量，才能獲得顯影時的好品質。如附圖七所示，目前所測試的客戶乾膜製程邊緣缺口及圓 Pad 邊緣都較平滑，線寬的均勻性也較規律，量測值都在誤差範圍內，符合客戶要求。

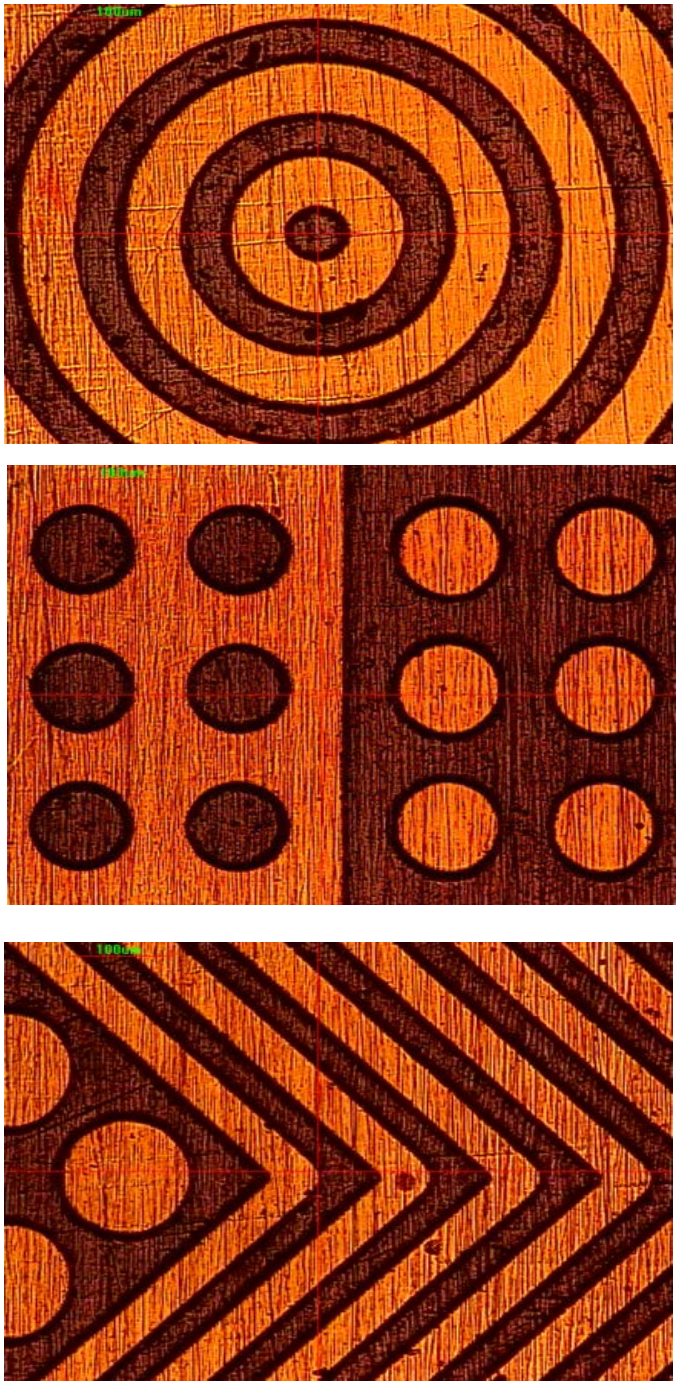
在推廣方面，目前恩德所生產製造的直接成像曝光機，還在品質測試修改階段，後續品質測試完成後，將再進行加工效率改善，如何可以在維持品質及機台穩定性的同時，能夠提高產能 (Throughput)，藉以降低客戶的生產製造成本，提高產品利潤。進而拉高機台的 C/P 值。



圖六 , 底片顯影誤差說明 [3]
Fig.6 Film developing error description [3]

The minimum exposure line width and line distance of the currently developed direct image exposure machine is 30um. This machine adopts AGFA CDF photosensitive film for exposure. Its thickness is 4mil, as shown in Fig.6. The exposure line width and line distance in both the slash part and straight line part is 30 um, with a 200um diameter. The permissible error is 10% of the aforementioned dimensions. The measured errors of the line width and line distance are within 3um, meeting the requirements for allowable error. The ETERTEC HT-9615 photoresist used for dry film produced by Eternal Chemical is used for hard board dry film testing. The resolution of this photoresist is excellent, and it requires higher exposure energy to obtain good developing quality. As shown in Fig.7, the edge notch of the tested dry film and the edge of the round pad is smooth, and the line width is uniform. Besides, the measurement values are within the acceptable error range and meet the requirements of the customers.

In terms of promotion, the direct image exposure machine developed by Anderson is in the stage of quality testing and modification. After the follow-up quality test, operating efficiency will be improved. It is important to explore how to maintain the quality and stability of the machine, and at the same time, improve throughput to decrease production cost and increase profitability for the customer, in order to further improve the C/P value of the machine.



圖七 , 乾膜 (Dry Film) 顯影均勻性說明 [3]
Fig.7. Dry film developing uniformity description [3]

結論
Conclusion

傳統的微影技術機器，一台機器只能進行單層成像，下一層就必須在另一台機器進行。此外，製造區域中每台機器都需配置不同的光罩，這意味著在製造過程中，一台機器就等於增加一道製程。為了降低成本以及增加使用靈活性，無光罩微影技術已經被討論多年。若希望降低成本，就需降低光罩製作，儲存，維護，檢查，以及修正所產生的費用；除了材料成本，也需減少在這些製造流程中所產生的人工費用。

直接成像技術提供更高的靈活性，因此無需建立並安裝光罩組，即可將新設計快速地裝載或設定在機器上；而且可使用同一台機器進行多層顯影，取代原本每個光罩就需一台機器的作法，所以直接成像設備已被一些新廠列為主要採購設備，雖然目前占市場比例不多，但未來將會成為主流。目前 PCB 產業採用直接成像設備的廠家仍偏低，但未來在高密度連接板 (HDI), IC 載板的廣大需求上，也會促使直接成像設備成為未來的趨勢。所以現階段我們必需加快測試客戶生產製程參數，進而改善機台的功能及性能，提升客戶產品良率及產能。後續的市場是可期的，也期待未來可以為恩德帶來更高的利潤及成長。

Traditional photolithography technology machine is only capable of single layer imaging, and the next layer of imaging must be done on another machine. Besides, each machine in each area must be equipped with different masks, which means an additional procedure in the manufacturing process. In order to reduce cost and increase flexibility in application, photolithography technology without mask has been discussed for many years. To reduce overall cost, the cost incurred in producing, storing, maintaining, examining and revising the masks must be reduced. Other than material cost, labor cost incurred in manufacturing must also be reduced.

Direct image technology provides higher flexibility. New designs can be quickly loaded and set on the machine without stalling the mask group. Moreover, each machine can be used for multi-layer display, replacing the original method that required one machine for each mask. Therefore, direct image equipment has been purchased by many factories. Though the market share is not high at present, it will become the mainstream product in the future. Currently, there are few manufacturers using direct image equipment in PCB industry. However, direct image equipment will become a trend in the future with increasing requirements for high-density interconnection (HDI) and IC support plate. Therefore, we must quickly test the parameters of customer production processes to improve the functions and properties of the machines, with the purpose of improving the yield and productivity of the products. The subsequent market is prospective and we also expect that it can bring higher profit and growth to Anderson in the future.

參考文獻
References

[1]FUJIFILM CORPORATION“INPREX 系列機種簡報”， 2013
[2] VISITECH“LUXBEAM Lithography System-LLS REPORT”，2012
[3] 陳永裕“ DI 機台測試報告”，總格實業 2014, 5 月
[4] Eric Braddom, Jeff Farris, Rabah Mezenner, Jason Thompson “DIGITAL PROJECTION OF UV LIGHT FOR DIRECT IMAGING APPLICATIONS”，Texas Instruments，2008 3 月

[1]FUJIFILM CORPORATION“BRIEF REPORT OF INPREX SERIES MACHINES”, 2013
[2] VISITECH“LUXBEAM Lithography System-LLS REPORT”，2012
[3] Chen Yongyu“DI machine test report”，Sogotec Industry，May, 2014
[4] Eric Braddom, Jeff Farris, Rabah Mezenner, Jason Thompson “DIGITAL PROJECTION OF UV LIGHT FOR DIRECT IMAGING APPLICATIONS”, Texas Instruments，March, 2008

新技術

產品
發表

New Technology
and
Product Release

FANUC 剛性攻牙系列主軸開發

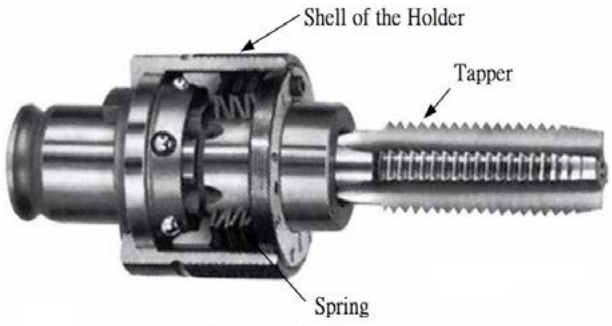
Development of FANUC Rigid Tapping Series Spindle

文/ 黃富盛

—By Huang Fu Sheng

現代科技的進度，工具機產業的技術發展也隨之成長，高轉速、高精度、高效率、低成本的切削加工，更是現代台灣工具機產業的發展方向。目前各家公司皆致力於開發高速銑削、低速攻牙的主軸，於機器上能完成所有加工，所以開發具低慣量剛性攻牙主軸將是未來所需。

With advancements in modern technology, technology in the tool machine industry is also evolving. High speed, high accuracy, high efficiency and low cost is the trend of the tool machine development in Taiwan today. Currently, companies are devoted to developing and researching on spindles capable of high-speed milling and low-speed tapping, with all the processing being finished in the machine. Therefore, it is the trend in the future to develop and research the rigid tapping spindle with low inertia.



Floating tapping holder

剛性攻牙介紹

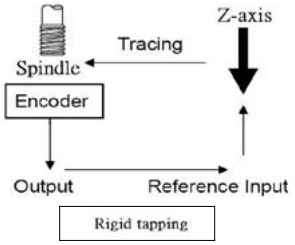
攻牙的分類有浮動攻牙與剛性攻牙，而浮動攻牙與剛性攻牙最大不同處在於剛性攻牙的速度比浮動攻牙的速度和精度高上許多，可以減少加工時間與增加刀具壽命，並降低螺絲攻之磨耗。

浮動攻牙

傳統的浮動式攻牙是利用機構來補正補償，因此加工轉速不能太高。

剛性攻牙

剛性攻牙分爲兩種，第一種使用 Z 軸伺服器馬達追隨主軸，第二種使用主軸與 Z 軸伺服馬達必須維持一定的位置比例，依控制器的參數調整以提升兩軸同動效果，且能降低兩軸間的同齊誤差。



Rigid tapping

Introduction to rigid tapping

Tapping can be divided into floating tapping and rigid tapping. The largest difference between floating tapping and rigid tapping lies in that the speed and accuracy of rigid tapping is much higher than that of floating tapping. Rigid tapping reduces the processing time and increases the service life of the tools, and at the same time, reduces the wear of the screw tap.

Floating tapping

Traditional floating tapping relies on mechanisms for compensation; therefore, the processing speed cannot be too high.

Rigid tapping

Rigid tapping can be divided into two categories. The first category utilizes Z axis servo motor to follow the spindle while the second category utilizes the spindle and Z axis servo motor which must maintain a certain positional proportion. Adjusting the parameters on the controller could improve the coaction effect of the two axes. Moreover, it can decrease the coaction error between two axes.

新技術

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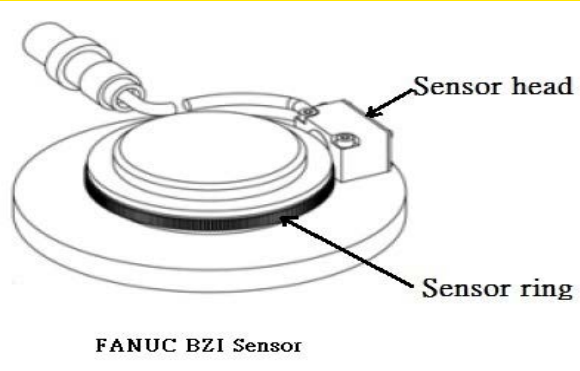
主軸定位

通常主軸只是進行速度控制，但在一些特殊的情況下（如攻牙、換刀），須要對主軸進行位置控制。主軸定位功能即 NC 發出定位命令後，通過主軸上的位置傳送感器上的感應環，感應環上有齒型（96~512 齒），使主軸停在一個特定的位置上，並提供一定的保持力矩。

Spindle positioning

Under general circumstances, only speed control is conducted by the spindle. However, under some special circumstances (such as tapping and tool changing), the spindle also requires position control. After the spindle positioning function, namely NC, gives a positioning command, the induction ring on the sensor is transmitted through positions on the spindle. The induction ring is of gear shape (96~512 teeth) and makes the spindle stop at a fixed position, providing a certain holding torque.



FANUC BZI Sensor

主軸設計概要

1. 搭配旋轉接頭於加工進行間持續吹送油氣，用於排屑與潤滑刀具，降低加工物件纏屑、加快切削速度、縮短工時、減低切削刀具損耗、延長刀具壽命與消除加工件表面毛邊．，應用範圍非常廣泛（如鋁合金、複合材料、非鐵金屬加工……等）。

2. 搭配 FANUC 轉定子，選用 2 組線圈，可以高低線圈切換選擇。低線圈用於低速高扭力，應用於攻牙與粗加工，高線圈用於高速輕切削。

3. 攻牙範圍大於 M12 以上，可採用螺紋銑削方式完成。其原理爲 X、Y 軸走一圈時，Z 軸同步移動一個螺距 P 的量。其優點如下：

(1). 提高加工精度、加工效率。

(2). 不受內、外螺紋和正、逆牙的限制。

(3). 能高精度地加工深螺紋，大螺紋，大螺距螺紋。

(4). 同一螺距的螺紋銑刀可加工不同直徑的螺紋。

Spindle design summary

1. The spindle is equipped with rotating joints to continuously blow oil and gas during the processing periods for removing chips and lubricating tools. This removes the chips entangled with the processing work pieces, accelerates the cutting speed, shortens the labor hours, reduces the wear on cutting tools, prolongs the service life of the tools and removes the burrs on the surface of the work pieces. It has a broad application range (including aluminum alloy, composite material and nonferrous metal processing).

2. The spindle is equipped with FANUC rotor and stator. Two groups of coils can be selected (high and low winding). Low winding is used for tapping and rough machining with low speed and high torque. High winding is used for high-speed light cutting.

3. When the tapping range is above M12, processing can occur by adopting thread milling. The principle is that the Z axis synchronously moves a quantity of one screw pitch P when X and Y axes move by a cycle. The advantages are as follows:

(1). Improves processing accuracy and efficiency.

(2). Unrestricted by internal and external threads as well as the forwarding and reversal threads.

(3) Capable of processing deep thread, coarse thread and coarse pitch thread.

(4) The thread milling cutter with the same pitch can process threads with different diameters.

恩德科技目前所進行設計開發之 FANUC 剛性攻牙主軸，規格如下：
The specifications of the FANUC rigid tapping spindle designed and developed by Anderson technology are as follows:

主軸規格 Spindle specification

電壓 Power	220V
功率 Power	15kw
轉速 Speed	18000RPM
刀把 Tool handle	HSK63E
潤滑 Lubrication	Grease
轉定子 Armatures and stator	FANUC
編碼器 Encoder	FANUC
攻牙範圍 Tapping range	M3~M12(鋁材 /aluminum material))

發展與應用

恩德致力於發展內藏式主軸，除了運用於一般三軸機械外，亦可運用於自行開發的五軸機，這種組合適用於加工鋁與非金屬材料，搭配攻牙功能，使機器能完成所有加工，節省時間。搭配 FANUC 整套系統（含控制器、轉定子與編碼器），藉由參數調整，使機器加工能力達成最佳化。

Development and application

Anderson is devoted to developing the built-in type spindle, which can be applied not only in general three-axis machines but also in the self-developed five-axis machine. This combination is applicable for processing aluminum and non-metallic material. When equipped with the tapping function, the machine can finish all processing and save time. When the machine is equipped with the entire FANUC system (including controller, rotor, stator and encoder), its processing capacity can be optimized by adjusting the parameters.

參考資料 References

- FANUC 技術資料
- CNC 工具機剛性攻牙之實現蘇奕丞國立中央大學機械工程研究所碩士論文
- FANUC technical data
- CNC tool machine tapping, implementing Su Yicheng master thesis, mechanical engineering institute, national central university

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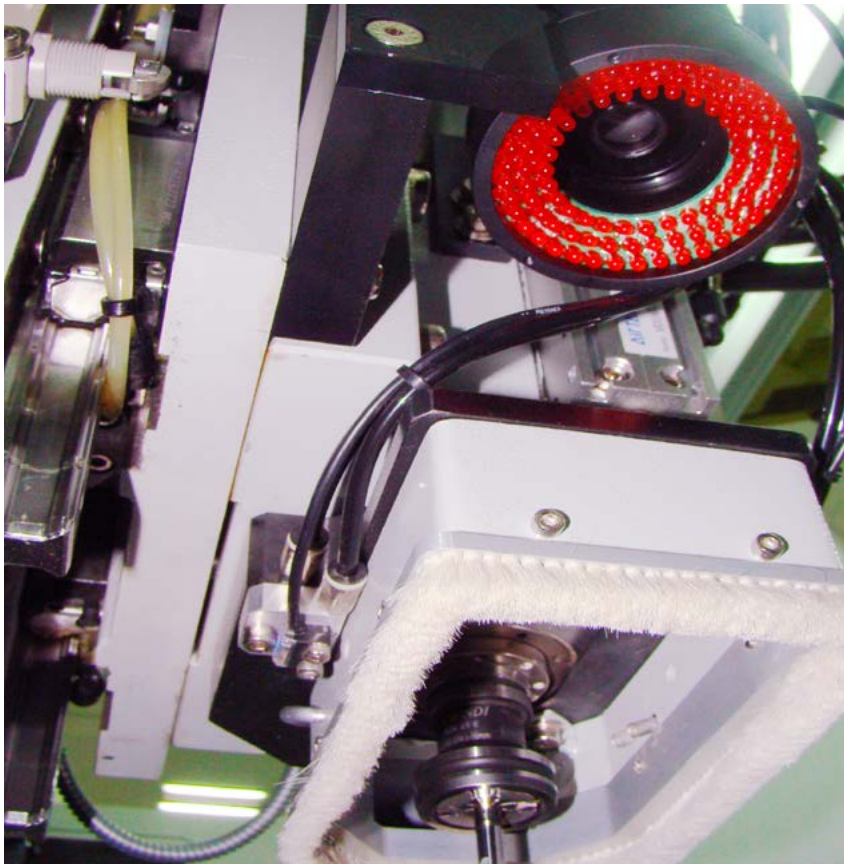


印刷薄板加工機

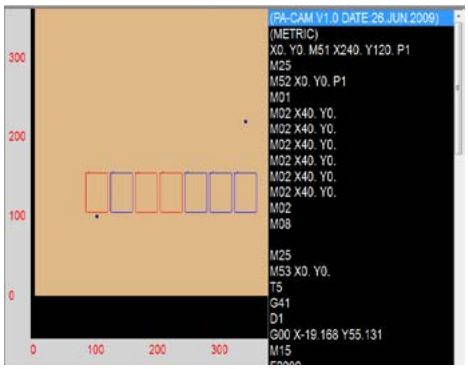
Printing Plate Processing Machine

印刷薄板加工機，是視覺、排版及控制介面皆爲客製化的機種，機械的設計力求操作簡易方便，爲求更高的加工精度，系統允許將每一材料利用視覺做單一補正，操作者可依不同運用需求做必要的深度補償；目前薄板加工機廣大應用於攜帶式裝置，未來隨著攜帶式裝置市場的熱銷需求，薄板加工機將成爲客戶高效率、高品質的最佳生產幫手。

Printing plate processing machine is a machine customized in vision, typesetting and control interface. The mechanical design aims to make operation easy and convenient. For higher processing accuracy, single compensation for each material with vision is allowed in this system. The operator can make some necessary advanced compensation in accordance with different application requirements. Currently, the plate processing machine is widely applied in portable equipment. With hot demand in the market of portable equipment in the future, the plate processing machine will become the best production assistant, delivering high efficiency and high quality to customers.

文 / 江紹華
By Jiang Shau Hua

介面控制
Interface control



讀入程式後顯示的資訊
Display information after reading in the program

為了讓使用者方便操作介面，恩德在設計上分類成兩大部分，分別為一般使用者和工程專用使用者。
一般使用者大部分的工作為上料和下料，這部分在可預見的未來也將變成自動化的一部分。

工程專用使用者大部分的工作在於設計成品的藍圖，在當中先把加工參數、材料特性參數等，設計至加工程式中，讓一般用者可以更容易的使用機械。

In order to make the interface convenient to operate, Anderson, in its design process, classified users into two categories: general users and advanced users.
Most of the work by general users lies in feeding and cutting, which will be automated in the foreseeable future.
Most of the work by advanced users lies in designing the blueprint of the finished product. Firstly, the user designs the processing parameters and material characteristic parameters in the processing program, which allows the general users to use the machine much more easily.

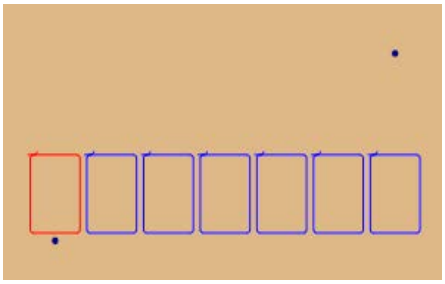
工作日誌
Work diary

Date	Class	Content
2014/04/11_16:35:51	PLCALARM:65	TestAlarm
2014/04/11_16:35:51	PLCALARM:65	TestAlarm
2014/04/11_16:35:49	PLCALARM:65	TestAlarm
2014/04/11_16:35:49	PLCALARM:65	TestAlarm
2014/04/11_16:35:47	PLCALARM:65	TestAlarm
2014/04/11_16:35:47	PLCALARM:65	TestAlarm
2014/04/11_16:35:45	PLCALARM:65	TestAlarm
2014/04/11_16:35:45	PLCALARM:65	TestAlarm
2014/04/11_16:35:43	PLCALARM:65	TestAlarm
2014/04/11_16:35:43	PLCALARM:65	TestAlarm
2014/04/11_16:35:42	PLCALARM:65	TestAlarm

工作日誌
Work diary

為了讓工程使用者更快速發現問題，恩德開發出使用者可搜尋紀錄的系統。在系統中操作者可藉由輸入關鍵字找到之前的歷史紀錄。
In order to help the advanced users find problems more quickly, Anderson developed a system in which the users can search for records. In this system, the users can query historical records by using keywords.

中斷點
Breakpoints



加工圖像模擬示意圖
Processing image simulation diagram

第一次加工時，需先試打樣品和調整加工參數，客戶可在加工畫面挑選要加工的排版，CCD 只針對選擇的排版取像，進行加工。
此功能主要分成兩大類，第一類為挑板動作，主要只加工恩德想加工的那片小板。

第二類為加工路徑的中斷點，舉例說明：假設一個小板需要多次下刀及提刀，恩德的系統可記憶最後一個下刀點，此時停止加工並修改參數，再回復前次加工的下刀點處再進行加工。

在加工新成品的時候，恩德的系統通常先進行試打，如上圖所示，紅色為必須加工的小板，藍色為不加工的小板。

During first time processing, users need to print a sample and adjust processing parameters first. Users can select the typography to be processed on the processing menu. The CCD captures the image specific to the selected typography for processing.
These functions can be divided into two categories. The first category is plate picking, in which small plates that Anderson wants to process are completed.
The second category is the breakpoint in the processing paths. For example, suppose that a small plate requires several cutting and lifting motions. Anderson's system is able to remember the last cutting point. At this time, processing should be stopped and parameters should be revised, before resetting to the cutting point of the previous action to continue processing.
When processing the new finished products, Anderson's system will test printing, as shown in the following figure, where the red shape is the small plate that must be processed, and the blue shapes are the small plates that do not need to be processed.

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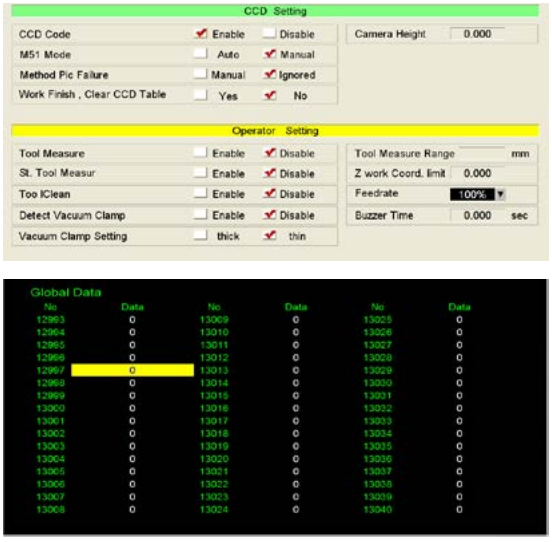
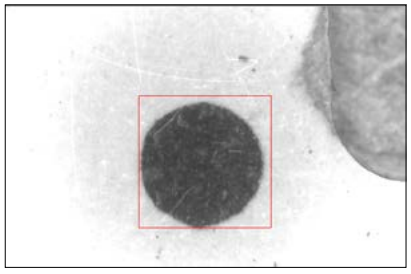
參數設定
Parameter setting



一般參數設定圖
Parameters setting figure

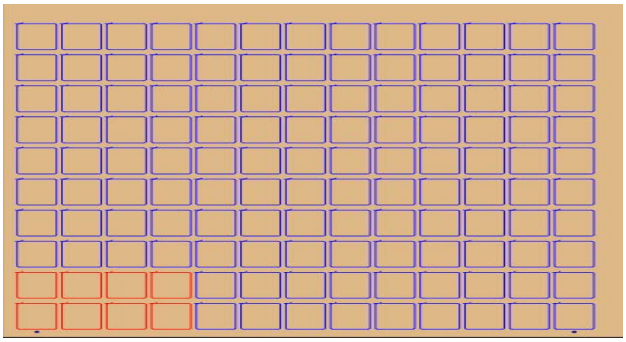
恩德的系統可將使用者分級別，依照使用者的級別不同，開放不同的參數加以設定。

Anderson's system separates users into different levels. Different parameters are open for users at different levels to set.



實際的定位點取像截圖
Screenshot for the image of anchor locating points

視覺系統
Vision system



加工圖像模擬示意圖
Processing image simulation figure

在取像補償部分，主要補償分成大版和小版。大版上取像的參考點，需定義出兩個座標，當 CCD 取像後，系統計算出大版的偏移值和旋轉角度後，移動至小版取像參考點，再計算出小版的偏移值。

第一趟加工時，需要先試打樣品和調整加工參數，客戶可以在加工畫面挑選要加工的排版，CCD 只針對有選擇的排版取像，然後執行加工。

如圖所示，紅色為第一次加工的區域，藍色為第一次不加工的區域，恩德的系統可藉由選擇紅色的部分決定該進行哪些排版，視覺系統則依照加工需求，選取需加工的定位點進行補正。

一般而言，定位點大都採用圓形，不過恩德的系統只要在 CCD 可視範圍內，其他獨特的形狀，皆可以做定位點，如十字、矩形…等。

In image capture compensation, the main compensation can be divided into large format and small format. Two coordinates should be defined among the imaged reference points on large formats. After the CCD captures images, the system calculates the deviation values and the rotation angles of the large formats. Then, it moves to the small format image capture reference points, calculating the deviation values of the small formats.

During the first processing, users should print the sample and adjust the processing parameters to begin the process. Users can select the typography to be processed on the processing menu. The CCD captures the image specific to the selected typography for processing.

As shown in Fig, the red area is processed during first processing, and the blue area is not processed during first processing. Anderson's system can determine typesetting area by selecting the red area. The vision system selects the anchor points to be processed for compensation.

Generally speaking, most of the anchor points are round. In Anderson's system, however, other unique shapes such as a cross and a rectangle are possible, as long as they are within the viewable range of the CCD.

自動量刀系統
Automatic tool measurement system

Tool Parameter

Magazine	Toolnumber	Diameter	RPM	Downrate	Uprate	Z Comp.	Tool Life	Tool Cut
1	1	2.000	20000	0.800	5.000		2.330	50.000
2	2	2.000	30000	0.500	4.500		3.550	45.000
3								
4								
5								
6								
7								
8								

Diameter Table

D	Diameter mm	D	Diameter mm	D	Diameter mm	D	Diameter mm	D	Diameter mm	D	Diameter mm
1	2.000	5		9	1.000	13		17		21	
2	2.400	6		10		14		18		22	
3		7		11		15		19		23	
4		8		12		16		20		24	

刀具補正表
Tool compensation table

爲防止壓克力被刮傷，在兩面都有貼保護膜，加工時不能切破下保護膜（厚度約爲 0.1~0.20㎜），因此 Z 軸的深度控制非常重要，所以刀長量測後，系統需自動補正 Z 軸加工高度。此外還有標準刀校正功能，在機構允許的範圍內，客戶可自由定義標準刀長。

1. 刀長測量並自動補正功能

刀長量測補正功能可由以下兩種方式達成，在操作設定將刀長量測功能開啓，當執行自動換刀時，系統會自動執行刀長量測，並補正 Z 軸加工深度；或是當使用者需要手動量刀長並自動補正時，可以點選主頁面的刀長量測。

2. 標準刀自動校正功能

客戶可以在機構允許的範圍內，自由定義標準刀長；例如，標準刀長定義爲 20.5㎜，操作者取用一把刀長 21㎜ 的銑刀，執行標準刀校正功能後（此時的標準刀長已變更爲 21㎜），用這把刀去銑平台面，之後加工使用的每一把刀，都以此刀當作標準刀去補正。

In order to avoid scratching the acrylic, both sides of the machine are covered with protective films. The lower protective film (with a thickness of about 0.10~0.20mm) should not be cut during processing. Therefore, it is extremely important to control the depth of the Z-axis. As a result, the system automatically compensates for the processing height of Z-axis after tool length measurement. In addition, the machine is also equipped with a standard tool correction function, so that the users can define the lengths of the standard tools freely within a permissible range.

1. Tool length measurement and the automatic compensation function

The tool length measurement compensation function can be achieved in the following two ways: the system will automatically measure the tool length and compensate the processing depth of Z-axis when the operator turns on the tool length measurement function for executing automatic tool changing. When the user needs to manually measure the tool length and set automatic compensation, the user can click and select the tool length measurement on the home page.

2. Standard tool automatic correction function

The user can freely define the standard tool length within the permissible range of the agency. For example, the standard tool length is defined as 20.5 mm. The operator may use a 21 mm-long milling cutter for standard tool correction function (at this time, the standard tool length has changed into 21mm) and uses this tool to mill the platform surface. This tool is used as the standard tool for compensation for each tool processed and used afterwards.

未來展望
Outlook

壓克力複合材料具可塑性、成本低和加工完成後的高良率等特性，可滿足不同行業的需求，且近來許多複合材料發展進步神速，有的複合性材料透光率已幾乎接近薄玻璃的透光率，可以取代部份使用薄玻璃的產品（玻璃加工良率比較差，且加工時間較慢）。綜觀上述，此類機台的需求相當具有市場潛力。

Acrylic composite material is of good plasticity, low cost and high yields after processing is finished, meeting the requirements of different industries. With rapid development in composite materials recently, light transmission in some composite materials is almost on par with light transmission of thin glass, even replacing some thin glass products (glass is of poor processing yield, and processing is very slow). In conclusion, this machine has high potential market demand.

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超音波主軸在脆性材料切削的應用

文 / 陳彧士

Application of Ultrasound Spindle in Brittle Material Cutting

—By Chen Yu Shih

現今高科技產品蓬勃發展，新穎易脆、高硬度合金及複合材料不斷被創造出來，如：玻璃、陶瓷、石英、合金及碳纖等；上述材料無論是於民生工業之車輛、休閒、醫療、通訊及光電，或國防工業之航太、武器等，應用皆與日俱增，但如何將此類材料加工成高精密度之零件，已成爲當前重要關鍵技術。

With the thriving development of current high-tech products, novel, brittle, alloy with high hardness and composite materials such as glass, ceramics, quartz, titanium alloy and carbon fiber have been continuously developed. The aforementioned materials are widely applied in industries such as vehicles, recreation, medical treatment, communication and photoelectricity, or in national defense industries such as aerospace and weaponry. However, how to process these materials into parts of high precision has become an important technological challenge.

超音波簡介

蒐集市場相關加工資訊得知，各式脆硬材料具有高硬度、耐磨耗、防腐蝕與耐高溫特性，對其進行切割加工，會因本身特性而使工件崩裂、或刀具斷裂現象。傳統機械之車、銑、鉋、鑽等加工方式，已無法承受易脆材的特性；然而，在高精密零件需求提升，品質要求日漸嚴苛的現今，非傳統加工法：光能、電能、熱能及聲能等加工方式便受到廣泛使用。目前業界常使用的非傳統加工法有：蝕刻法、雷射加工 (Laser Beam Machining LBM)、放電加工 (Electrical Discharge Machining EDM) 及超音波加工 (Ultrasonic Machining USM)，其中，超音波加工法的使用較被推崇，其優缺點如下。

優點

i. 不受材料是否爲導體條件拘束
i. 無熱效應產生變形
ii. 加工區域殘留應力小
iii. 工件表面粗糙度佳
iv. 環境污染小

缺點

i. 加工面積小
ii. 刀具外徑受限
ii. 較傳統加工速度慢
iii. 參數設定較難掌控

Introduction to ultrasonic wave

By collecting relevant information in the market, it is evident that various types of brittle materials contain properties of high hardness, anti-wear, anti-corrosion and high temperature resistance. If cutting processing is conducted on brittle materials, the work piece will crack or the tool will break due to its own properties. Traditional processing methods such as machining, milling, planning and drilling are unable to bear the properties of the brittle materials. With the improvement in demand of precision parts and increasingly rigorous quality requirements today, however, non-traditional machining methods – light energy, electric energy, thermal energy and sound energy – have been widely used. At present, the commonly used non-traditional processing methods in the industry include etching method, laser beam machining (LBM), electrical discharge machining (EDM) and ultrasonic machining (USM). Among them, ultrasonic machining is highly regarded, and the advantages and disadvantages are as follows:

Advantages

i It is not constrained by whether the material is a conductor
ii. No heat effect that would cause deformation
iii. Small residual stress in the processing area
iv. Better surface roughness on the work piece
v. Less environmental pollution

Disadvantages

i. Small processing area
iv. Restricted external diameter of the tool
iii. Slower in speed compared with traditional processing
iv. Hard to control parameters setting

超音波原理

『聲波』是人耳能感受到的一種縱波，範圍頻率爲 16-16KHz，當聲波高於 16KHz 稱之爲超音波。超音波加工係由發生器、放大器、變幅桿、振動子及磨料等多項原件構成（圖 1）。依照磨粒種類可分爲二項：

a. 自由磨粒，亦稱非迴轉式超音波加工 (UM/USM, ultrasonic machining)，利用持續提供磨粒方式進行材料移除。加工時，高頻電源連接超音波轉換器，將電震盪轉換爲同一頻率並垂直於工件表面振動，經由變幅桿將振幅放大，不停的以高壓狀態作用於加工區域，透過錘擊 (Hammering)、衝擊 (Impact) 表面，產生微壓痕式破壞 (Micro-indentation)，使該處材料變形；一系列之微壓痕累積後生成爲裂痕 (Micro-crack)，再加上磨粒經鎚擊嵌進工件後轉動的滾削 (Hobbing) 及空孔侵蝕 (Cavitation)，最後延伸聯結造成材料內部微破裂 (Micro-chipping)，材料表面形成碎屑達成去除材料之目的。除了高壓衝擊外，亦因不斷攪動懸浮液體（磨料），促使磨料高速拋磨工件表面，強化機械拋磨工件材料的作用。

b. 固定磨粒，即迴轉式超音波加工 (RUM, rotary ultrasonic machining)。將振動子與研磨棒或砂輪鋸片安裝於主軸上，運轉時，除進給方向有超音波做振擊磨削外，刀具同步隨著主軸高速迴轉切削，因而切削速度較快；磨料已預先燒結於刀柄上，加工期間無須再使用任何懸浮磨料，只需連續提供冷卻液帶走熱及切屑即可。因此，迴轉式超音波加工材料去除率 (MRR, material removal rate) 及表面粗糙度，優於非迴轉式超音波。

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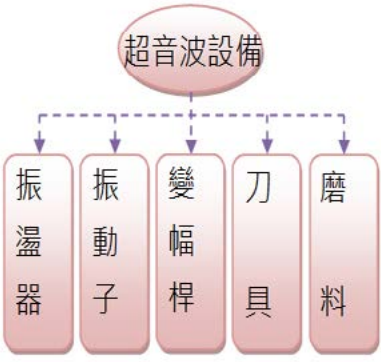
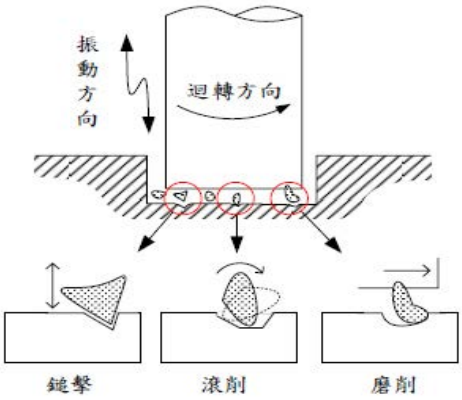
Principle of ultrasonic wave

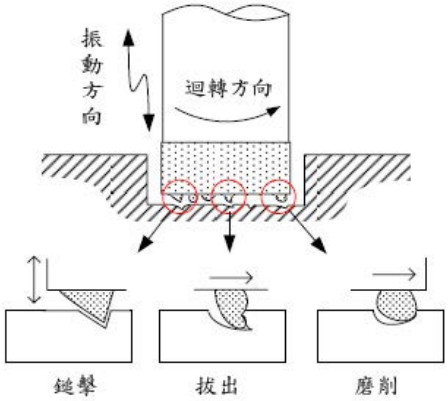
Sound wave is a longitudinal wave that can be sensed by the ears of human beings, and its frequency range is between 16Hz and 16KHz. When the frequency of the sound wave exceeds 16 KHz, it is called an ultrasonic wave. Ultrasonic processing consists of components such as the generator, amplifier, amplitude-change pole, vibrator and grinding materials (Fig.1). It can be divided into two categories in accordance with the types of abrasive particles:

a. Free abrasive particles, also known as ultrasonic machining (UM/USM), remove materials by way of continuously providing abrasive materials. During processing, high frequency power supply is connected to the ultrasonic transducer to transfer the electric vibration into vibration of the same frequency and perpendicular to the surface of the work piece. Then, the amplitude is increased by the amplitude-change pole, applying high pressure on the processing area, through the surface of hammering and impact to produce the micro-indentation, deforming the material on this area. The micro-crack is generated after a series of micro-cracks accumulation, in addition to the rotary hobbing and cavitations of the abrasive particles being embedded into the work pieces through the hammer. Finally, the extension of the coupling causes micro-cracks inside of the material. Chips are formed on the surface of the materials to remove the materials. In addition to high-pressure impact, the constantly stirred liquid (abrasive particle) creates an abrasive polish and grinds the surface of the work piece at high speeds, strengthening the function of the materials of the work pieces.

b. Fixed abrasive particles, namely the rotary ultrasonic machining (RUM). Install the vibrator and grinding rod or the grinding wheel blade in the spindle. During the revolution, except for the ultrasonic polishing and grinding in the feeding direction, the tools synchronously rotate and cut at high speeds along with the spindle. Therefore, the cutting speed is very fast, and the abrasive materials have been sintered on the tool in advance to handle the speed. No suspending abrasive materials should be used during the processing period, with the only requirement being to continuously provide coolant liquid to remove the heat and chips. Therefore, the material removal rate (MRR) and surface roughness of the rotary ultrasonic machining materials are superior to those of non-rotary ultrasonic.







超音波加工應用

陶瓷因具有多樣特性，適用於精密零件如：飛機引擎、風力發電機葉片及渦輪增壓器等，在眾多新穎材料中可說是最受歡迎的寵兒；另外，隨著科技高速發展，玻璃也不再只用於櫥櫃、窗戶及鏡子，3C 產品如智慧型手機與平板電腦的面板及相機鏡頭等，亦都是由玻璃製造而成。在對陶瓷、玻璃及金屬等難切削材料進行切割加工時，容易出現以下問題：

1. 氣孔堵塞。刀具端部黏附加工物的切屑，導致表面磨粒無法突出，確實的與工件接觸，達到移除材料效果，進而使刀具鈍化。
2. 刀具鈍化。因氣孔堵塞磨粒毀損，表面磨粒產生鈍化現象，進一步增毛邊的形成及加工件崩裂，異常磨損致使加工物產生過熱現象。

目前脆硬材料之加工方法有雷射、超音波及放電。放電加工受限於材料之導電性；若以雷射加工，除因焦距景深及小孔效應造成之孔側壁斜角外，熱效應引發之加工區材質改變、表面微裂及材料飛濺殘留。超音波是唯一非熱、非化學及非電的加工方法，所以對於放電及雷射限制而言，可說是有很大的應用彈性。市面上可見的有德國 Deckel Maho 公司製造之 DMG ULTRASONIC 系列複合加工機；日本多賀電氣株式會社、富士工業株式會社等生產的超音波複合化刀具模組。

Deckel Maho 公司的超音波振動加工技術來自於 Hermann Sauer GmbH 公司，該公司研發超音波加工相關技術已有三、四十年之久。機台主軸附加了一組超音波裝置於心軸上，激振核心由壓電材料構成，激振時產生 20 kHz 的高頻振動，使心軸於軸向作往復振動，搭配耐衝擊的鑽石刀具，工作物的表面粗糙度小於 RA0.2mm（圖 4）。

圖 4 DMG ULTRASONIC 系列複合加工機
Fig.4 DMG ULTRASONIC series of composite processing machine

Ultrasonic processing application

As ceramic has diverse properties, it is applied in precision parts such as aircraft engines, blades of wind turbines and turbochargers. It is the most popular material among various novel materials. Also, with rapid development in science and technology, glass is not only used for cupboards, windows and mirrors, but also used for panels of 3C products such as smart phones, tablets, personal computers and camera lenses. The following problems easily appear during the cutting and processing the materials such as ceramics, glass and metal:

1. Blockage in pores. The chips of the processed materials are covered on the end of the tool so that the surface abrasive particles cannot extrude and contact with the work pieces to remove the materials, causing tool deactivation.
2. Tool deactivation. As the blockage in pores and damage in abrasive particles, deactivation happens on the surface abrasive particles, which further accelerates the formation of burrs and cracks on the work pieces. Abnormal wear causes overheating on the processing bodies.

The current methods to process brittle materials include laser, ultrasound and electric discharge. Electric discharge processing is restricted by the electrical conductivity of the material. If it is processed by laser, the heat effect causes the materials in the processing area to change, causing micro-cracks on the surface and splashing of residual material. Ultrasonic is the only non-heat, non-chemical and non-electrical processing method. Therefore, it is used more widely compared with electric discharge and laser. The ultrasonic processing machines that are found in the market today are the DMG ULTRASONIC series of composite processing machines made by German Deckel Maho Company and the ultrasonic composite tool modules made by Japanese Tagajo Electrical Co., Ltd. and Fuji Industrial Co., Ltd.

The ultrasonic vibration machining technology of Deckel Maho Company can be traced to Hermann Sauer GmbH Company. The latter has developed and researched ultrasonic processing technology for thirty to forty years.

A group of ultrasonic equipment is fixed onto the mandrel of the spindle of the machine. The excitation core is made of piezoelectric materials, producing high frequency vibration of 20KHz during the excitation process and causing the mandrel to vibrate, reciprocating in the radial direction. The equipment is also equipped with diamond tools with impact resistance. The surface roughness of the work piece is less than RA0.2mm (Fig.4)

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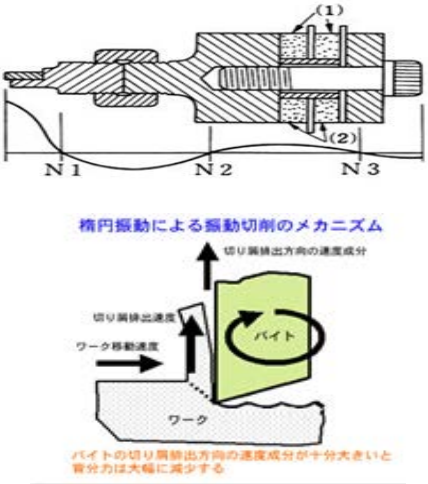
New Technology and Product Release

日本多賀電氣株式會社所開發展 SB、EL 系列超音波振動車削複合化刀具模組，其壓電材料附加於刀具模組結構上，爲相當高頻的自主振動模式。SB 系列的振動方向與車製工作物的徑向同向，加工後表面粗糙度幾乎趨近於零；另外 EL 系列的振動方向爲橢圓振動，最大的優點爲有效地減少切削阻抗（圖５）。

日本富士工業株式會社 S-2501、S-3501 系列超音波複合化刀具模組，作用原理係以刀具軸心做旋轉及扭曲（Twisting）的高頻振動，適用於與高硬度鋼。使用方式與一般傳統刀把相同，加工時直接由主軸夾鬆刀機構挾持（圖６）超音波複合化加工，對於硬脆難切削材料，兩種以上的能量形式相互結合，可以得到優質的表面精度，使奈米級的超高精度得以實現。多製程加工時，不需經常重新校驗工件與刀具，可減少校驗精度錯誤的風險，並大幅縮短整體加工時間，提高生產效率。

The SB and EL series of ultrasonic vibration composite tool modules developed by Japanese Tagajo Electrical Co., Ltd. feature an autonomous vibration mode with relatively high frequency, with the piezoelectric materials attached on the structure of the tool modules. The vibration direction of the SB series modules is the same as the radial direction of the turning work piece, and the surface roughness after processing is almost close to zero. On the other hand, the vibration direction of the EL series modules is elliptic, effectively reducing the cutting impedance (Fig.5). The working principle of the S-2501 and S-3501 series of ultrasonic composite tool modules developed by Japanese Fuji Industrial Co., Ltd. is the high frequency turning and twisting vibration around the axis of the tool. These modules are applicable for greatly hardened steel. The operation is the same with that of traditional tool handles: directly clamp the modules with the spindle clamping tool mechanism (Fig.6).

圖 5 超音波振動車削複合化刀具模組
Fig.5 Ultrasonic vibration turning composite tool module



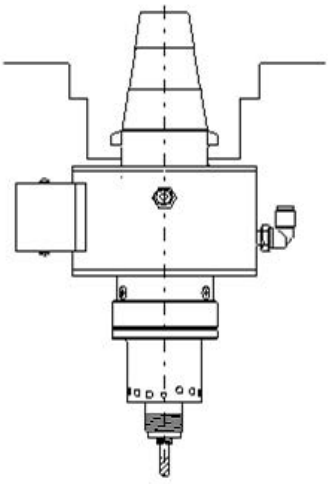
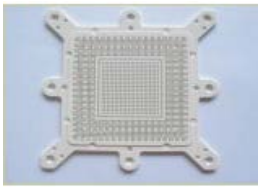
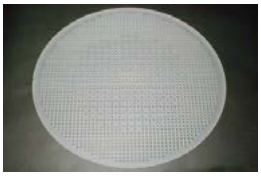


圖 6 超音波複合化刀具模組
Fig.6 Ultrasonic composite tool module

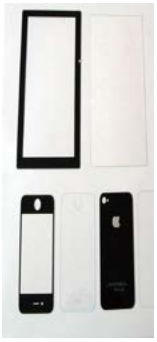




^ > 超音波加工應用於陶瓷
Ultrasonic processing applied in ceramics

超音波複合化加工，對於硬脆難切削材料，兩種以上的能量形式相互結合，可以得到優質的表面精度，使奈米級的超高精度得以實現。多製程加工時，不需經常重新校驗工件與刀具，可減少校驗精度錯誤的風險，並大幅縮短整體加工時間，提高生產效率。

When ultrasonic composite processing is applied for cutting brittle materials, surface roughness with high quality can be obtained by combining more than two energy forms, allowing for high precision at a nanometer scale. It greatly shortens the overall processing time and improves the production efficiency.



< 超音波加工應用於玻璃
Ultrasonic processing applied in glass

結論 Conclusion

恩德集團由早期的木工機械產業跨足至各加工領域，不僅製造機檯，主軸亦爲自行研發生產。近年來科技高速發展，硬脆材料廣泛被應用於高精密度零件，同時衍伸許多新的加工技術需求。面對未來的發展與挑戰，先進複合化切削加工技術是突破目前瓶頸的可行方向之一，恩德集團仍會秉持「責任、用心、特色」的理念，開發更多新產品，滿足市場需求，協助客戶突破一些技術瓶頸提升國際競爭力。

Anderson Group has expanded from the woodworking machinery industry at its inception to include all processing machinery. It not only manufactures machines, but also researches and develops spindles. With the rapid advancement in science and technology in recent years, brittle materials are widely used in high precision parts. At the same time, the requirements for many new processing technologies are also evolving. Anderson Group will always uphold its concepts, responsibility, diligence and characteristics to develop more new products, meet market demand and serve the customer to break through technical bottlenecks and improve the firm's international competitiveness.

參考文獻

〔1〕林清源、許晉謀 " 先進複合化切削加工技術介紹 "，2005 3 月 .
Lin Qingyuan, Xu Jimou. Introduction to advanced composite cutting processing technology, March, 2005
〔2〕馬家駿 " 迴轉式超音波輔助硬脆材料銑削及工具設計 ", 2006 7 月
Ma Jiajun. Rotary ultrasonic auxiliary crisp and hard material milling and tool design, July, 2006.
〔3〕SAUER GmbH, Deckel Maho Gildemeister,http://www.gildemeister.com/
〔4〕日本多賀電氣株式會社，http://www.tagaele.com/
Japan Tagajo Electrical Co., Ltd.
〔5〕日本富士工業株式會社，http://www.fuji-us.co.jp/
Japan Fuji Industrial Co., Ltd.,

新技術

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實木傢具CNC加工中心應用

Application of Solid Wood Furniture in CNC Machining Center

隨著近年來中國大陸地區的房屋更新率越來越高，加上民衆對於住宅的家具要求提高，並且可以負擔的條件越趨富裕，造就市場對於實木家具的需求年年提高。而實木家具製造商的競爭愈趨激烈，因此，對於實木家具的造型變化更加多元化，伴隨全球化的資訊交流相較以往是更快速且更簡易，因而實木家具的設計理念更容易整合各項元素，加上中國五千年歷史文化的融合，而使得中國實木家具的外型已經不再是以往平面直線條的單一概念。

In recent years, there have been increasing housing renewal rates in Mainland China, followed by increasing market requirements for solid wood furniture, and improved requirements and affluency of the public for residential furniture. As a result, the requirement for solid wood furniture and the competition among solid furniture manufacturers increases year by year. Therefore, the styling changes to the shape of solid wood furniture is getting more diversified. Furthermore, as globalized information exchange has improved, design concepts of the solid wood furniture integrates various elements more easily. Because of the integration of five thousand years of Chinese history and culture, the appearance of solid wood furniture is no longer the previous single concept of planes and straight lines.

過往的實木家具中，變化的不外乎木材原料、顏色，而現今更融入曲面的造型藝術，但是過往的經驗中，如此曲面的造型是無法被量產的產品，因爲，無法標準化生產且傳統設備功能簡陋，只能依靠老師傅的個人經驗手工生產，所以無法實現量產模式。但以現今的機械生產工藝中，這些過去僅靠手工的技藝，已經可以很廣泛的應用機械化生產，最大的原因就是 CNC 加工中心的技術成熟。

Colors and raw materials of past solid wood furniture are left untouched while the modeling art is integrated into the surface. In the past, surface modeling could not be used for products in mass production because there were no methods for standardized production and the traditional equipments are too simple they could only be manufactured by experienced workers. But with current mechanical production processes, manual production technologies can also be widely applied in new mechanical production. The biggest reason for this mature technology can be found in CNC processing centers.

文 / 鄧 福超
—By Shawn Teng

新技術

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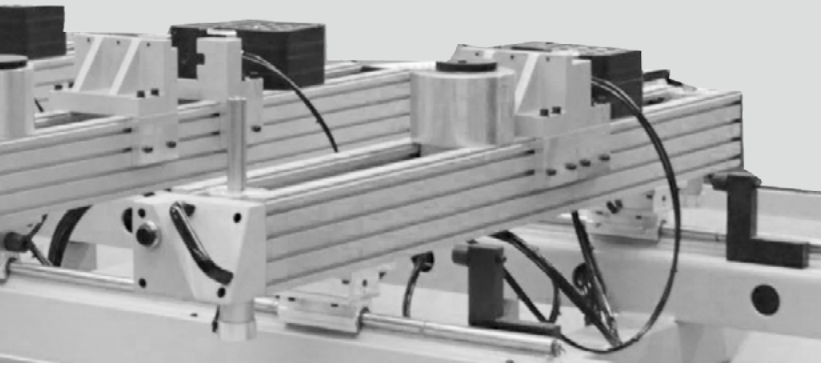
恩德一直是 CNC 機械設備製造的佼佼者，台灣曾經是實木美式家具的出口王國，經過 20 來年的市場洗禮淬鍊，造就了恩德的 CNC 加工中心機械，成為實木家具產業設備中首屈一指的指標性產品。20 年前，在實木家具的木工機械業界，恩德就已是日系品牌互競互長的可敬對手，當年的 NC 機種首重品質優良、價格親民、穩定耐用並且接受客製化的特殊訂單，經過多年來的競爭，恩德引領台灣品牌在國際實木加工市場中殺出一條血路，留下光輝的一頁。

Anderson has always been the the leader in CNC mechanical equipment manufacturing. Taiwan was once the export king of Americanized wooden furniture. After more than twenty years of market baptism, machines in Anderson's CNC processing center have been brought in and become the leading major products in solid wood furniture industry. 20 years ago, Anderson was a worthy opponent to japanese brands in the woodworking industry. The NC machines in those years were high quality, reasonably priced, stable and durable, and accepted customized special orders. After years of competition, Anderson, the leading brand in Taiwan, blazed a new path for Taiwan to successfully ensure a strong presence in the international wood processing market.

時至今日，綜觀恩德的產品種類已經不再僅只侷限於木工產業，更在電路板產業、塑料、汽車模具、航太鋁合金、各式複合材料等不同的領域當中都有經營足跡。因此，技術團隊集結各式產業的加工應用知識，加上自身技術的進化，使得恩德可以更上層樓，針對實木家具市場推出專用的五軸同動 CNC 加工中心。

Now, Anderson products cover not only the woodworking industry, but also the circuit board industry, plastic industry, automative mold industry, aerospace aluminum alloy industry, and a variety of composite materials industries. Therefore, the technical team gathered processing and application knowledge in various industries. The improvement in its technology makes Anderson even stronger and ensures a dedicated axis for wood markets fulfilled by its dynamic CNC processing center.

STRATOS-1325IP



今年恩德很驕傲的向市場推出 STRATOS-1325IP 五軸系列，針對實木家具的曲面造型加工提出更有效的解決方案，機械的加工主軸是來自擁有自主研發、生產的恩德主軸廠，恩德已將產業加工特性直接規劃在主軸上，滿足實木家具重型切削量的需求。為協助客戶解決五軸機械加工中最困難的課題 - 加工干涉，恩德技術團隊設計出彈性化的條型檯面，搭配客製化的工件固定方式，如上下夾具、左右夾具、吸盤等，避免實木加工時各面向的干涉問題，這些都是恩德研發團隊的心血結晶。

由於以上幾個重點因素，恩德期許能夠在實木家具行業中再度開創新的一頁。

This year, Anderson is proud to announce its STRATOS-1325IP five-axis series made as an effective solution to the surface modeling processing for the wood furniture. The processing spindle of the machine is created and manufactured by its own independent research and development teams. Anderson directly sets industrial processing features in the spindle to meet the requirement for cutting large loads of wood furniture. In order to assist the customer's needs, the Anderson Technology team designed a flexible strip-type table with customized work fixing methods, such as the left and right fixtures and suckers, to solve machining interference problems during wood processing.

Due to the above mentioned key factors, Anderson can expect to create a new chapter in the solid wood furniture industry.

新技術

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箱型五軸加工機在汽車內飾的加工運用

文 / 江天議

Processing and Application of Box-type Five-Axis Processing Machine

— By Chiang Tien Yi

非金屬複合材料在汽車的零部件應用廣泛，可將它們分爲內飾件、外飾件、車殼和功能結構件共四種類型。尤其塑料及碳纖維在汽車內部裝飾零件領域裡已漸漸取代金屬，除發動機等少數部件，非金屬汽車時代已經越來越近。汽車塑料製品的發展不僅仰賴於新材料的開發，新的加工方式也成爲此新穎材料製造之關鍵。

Non-metallic composite materials are widely used in auto parts, which can be divided into four categories: interior parts, exterior parts, car shell and functional structural parts. In particular, plastic and carbon fiber have gradually replaced metal in auto interior parts. Except for a few parts such as engines, the era of the non-metallic automobile has been approaching. The development of automotive plastic products does not just depend on the development of new materials. New processing methods have also become a key factor for the manufacturing of new materials.

新技術

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New Technology and Product Release

一輛汽車最能讓消費者感受到這台車的價值來自於內飾件，其強調觸覺、手感、視覺和舒適性。汽車內飾件包含：車廂隔板、門內裝飾板、儀表板、扶手、地毯、門內手柄、裝飾條等等。歐美汽車內飾板一般以 ABS 或聚丙烯 (PP) 工程塑料爲主要材料，這類材料價格低、輕量化、成型性及二次加工性良好，易於大量製造。以天然纖維增強工程塑料是目前汽車塑料的研究重點之一。某些車商已成功將天然纖維複合材料應用於高階車款內飾件，使重量減輕 20% 且材料機械性能也得以改善。

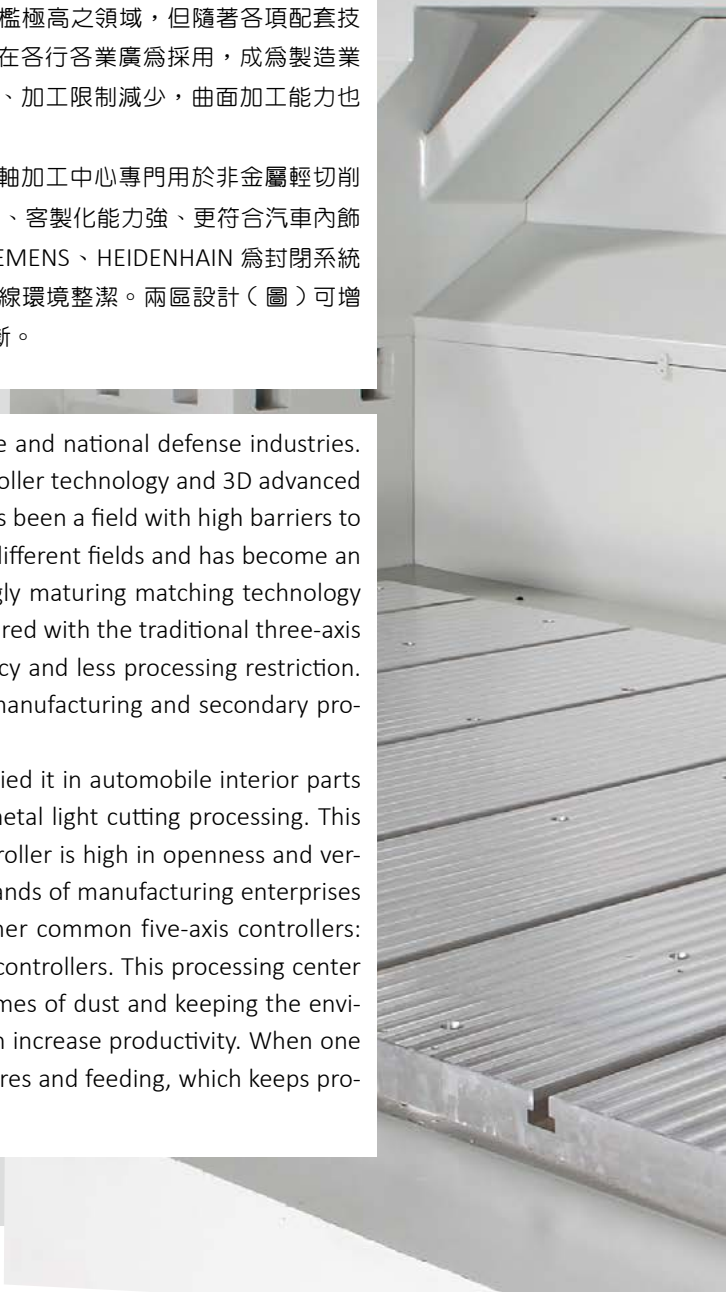
The interior parts of an automobile are where the consumer derives most the value of the automobile. It is where attention is paid to the sense of touch, feel, visual sense and comfortableness. Interior parts of the automobile include: car plate, indoor panels, instrument board, handrail, carpet, door handles and trim strips. The main component materials of European and American automobile interior trim panels are ABS or polypropylene (PP) plastics. These materials are low in price, light in weight, easy to mold and modify aftermarket, and easy to mass produce. One of the research emphases of current automobile plastics is natural fiber-reinforced plastic. Some dealers have successfully applied natural fiber composite materials in the interior parts of luxury vehicles. These materials achieve a 20% weight reduction, and the mechanical performance of the materials is also improved.

五軸加工技術主要應用於航太、國防工業，此項技術必須整合機構設計、控制器技術以及 3D 高階 CAD/CAM 軟體 (ex. CATIA，UG etc.)。一直以來五軸加工爲進入門檻極高之領域，但隨著各項配套技術日益成熟，以及具 CNC 加工經驗的人才增多，五軸加工應用逐漸在各行各業廣爲採用，成爲製造業不可或缺的加工手法。五軸加工設備相較於傳統三軸設備更有效率、加工限制減少，曲面加工能力也大大減少後製及二次加工時間。

目前恩德科技擁用五軸加工技術並應用在汽車內飾件加工；箱型五軸加工中心專門用於非金屬輕切削加工上，此加工中心搭載新代 (SYNTEC) 控制器，此控制器開放性高、客製化能力強、更符合汽車內飾件製造業多變的需求，有別於目前常見的五軸控制器：FANUC、SIEMENS、HEIDENHAIN 爲封閉系統控制器。此加工中心採包覆式設計，便於集中切削粉塵，保持生產線環境整潔。兩區設計（圖）可增加產能，當一區加工則另一區準備裝配治具及上料，保持生產不間斷。

Five-axis processing technology is mainly applied in the aerospace and national defense industries. This technology must be integrated with mechanism design, controller technology and 3D advanced CAD/CAM software (ex. CATIA, UG). Five-axis processing has always been a field with high barriers to entry. However, five-axis processing has been adopted in various different fields and has become an indispensable processing technique, complemented by increasingly maturing matching technology and an increasing talent pool familiar with CNC processing. Compared with the traditional three-axis equipment, five-axis processing equipment deliver higher efficiency and less processing restriction. In addition, the surface processing capacity greatly reduces the manufacturing and secondary processing time.

Anderson has developed five-axis processing technology and applied it in automobile interior parts processing. Box type five-axis processing center is used for nonmetal light cutting processing. This processing center is equipped with a SYNTEC controller. This controller is high in openness and versatile in customization capacities, which meets the changing demands of manufacturing enterprises of automobile interior parts. This controller is different than other common five-axis controllers: FANUC, SIEMENS and HEIDENHAIN controllers are closed-system controllers. This processing center adopts a covered design for the convenience of cutting high volumes of dust and keeping the environment of the production line clean. Two-region design (Fig.) can increase productivity. When one region is processing, the other region is ready for assembling fixtures and feeding, which keeps production continuous.



>（圖）分區設計：可同時上料和加工，節省時間
> (Fig.)Divisional design: feeding and processing at the same time, saving time

越來越多非金屬材料取代原有金屬用料，不論是製程或是設計上的考量，複雜的幾何外型和曲面加工已不可避免，高速切削五軸加工之應用，也將成爲重點發展的技術之一。恩德科技已掌握此關鍵技術並在此領域中以先驅者自居。

Nonmetal materials are replacing original metal materials. Considering processing or design, complex geometric shapes and surface machining are inevitable. The application of high-speed cutting with five-axis processing will become one of the most important technologies in its field. As a pioneer, Anderson has mastered this key technology.

櫥櫃傢俱新思

-UV 噴

Cabinet Furniture New Thin

-Intr

在台灣的傳統觀念中，室內設計大多是一次完工型的裝修，爲了完整的風格，大量的木作、油漆、薄片石材…等，幾乎是客製品，造價高又不環保。而裝潢是帶不走的，只要搬家，往往又重新來過。而國外其實常利用部分裝修及傢俱進行住家的改造。

省下天、地、壁的費用，而投資在傢俱、傢飾上，雖然傢俱有可移動性的好處，但往往好的設計傢俱其售價不低，而輕裝的板材更是有一定的風格限定，想跟上現代人較個人化的生活性調的設計，其實是有一定的難度。

製造業一直以來，依然固守著產量的思維，而這項思維也一直使數位印刷無法導入產線。但如果仔細剖析可以發現目前的市場，銷量往往遠低於產量，而爲了分攤開版成本，而大量生產後，增加了庫存成本，多了庫存就多了許多的隱藏風險；現在處處可見系統櫥櫃、系統傢俱，打著免費丈量估價，全品量身訂做，但往往價格不斐，而且樣式都是有限的，以設計的觀點來看，並非稱得上個人化，而真的要個人化也不是完全不可能，只是價格上往往超出一般人可接受的範圍。

According to the traditional concept in Taiwan, most of the interior designs are complete decoration. For the sake of the complete style, a large quantity of wood, paint, chip stones etc. are almost customized products, high in price but not environmental friendly. However, the decoration cannot be taken away. Once you move to another place, you have to do the decoration again. In foreign countries, part of the decoration and furniture are often used for home renovation.

You can save the costs of the ceiling, floor and wall and invest them in the furniture and decorations. Although the furniture is movable, well designed furniture is often high in price. The board materials which pay less attention in decoration are restricted in style. It is hard to follow the personalized design in current life style.

The manufacturing industry has always held the output thinking, which has always prevented digital printing from entering the production line. However, if the current market is carefully analyzed, it can be found that the sales are often much less than production for absorbing the cost of open version. After mass production, however, the inventory cost is increased. Large inventory increases many hidden risks; at present, system cabinets and system furniture can be found everywhere, the sales person claims to provide free measurement and valuation and all the furniture are tailor-made. However, the price is often very high and the styles are restricted. From a design standpoint, they are not personalized. Actually, personalization is not impossible, but the price is always beyond the acceptable scope of the man in the street.

思維
繪技術的導入
king
roduction of UV Print Technology

文／吳權育 — By Wu Chiuan Yu

當市場轉變，企業的思維也將跟著轉變，配合科技的進步，新的生產模式也將會快速的導入產線。近年來，最為引人矚目的印刷技術，莫過於 UV 噴印這塊領域了，噴印的發展一直以來最直接的關係就是墨水的可用性；而近幾年來，由於 UV 墨水的發展快速，使得原本被市場冷落的 UV PRINTER 有著爆炸性的發展及多元的市場出現，以下將舉出幾個應用面的案例。

When the market changes, the enterprise changes their thinking too. With the progress in science and technology, new production mode is also introduced to the production line quickly. In recent years, the most eye-catching printing technology is UV spray printing. The availability of ink is most directly close to the development of spray printing; in recent years, UV printer which was ignored by the market is greatly developed and the multiple markets appear due to the rapid development in UV ink. Several application examples are given hereinafter.

新技術

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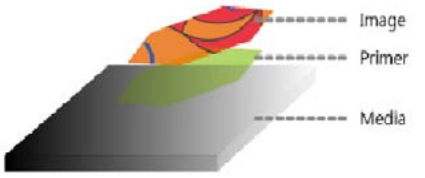
塑合板
Particle board

一般又稱爲粒片板，是目前最流行的環保建材，主要分爲兩大類：V313、V20，因爲表面的美耐皿具有抗燃、防潮、耐磨、抗酸鹼等特性，因此在噴繪時的密著上有一定的難度，爲了克服這一點，在製程上就必需在噴繪前加一道程序：架橋劑塗佈，架橋劑的使用可以大幅提高墨水於板材之間的密著度，而墨水固化後的硬度更可達 3H，使得成品不管是否有上保護層，表面都能有耐磨、抗刮的特性

然而在塗佈上也是有另一項難題，就是板材表面的改變，在全面塗佈時，墨水未覆蓋的區域，表面將會和未上塗佈的板材有異，而傳統的解決方式是不管有沒有要噴繪的區域，全都加上塗佈的程序，但也造成了額外的成本浪費。

It is also known as particle board. As the most popular environmentally friendly construction material, it can be divided into two categories: V313,V20.As the melamine on the surface is fireproof, waterproof, wear-resisting and acid and alkali resistant. Therefore, it is difficult in adhesion during the spray painting. In order to solve this problem, a procedure, bridging agent coating, must be added before the spray painting. The function of the bridging agent is to greatly improve the adhesion between the ink and the board.And the hardness of the ink after solidification is as high as 3H so that the surface of the finished products is wear resistant and scrape resistant where there is a protective layer on the surface.

However, there is another difficulty in coating, change in surface of the board. The surface of the board where is no ink has a difference compared to the unpainted board during overall coating. The traditional solution is to execute the coating program on the area whether it is spray painted or not. This causes some additional cost and is a waste of time.

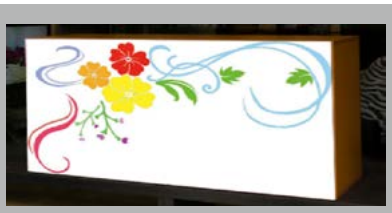


目前 DPC 已推出架橋墨水，將可解決上面所有的問題；1. 利用數位噴繪的好處可以不需開版，即可做架橋劑的局部塗佈，可以直接省去傳統的架橋製程，配合 DPC〔獨特的前、後排噴頭排序及 P+C(primer+color) 的噴印模式，即可在不增加時間成本下，一次完成架橋和彩繪的噴印程序，以最精準的墨量及最精確的產能形成最大的製造效益。

The bridging ink developed by DPC can solve all the above mentioned problems; 1. No open version is required to the benefit of using digital spray painting. Namely, local coating the bridging agent can be conducted. The traditional bridging program can be directly omitted. With the DPC unique front, rear nozzle sorting and the P+C (primer+color) printing mode, the spray printing program of bridging and color painting can be completed without any increase in time or cost. It forms the greatest manufacturing benefit with the most accurate ink quantity and productivity.

案例：系統廚櫃門板的噴繪加工

Example : Print processing the door panel of the system cabinet



系統廚櫃 - 塑合板噴繪後加保護層
System cabinet-add protective layer on the particle board after painting

衣櫥 - 塑合板直噴
Clothespress- particle board direction spray

圖案尺寸 Dimension	700 x 400mm
解析度 Resolution	720 x 720
噴印模式 Spray printing mode	840mm/sec, 2Pass speed up bi-direction
墨水 Ink	NTD 4500/ L · 架橋劑 /bridging agent：NT 7400
UV 燈 UV light	USD 400/ 支 No. (平均壽命 average service life 800 hr)

噴印時間 Spray printing time	1’ 58”
總墨水耗用 (c.c.) Consumption of total ink (c.c)	0.424
墨水平均成本 (每 c.c.) Average cost of the ink(every c.c.)	4.5
總墨水成本 Total ink cost	1.908
架橋劑耗用 (c.c.) Consumption of bridging agent (c.c.)	0.468
架橋劑平均成本 (每 c.c.) Average cost of bridging agent (every c.c.)	7.4
架橋劑成本 Cost of bridging agent	3.463
UV 燈成本 Cost of UV light	0.983
總成本 Total cost	6.35

原本需塗滿整片門板的架橋劑，約需 5c.c. 以上的成本，在使用架橋墨水的噴繪生產時，只耗用了不到 0.5 c.c.，既保有空白處的原始樣貌，又有節能環保的作用。

The cost of the bridging agent to be originally covered to the whole piece of the door panel is more than 5c.c. However, during the spray painting production using bridging ink only costs less than 0.5c.c. It keeps not only the original appearance of the blank, but also has the function of energy-saving and environment protection.

密集 板

Medium density fiberboard

英文爲 Medium Density Fiberboard 中密度纖維板，所以大都取字首三個字母稱爲 MDF 板，其生產方式就是木材纖維混合樹脂及黏膠經過高溫高壓而壓製而成的人工板材，因價格低廉因此最常使用於 DIY 傢俱或組合式的系統傢俱，也常用於方正設計的櫃體；而表面處理，因大都走較低價的市場，因此多使用印刷的 PVC 來進行貼皮，而傳統印刷或一般平面印刷，無法使表面產生較爲明顯的立體觸感，需配合到開版、開模來進行壓紋，此流程時間長、費用高，且可控制因素較少，因此所生產的商品會缺少獨特性。

MDF is short for medium density fiberboard, it is the artificial board which is made of wood fiber mixed resin and viscose under high temperature and high pressure. As it is cheap in price, it is often used for DIY furniture or combined system furniture. Also, it is usually used as the material of the cubicles designed by Founder Group; Most of the MDF is sold in the low-price market, the surface is pasted with printed PVC materials. However, traditional printing or general planar printing cannot create obvious stereo tactile impression on the surface. Embossing shall be made to the MDF by opening version and opening mould. This process is time-consuming and high in price. As there are few controllable factors during this process, the products will be lacking in uniqueness.

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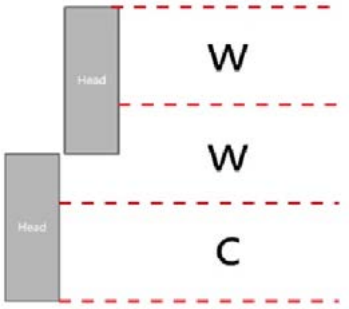
而 DPC-UV 噴繪技術，解決了上述的製造缺點，而主要的對應方法就是－ 3D 立體彩繪，利用 UV 墨水的可堆疊特性，配上 DPC 所開發的特殊噴印模式，將可以輕易的達到所需的 3D 樣式

特殊的噴印模式有三大特點：

1. 分層模式：將列印區塊分二層或三層來進行白色的堆層及彩色的彩繪（W+C、W+W+C），如此一來配合噴頭的排列方式，可以使工作效益最大化。

2. 各層墨量控制：將特別色與彩色區分開來，可以各別選擇不同的墨量，讓使用者可以更精確的控制堆疊量及顏色深度，最高可達 1600%。

3. 一次性：上述的二點都是一次性的作業，不需重覆作業來進行，所以不管在成本或風險上都降到最低，不浪費一絲一毫的資源。



However, DPC-UV spray painting technology overcomes the above-mentioned disadvantages in manufacturing. The main solution is 3D color painting. The required 3D model can be easily obtained by taking advantage of the stackable feature of the UV ink and the special spray printing model developed by DPC.

The three characteristics of the special spray printing mode are given below:

1. Hierarchical model: The printing block is divided into two or three layers for white stacking and color printing (W+C, W+W+C). In this way, the work efficiency can be optimized with adjusting the nozzle arrangement.

2. Ink quantity control on each layer: The special colors and multicolor can be distinguished and different quantity of ink can be selected separately so that the user would control the stack amount and depths of colors more accurately, as high as 1600%.

3. One-time operation: the above mentioned characteristics are all one-time operation and no repeated operation is required. Therefore, both the cost and risk are controlled to the minimum levels and no resources are wasted.

案例一：立體木紋拼花桌面

Case Ⅰ: Stereo wood parquet desktop

密集板貼 PVC 後，UV 直噴 3D 堆疊
Medium Density Fiberboard after pasting PVC, UV direct spray 3D stack

圓桌直徑 Diameter of the round table	600mm
解析度 Resolution	720 x 1440
噴印模式 Spray printing mode	F420 3pass bi.
墨水 Ink	NTD 4500/ L ·
UV 燈 UV light	USD 400/ 支 No. (平均壽命 average service life 800 hr)

拼花木紋噴繪 (700%) Wood parquet spray painting 700%)	一次噴印 3 片 Spray paint 3 pieces for one time	每片平均 Average value for one piece
總噴繪工時 Total painting hours	17'38"	5'53"
耗墨量 (C.C) Ink consumption (c.c.)	106.74 cc	35.58 cc
墨水成本 (1C.C) Cost of ink(1C.C)	4.5	4.5
總耗墨量成本 Total cost of ink consumption	480.33	160.11
2 個 UV 燈 2 UV lights	4.41	1.47
小計 Total	About NTD 485	About NTD 162

案例二：MDF 仿實木

Case II: MDF imitation solid wood

噴塗白漆
Spray coating white paint

使用砂光機磨平表面
Smoothen surface with sanders

直接噴印圖檔
Smoothen surface with sanders

在 MDF 表面先噴塗白漆後再進行其他加工也是常見的應用之一。

將 UV 墨水噴印於上完白漆的 MDF，建議的操作流程爲：

1. 先將白漆噴塗於 MDF 表面（可透過噴槍或是自動噴漆線等）
2. 使用砂光機處理表面使其平滑
3. 直接噴印圖檔於白漆上

（平均總耗墨量： 13 c.c. / m^2)

One of the common applications is to paint white paint on the surface of MDF before other processing.

To spray print the UV ink on the MDF covered with white paint, the suggested operation flow is given below:

1. Firstly, spray the white paint on the surface of MDF (it penetrates the spray gun or automatic painting line etc.)
2. Use sanders to machine the surface to make it smooth
3. Directly spray print the figure file on the white paint (average total ink consumption: 13 c.c. / m^2)

夾 板
Plywood

夾板就是以一層層的薄木片上膠後堆疊壓製而成，而有時爲了使承載力更大，會依木片的紋理方向，交錯堆疊再進行壓製。

夾板的特色是結構體堅固，不易變形，密度厚實，比起塑合板或密集板都有更強的承重度及耐壓度，另外在鑽孔施工上也較不會掉粉屑，是隔間裝　及傢俱承重部件的常用材料。

雖然比起原木來得堅固，但表面紋理仍無法如原木的自然質感，因此大多數會再利用貼木皮的方式做表面的加工包裝；而高級木皮的取得相當不易，像有特殊鳥眼紋、雀眼紋、樹瘤紋的特殊紋理木皮，更是驚人的高價，而且可遇不可求，而貼低價位的木片則有約 30% 的瑕疵存在，無法有較好的性價比，所以一般會直接使用面板來修飾，如防火膠板，再來也有直接塗上保護漆後再上面漆來做使用

Plywood is made of layers of wood veneers being stacked and pressed after sizing treatment. In order to make the bearing capacity greater, sometimes the wood veneers are stacked alternatively in accordance with the grain direction of the wood veneers.

The features of the plywood are strong in structure, difficult deformation and thick density. Compared with the particle boards and MDF, the plywood is of stronger bearing capacity and pressure withstanding capacity.

Compared with the logs, plywood is firm. However, its surface texture is not as natural and tactile as those of the logs. Therefore, in most cases, wood veneer pasting will be adopted for surface processing and package; however, high-ranking wood veneers with special textures such as special bird eye pattern, skylark eye pattern and burl pattern are hard to get. The prices of the wood veneers are prohibitive and they are very hard to seek. When using low priced wood veneers, there exists 30% flaws without good cost performance. Therefore, panels such as laminated plastic sheet are usually directly used for decoration, or it can be used after directly painting protective paint and finishing paint on the surface.

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而更有設計感的拼花貼皮則是往上定位到奢華路線，利用色澤紋路不同的異木皮，來拼湊出高級質感，不只考驗設計也講求拼貼的技術，因此價格不斐。

針對噴繪對夾板的應用，DPC 利用平板 UV 噴繪機的優勢，發展了兩種不同的應用；一種是直接於夾板表面噴印上特殊木紋，這個做法並不是完全覆蓋原始的木皮表面，而是利用到本身木皮表面上的紋理，再利用噴繪機改變色澤及附加紋理，創造出無限的視覺效果，簡單來說就是便宜的木片也能整型爲高級的木紋，而本身的獨特紋路也可讓每片成品都有不同的紋理，另外也將些許的瑕疵給修飾掉，完美呈現木紋特性；而 DPC 提供的產能可達每小時 100 平方米的高產能，顛覆數位噴印給人慢吞吞的刻板印象；另一種不同的應用則是拼花上的應用，傳統拼花上的缺點有工時長、工序復雜、成本高、無法預視，而數位噴繪的好處就是設計師直接利用電腦來設計拼花圖稿，完全掌控圖樣，不管色澤、紋路或拼貼方式等，都可以在營幕上預視，而工序完全簡化，像使用桌上型印表機一樣，模式選好，一個按鈕就完成，製程快又便捷。

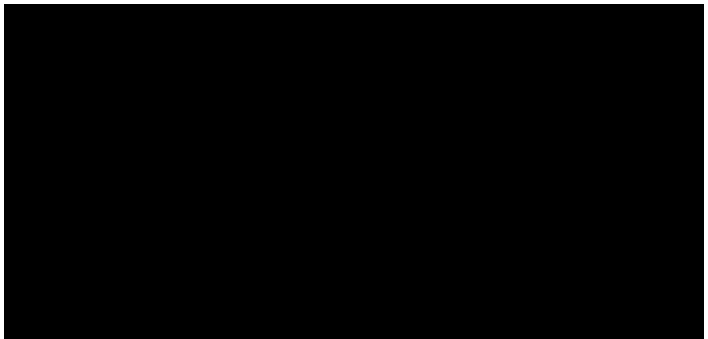
The parquet veneer with sense of design is designed luxurious. Use veneers with different textures to make up the tactile sense of good quality, considering both the design and parquet technology. Therefore, the price is high.

For the specific to the application of spray painting in plywood, DPC makes use of the advantages of the flat panel UV inkjet printer to develop two different applications; one is to directly spray print special texture on the surface of the plywood and then change the color and the additional texture with the inkjet printer to create the unlimited visual effect. To be simple, cheap veneers can also be painted with textures of good quality. The unique texture brings different textures on each finished veneer. Moreover, it also decorates some of the flaws so as to perfectly present the properties of the texture; The production capacity provided by DPC is as high as 100 square meters per hour, changing the slow and stereo impression of the digital spray printing; another different application is the application of parquet. The disadvantages of traditional parquet are long working hours, complicated working procedure, high cost and unable to preview. The advantage of digital spray printing is that the designer directly designs the parquet using the computer and completely controls the parquet. The color, texture and jointing method can be previewed on the screen. The working procedure is simplified; the operation is the same as the desktop printer. Select the mode and press the button to finish, the program is fast and convenient.

傳統手工拼花
Traditional manual parquet

數位拼花樣稿
Sample of digital parquet

數位拼花成品
Finished products of digital parquet



案例三：夾板仿柚木木紋加工

Case Ⅲ：Plywood imitation teak wood texture processing

夾板的噴印可選用最高速的噴印模式來進行
Spray printing plywood can be done by selecting the spray printing mode at the highest speed.

夾板噴印的產能可高達 100 m2/hr
The capacity of plywood spray printing is as high as 100 m2/hr.

約 1 分 55 秒可噴印完一片台面大小的夾板 (2400mm x 1200mm)
A plywood with the size of a table top can be spray printed in about 1 minute and 55 seconds

總耗墨量約為 30.12 c.c.
Total ink consumption is about 30.12.c.c.

材料尺寸 Image Size	2400 X1200 mm , 360x360 dpi
Carriage Speed	840 mm/sec 2Pass speedup bi direction
Ink	USD 150/L
UV lamp	USD 400/Piece Average Life time 8 hr
噴印時間 Spray printing time	1'55"
總耗墨成本 Total ink consumption	30.12
墨水成本 (每 c.c.) Cost of ink (every c.c.)	4.5
總墨水成本 Total ink cost	135.54
UV 燈成本 / Cost of UV light	0.958
總成本 Total cost	136.498

UNIT:NTD

ＵＶ噴繪在應用上的進步可以歸功於：

The improvement in the application of UV spray painting lies in the following factors:

- 速度的提升：不再定位於打樣的技術，而是可以實際量產。
- 架橋墨水的開發：架橋墨水的出現，使簍空的空白區塊可以完美的呈現原物料的質感。
- 多元化的墨水：ＵＶ墨水不再只是硬梆梆的壓克力感，軟性，可撓性的墨水讓材質的選擇性變多了，也讓加工的程序更爲彈性。
- 環保意識的抬頭：有限的自然原料（如：木材、石材、礦物、……等）使環保成爲世界趨勢；利用數位噴繪的技術加上ＵＶ墨水的堆疊特性，可以仿出不管視覺或是觸覺都幾乎與被仿原物一樣的質感，大幅提升環保材質的可用性及實用性。

其實在這跨界的時代中，每項科技都不斷的進步，每個行業都在整合、交融、相互的滲透，要保持在成功的那一端，就必須不斷的學習、資源整合及改變，與時俱進，保持主動，才不會被淘汰。

改變一下思維，運用適宜的生產技術，在完善的規劃下，將ＵＶ噴繪的技術與傢俱傢飾的應用整合出創新的生產模式，於時間成本、庫存成本、開發成本都可大大的降低，不只使產品更多元、更環保也更易於掌控。

●**Increase in speed:** It is aimed at actual production rather than the sample making technology.

●**Development in bridging ink:** The bridging ink makes the empty block take on the texture of the raw material perfectly.

●**Diversified ink:** UV ink has no longer the sense of the hard acryl. Soft and Flexible ink makes the selection of the textures more diversified, which also makes the processing program more flexible.

●**Raising in environmental awareness:** limited natural raw materials (such as wood, stone, minerals etc) makes becoming environmentally protective a world trend; taking advantage of the digital spray painting technology in addition with the stack properties of UV ink, both visional sense and tactile sense can be almost the same with the original object being imitated, which greatly improves the availability and practicability of the environmental protection materials.

In this crossover age, each technology keeps advancing. All industries are integrating, blending and penetrating with each other. You must learn, integrate resources and change constantly if they want to be successful. The companies must keep pace with the times and be active so as not to be eliminated.

Change the thinking and use appropriate production technology to integrate the UV spray painting technology and furniture and decoration application into the new production mode. It will greatly reduce the time cost, inventory cost and development cost. It makes the products more diversified, more environmental friendly and easier to control.

新技術

產品
發表

New Technology
and
Product Release

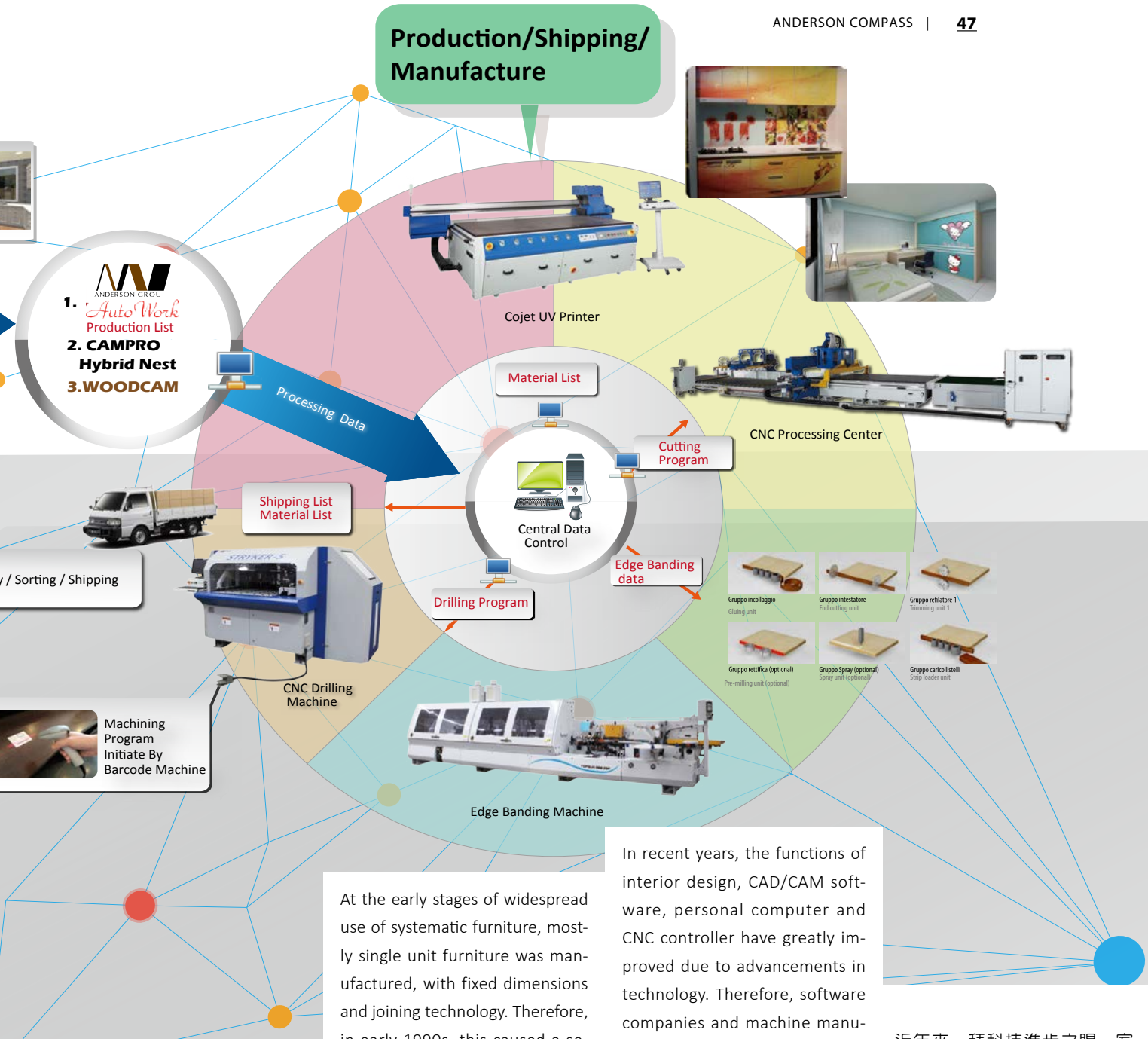
板式家具自動線整合系統

Panel-Type Furniture automatic Line Integration System

文 / 曾正芳
—By Tseng Jeng Fang

1940 年代因爲戰爭需求，塑合板在德國首先被開發問世。於德國的布裡曼（ Bremen ），工廠採用廢木料如木材削片或者鋸木屑等等素材，加上樹脂等塑膠加以高溫重壓，重新聚合成板。到了 60 年代，德國 INTERLUBKE 公司，以規格化的小單位，延伸出家具的多樣組合，這一系列產品也爲系統家具未來發展方向，奠定了基本模型。後來因世界人口急速膨脹，樹木成長速度不足以應付市場需求，以木屑或人造速豐林所生產之塑合板逐漸受到市場重視，以塑合板貼合高硬度之美耐皿（melamine）表皮所製成之美耐板被廣泛應用於各式家具。因以板材製造家具其生產製程簡單且使用空間易規劃，故由早期只用於廚具桶身，漸漸導入於公共建設與辦公家具工程，隨後進一步跨入居家領域，90 年代時已一步一步佔有獨立的地位。

Due to the demands of war in the 1940s, particle boards were first developed in Germany. In Bremen, Germany, factories used waste wood such as wood chipper, saw dust and plastics such as resin pressed together in high temperature to create the boards.In the 1960s, German INTERLUBKE Co. Ltd., developed a diversified combination of furniture in normalized small units. This series of products provided a basic model for the further development of systematic furniture. Afterwards, the growth rate of trees failed to meet market demand as the population of the world swelled. Particle boards made of saw dust and artificial forest gradually drew the attention of the market. Fitting the plastic boards with laminate hard plastic sheets made of melamine coat with high hardness had been gradually applied in various kinds of furniture. As furniture made of boards has a simple production process and is versatile in functionality, it has been gradually used in kitchens, public construction and office furniture, eventually becoming more prevalent in households. In the 1990s, it already occupied a solid position in the furniture market.



系統家具廣泛使用的初期，以製造單元家具爲主，即固定尺寸及結合工藝，於是於 90 年初引起歐洲木工機製造廠購併風潮，以打造全自動化大量生產線。同時爲因應客製訂單需求，亦打造小型自動生產線(mini factory)：包含開料、鑽孔、貼邊等機械及簡易軟體，提供家具店面直營工廠及裝修師傅使用，此爲訂製家具的生產雛形。

At the early stages of widespread use of systematic furniture, mostly single unit furniture was manufactured, with fixed dimensions and joining technology. Therefore, in early 1990s, this caused a series of mergers in the European woodworking machine industry, as manufacturers sought to build a fully automatic production line. Meanwhile, as required by custom orders, mini-factories, which produced machines that performed cutting, drilling and facing, as well as simple software, were formed. Furniture stores operated by the factories and their decorating experts were provided this solution as an early form of custom-made furniture manufacturing.

In recent years, the functions of interior design, CAD/CAM software, personal computer and CNC controller have greatly improved due to advancements in technology. Therefore, software companies and machine manufacturers began to create a total solution featuring full information from design to production and automated production. It became popular at once and caused a revolution in the manufacturing method of board-type furniture. Responding to the market trend, Anderson also invested a large quantity of manpower to manufacture a screen-to-machine technology (SMT) system that features full information from design to production and automated production.

近年來，拜科技進步之賜，室內設計、CAD/CAM 軟體、個人電腦及 CNC 控制器之功能大幅提升，故軟體公司與機械製造廠開始聯手打造從設計至生產全方位資料 / 機械自動化生產模式 (Total solution)，一時蔚爲風潮，引發板式家具生產模式變革。

爲因應市場趨勢，恩德亦投入大量人力，打造從設計至生產資料 / 機械自動化之全方位解決方案 SMT(Screen to Machine Technology) 系統。

新技術

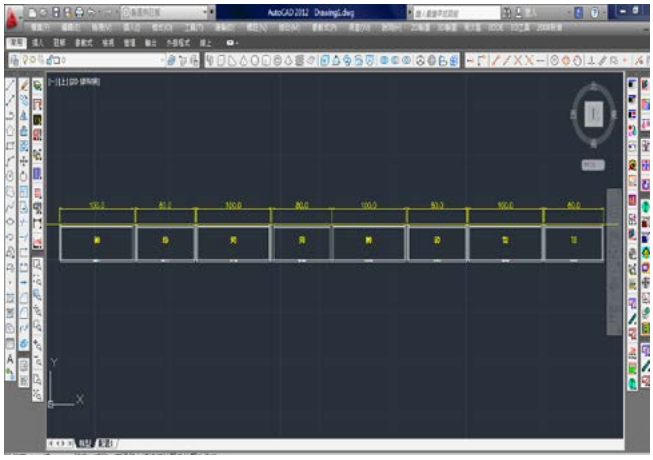
產品
發表

New Technology
and
Product Release

SMT 系統係由：Autowork、Campro Hybrid Nest、Gplan 及 Woodcam 所 組 成。

1

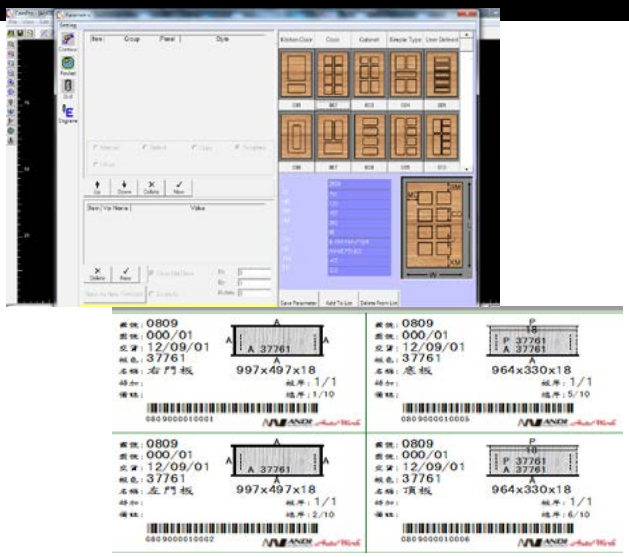
Autowork（架構於 AutoCad）室內設計軟體：
除可繪製 3D 效果圖及輸出報價單外亦可產生：
a. 工廠加工所需之 CSV 板材加工清單
b. XML 格式之 CNC 加工程式。



Autowork (in AutoCad) interior design software: other than enabling 3D effect drawing and providing a quote for the project, this software can also produce the following:
a. CSV board processing list used for factory manufacturing
b. CNC machining program in XML format.

2

Campro Hybrid Nest：使用於 CNC 開料機（如 ANDI Genesis EVO）之優化排版軟體，用以接收來自 Autowork 之 CSV 及 XML 正面加工檔案，執行優化排版並產生：
a. 排版後之 CSV 材料需求清單
b. CNC 加工程式及標籤列印貼合資料程式



Campro Hybrid Nest software used for CNC cutting machine (such as ANDI Genesis EVO). It is used for importing the CSV and XML front processing files from Autowork, executing optimization and producing the following:
a. CSV material requirements list after optimization
b. CNC machining program and label printing program

SMT system consists of Autowork, Campro Hybrid Nest, Gplan and Woodcam.

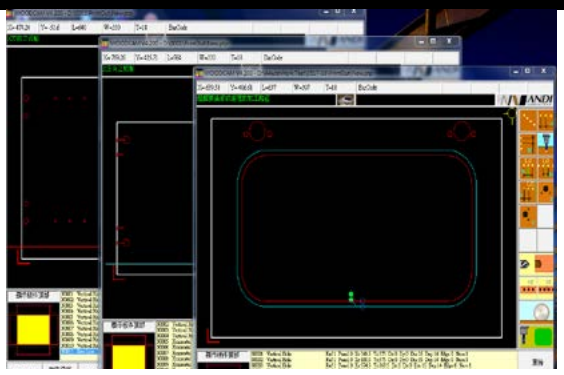
3

Gplan：GIBEN 系列之裁板機優化排版軟體，用以接收來自 Autowork 之 CSV 板材加工清單檔案，執行優化排版並產生材料需求清單及裁板程式

Gplan:optimize software for GIBEN series panel saw. It is used for importing the CSV processing list files from Autowork, executing optimization and producing the production material requirements list and cutting program.

4

WOODCAM：ANDI 系列鑽孔機程式編輯介面程式，用以開啓並執行來自 Autowork 之 XML 加工程式，進行板材鑽孔加工。



WOODCAM:ANDI series point-to-point machine program editing user interface. It is used for executing the XML machining program from Autowork to enable board drilling and machining.

新技術

產品發表

New Technology
and
Product Release

SMT 接單 -
生產作業流程
SMT order receiving production process

室內設計圖
Interior design drawing

材料清單
Material list

計價
Material list

CSV 材料清單：
NestSheetData.csv 用以準備加工材料

CSV material list:Nest-SheetData.csvUsed for preparing processing materials.

*XML 加工資料
XML processing information

Woodcam

PTP 鑽孔機
STRYKER 鑽孔機

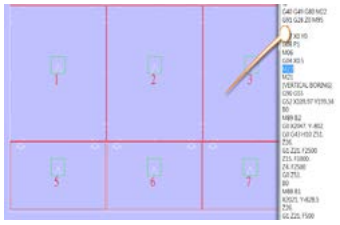
PTP 鑽孔機操作人員以條碼機讀取板材上之條碼標籤，以啓動 XML 加工程式進行板材之其餘五面加工。

鼎加工材料清單
List of materials to be processed

CAMPRO HY. NEST type-setting software

CAMPRO HY. NEST 排版軟體

NC 程式 & 標籤資料
NC program & Label information



板材加工檔案及 NC 程式：
用於手動補列印標籤及板材加工

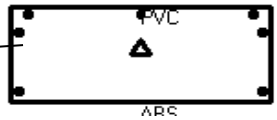
Board processing file and NC program:
Used for manually print labels and panel processing

G-plan 排版軟體
Gplan typesetting software

裁板程式 & 標籤資料
Board cutting program & Label information

標籤列印檔案：temp.csv
搭配標籤格式檔案，以列印標籤
標籤貼合位置檔案：*.lab
用以指定標籤貼合位置，通常標籤位置定義於板材中央

Label printing file:temp.csv
Matching files in label format for printing the label
Label sticking location file:*.lab
Used for the specified label sticking position and usually the label location is defined in the center of the board.



正面加工示意圖
可將此圖形列印於標籤上，提供後續加工參考

Front processing diagram
You can print this graph on the label for the reference of the following –up processing

貼邊機進料控制系統
Feeding control for welt fitting machine

貼邊機 Feeding control for welt fitting machine

貼邊機操作人員可依標籤說明進行貼邊，或如貼邊機有自動判斷貼邊功能，可匯入材料清單上之貼邊資訊，由貼邊機自動控制貼邊方式。

The operators of the edge banding machine can conduct edge banding according to the label instruction. If the edge banding machine is equipped with an automatic edge selection function, the edge information on the material list can be inputted so that the machine can automatically control the edge banding method.

＊註：

*1. XML 加工資料爲文字格式之 CAMPRO or WOODCAM 加工程式

2. 橘色框線爲室內設計軟體及拆料軟體及產生之資料

3. 紅色框線爲機械附屬 CAD/CAM 軟體及產生之資料

4. 藍色框線爲機械作業軟體及產生之資料

*Notes:

*1. The XML processing program is CAMPRO or WOODCAM machining program in text format

2. Orange borders are interior design software and unloading software and the information produced.

3. Red borders are mechanical auxiliary CAD/CAM software and information produced

4. Blue borders are mechanical operation software and information produced.

報價單
Quotation

作業說明

1. 以室內設計軟體（如 Autowork) 繪製室內設計圖 ＞算料估價 ＞產生報價單
2. 由室內設計圖拆料產生：a. 需加工之 CSV 材料清單及 b. XML 格式加工程式
3. 以排版軟體 Campro Hybrid Nest 匯入：a. CSV 材料清單 b. XML 格式加工程式進行排版並 產生 CNC 開料機所需之加工資料。
4. 客戶除使用裁板機進行裁板，亦可將材料清單匯入裁板機之排版軟體（如 GPLAN）進行排版，並產生裁板程式，進行裁板並同步列印標籤，由操作人員進行標籤貼合
5. 也可將板材加工清單載入 PDA 進行出貨盤點。
6. 客戶亦可使用其他室內設計 / 拆料軟體，進行室內設計及拆料，並輸出板材加工清單及 XML 加工程式。

Operational instruction

1. Interior design software (such as Autowork) draw interior design>material valuation>produce quote
2. Generate from the interior design drawing: a. list of CSV materials to be machined and b. machining program in XML format.
3. Input the following through the optimization software Campro Hybrid Nest: a. CSV materials list and b. XML format processing program for optimizing and producing the processing information required for CNC cutting machine:
4. Except for using CNC cutting machine to cut the board, the customer can also input the material list into the optimization software of the panel saw (such as GPLAN) to produce the program for cutting and synchronously printing the labels. And then the operators stick the labels.
5. The board processing material list can be inputted into PDA for shipment check.
6 .The customer can also use other software for interior design and material demolition and export the board processing material list and XML processing program.

STRYKER & PTP Drilling machine

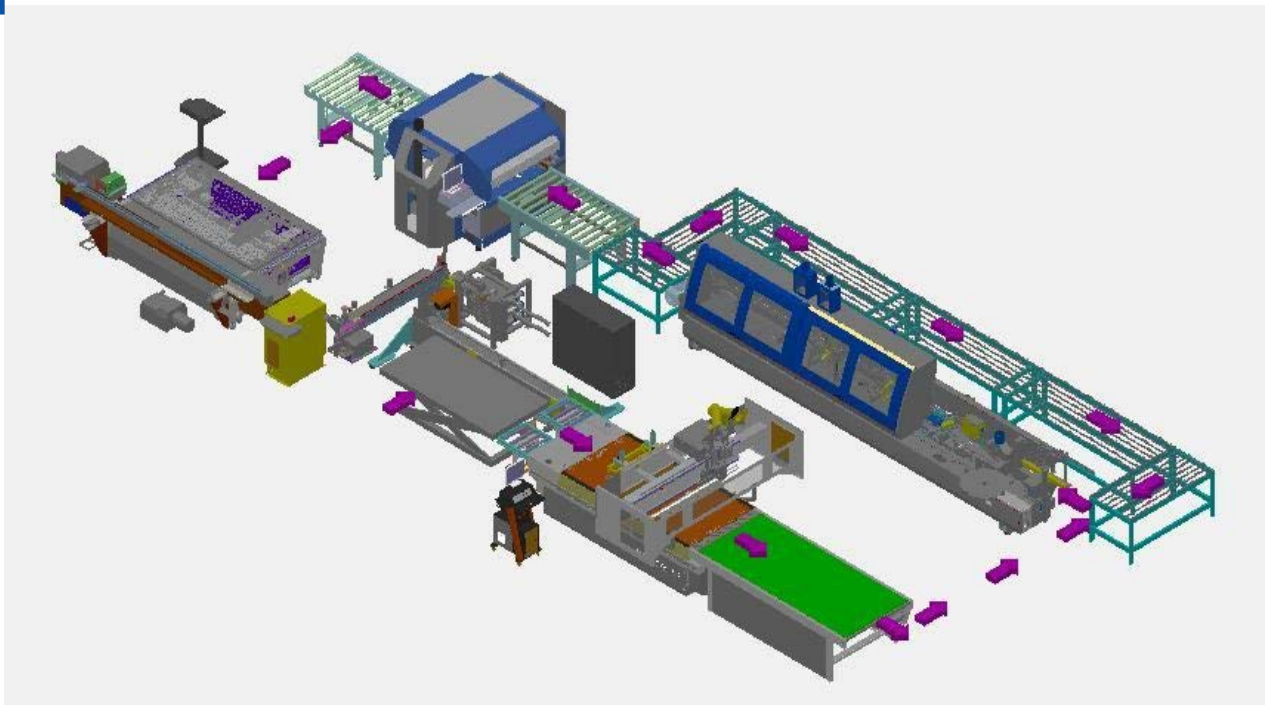
Operators of PTP drilling machine should scan the code label of the board with the barcode reader to start the XML processing program for machining remaining five surfaces of the board.

CNC 開料機 Welt fitting machine

CNC 開料機（如 ANDI GENESIS EVO) 操作 人員只需依 CSV 材料清單準備材料，並依材料順序將 NC 程式進行排序加工。當啓動機械加工後，CNC 開料機可自動執行上料＞標籤貼合正面鑽孔 / 開溝 / 切割＞ 出料（板材之開料及正面加工完成）。

裁板機 Board cutting machine

Operators of CNC cutting machine (such as ANDI GENESIS EVO) can prepare materials according to the CSV material list. Then, operators should conduct order processing in NC program in accordance with the order of the materials. After starting the machine, the CNC cutting machine will automatically execute the following procedure: loading >label sticking> drilling/grooving / cutting> discharging.



新技術

產品發表

New Technology
and
Product Release

CSV 材料清單（板材加工代碼）
CSV material list (board processing code)

如客戶所選用之室內設計軟體，無法產生 XML 格式之板材加工程式，可依板材功能於 Campro Hybrid Nest 軟體中建立多組巨集 (MARCO) 加工模組，並於巨集 (MARCO) 內加入尺寸判斷功能，於排版時匯入板材尺寸，將 CSV 板材加工清單與 MACRO 進行整合排版，產生所需之所有加工資料。

If the interior design software selected by the customer cannot produce the board processing program in XML format, several groups of MARCO manufacturing modules can be built into the Campro Hybrid Nest software. First, the customer needs to add the dimension judgment function into the MARCO and then input the dimension of the board during optimization. The CSV board processing material list and MARCO need to be integrated for optimization to produce the processing information required.

同時使用鑽孔機之 WOODCAM 作業軟體，建立與 MARCO 相同名稱之參數式模組，以條碼機讀取於開料時所建立 / 貼合於板材之條碼，啓動參數式加工程式並輸入板材尺寸，以產生 PTP/STRYKER-5 鑽孔機 NC 程式進行加工。

Use the WOODCAM operation software of the PTP drilling machine to build the parameter type module which is also named as MARCO. Read the code pasted on the board which is given at cutting process. Start the parameter type processing program and input the dimension of the board to produce PTP/STRYKER-5 drilling machine NC program for processing.

CAMPRO MARCO
CAMPRO HY. NEST 排版軟體
NC 程式 & 標籤資料

CAMPRO HY. NEST
typesetting software
NC program & label information

CNC 開料機
CNC Cutting machine

Gplan 排版軟體
裁板程式 & 標籤資料

Gplan type setting software
Board cutting program &label information

貼邊進料系統
Feeding control system for welt fitting machine

裁板機
Cutting machine

貼邊機
Welt fitting machine

註：

1. MACRO 爲 CAMPROHYBRIDNEST 之標準功能是種變數形式之文字格式加工資料，參數式是 WOODCAM 之變數形式加工程式，可使用判斷式。
2. 橘色框線爲室內設計軟體及拆料軟體及產生之資料
3. 紅色框線爲機械附屬 CAD/CAM 軟體及產生之資料
4. 藍色框線爲機械作業軟體及產生之資料

Notes:

1. MARCO is the standard function of CAMPROHYBRIDNEST and it is the variable processing information in word format. The parametric form is the WOODCAM processing program in variable form. And the predicates can also be used.
2. Orange borders are interior design software and unloading software and the information produced.
3. Red borders is the mechanical auxiliary CAD/CAM software and the information produced.
4. Blue borders are the mechanical operation software and the information produced.

訂製板式家具係指可指定板式家具之型式、尺寸、顏色。因顏色並不會影響加工方式，故只要充分利用軟體功能，作完整之規畫，訂製家具將不再是惡夢。訂製家具輕鬆做，接單生產”零”時差，將不再只是理想。

Customer-assembled board-type furniture enables the customer to specify the type, dimension and color of the furniture. As color will not influence the processing method, customer-made furniture will no longer be a nightmare if we take full advantage of software functionality. It is no longer a dream to easily manufacture customer-assembled furniture with “zero” time difference between order receiving and manufacturing.

新技術

產品
發表

New Technology
and
Product Release

板面板邊噴繪整合設備

Integrated Equipment for Panel and Panel Edge Printing

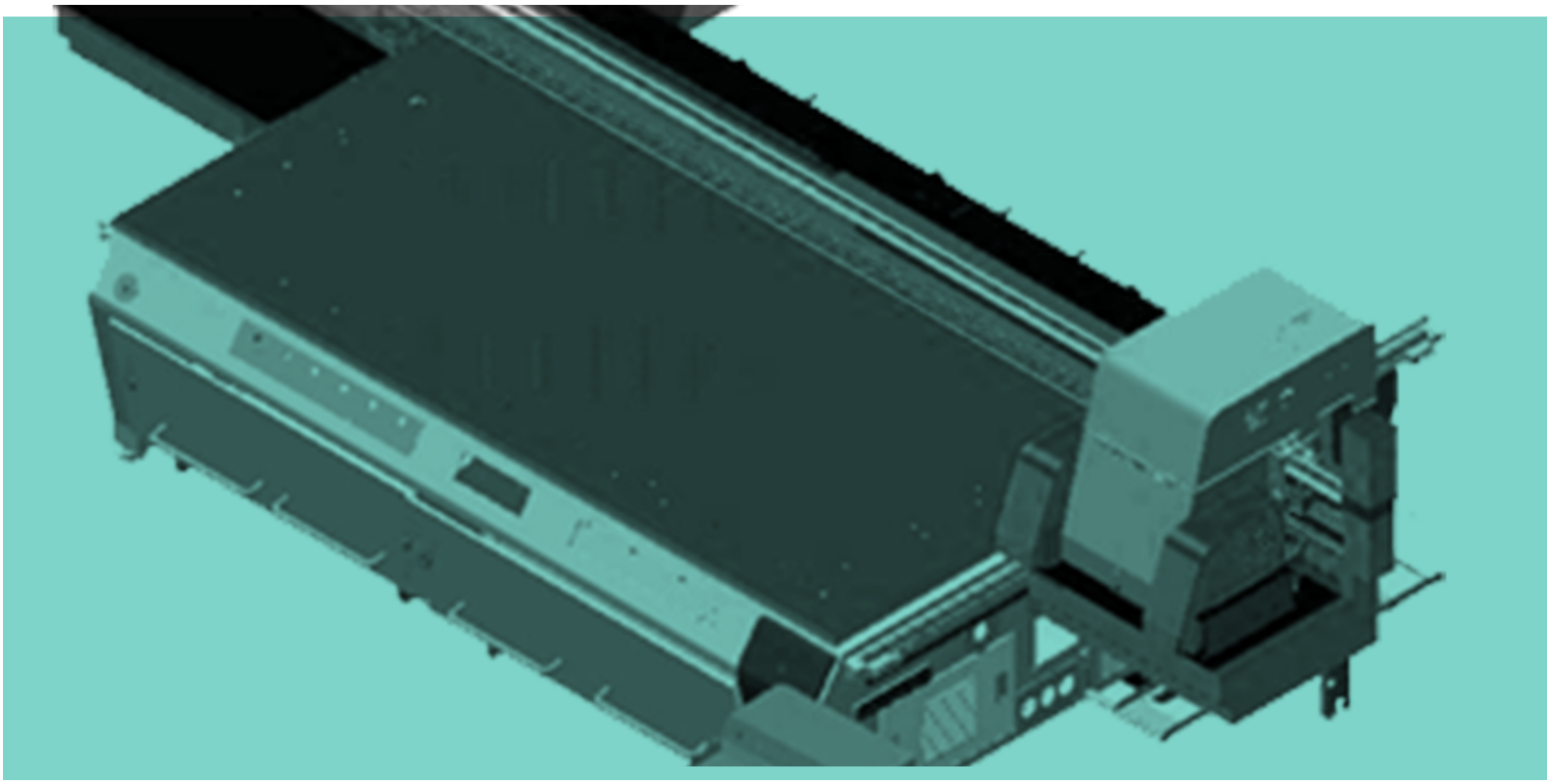
—By Lin Wu Chiang —

文 / 林 武強

UV 噴印機在噴印的材料運用上不外乎是軟質捲材與硬質平板片材，當恩德推出平台式 UV 數位噴繪機 CoJet 系列時，就是要充分利用既有 CNC 平台技術的優勢爲開發基礎；在木工 CNC 的技術與運用上，恩德已是世界翹楚，而恩德且將平板噴繪機定位在於建材噴印領域上，是希望能和木工 CNC 的整合，而現今恩德平台噴繪機在市場上亦占有一席之地。

另外，以往在噴繪製作圖像時，若想要平面與四邊的圖像有連接感，需將圖噴印在軟質材料上，再利用封邊方式將圖樣顯現在平面與四周上，這樣的製程有其風險，容易將噴印好的圖像因封邊動作的拉扯，使噴印完成的圖像產生變形甚至磨損，進而造成圖像的不完整，但利用板面板邊噴繪整合設備就能解決這些問題。

在建材業來說以傢俱最爲大衆所廣泛運用，但也由於個人化傢俱需求越來越普遍，恩德針對此趨勢在傢俱大平面所開發的彩色噴繪機，已可滿足大部份客戶的需求；但板邊側面的製程目前均採貼邊機的方式製造，然邊條的製造大都採大量製造，無法完全符合目前個人化需求。故恩德提出創新的製作方式，既然原有設備可噴印在平板上，則板材的四邊也一定可以噴印，恩德設計部門投入板邊噴繪系統的研發，以期待提供市場更多選擇之設備。以門爲例，當正面大平面有圖樣已不足以滿足客戶，甚至要求門的邊框也一併要注意美觀，希望邊框上也可以加以用圖像來修飾，當有這樣的需求時板面板邊噴繪的開發設計就能完全符合用戶的需求，同時也可以達到整體性的設計。



The materials used by UV printing machines are nothing more than soft-coiled materials and rigid sheet materials. When Anderson Group launched the Cojet series digital flatbed UV printers, the purpose was to make full use of existing advantages of CNC platform technology as the basis for development. In terms of woodworking CNC technology and application, Anderson Group is a global leader. Anderson Group has positioned flatbed printers for printing building materials, with the hope of integration with woodworking CNC. Anderson's flatbed printers have already played an important role in the market.

In the building materials industry, printing is widely used in furniture. Because of the growing demand for personalized furniture, Anderson Group has developed color printers for large, flat furniture in response to this trend. The machines can meet the needs of most customers. The sides of panels are currently manufactured by edge banding machines. However, most sidebars are made by mass production and cannot fully meet personalized needs. In response, Anderson Group presents innovative production methods to print on four sides of panels based on the concept that the original machinery technology allows for printing on a flat panel. The Anderson Group design department has conducted research and development on the panel edge printing system in order to provide more choices of equipment to the market. Take the door as an example. Patterns on front doors are no longer satisfying to customers, and some even want patterns on door frames to make them look more beautiful. When there is such a demand, the development and design of panel surface and edge printing have the potential to fully meet the demand of users and also achieve integrity in design. In addition, when images were printed in the past, if images on the plane and edges need to look connected, it was necessary to print patterns on a soft material first, before displaying images on the plane and edges by using a sealing method. Such a production process has risks, since it is easy for the printed images to become deformed or even wear due to pulling movements, resulting in an incomplete pattern. But with the use of panel surface and edge integrated printing equipment, such problems can be solved.

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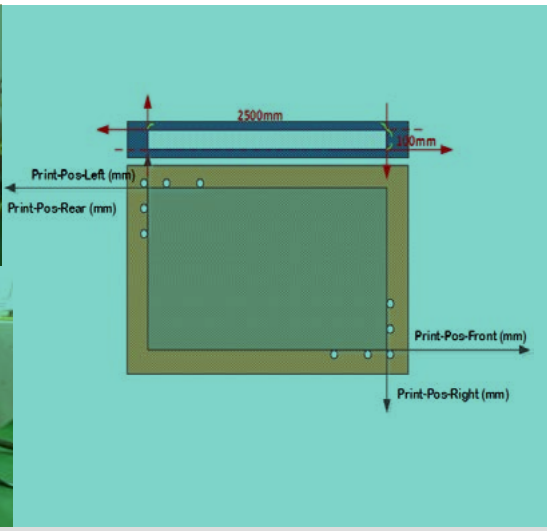


板邊機構的設計

延伸既有機台 CoJetPlus2512，在其後方增加板邊噴印模組以達到一機多用途，平面板和板邊噴繪的整合設備，開發重點在於安全的保護與軟體的控制，雖是一台整合的機種，但安全也有單獨的控制系統與操作介面。

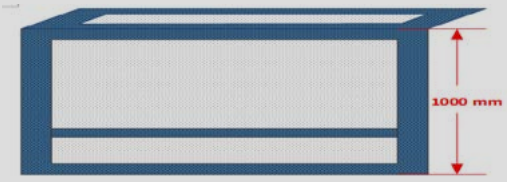
可以噴印的材料尺寸規格

長：100mm~2500mm

厚：10mm~100mm

高：100mm~1000mm

這樣的噴印尺寸是合乎一般門和儲櫃門的尺寸，恩德原主機架即可噴印的高度爲 100㎜，噴印邊尺寸低於 100㎜ 皆可在機台本體噴印。



Design of panel edge mechanism

Main structure for panel and panel edge printing

Building on the existing machine CoJetPlus2512, a panel edge printing module is added to its rear in order to become a multi-functional machine. The development of integrated equipment for panel and panel edge printing emphasizes safety of protection and control of software. Though it is an integrated model, it also has a separate safety control system and user interface.

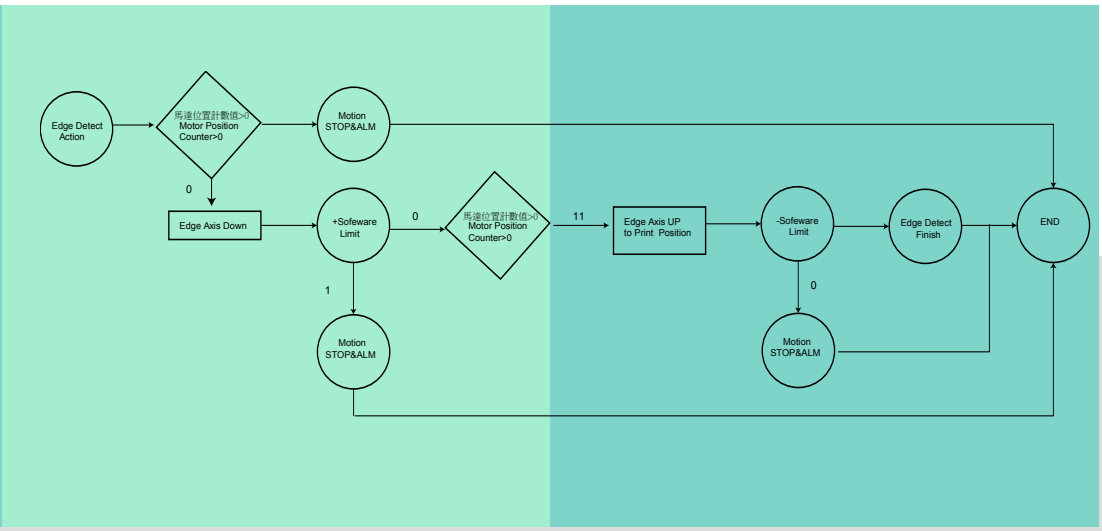
Dimensions of printable materials:

Length: 100mm~2500mm;

thickness: 10mm~100mm;

height: 100mm~1000mm.

This printing size is in line with the dimensions of ordinary doors and cabinet doors. The original machines of Anderson Group can print materials with a height of 100mm. Edges under 100mm can be printed on the machine body.



板面板邊噴繪的控制與安全

機台的完整性在於機構、控制、軟體所整合而成，機構大略陳述如上，上列圖示僅以流程圖描述板邊噴印作動控制原理。

如此的控制原理在於精確和穩定，將精度控制在可噴印範圍內，多次的保護迴授都是基於安全上的考量。

Panel and panel edge printing control and safety

The completeness of the machine lies in the integration of mechanism, control and software. The mechanism is roughly described above. The following will illustrate the control principle of panel edge printing operation by a flow chart.

The control principles are precision and stability. The control of precision within printable ranges and provision of multiple protecting feedbacks are all based on safety considerations.

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Safety mechanism for panel and panel edge printing

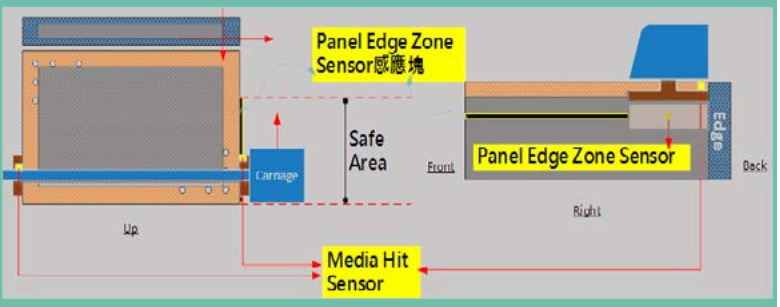
板面板邊噴繪的安全機制

對於機台的防撞在操作上有幾個保護機制：

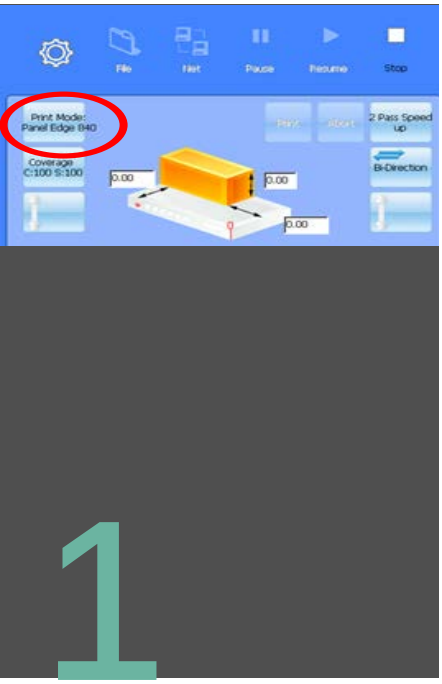
Media 軸進到 Panel Edge Module 區域時啓動 Media 軸防撞保護。Panel Edge Zone Sensor 脫離感應塊時若 Media Hit Sensor 被遮斷則 Media 軸 Motion 停止，Media Hit Sensor 機制需要 Media 軸脫離 Media Hit Sensor 感應塊，才會啓動，其目的是在 Flatbed 模式下，不會因板材厚度而觸發 Media Hit sensor，而導致無法列印，也加強以防萬一 Sensor 有所誤判將會有軟體啓動來做安全保護機制。

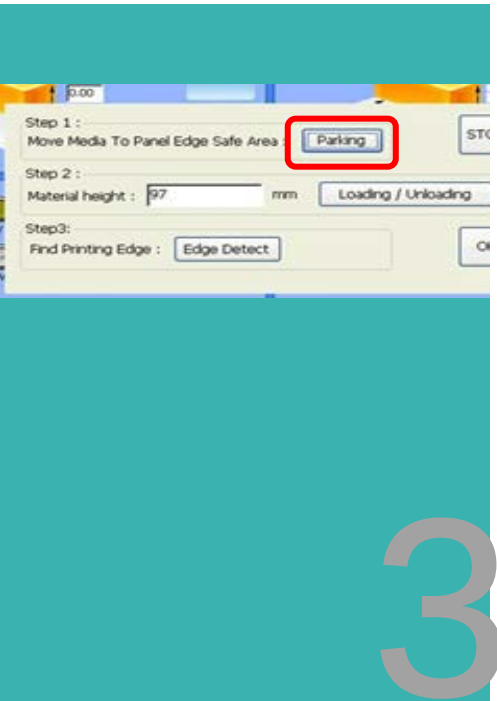
For anti-collision, there are several protection mechanisms during operation:

The Media axis anti-crash protection is started after the Media axis enters the Panel Edge Module region. When the Panel Edge Zone Sensor detaches from the sensing block, the motion of the Media axis will stop if the Media Hit Sensor is blocked. The Media Hit Sensor mechanism will be activated only when the Media axis detaches from the Media Hit Sensor sensing block. The purpose of this is to prevent triggering the Media Hit sensor due to the thickness of panel under Flatbed mode and leading to printing failure. And it is also a safety mechanism to prevent software activation due to misjudgment of the Sensor.



板面板邊噴繪的安全機制
Safety mechanism for panel and panel edge printing





板面板邊噴繪的軟硬體的操作
Software and hardware operation for panel and panel edge printing

1. 因爲是 CoJetPlus2512 與 Panel Edge 兩種機構的整合設備，所以會有兩種的噴印模式：平板噴印和板邊噴印，在此可以選取板邊噴印 (Panel Edge) 模式。
   Since it is the integrated equipment of CoJetPlus2512 and Panel Edge, it has two types of printing modes: flatbed printing and panel edge printing.
   Here, the operator can choose the panel edge printing (Panel Edge) mode.

2. 按螢幕上 “Panel edge”
   Press "Panel edge"on the screen

3. 按 “Parking “ 按鈕 carriage 就會移動到右 Capping 的位置
   Press the "Parking" button. The carriage will move to the right side Capping position.

4. 輸入板材高度後按 “Loading/Unloading” 按鈕，edge 軸將會移動至板材高度的一半位置，例如：板高爲 300mm，可以在螢幕上 Material Height 輸入 300，這樣載台會移至 150mm 的高度。
   After inputting the panel height, press the "Loading/Unloading" button. The edge axis will move to a position at half the height of the panel. For example, if the panel height is 300mm, the operator can enter 300 for Material Height on the screen. As a result, the carriage will move to a height of 150mm.

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操作人員可以移動到後方板邊噴印機構，當設定高度完成載台將會移動到適當的位置供操作人員將板材放置於板邊噴印機構上但必須靠左邊基準邊，靠緊基準邊是在做噴印精度的基準，方便操作者做噴印的動作時可以準確的定位。

The operator can move to the rear panel edge printing mechanism. When the height setting is completed, the carriage will move to an appropriate position for the operator to place panels on the panel edge printing machine. But the panel must be aligned to the left reference edge. The movement of the machine is for printing precision so that in the printing process, operators can position accurately.

在基準邊有一操控盒
按下 "Down Clamp" 按鈕將會啓動氣缸將板材夾住下方

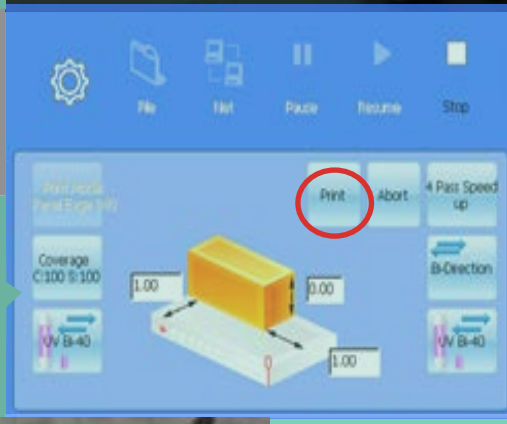
There is a control box next to the reference edge.
Press the "Down Clamp" button to start the cylinder to clamp the lower part of the panel.

氣壓缸的夾持可以確實讓板材安穩的站立
The clamping by the pneumatic cylinder allows panels to stand firmly.

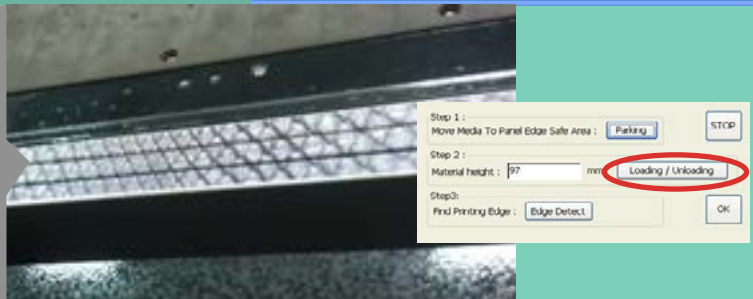
當噴印板材被夾住時按 " Edge Detect"
When the printing panel is clamped, press the "Edge Detect" button.

確定噴印的高度之後回操作台，便可進行噴印
When the printing panel is clamped, press the "Edge Detect" button.

在螢幕上按下 "Print"，上方的夾持機構將會啓動，把噴印板材確實夾住
Press the "Print" button on the screen. The top clamping mechanism will be activated to grip the printing panel.

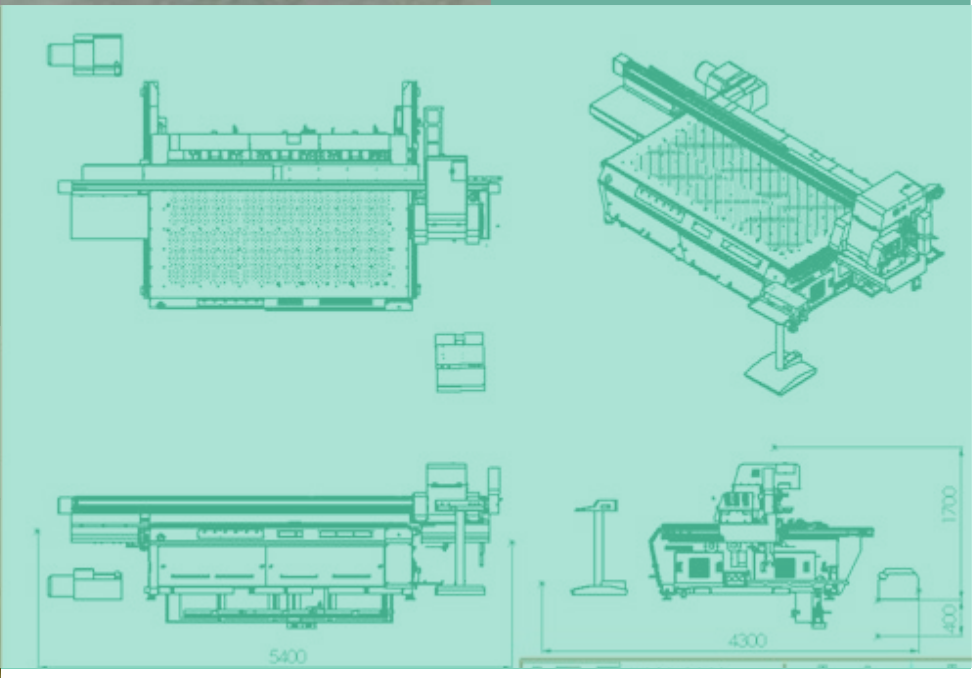


當上夾持機構完成夾持的動作時就會開始噴印，當噴印圖像完成之後，上夾持機構將會自動放開，按 "Loading/Unloading" 按鈕，材料將自動抬高至當初擺放材料的位置高度
When the top clamping mechanism completes the clamping operation, printing will start. When the image printing is complete, the top clamping mechanism will automatically release. Press the "Loading/Unloading" button. The material will be automatically raised to the original position where the material is placed.



操作人員移動後方，按下 "down clamp"，即可取下完成品準確的定位。

The operator moves to the back and presses the "down clamp" button to remove the finished product.



板邊噴印機構的伺服軸將會自動尋找噴印的高度，噴印的高度是對噴印的品質是絕對十分有相對的關係，所以在設計尋找噴印的高度時，恩德是透過高精度光纖感測器加數位光纖光學感測器，並在設定上的要求也要十分簡單只需單鍵即可完成設定，大功率光亮爲傳統的250倍，且具備可以自由自在操縱此功率的便利功能。

The servo axis of panel edge printing mechanism will automatically search for the height of printing. The height of the printing is definitely crucial to the printing quality. Therefore, when designing the height of printing, Anderson Group combined a high precision fiber optic sensor with a digital fiber optic sensor. The setup is very simple, completed with just a single click. High-power light is 250 times the intensity of traditional light. The power can also be freely and conveniently manipulated.

目前噴繪業界並無此種的運用開發，如果想達到相同的運用，只能透過不同的機台，或以另一製程處理，如：貼邊機、塑型機等等不同性質的機械結合而成，而恩德開發運用同一台機械做一次性的製程，讓其用途更加的廣泛，也解決以往板邊噴印的需求，以達到客製化、多變性的產品。

一般機台多受限於噴印的高度，而恩德的開發先是解決平板的板邊噴印高度，除了減少客戶投資的成本，也讓廠房的空間利用於最小，再搭配多色彩和高速的噴印，而且更在操作上可以讓使操作者易懂且方便操作，在安全上完全考慮到操作者的生產順序。

在業務的推廣上將也會是一大利器，增加這樣的功能性，將可以在噴繪的機種上注入了新的氣象；另，此機構是附加於 CoJetPlus 2512 機身上，對客戶購買成本也較輕，卻可達到雙重運用的功能。除恩德於噴繪研發產業，有更多元的發展，同時也提高設備的附加價值，並可望於市場上獲得廣泛的迴響。

So far, there is no such development and application in the printing industry. If the same application is to be achieved, the only way is to use different machines or another process such as a combination of machines with different features such as edge banding machines and molding machines. Anderson Group has developed a technique to use the same machine to execute a one-time process. The machine can be used in various ways, and the previous panel edge printing needs can be met in order to produce customized products.
Ordinary machines are limited by their printing height. Research and development by Anderson Group attempted to solve the problem of panel edge printing height first. In addition to reducing the investment costs for customers, the space that machines take up in the plant are also minimized. With multi-color and high-speed printing, the operation becomes easy and convenient for operators. In terms of safety, the production order for the operators is also fully taken into account.
This development breakthrough will also be an advantage in promoting the machine. With new functionality, variety can be added to models of printing machine. Furthermore, this mechanism is added to CoJetPlus 2512, thus reducing the acquisition costs for customers while obtaining dual functionality. In addition to a variety of development in the printing industry, Anderson Group also aims to improve the value added of the equipment with the hope of obtaining widespread positive responses from the market.

尿尿哲學
Urinating Philosophy

文 / 王 元男
—By Jason Wang

歐洲大部分的公共場所，就連車站甚至加油站，尿尿都要錢而且要一歐元，沒錢就沒得尿，所以平時出門隨時要備點零錢，以備不時尿尿之需；但最明智的做法還是先養成好習慣，並善用每個可尿尿的機會，例如在踏出機場大門前，或坐火車下車前，或從旅館出門前，或餐廳用餐完畢離開前，不管有尿無尿一定先去灑泡尿，以免跟自己的荷包過意不去，一天省下四泡尿就可換一頓豐盛的德國豬腳（法蘭克福火車站進去的左邊）。想當省錢一族的遊子，或經濟拮的背包客，除了以上的尿尿原則外，更須要牢記以下兩句話，且早晚朗誦三次。

“有尿需尿直須尿 ，莫待想尿溢尿無處尿”

PS: 我的尿桶（火車）還 30 分鐘才會到，真想尿。

In most public spaces in Europe, even at the train station or gas station, there is a fee of one Euro for using the restroom. No money, no urinating. Therefore, it is necessary to prepare some change for urinating when people normally go out. However, it is wise to cultivate a good habit in advance and take advantage of each opportunity to urinate, such as before stepping out of the entrance of the airport, before getting off the train, or before departing the hotel or leaving a restaurant after a meal. You should urinate in advance regardless of whether you want to. This will save your wallet. If you save four times of using public restrooms each day, you can enjoy a good German pork knuckle meal (to the left side of the entrance of Frankfurt’s railroad station). If you want to be an economical person traveling far from home or a frugal backpacker, in addition to the aforementioned principle of urinating, you should remember the two sentences below and read each aloud three times in the morning and evening.

“Go to toilet when you need to. And do not wait until you have to.”

PS: My urinal (train) will come in 30 minutes. I really need the toilet.

門禁深嚴的公共廁所 通關密語“一歐元”

Heavily guarded public toilet. Key to entry: “one Euro”

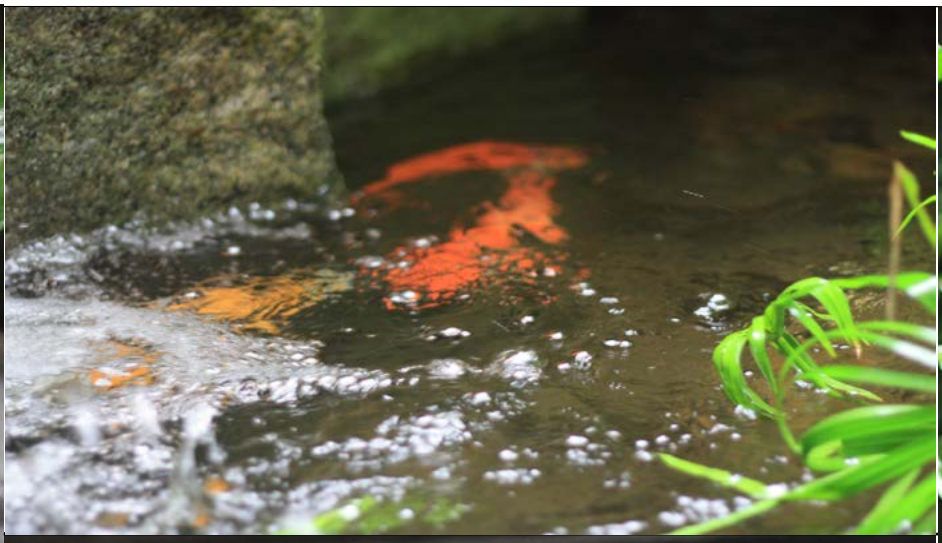
德恩之美

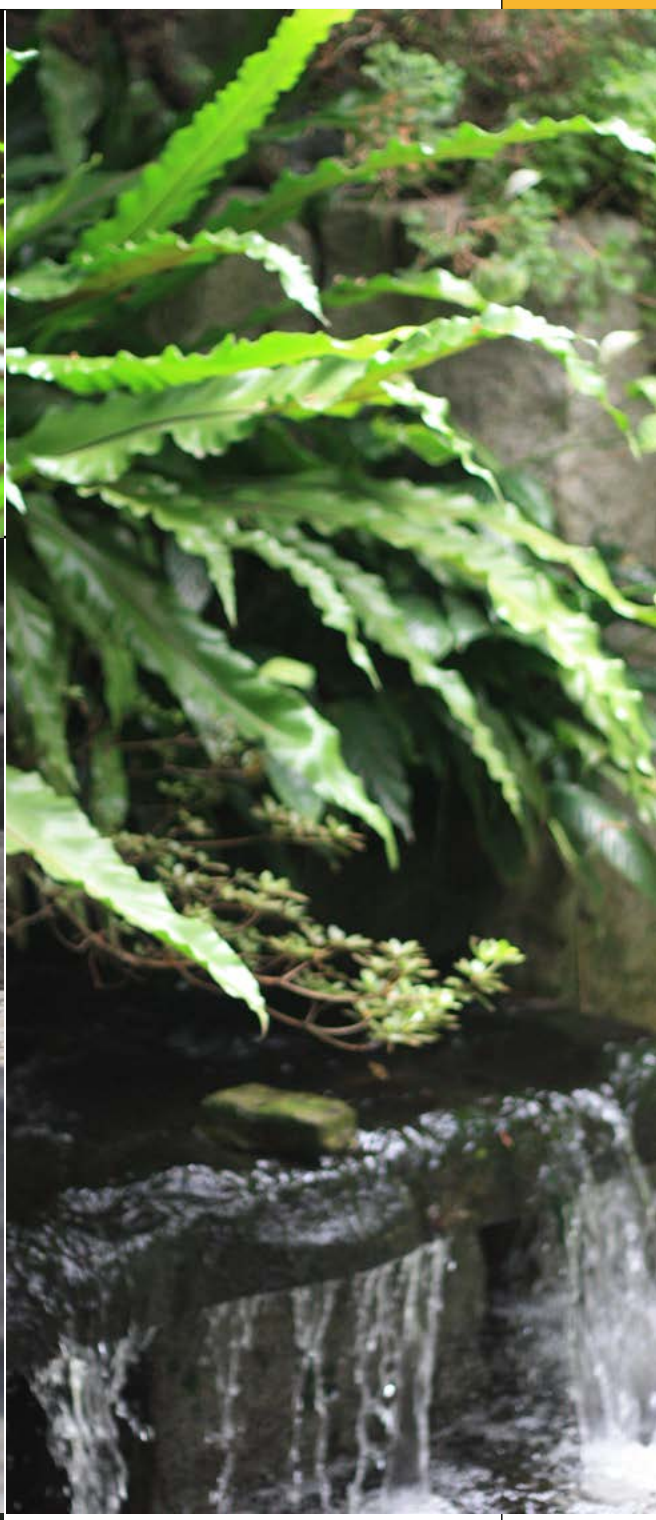
Amazing Scenery of The AIC Factory

—By 編輯部 Editorial department

放慢您的腳步，欣賞眼前景緻…

Slowdown the pace, and enjoy the amazing scenery of AIC factory



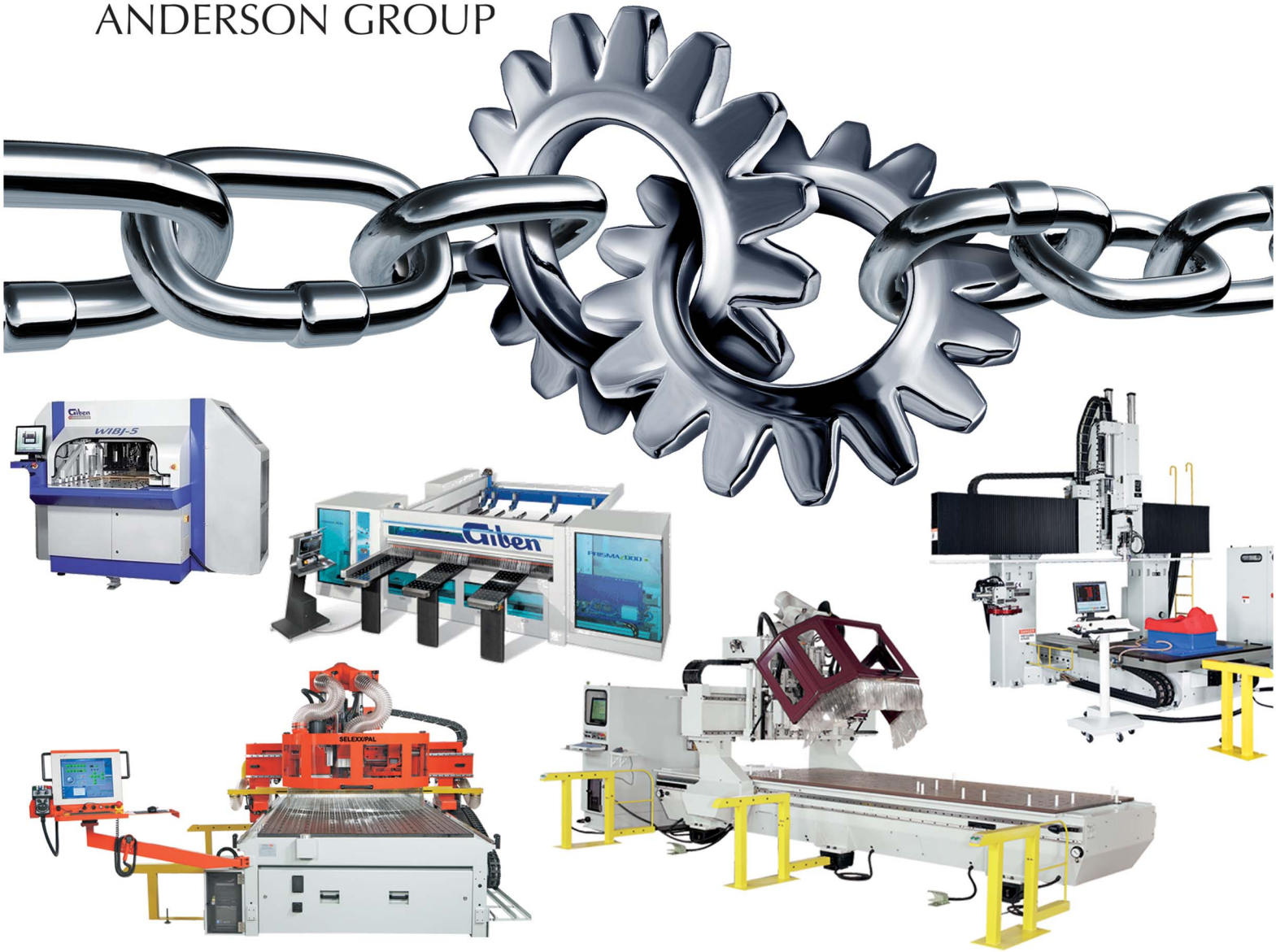


"Individually Successful, United Unbeatable"

Anderson Group is pleased to announce it's acquisition of Giben America and Giben Brazil. Joining together to provide markets with the highest quality in a range of products covering everything from Panel Processing to High-End CNC Machining applications.

Anderson Group's Global Workforce of over 1,000 employees, with it's facilities in the U.S., Brazil, Taiwan, Germany, and China, remains committed to deliver the best products and after-sale service and support in the industry.

ANDERSON GROUP + Giben®



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Norcross, GA 30071

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135 - Cidade Industrial
81.460-040 - Curitiba - Paraná
Brazil

四十年的焠煉 成就不凡

40 Years Refining Glorious Achievement

走過四十年....

恩德集團秉持提供卓越產品與專業快速服務的經營理念，持續努力在CNC精密加工機械領域深耕茁壯。從過去到現在，我們堅持滿足客戶需求的多角化經營與生產策略，期許以全球化、全方位的產品定位，追求企業理想的永續發展。

2015的未來

我們對集團目標深遠思索，將全面投入嶄新的思維，傾心全力，邁向更完美的品質標竿。

For more than 40 years, Anderson has taken pride in its outstanding products; fast and professional service of its CNC machining systems. Anderson continues to progressively move forward and thrive in the area of CNC processing center.

Until now, it is our ultimate goal to keep the strategy of diversification and production that can satisfy the needs of customers. We look forward to pursue the sustainable development of ANDERSON GROUP.

In the coming future of 2015,We consider the group purpose deeply, and will add comprehensive new ideas, with greater efforts toward achieving perfect quality.

Anderson Group
恩德集團

www.anderson.com.tw

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