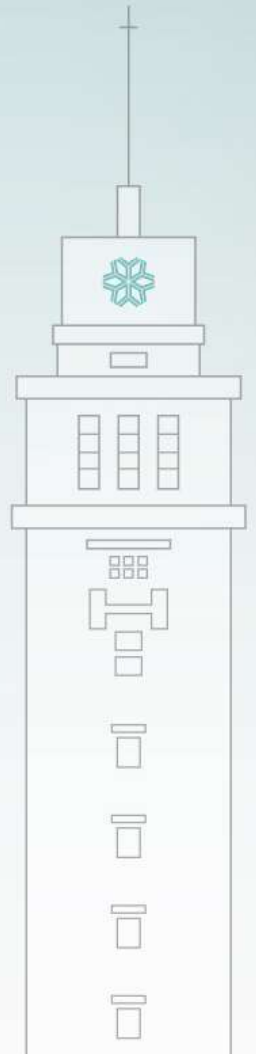


# 液壓傳動(含水基油壓)相關之產品與應用技術

國立雲林科技大學 機械工程系

演講者：鄭秦亦 助理教授

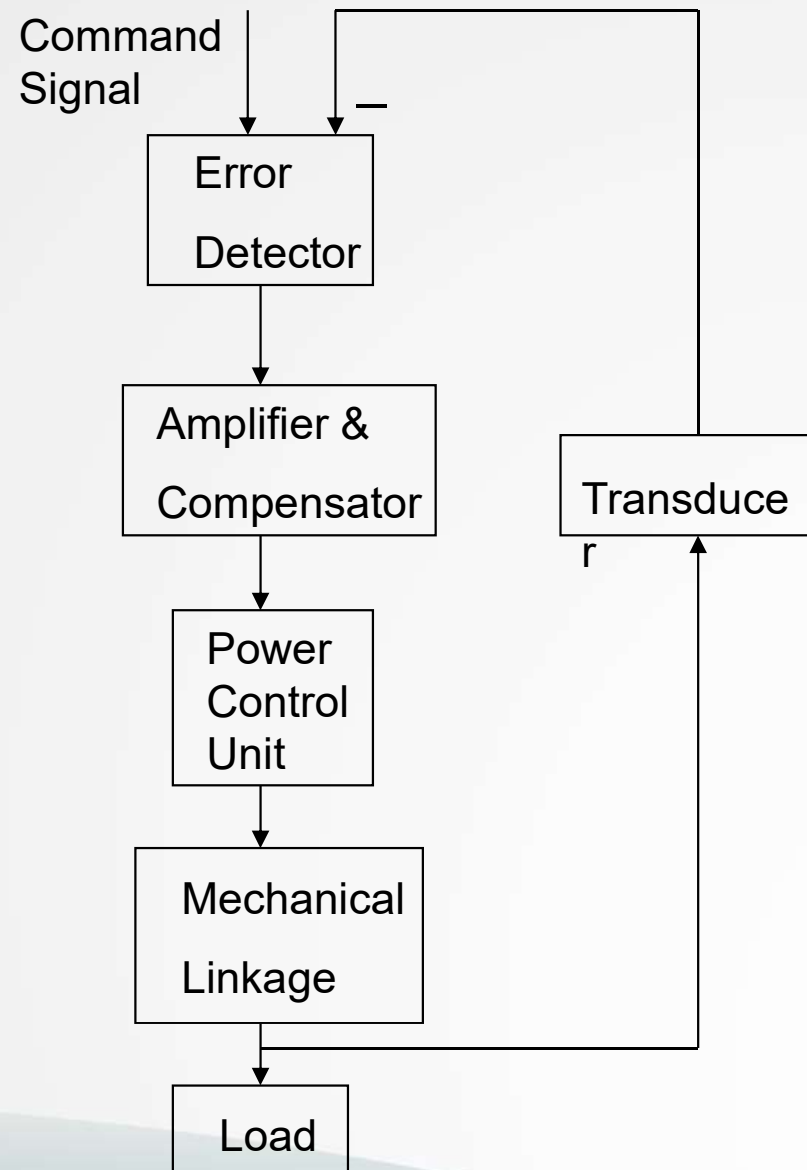


# 大綱

- 液壓控制原理介紹(Part I)
- 常見液壓元件控制
- 液壓系統整合應用技術說明(Part II)
- 結論



◆ A Typical Automatic Control System



(Figure 1-1)



## ◆ Advantages of Hydraulic Control

- 輸出功率大，重量輕，體積小；轉矩慣量或力質量比大
- 響應速度快
- 高機械剛度
- 散熱好
- 自潤滑
- 廣泛的速度和力控制
- 高效率
- 長壽

## ◆ Disadvantages of Hydraulic Control

- 成本高---容許公差小
- 尚不可用---需要額外的電源裝置
- 油污染問題---影響閥門可靠性
- 混亂且需要頻繁換油
- 火災和爆炸危險



## ◆ Classification of servo-hydraulic systems:

- Electro-hydraulic system
- Mechanical-hydraulic system



## Electro hydraulic control

- 結合了電子信息處理的靈活性和液壓執行器的強大功能

## Electro hydraulic servo valve

- 提供電子和液壓之間的接口; 將低功率電平的電信號轉換為高功率驅動
- 以與施加的電信號成比例並在與信號極性對應的方向上控制流向電動機或氣缸的液壓油流量



rotary (motor)

Actuators

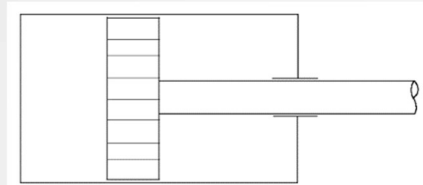
linear(cylinder)

single acting

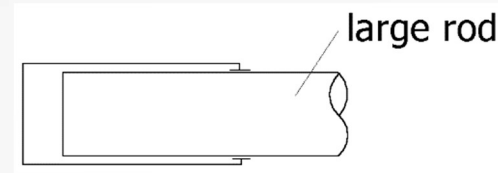
double acting

· single acting

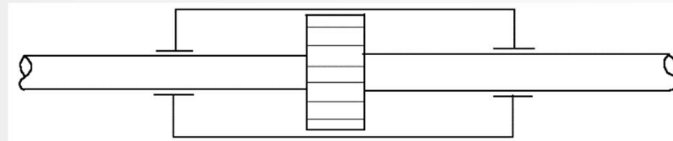
1) small rod



2) rams



· double acting



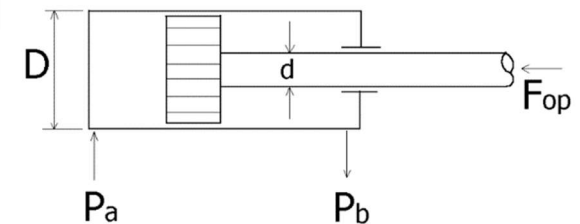
· Telescopic-cylinder

· Limited angle rotary cylinder

§ Design consideration of hydraulic cylinders

1. Output force

$$F_{OP} = F_h - F_b - F_f \pm F_g$$



Where

$$F_h = P_a \cdot \frac{\pi}{4} D^2$$

$$F_b = P_b \cdot \frac{\pi}{4} (D^2 - d^2) \quad (b: \text{back pressure})$$

2~6 bar

$F_f$  : friction force ( $\approx \frac{1}{10} F_{op}$ )

$F_g$  : gravity of piston and rod

## 2. Cylinder as a pushing unit

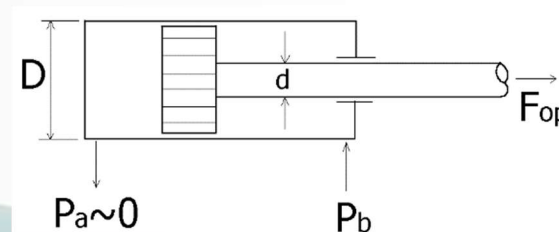
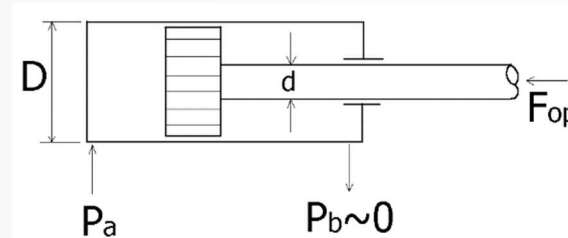
$$\text{effective area} = \frac{\pi D^2}{4}$$

$$\text{thus } D = 1.13 \sqrt{\frac{F_{op}}{P_a}}$$

$$\text{effective area} = \frac{\pi(D^2 - d^2)}{4}$$

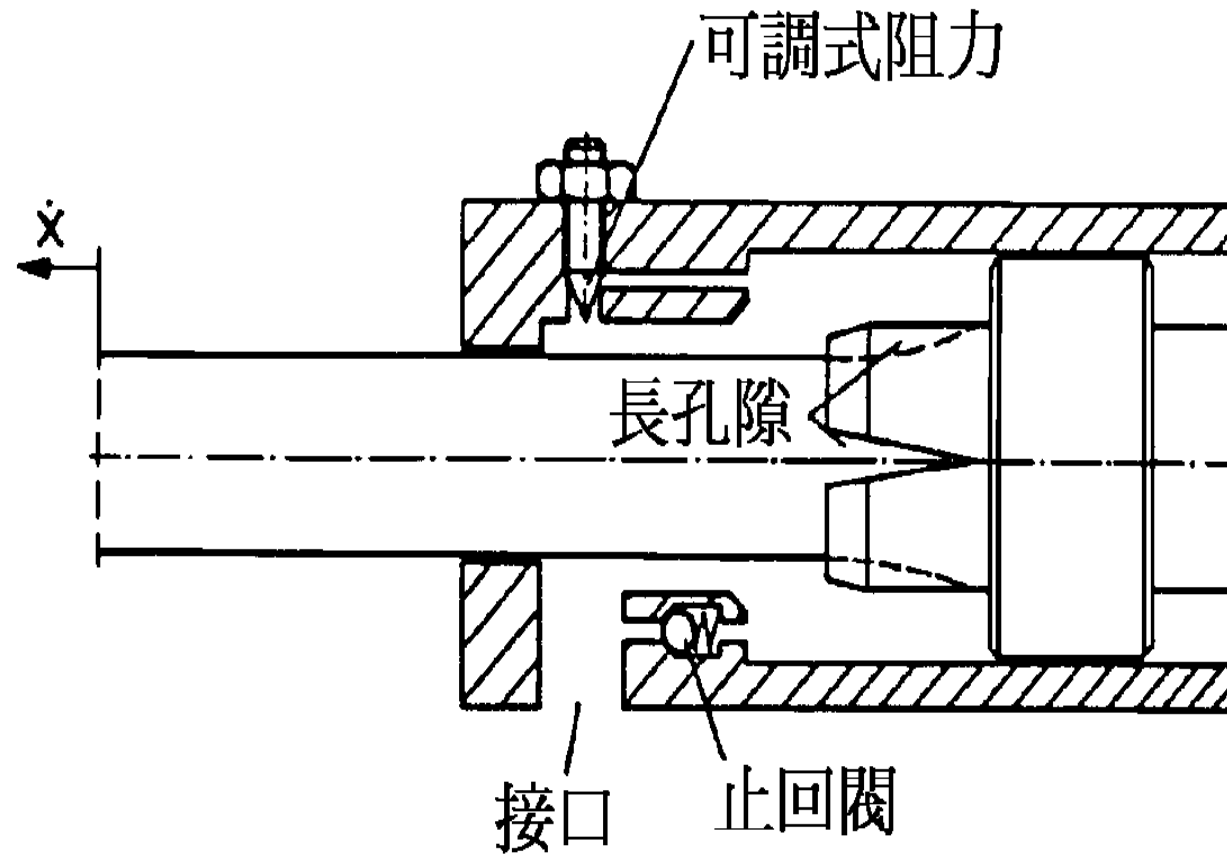
## 3. Cylinder as a pulling unit

$$\text{thus } D = \sqrt{\frac{4F_{op}}{\pi P_b} + d^2}$$





# Cushioning Devices



**Bild 4.7-7: Schema der Endlagendämpfung**

液壓缸的緩衝裝置



## Applications of Telescopic Cylinder



Some examples of servo-hydraulic systems:

[1] : 液壓力量放大機構(M-H) (1/2)

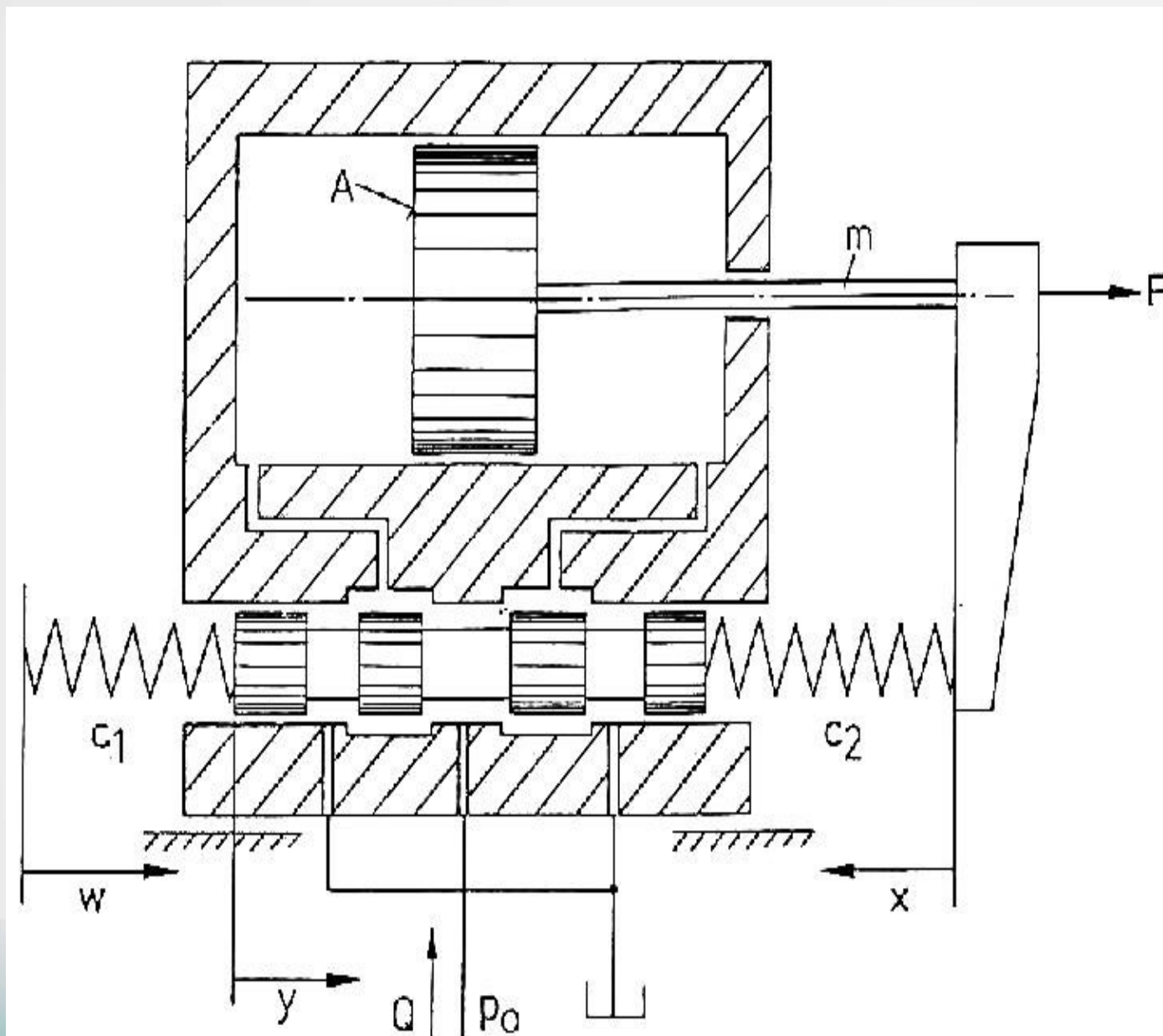


Figure1-2(a) : 力量平衡型之位置控制



# [1] : 液壓力量放大機構(M-H) (2/2)

Block diagram:

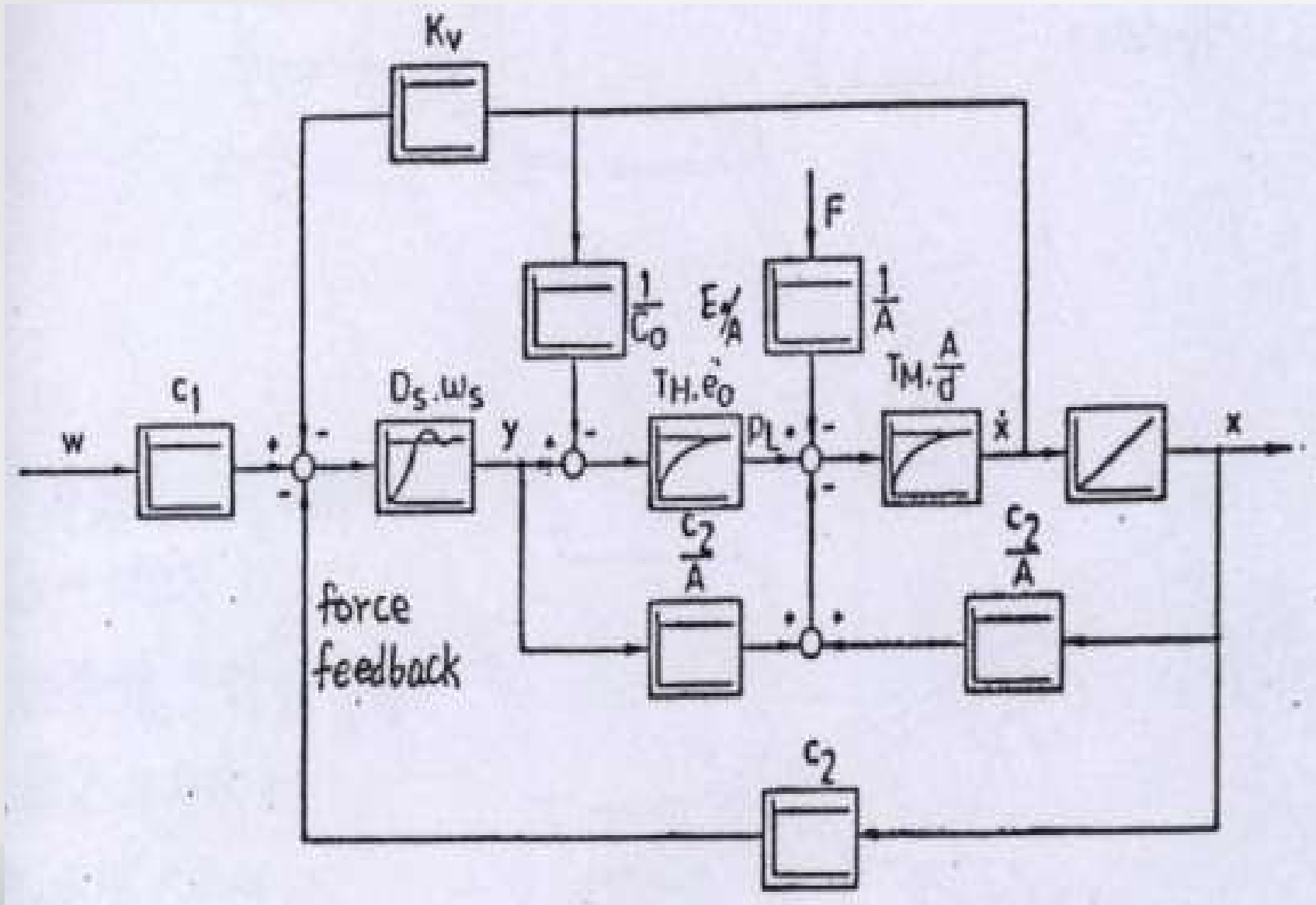
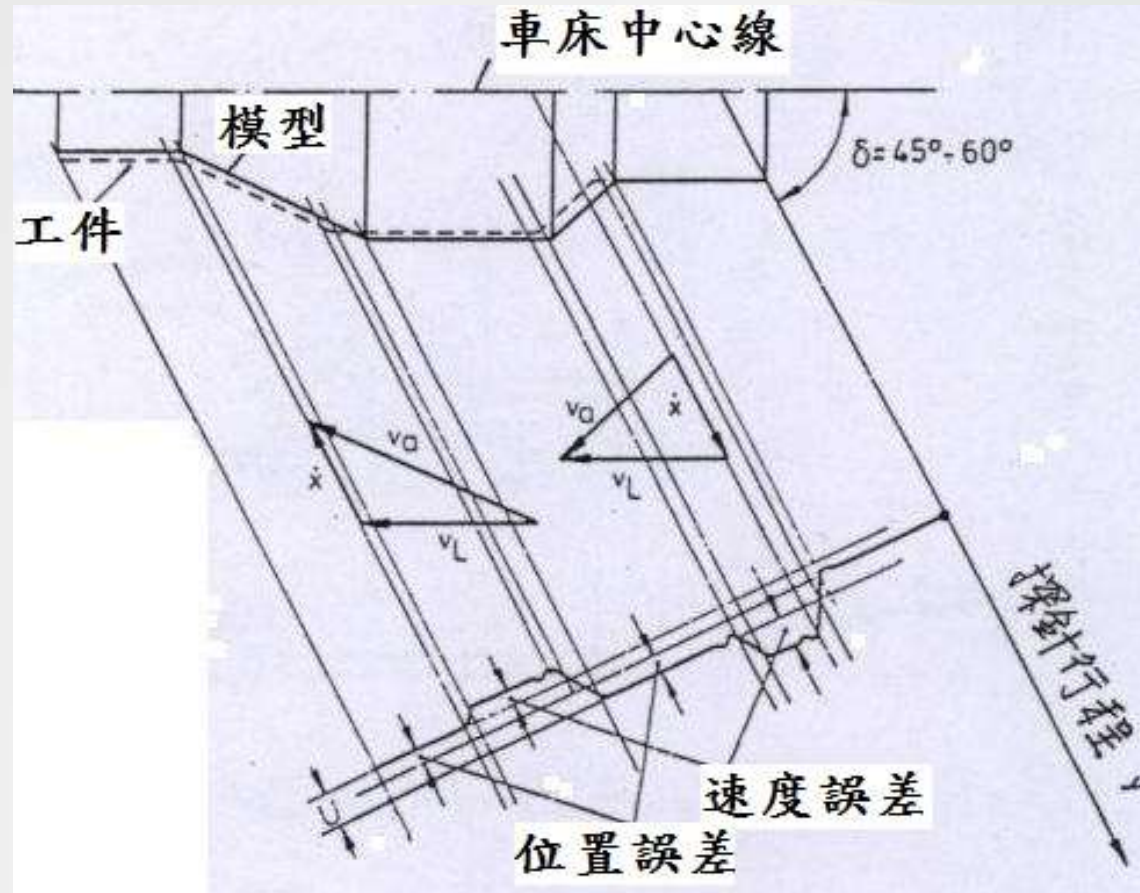


Figure1-2(b) : 力量平衡型之位置控制





## [2] : 液壓靠模車床(M-H) (2/2)



$V_L$  : 車床進給之速度(縱向)

( $V_L \cong \text{constant}$ )

$X$  : 車刀滑塊之移動速度

(上圖之 $X$ 方向)

$V_a$  : 合速度(平行於工件之輪廓)

Figure1-3(b) : 誤差曲線示意圖



### [3] : 液壓動力方向機[E-H]

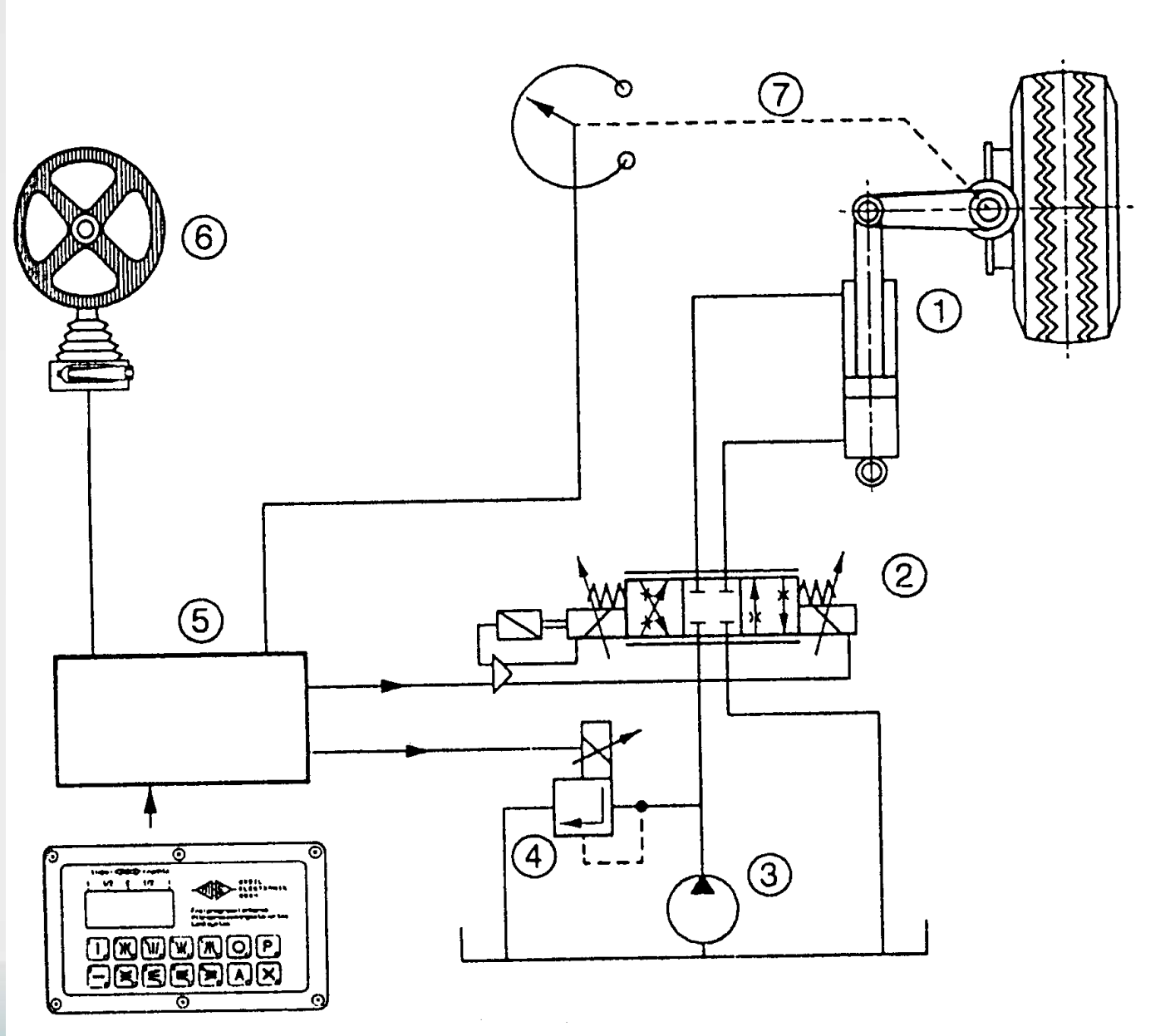


Figure 1-4b : 液壓比例伺服動力方向盤



# [4] : 飛機升降翼液壓控制(M-H)

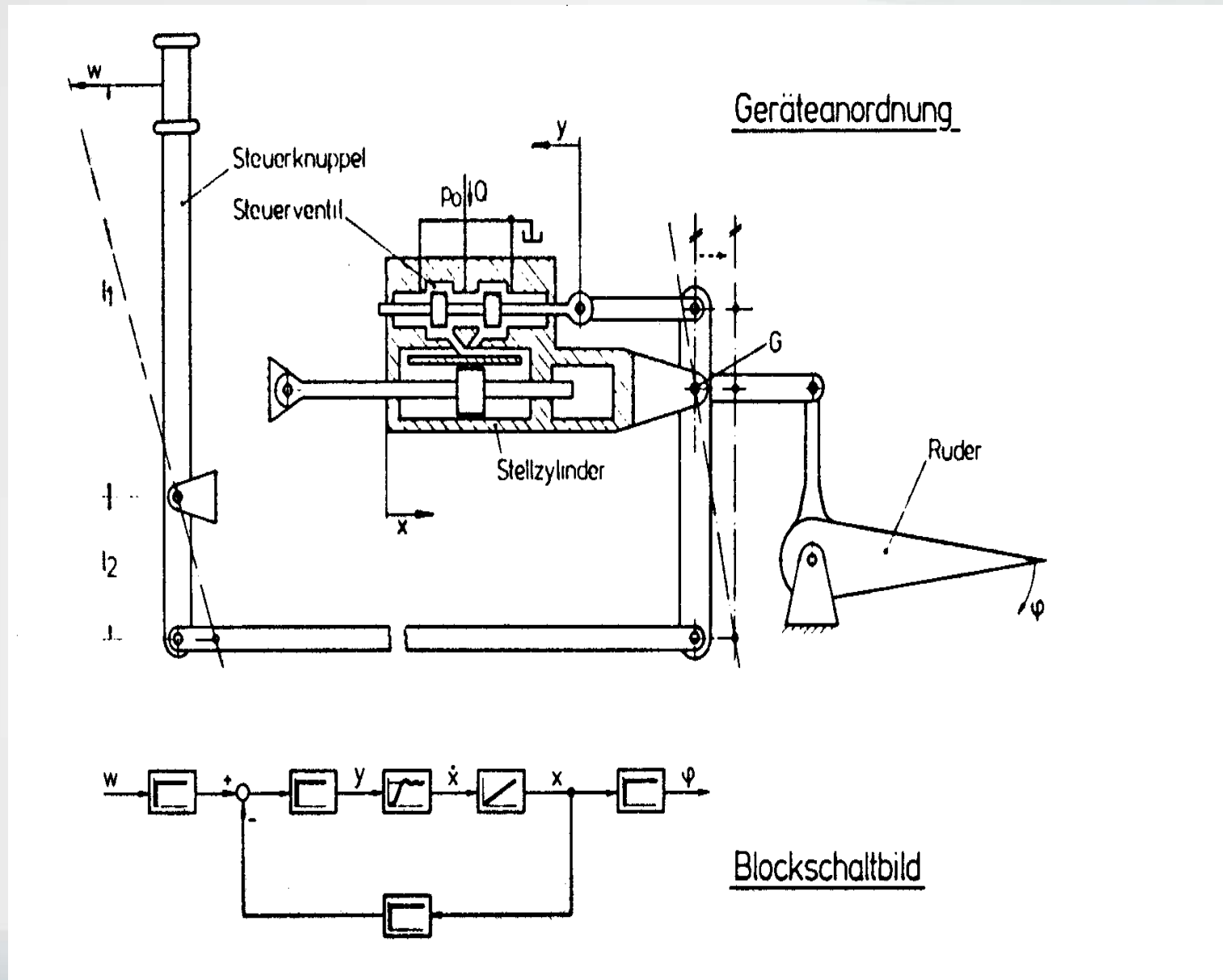


Figure 1-5 : 飛機升降翼液壓控制



# [5] : 液靜壓軸承(M-H)(1/6)

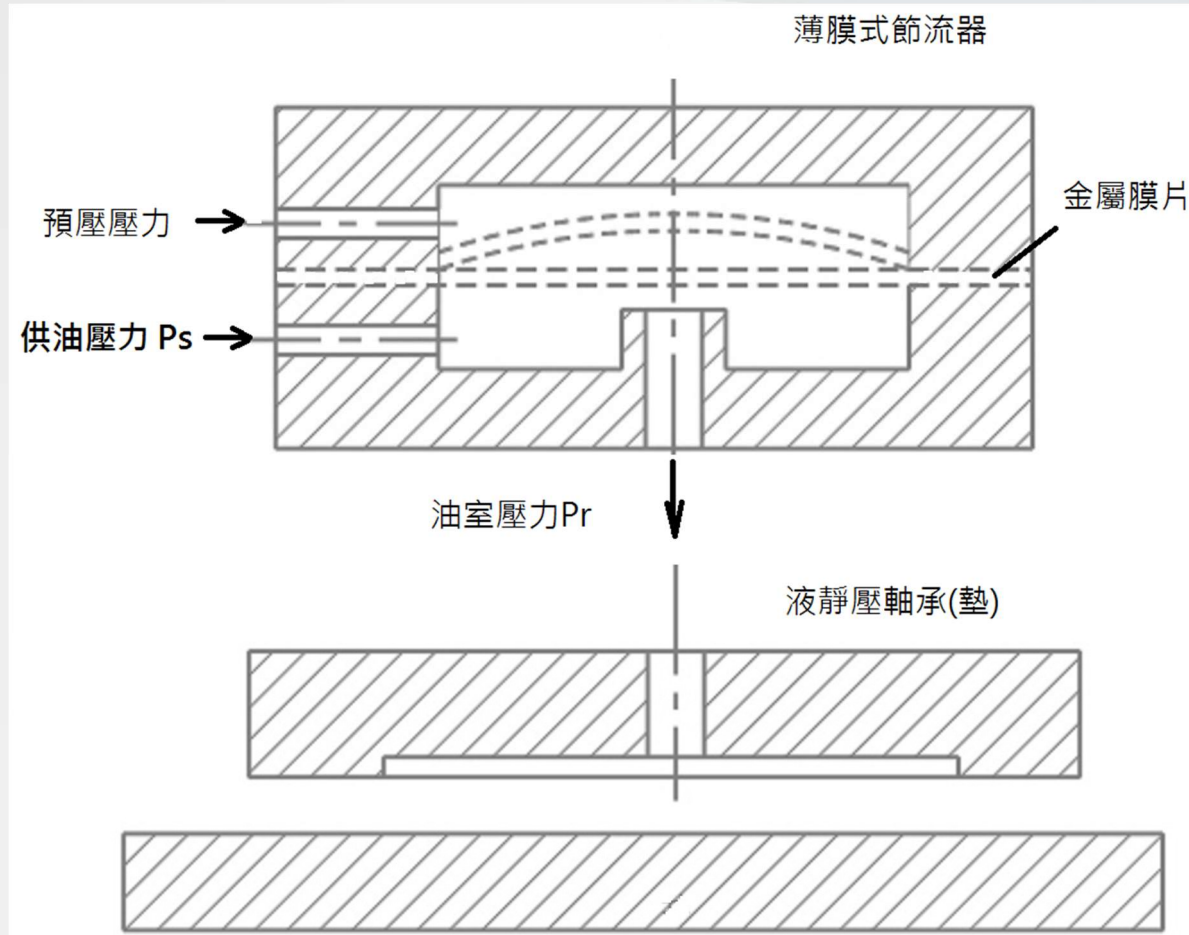


Fig 1-5a : 液靜壓軸承與薄膜式節流器





# [5] : 液靜壓軸承(M-H)(2/6)

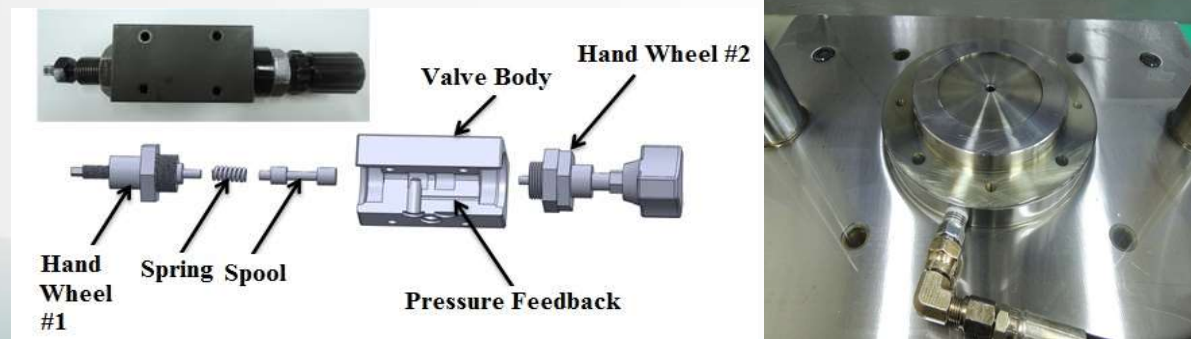
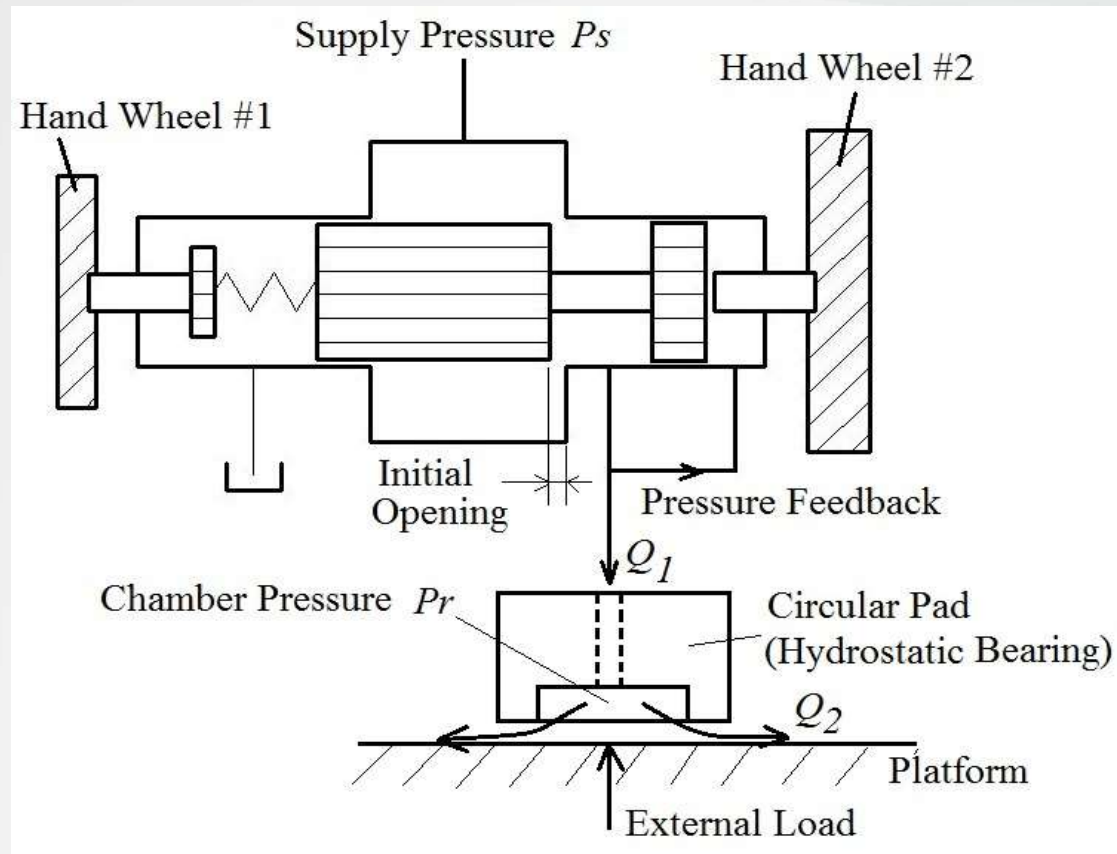
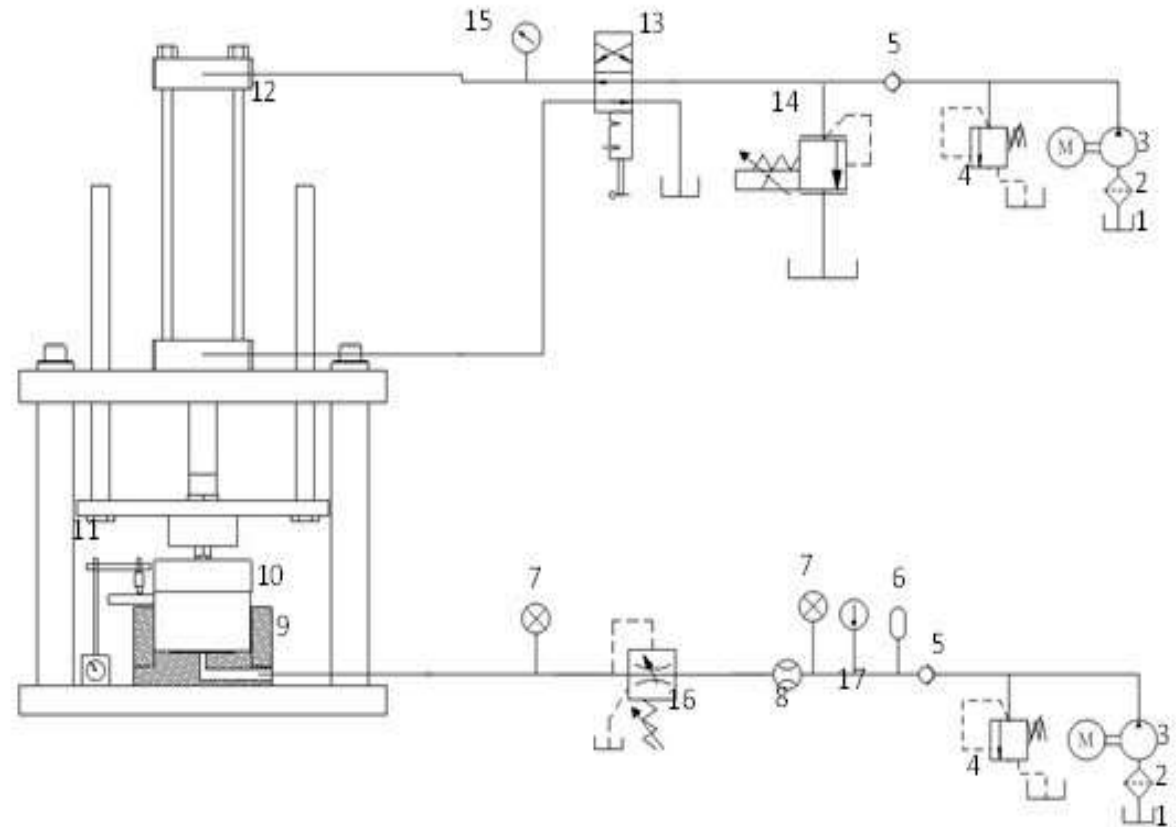


Fig 1-5b : 液靜壓軸承與滑閥式節流器



# [5] : 液靜壓軸承(M-H)(3/6)



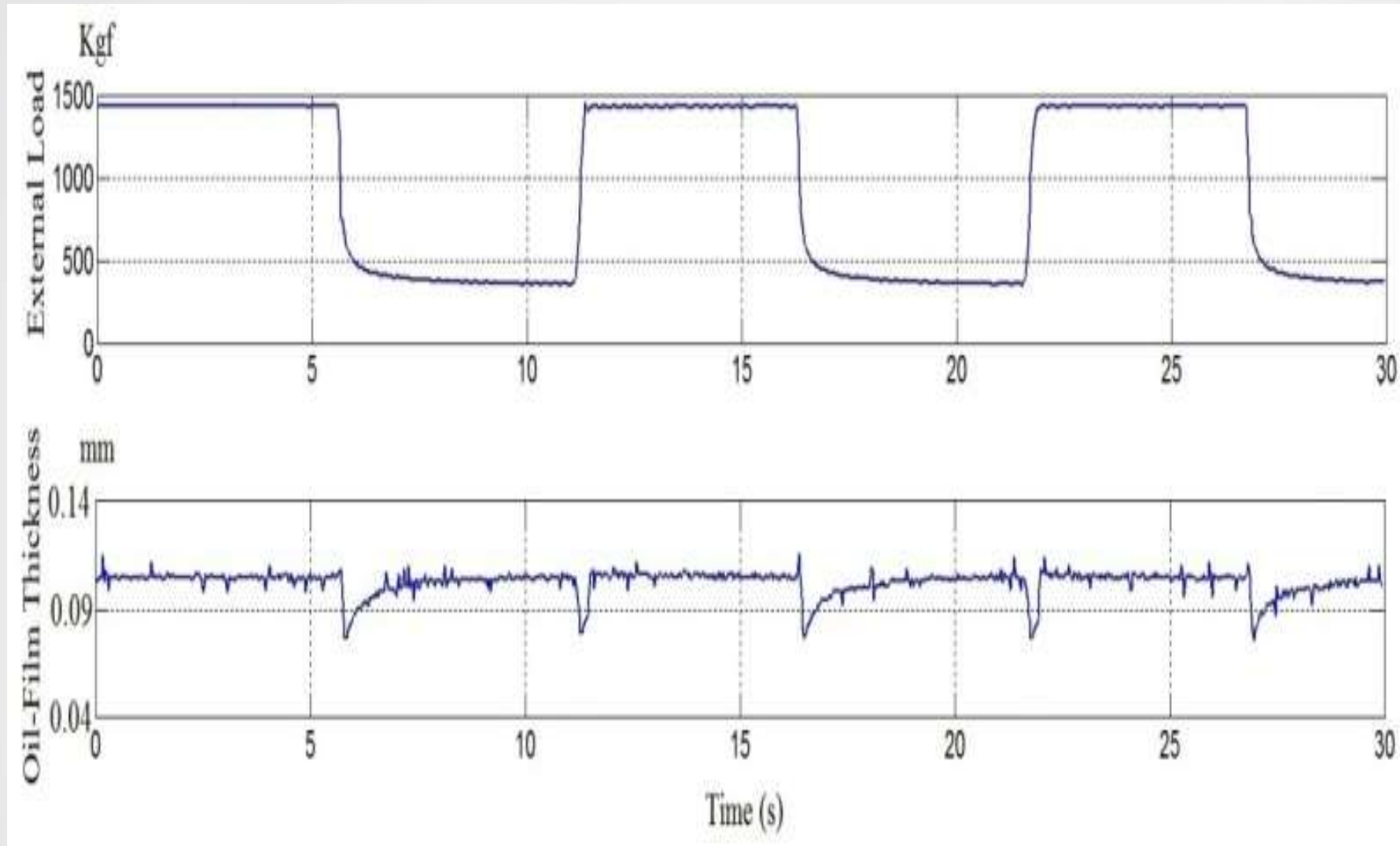
- |                 |                    |                                 |
|-----------------|--------------------|---------------------------------|
| 1. Oil Tank     | 7. Pressure Gauge  | 13. Switching Valve             |
| 2. Filter       | 8. Flow-rate Meter | 14. Proportional Pressure Valve |
| 3. Pump         | 9. Circular Pad    | 15. Pressure Gauge              |
| 4. Relief Valve | 10. Load Cell      | 16. Tested Restrictor           |
| 5. Check Valve  | 11. Gap Sensor     | 17. Temp. Gauge                 |
| 6. Accumulator  | 12. Cylinder       |                                 |



使用威力導演編輯



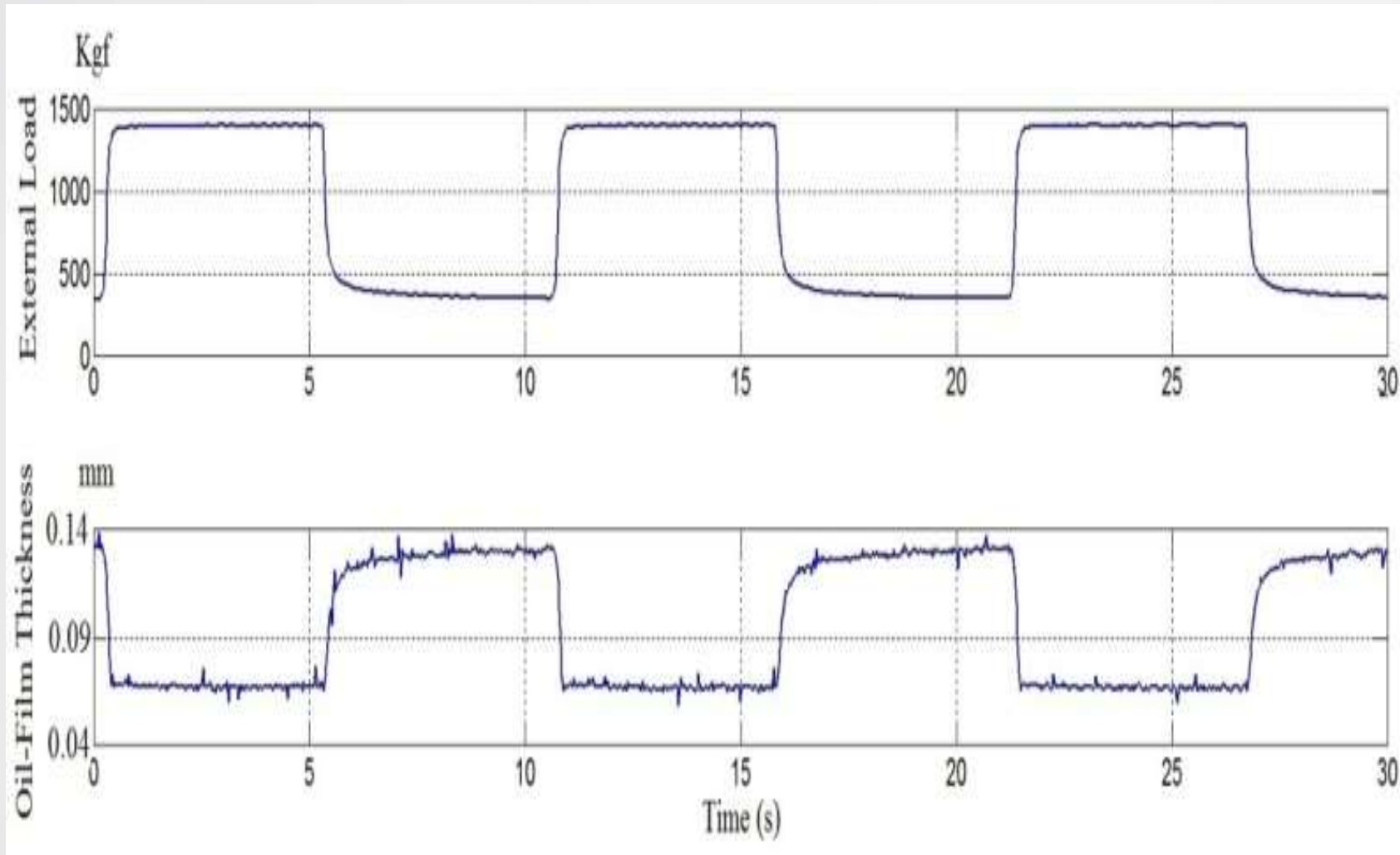
# [5] : 液靜壓軸承(M-H)(4/6)



Experimental results of hydrostatic bearing **with** restrictor



# [5] : 液靜壓軸承(M-H)(5/6)



Experimental results of hydrostatic bearing without restrictor



# [5] : 液靜壓軸承(M-H)(6/6)

## --大型單柱立式車床



★ The diameter of the rotary table vary from 6 m to 10 m.

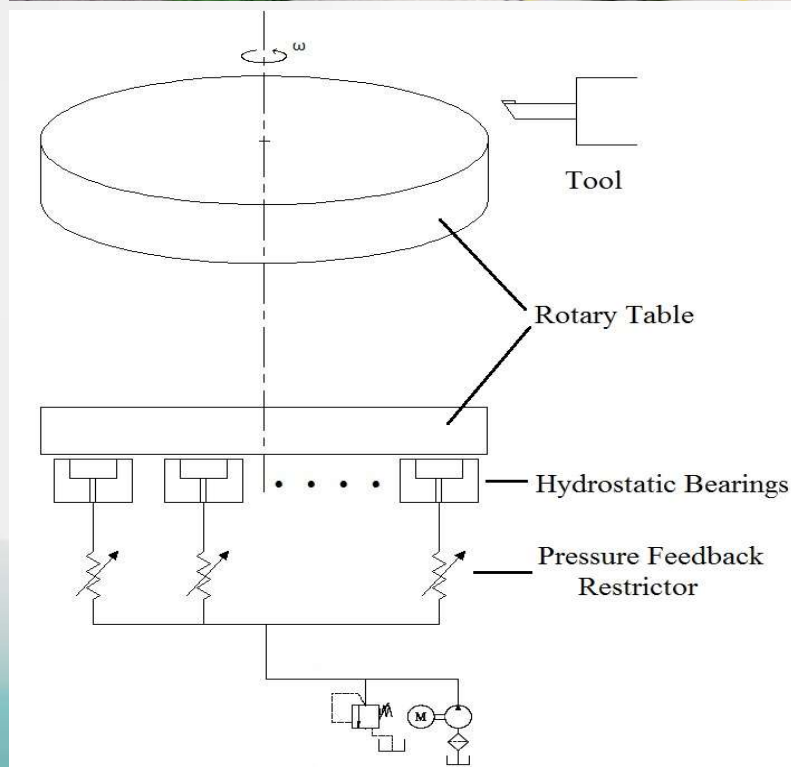
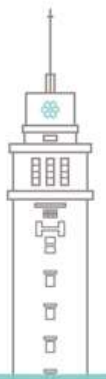
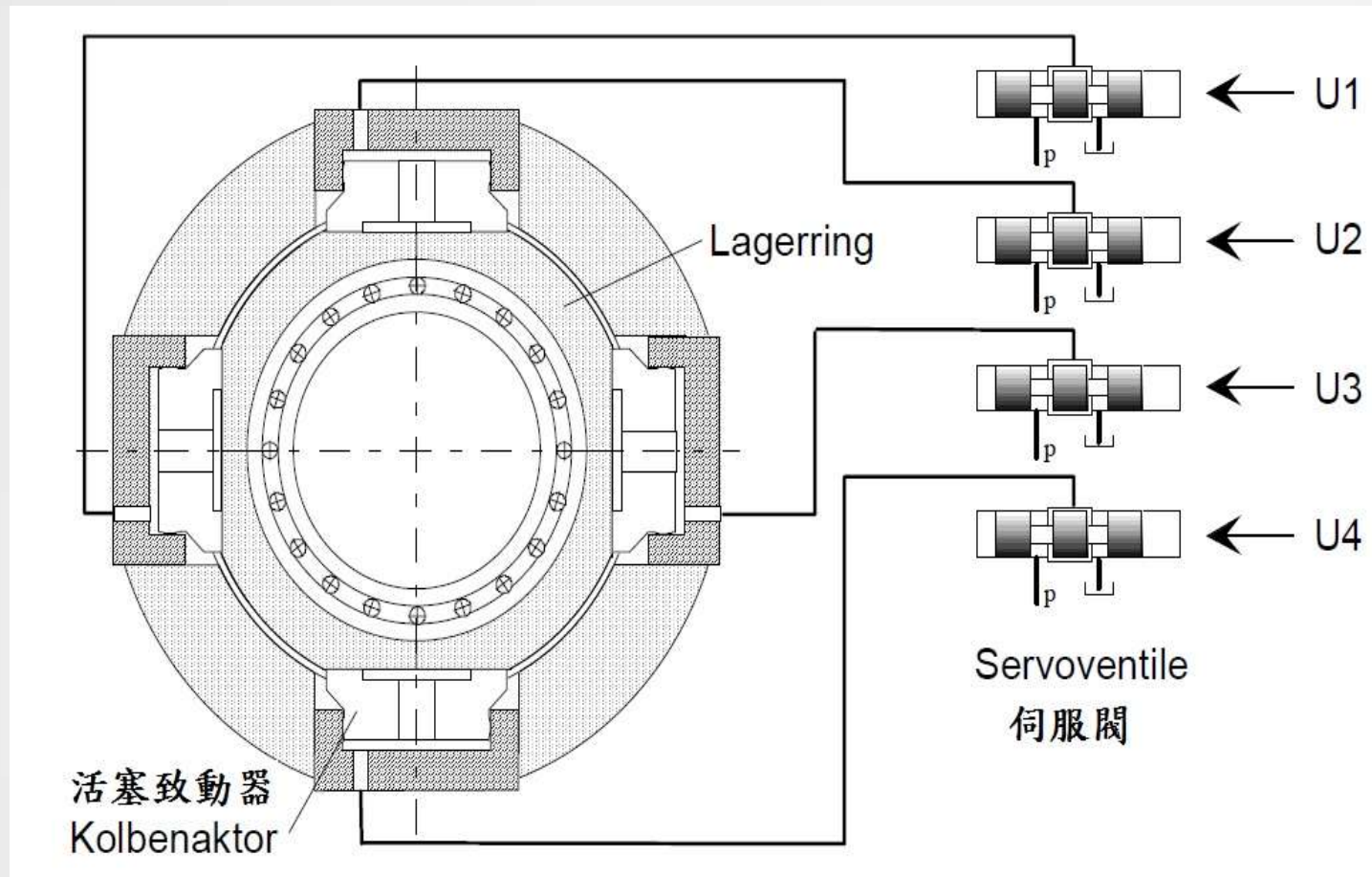


Fig 1-5c : 大型單柱立式車床



## [5] : 液靜壓軸承(E-H)(1/5)

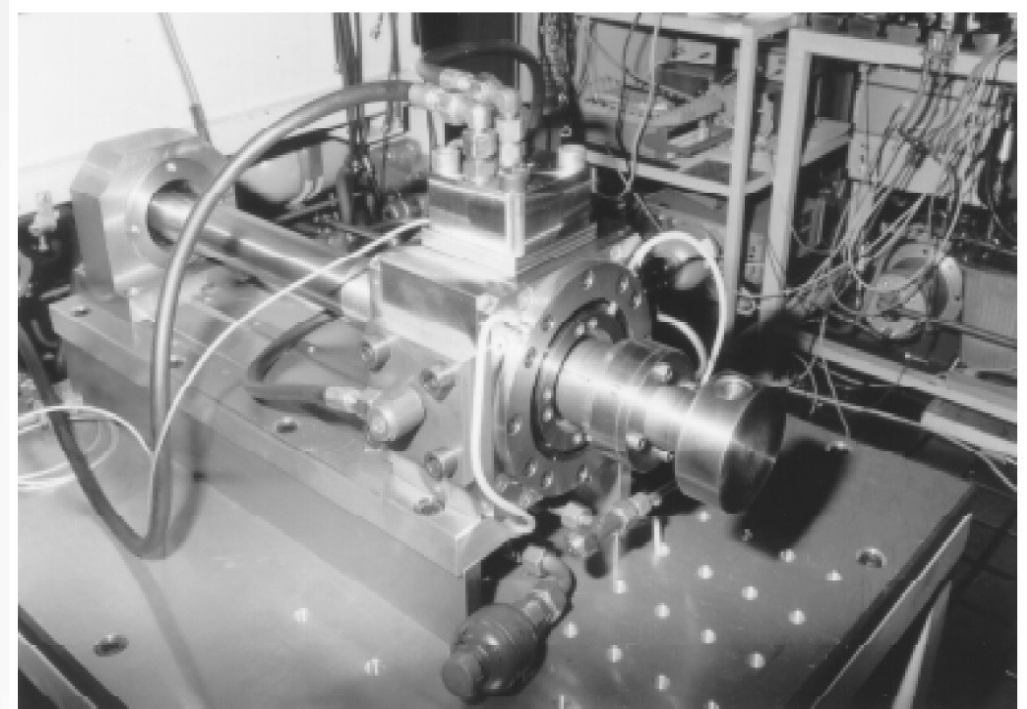
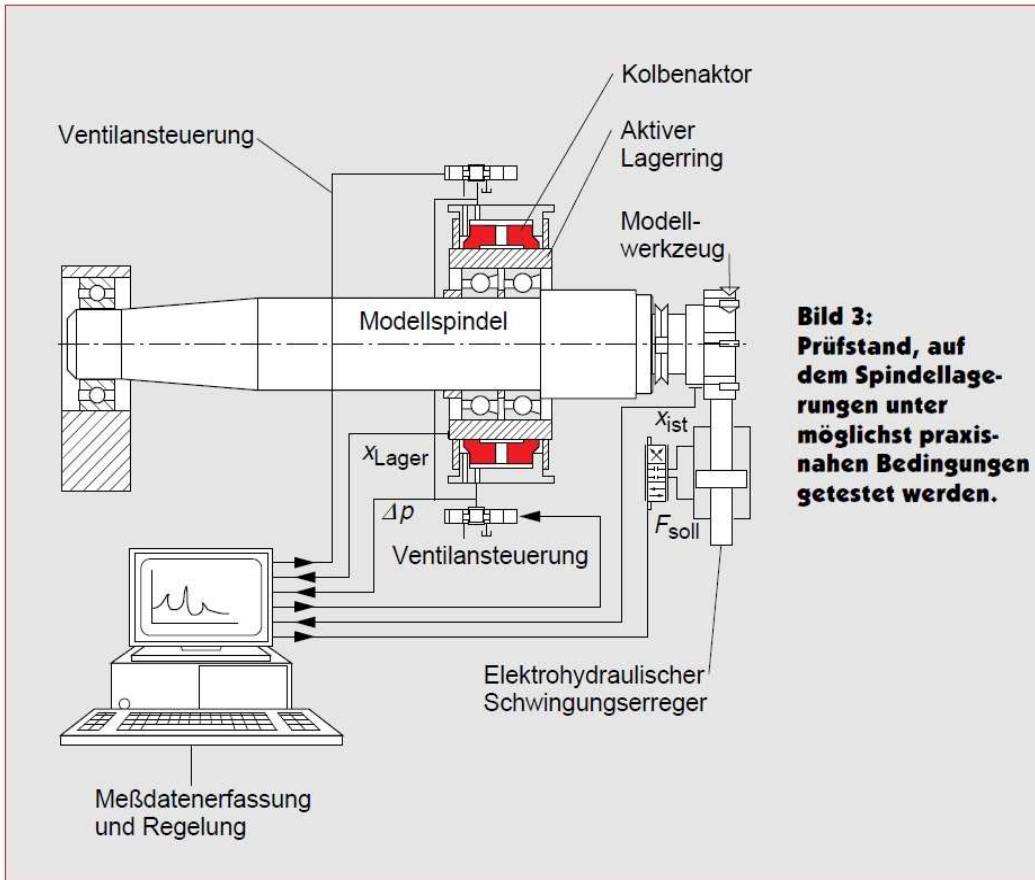


[Source: IFAS, 1997]





## [5] : 液靜壓軸承(E-H)(2/5)

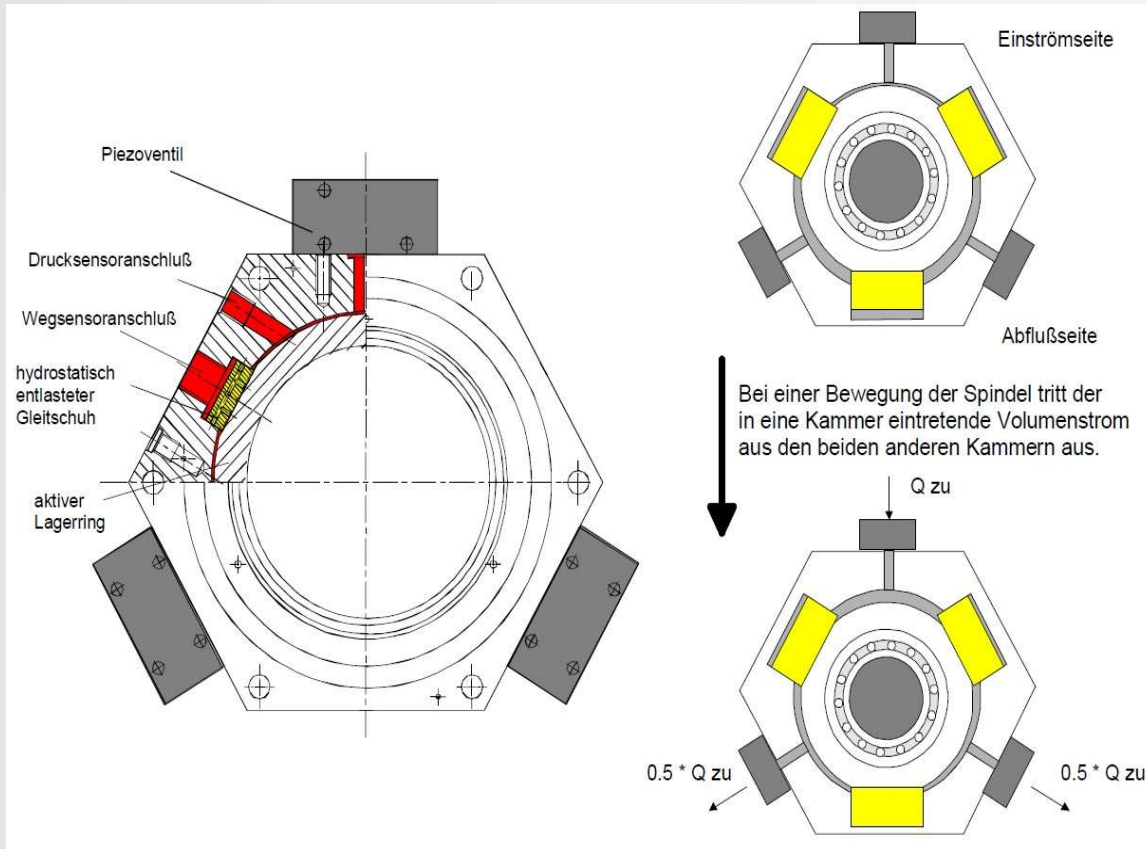


[Source: IFAS, 1997]





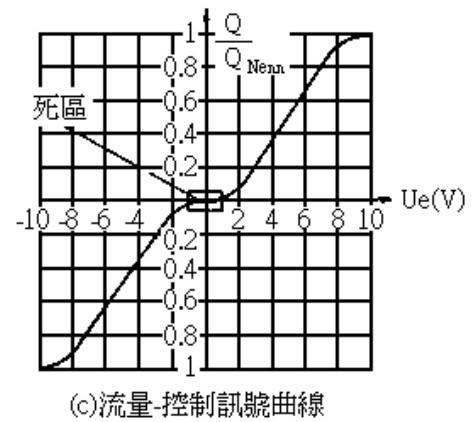
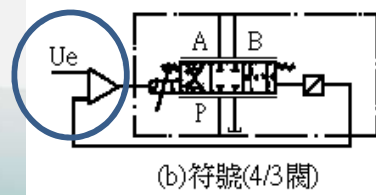
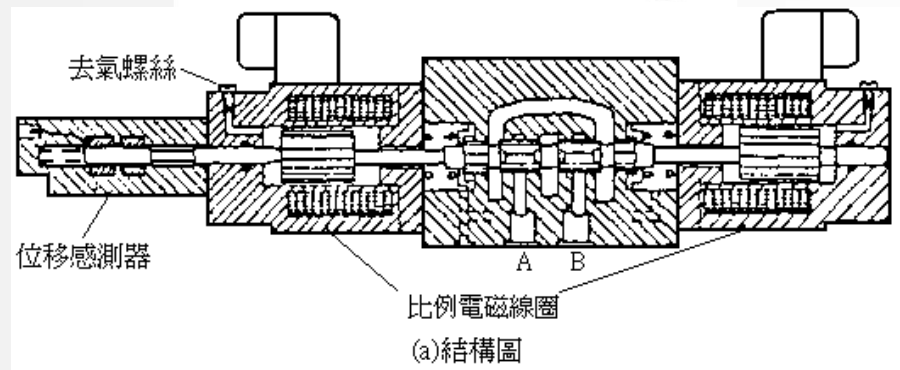
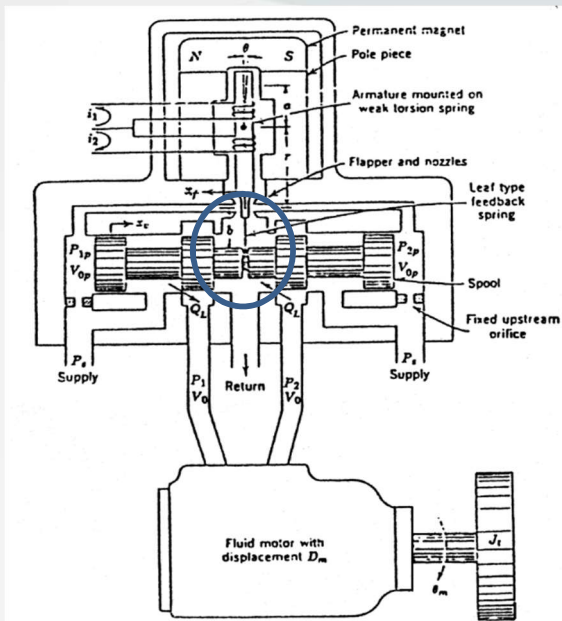
## [5] : 液靜壓軸承(E-H)(4/5)



[Source: IFAS, 2000]



# [6] : 液壓伺服閥(M-H)及比例閥(E-H)



[8] : 電液伺服工具機(E-H) (1/2)

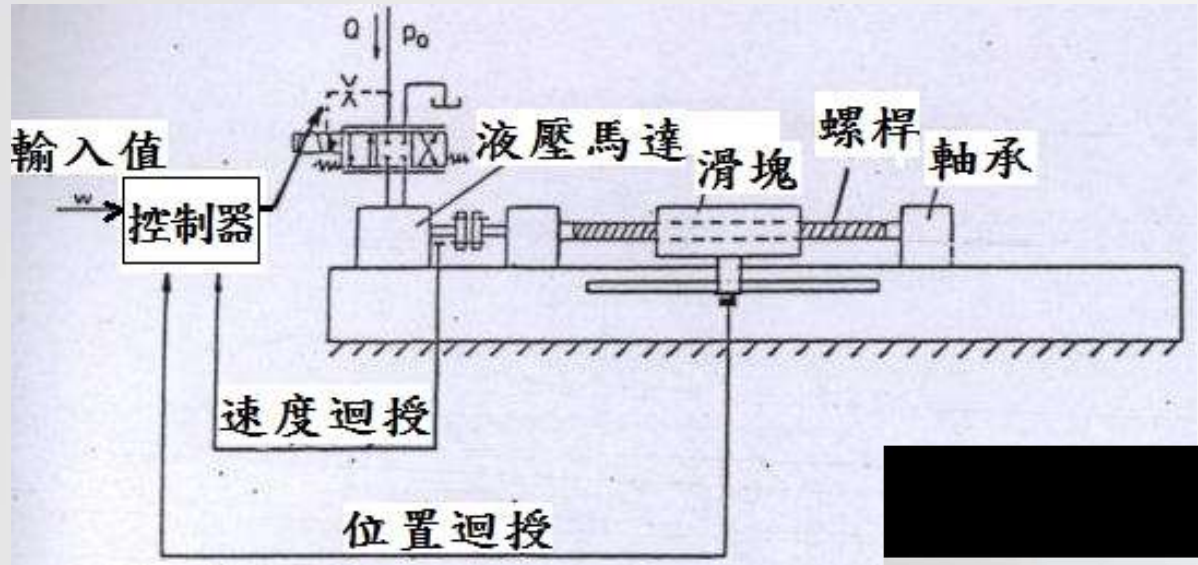
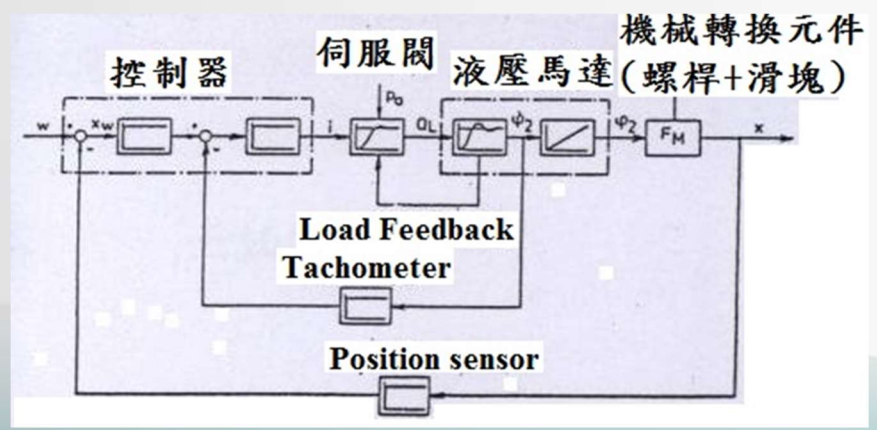
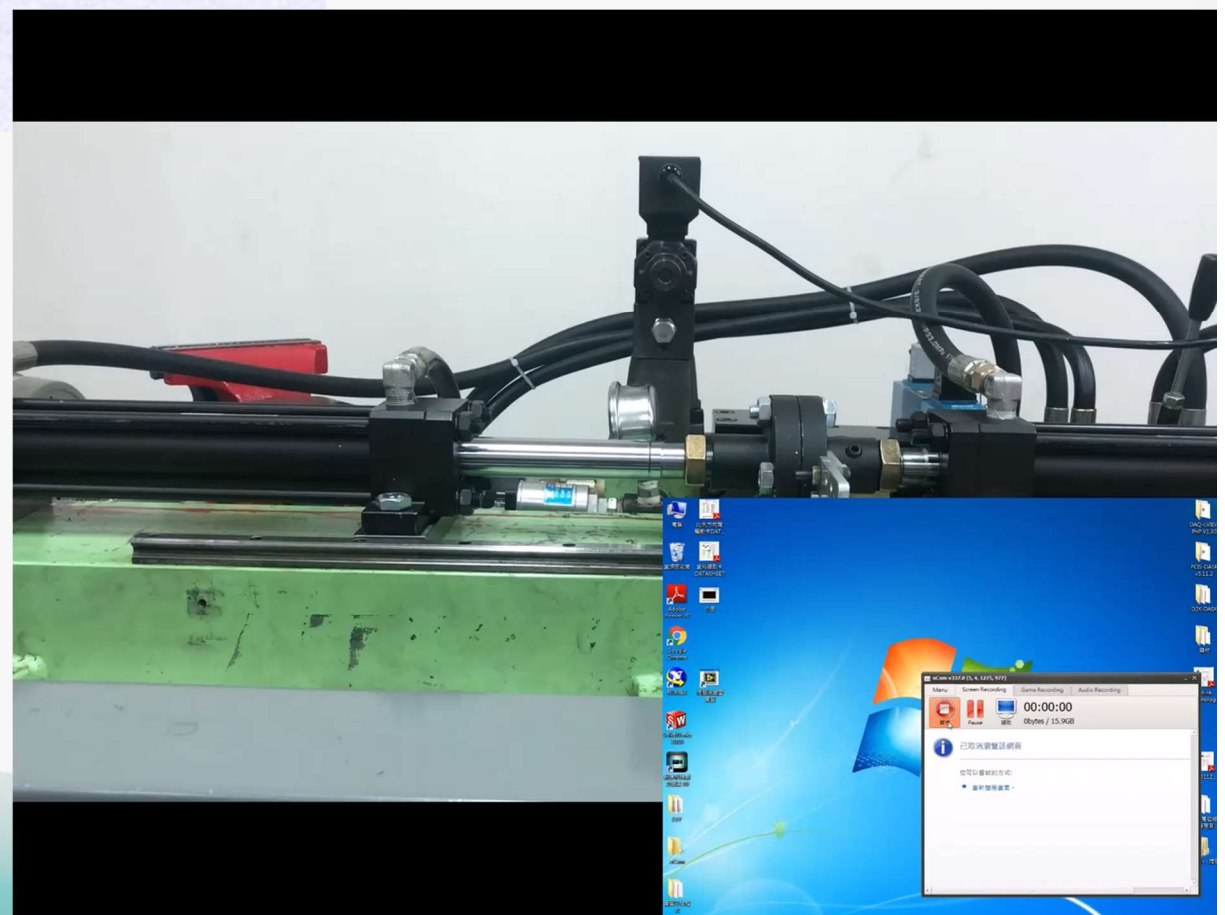


Figure 1-8(a) : 電氣-液壓伺服驅動之工具機(位置控制)

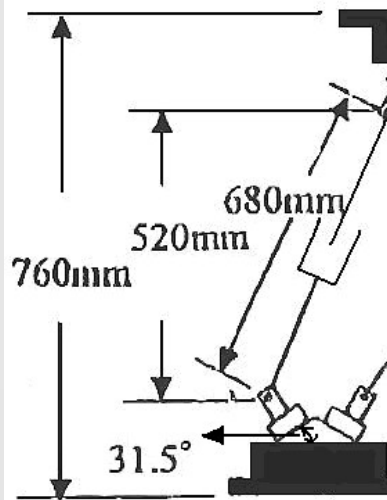
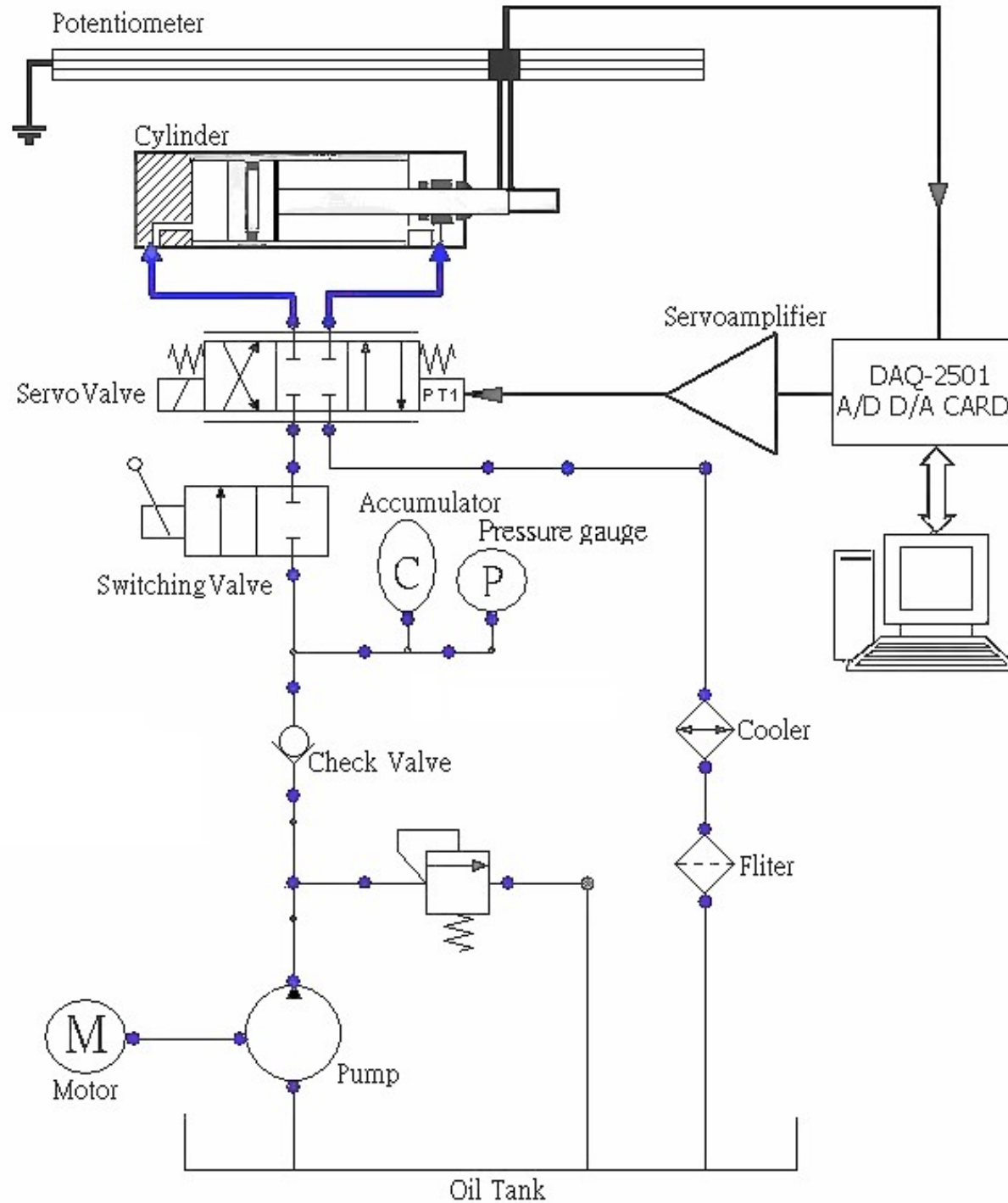


# 大綱

- 液壓控制原理介紹(Part I)
- 常見液壓元件控制
- 液壓系統整合應用技術說明(Part II)
- 結論



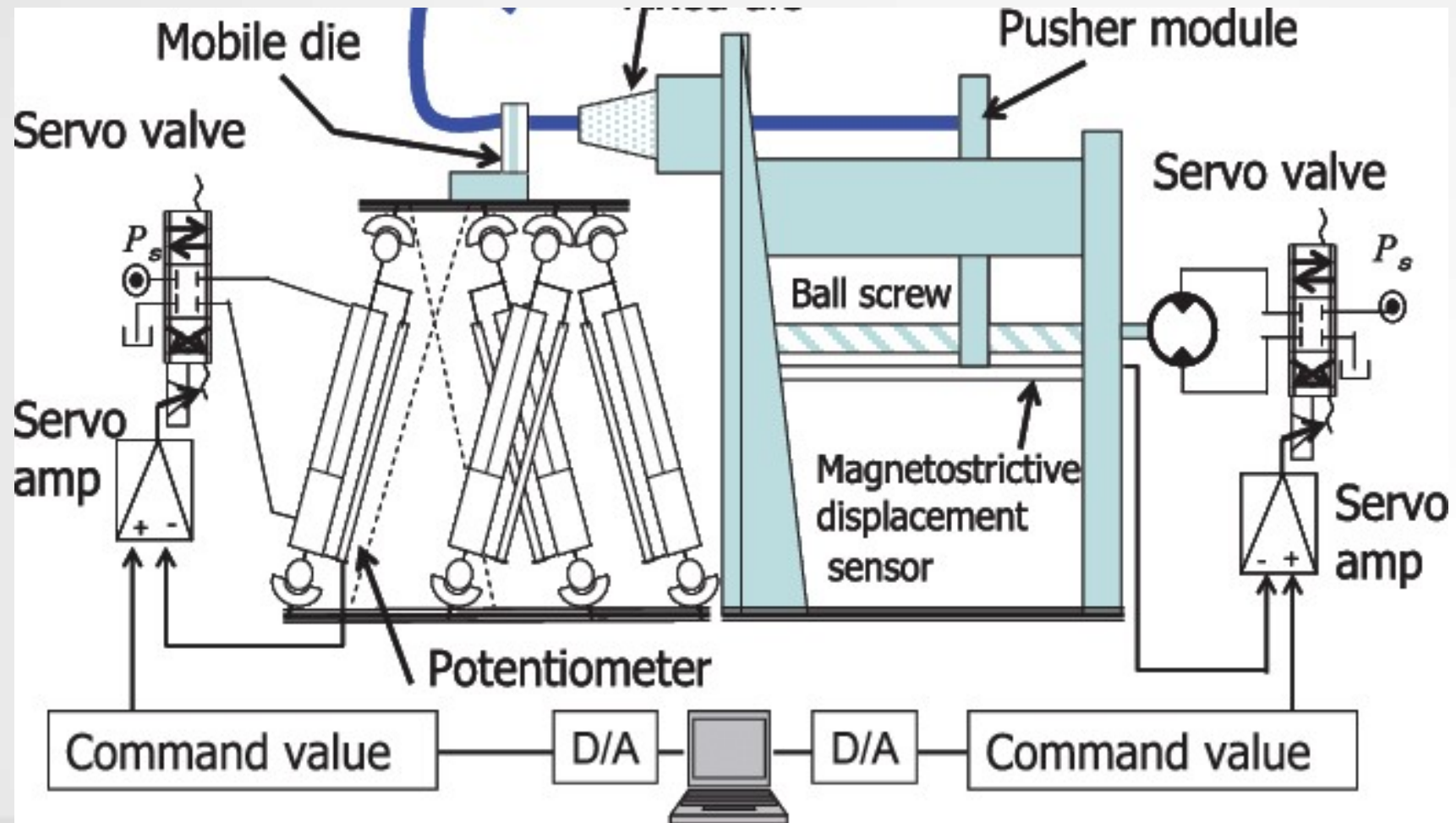




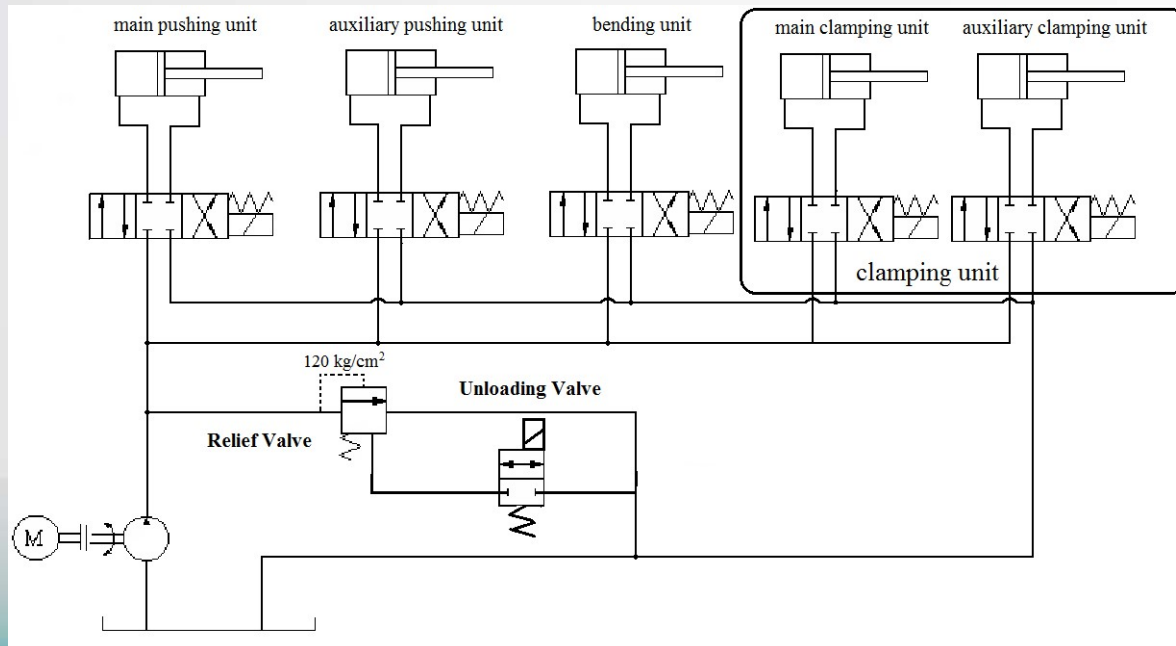
# 應用實例 -

## 六軸動感平台應用

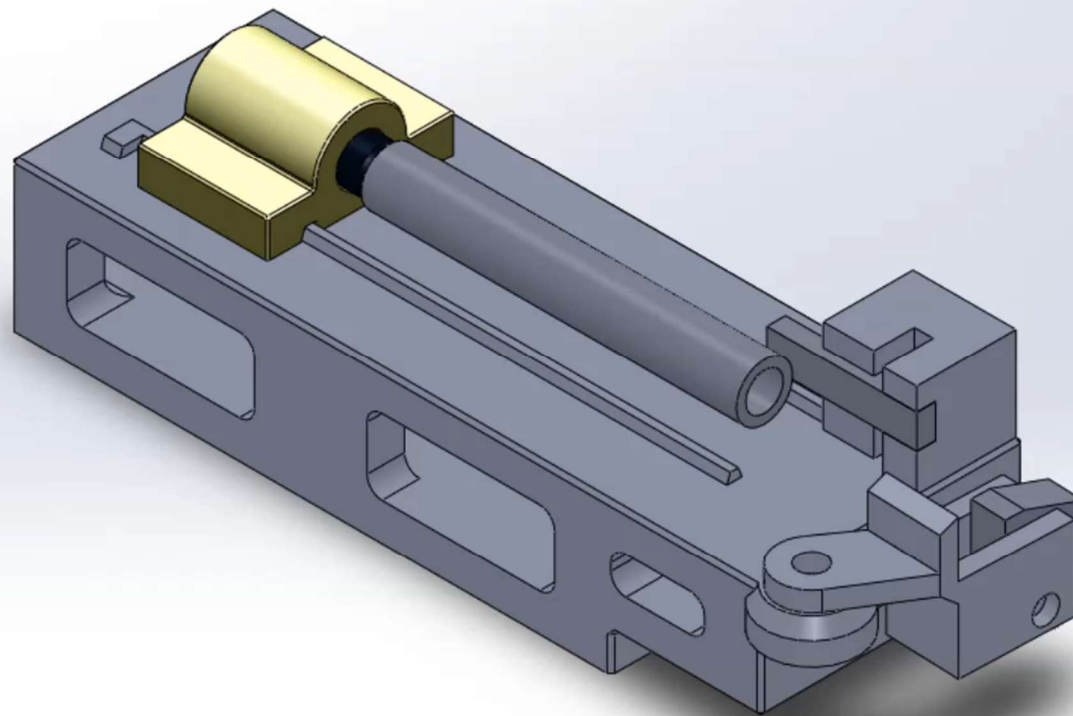




# Circuit for tube bender with unloading (1/3)



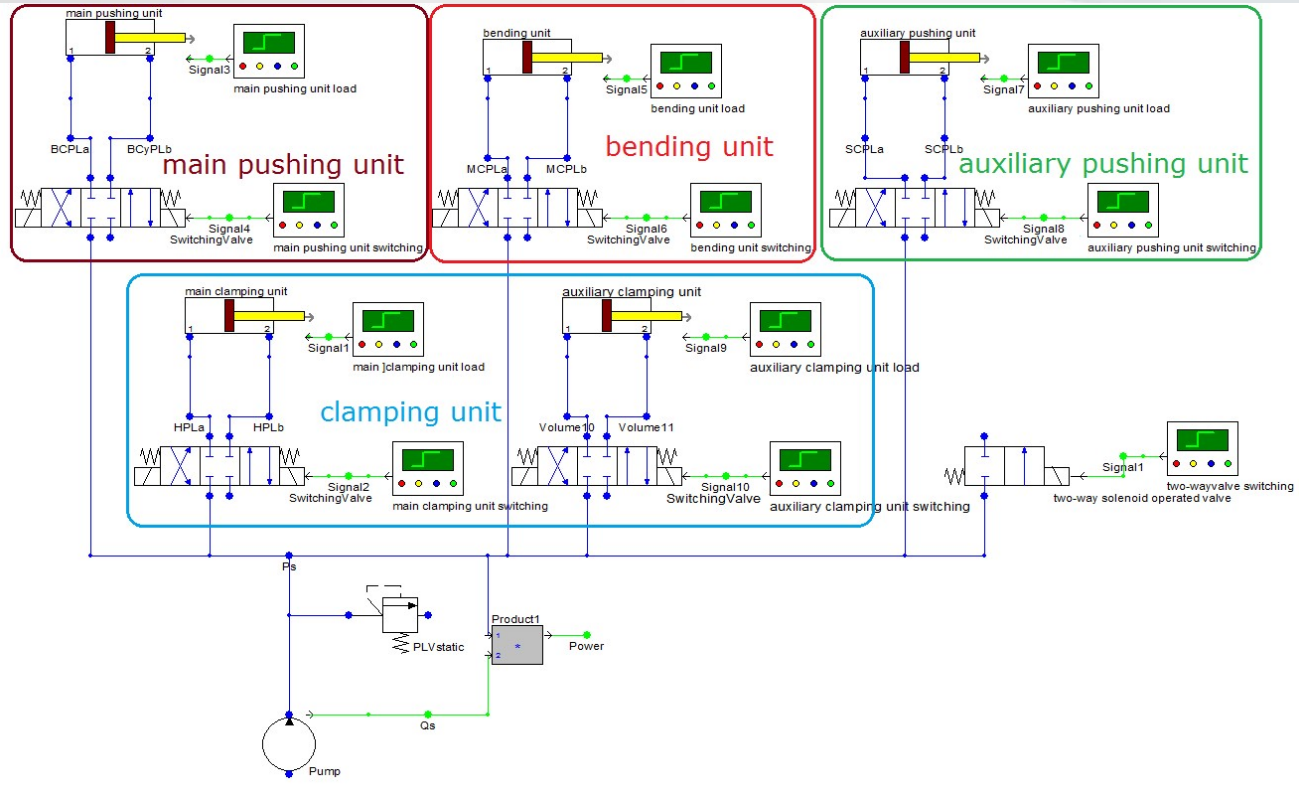




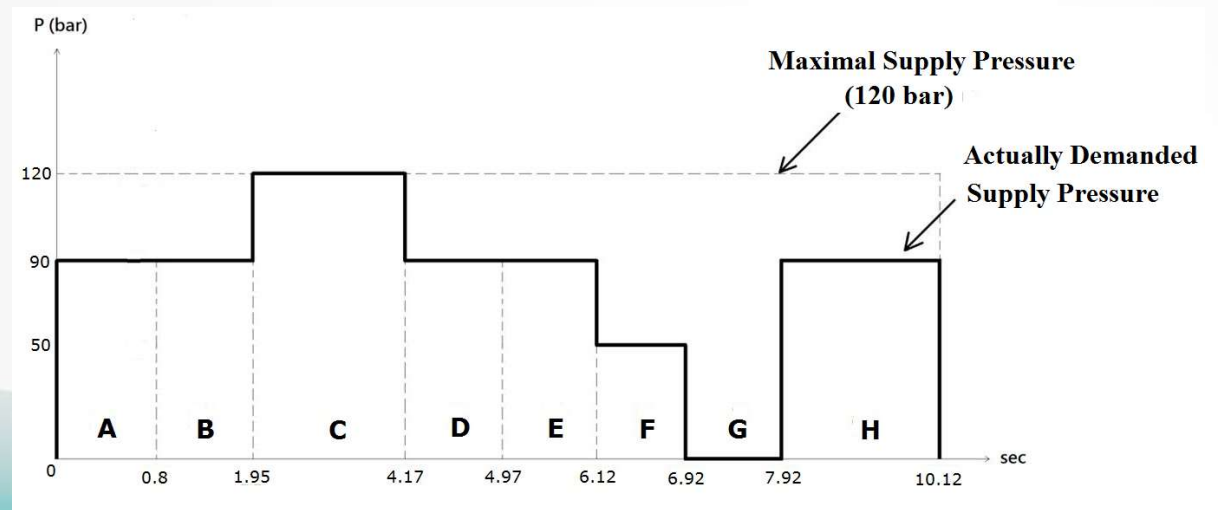
(Figure 11-3b,c)

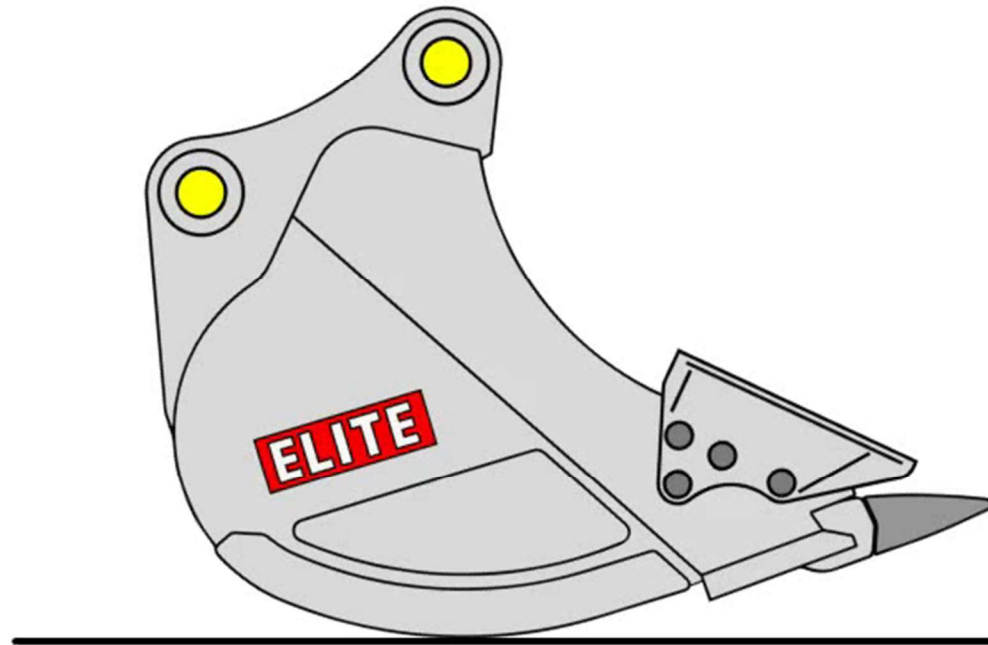
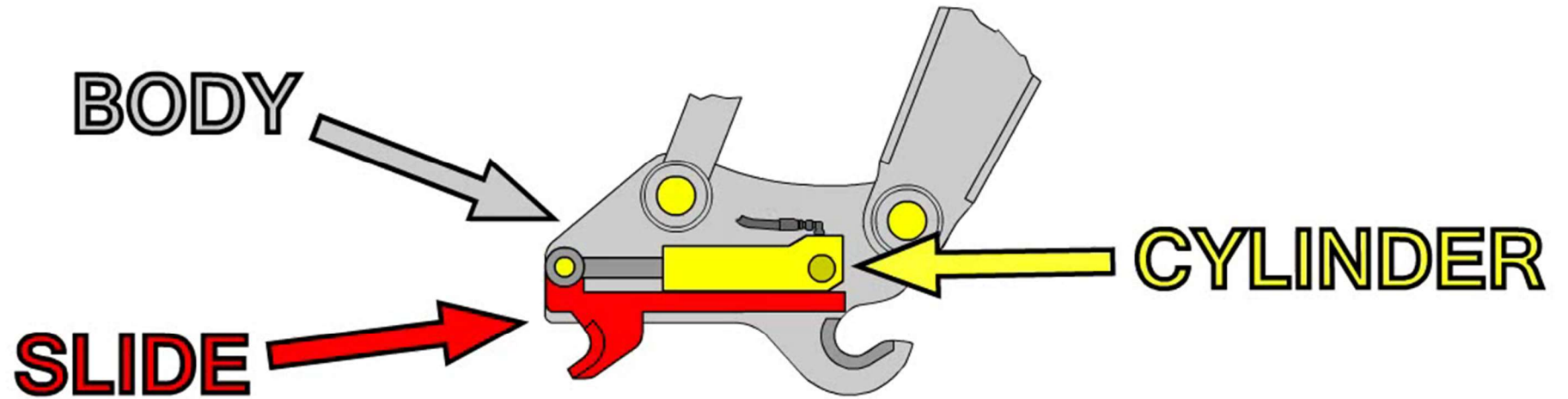


# Circuit for tube bender with unloading (3/3)



DSH-Plus Model

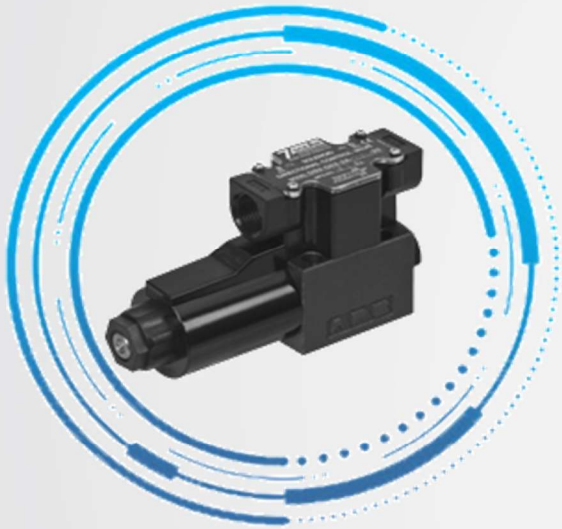




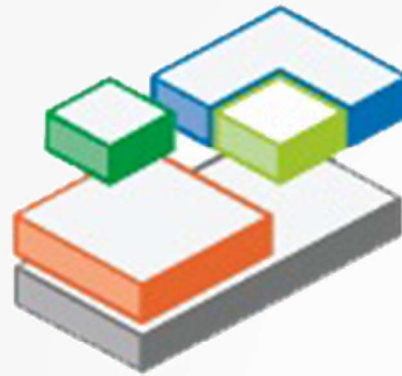
**AUTO LOCK™**  
1300 305 028



# Advanced Hydraulic Solenoid Valve with Wireless Bluetooth communication.



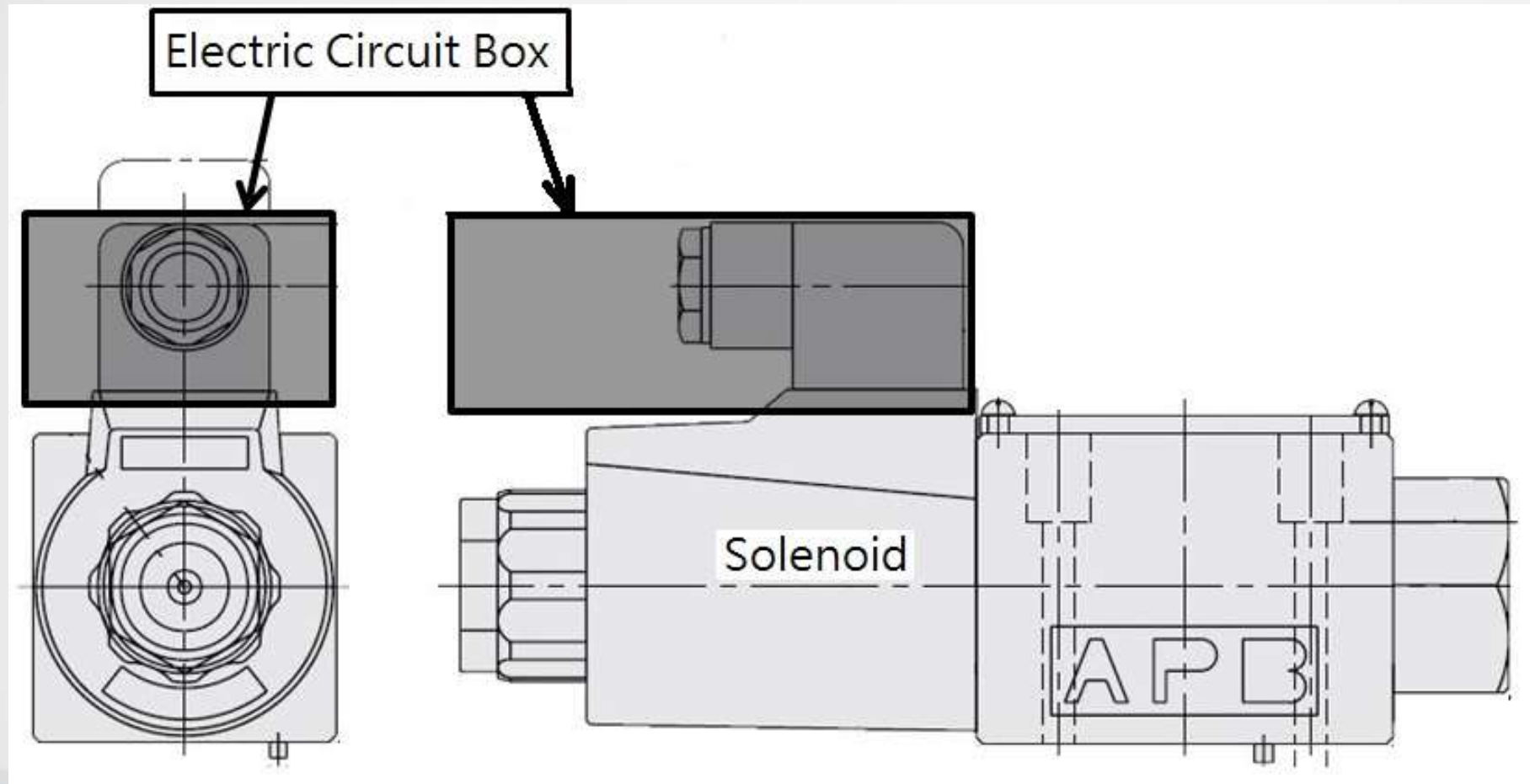
Hydraulic Solenoid Valve



Intelligent Bluetooth Module



# Integration into a single valve unit

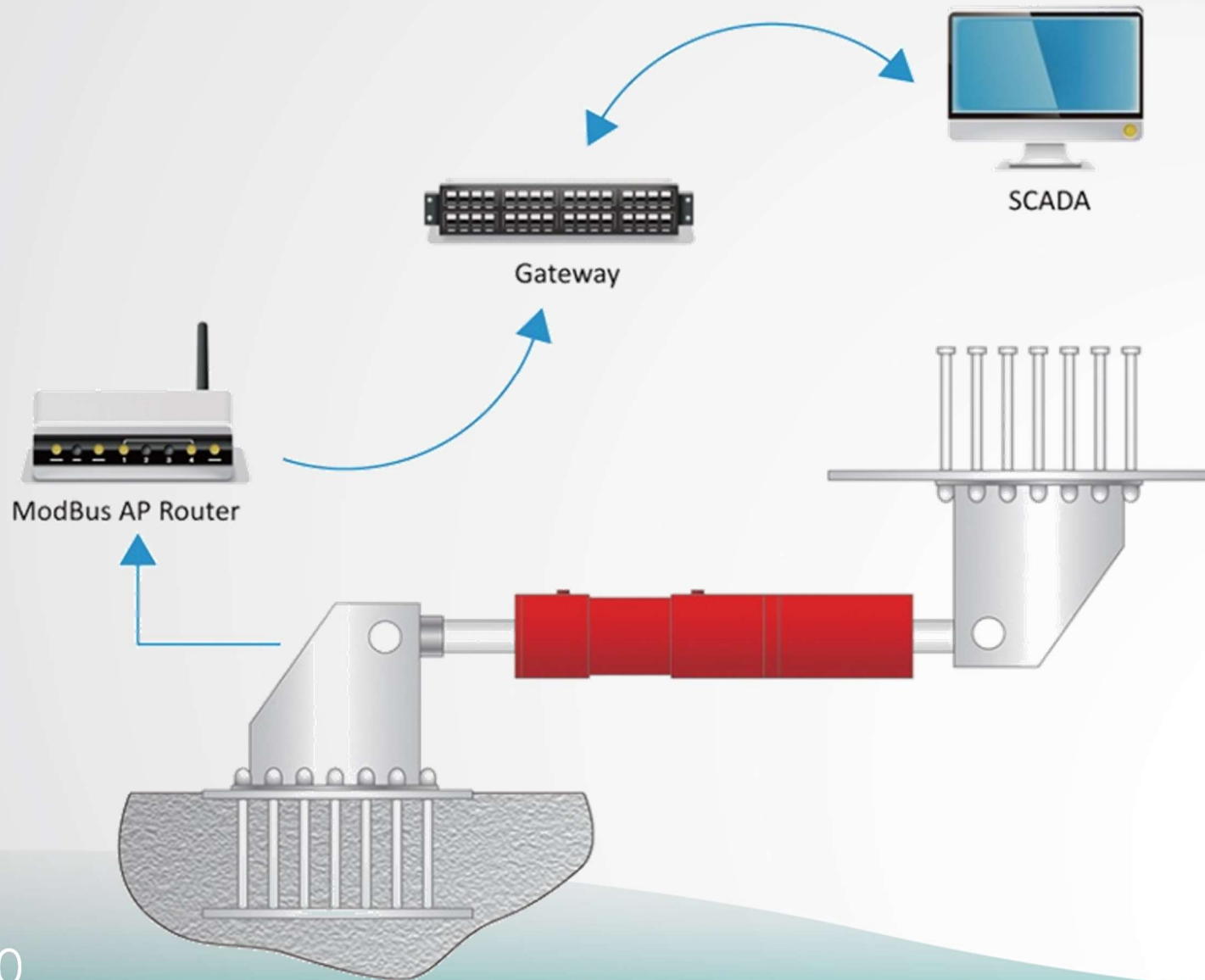




## Advanced functions :



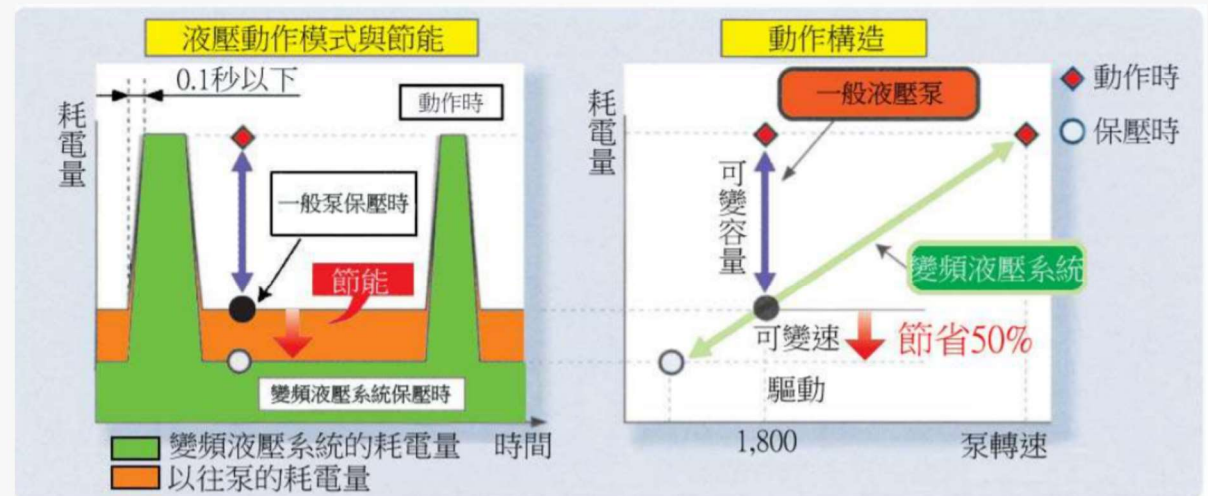
# IIOT : Remote Monitoring of Fluid Viscous Damper for Building and Bridges



Real-Time Monitoring of :

- 1. Leakage
- 2. Displacement

變頻液壓節能系統主要是採用伺服馬達，搭配變頻控制器，依據壓力感測器在不同工作條件下的回饋訊號，進行智慧控制驅動馬達轉速，提供設備實際所需的壓力和流量，並藉此達到最低功耗的節能效益。

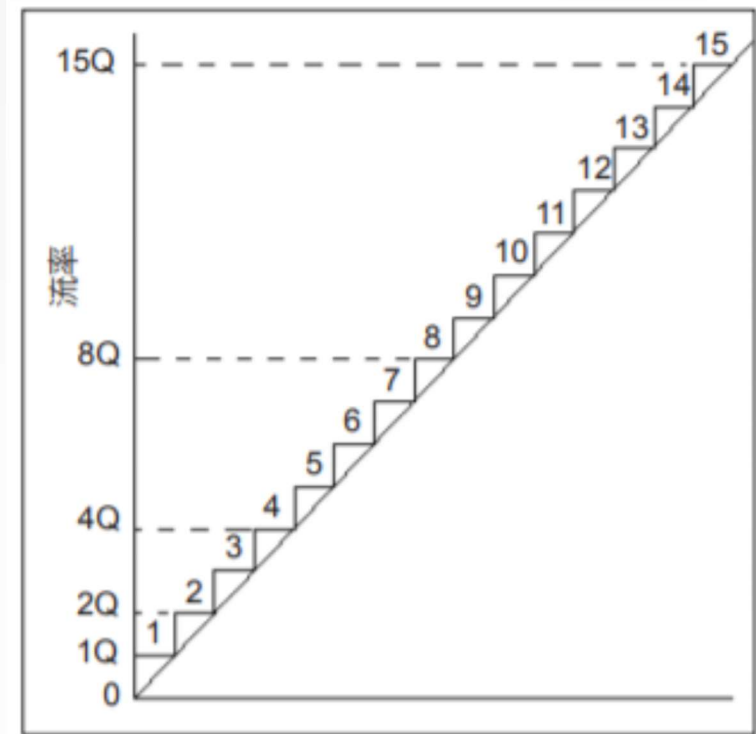
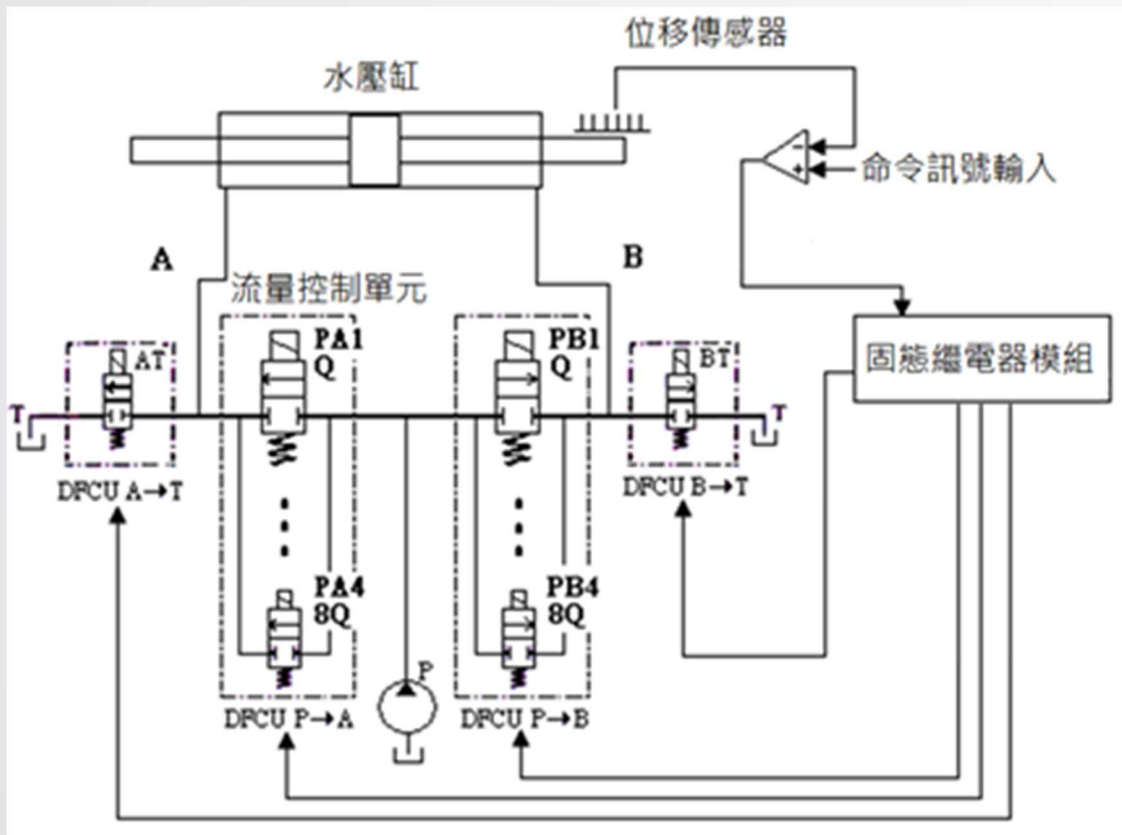


七洋變頻液壓系統 節能利器





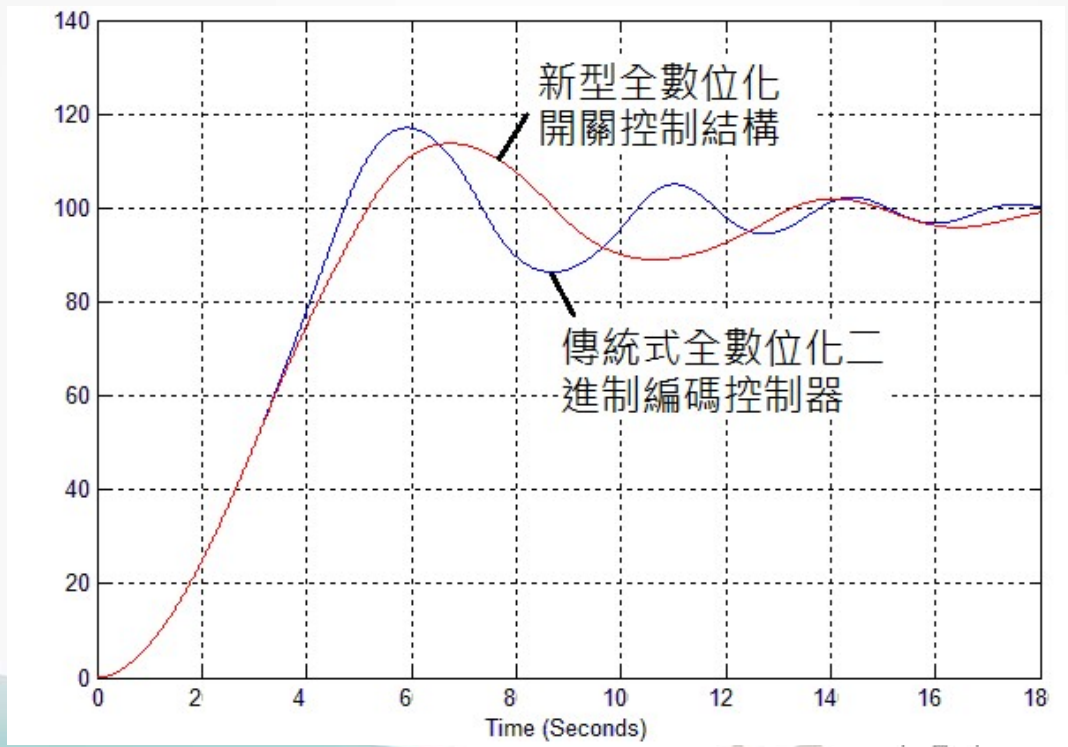
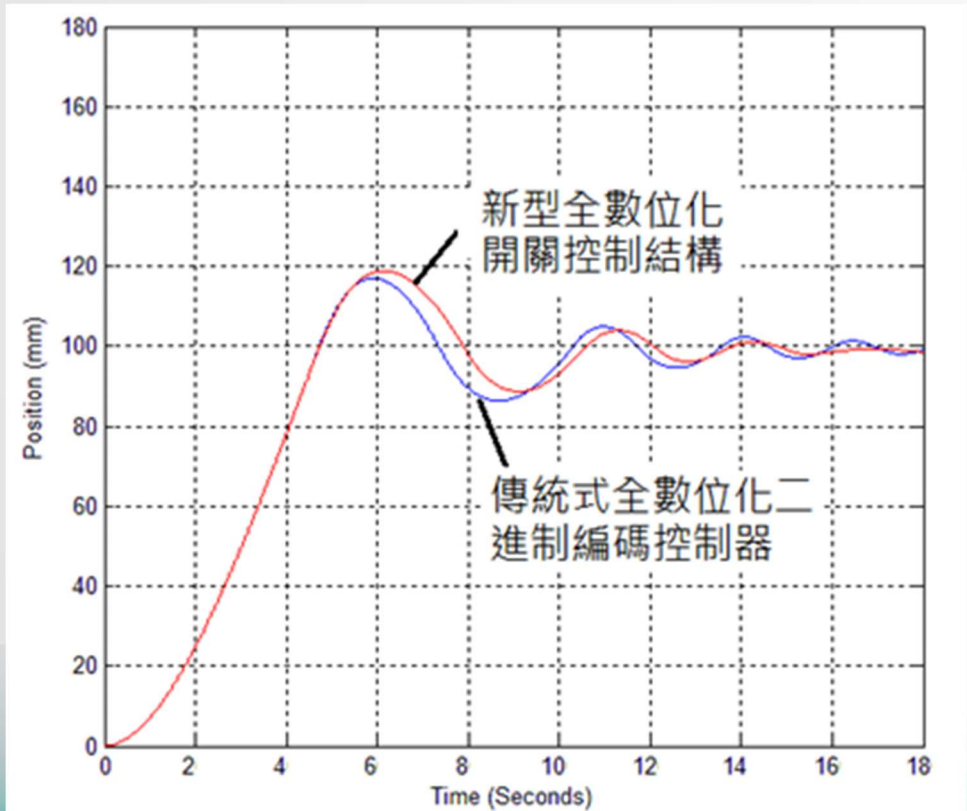
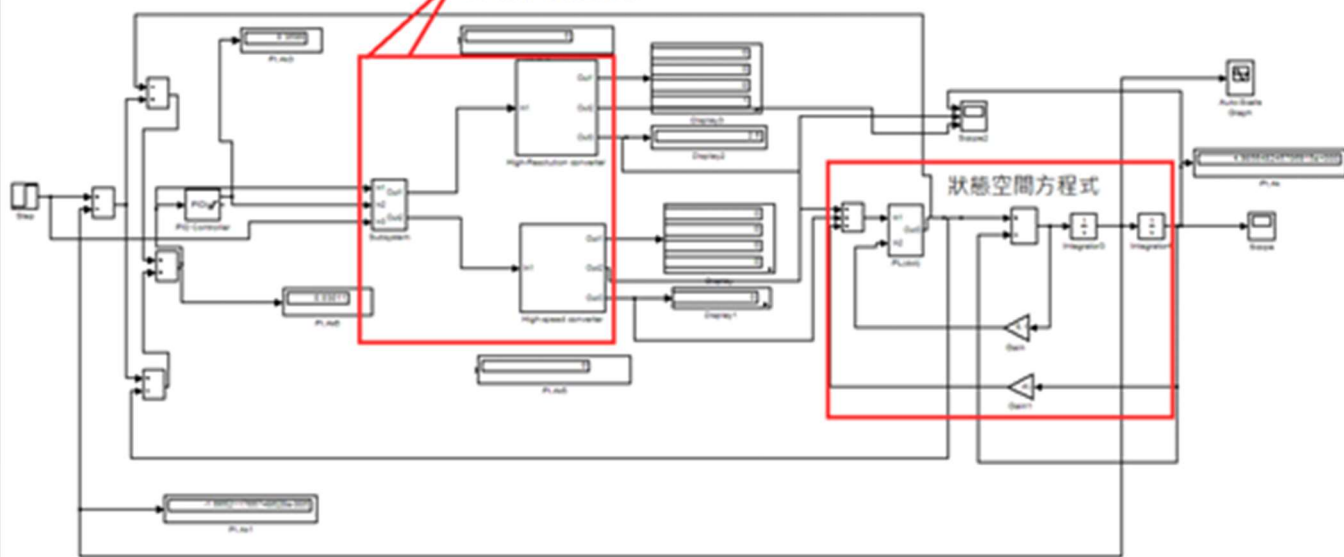
由於目前在水壓控制元件中並無低成本以及大量生產的比例閥或伺服閥，因此本文則採用快速開關閥來組成一套二進制編碼系統之比例流量控制單元(Digital Flow Control Unit; DFCU)並建構一全數位化水壓定位控制系統。



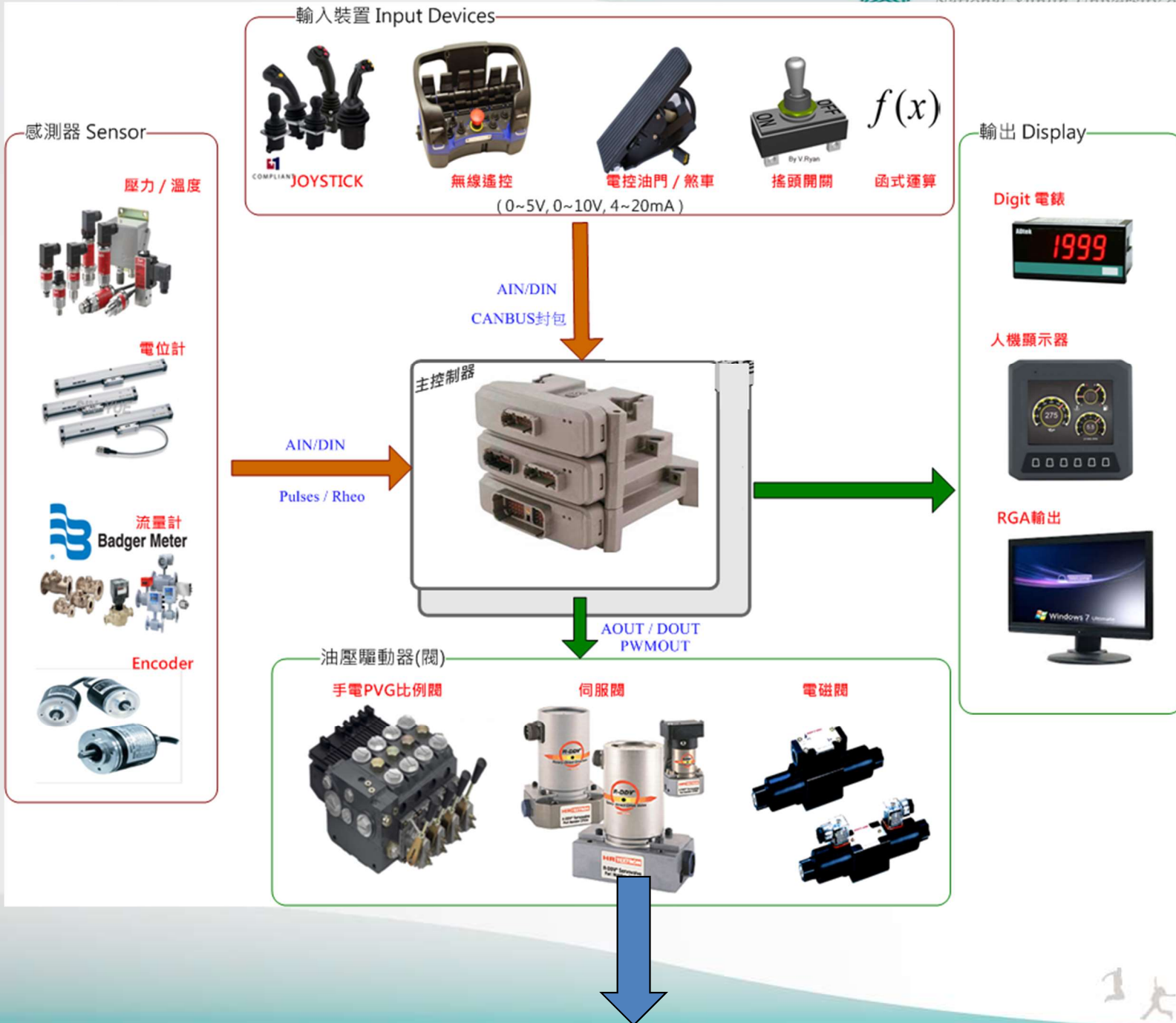
流量輸出示意圖



高速模式與高解析度  
模式邏輯判斷開關

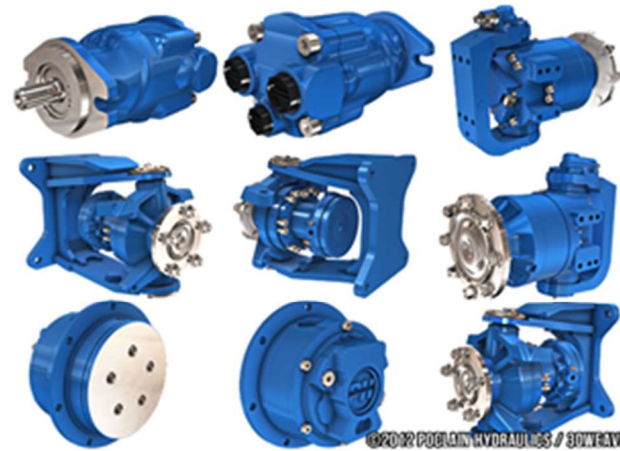


# 閉迴路控制基本架構(1/3)



## 旋轉式作動器 Actuator

Hydraulic Motor 油壓馬達



## 行星減速機



## 直線式作動器 Actuator

Hydraulic Cylinder 油壓缸





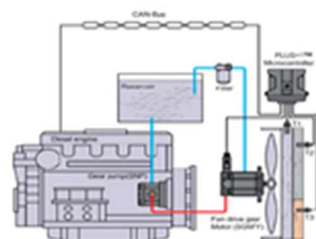
## 應用領域 APPLICATIONS



射出成型機



鑽挖潛盾機



車用風扇散熱系統



車吊系統



水泥攪拌車



鑽石研磨機



CNC工具機



船用吊桿系統



橡膠機械



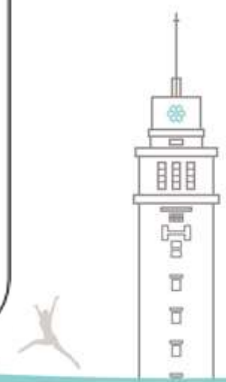
漁撈設備



破碎機



消防設備





## Application of Hydrostatic Transmission : Hydraulic hybrid vehicle

適合經常走走停停的車輛操作方式，例如：垃圾車、送貨車等。



液壓混合動力車輛  
(Hydraulic Hybrid  
Vehicle, HHV)是一種  
以液壓系統元件取代或  
輔助傳統車輛傳動系統  
元件的應用方式。

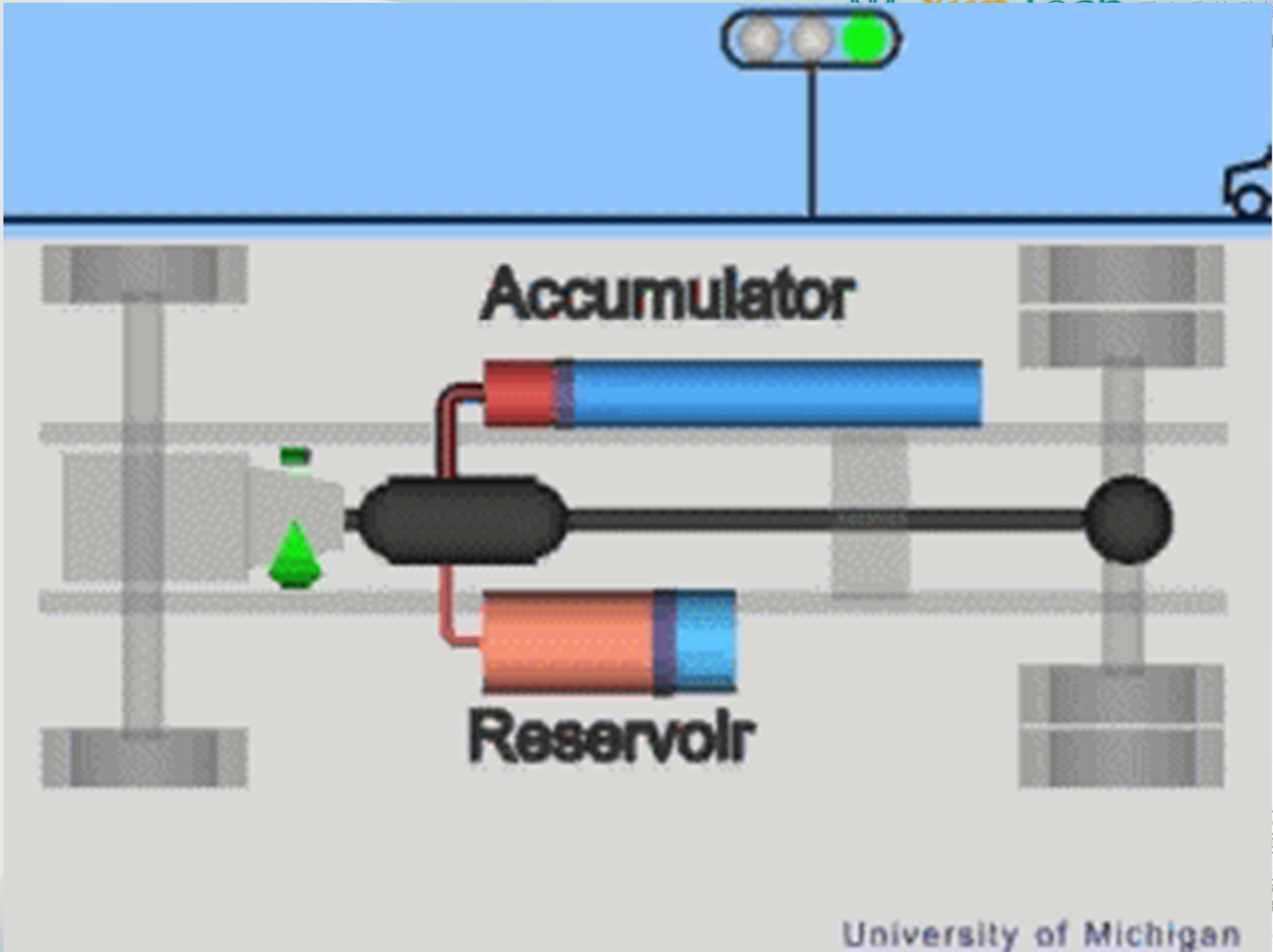


Pump/Motor

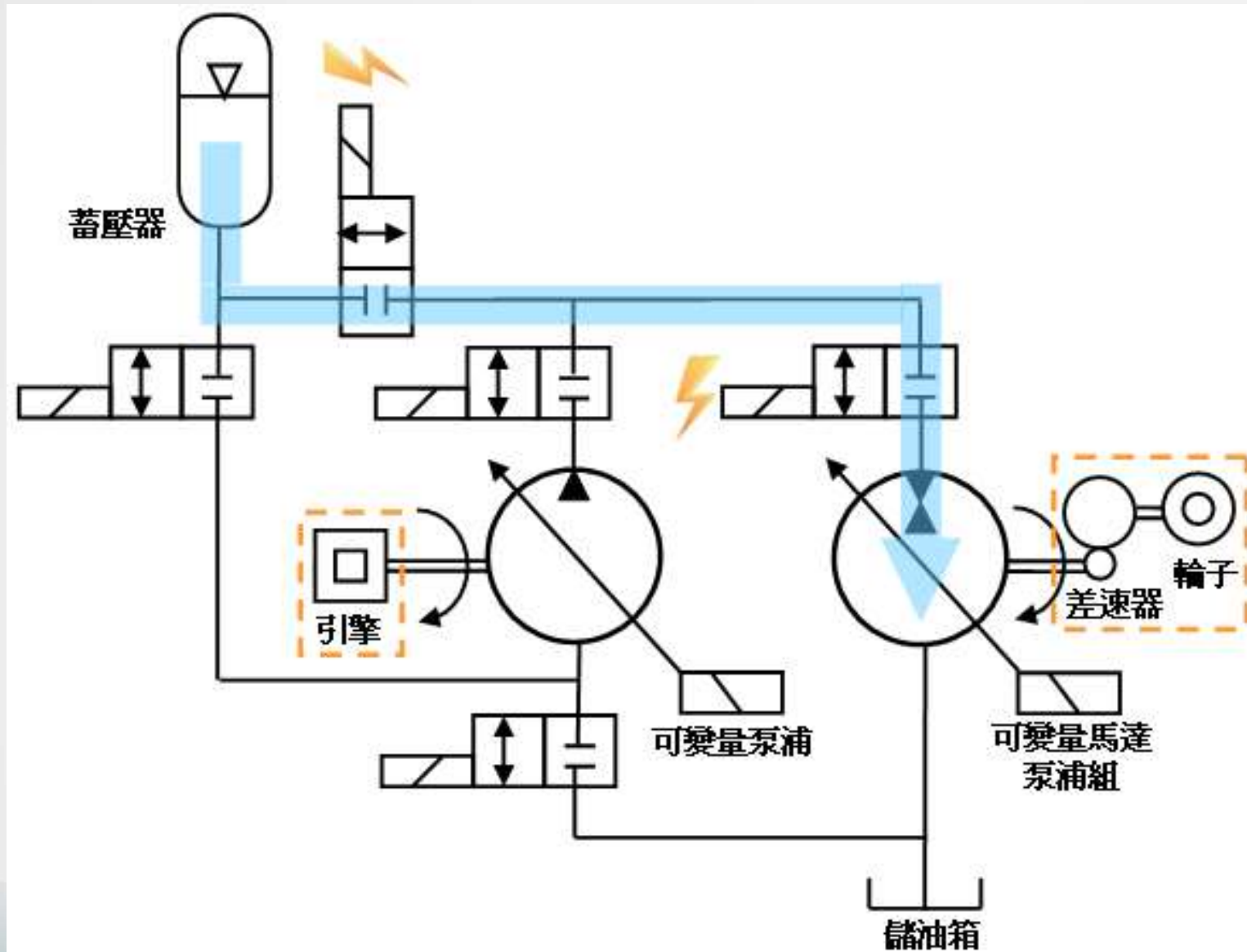


Accumulator



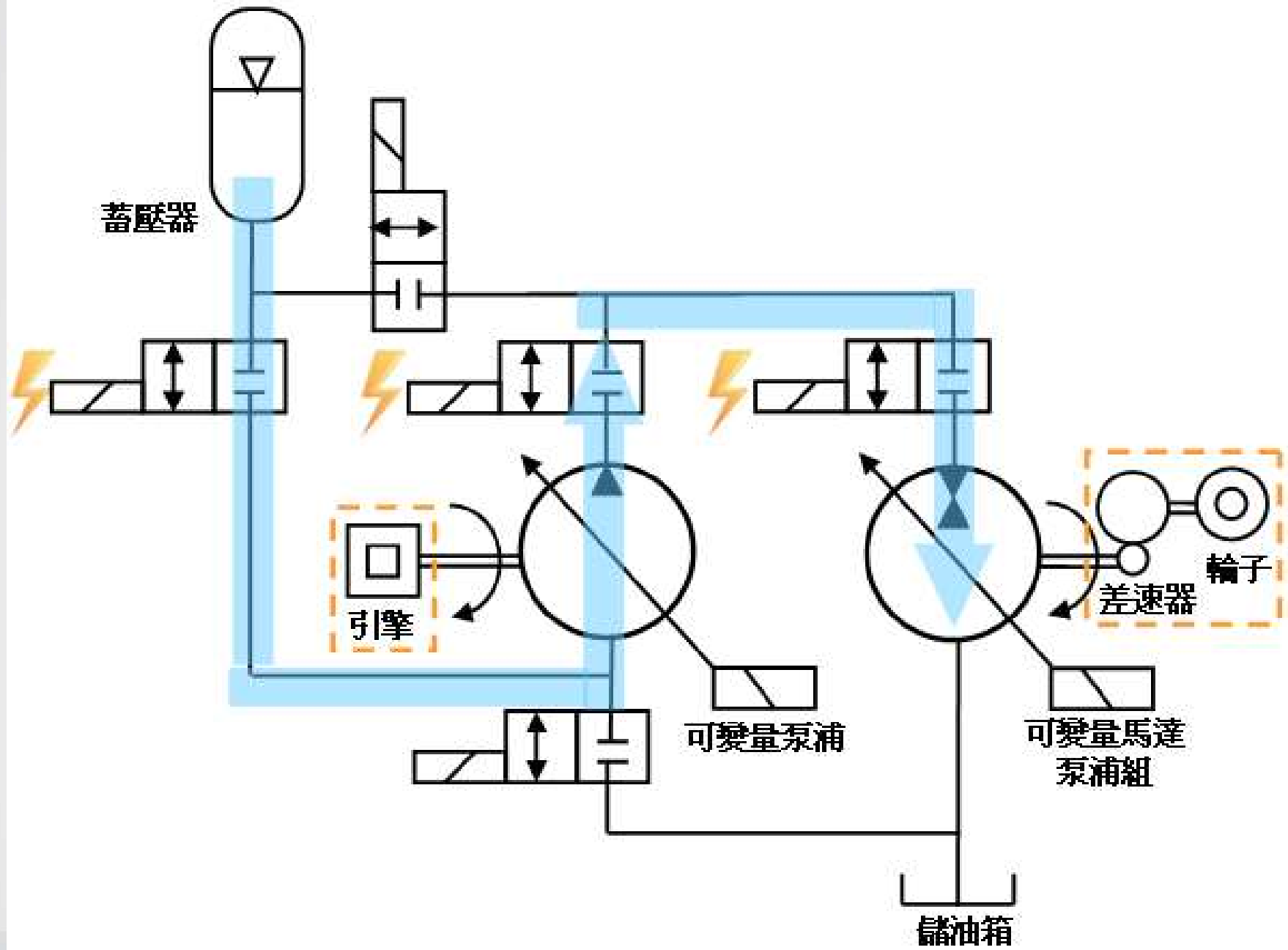


# 液壓混合動力車(hydraulic hybrid vehicle)原理



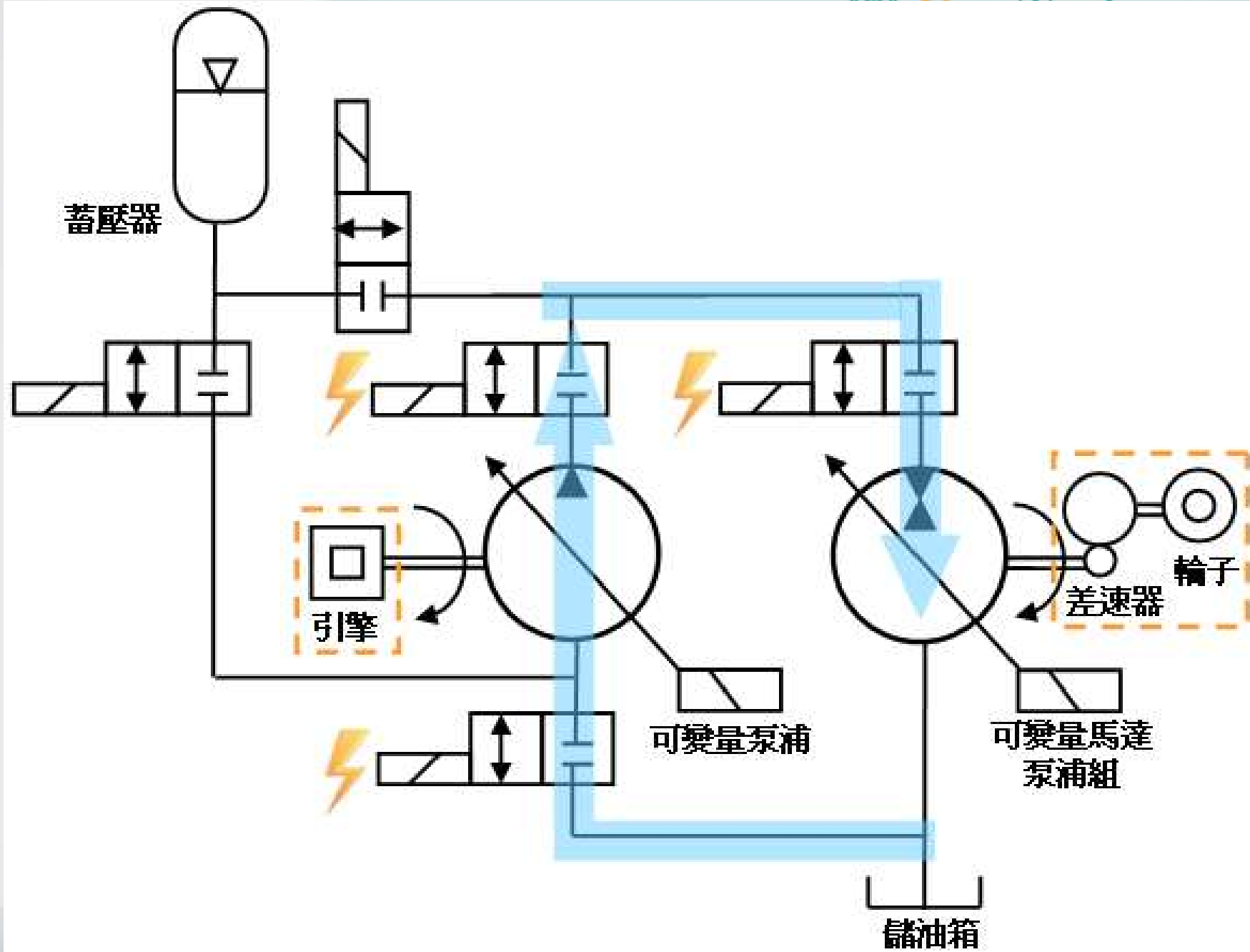
單蓄壓器傳動模式油路動作圖



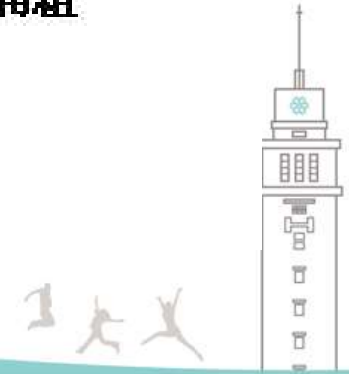


合併引擎與蓄壓器傳動模式油路動作圖

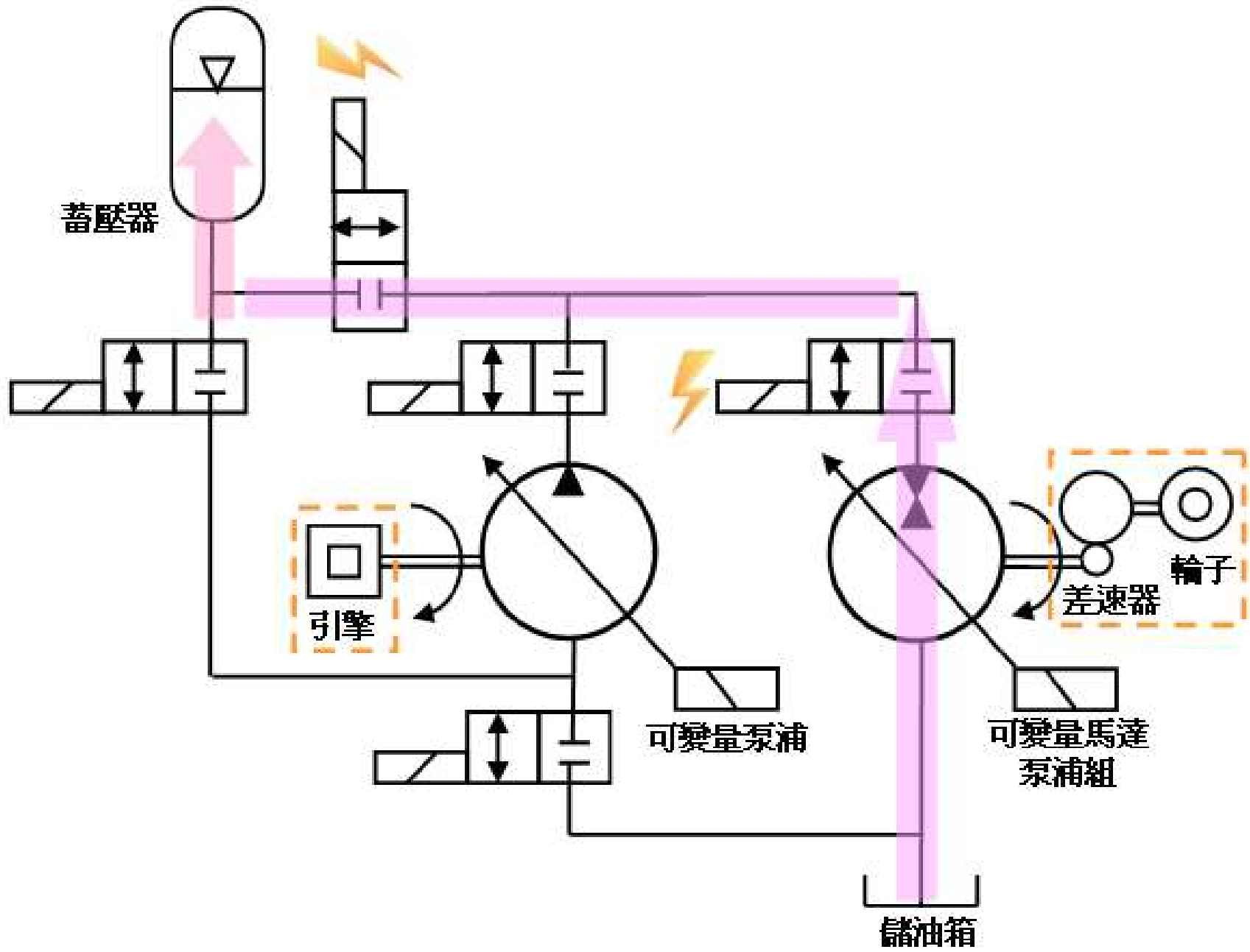




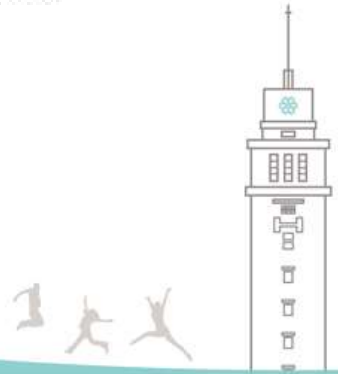
以引擎直接液壓傳動模式油路動作圖

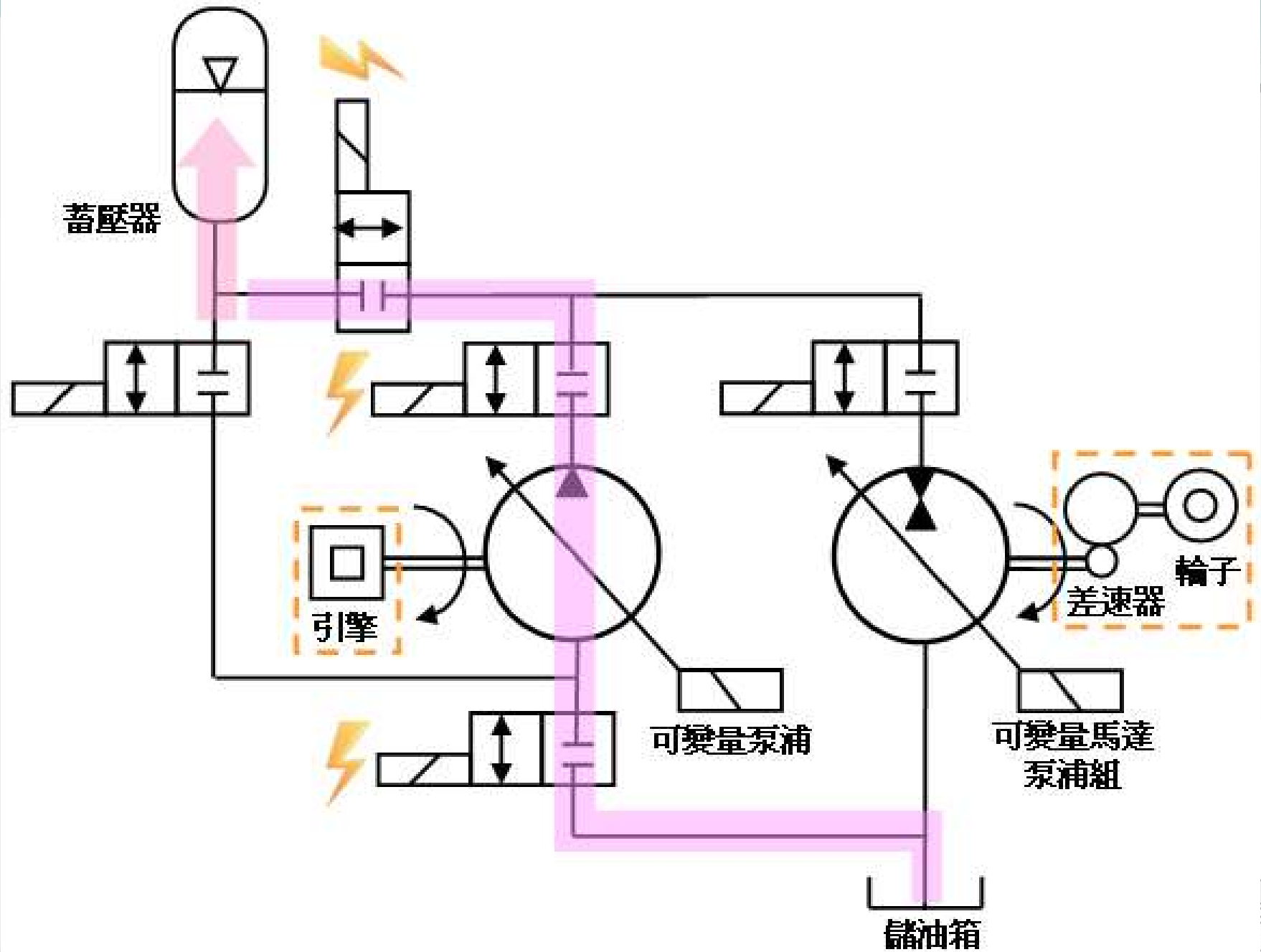






煞車能量回收模式油路動作圖

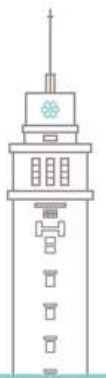




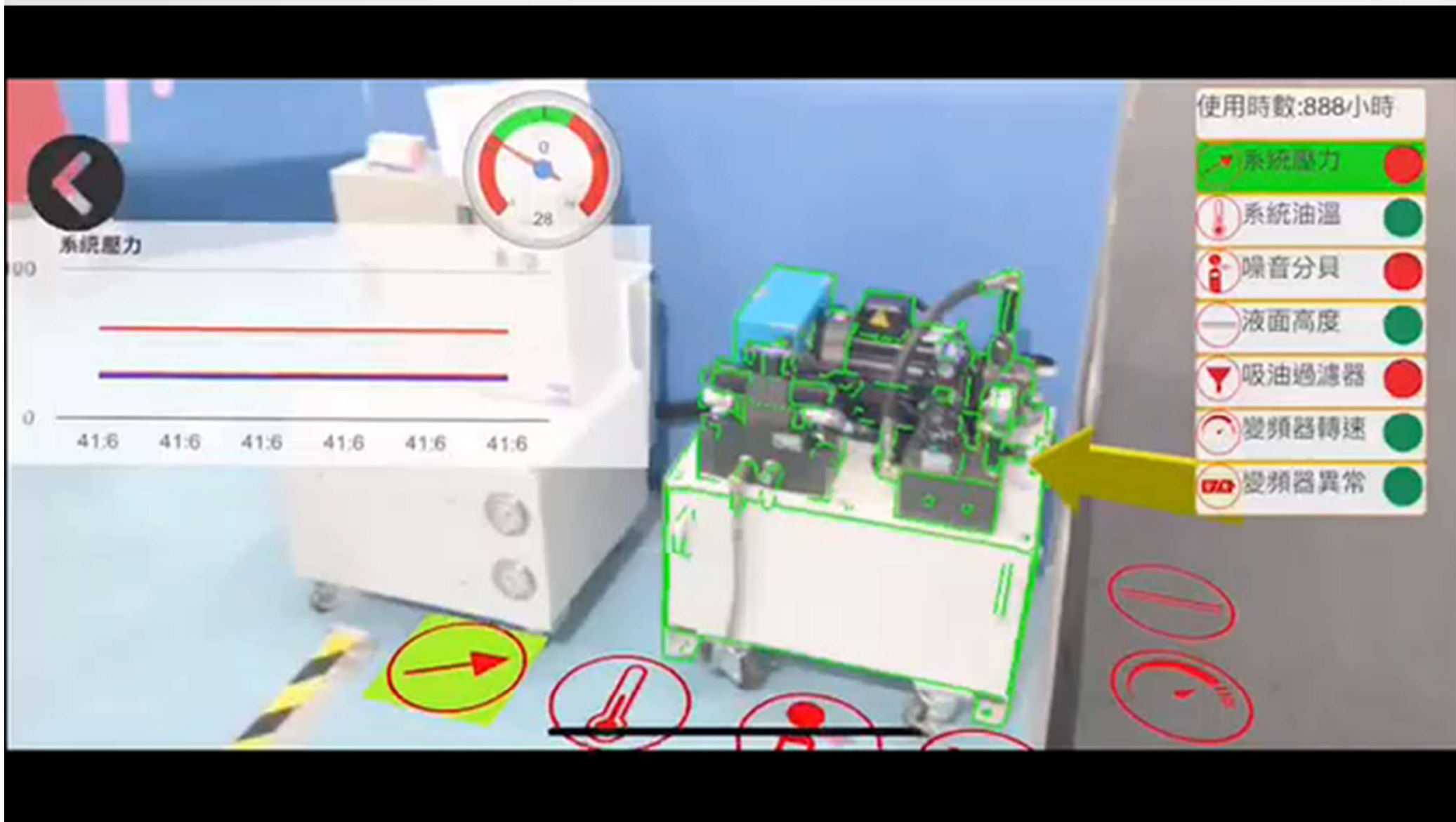
引擎惰轉能量回收模式油路動作圖



# Augmented Reality and Manufacturing AR虛實整合-製造業升級

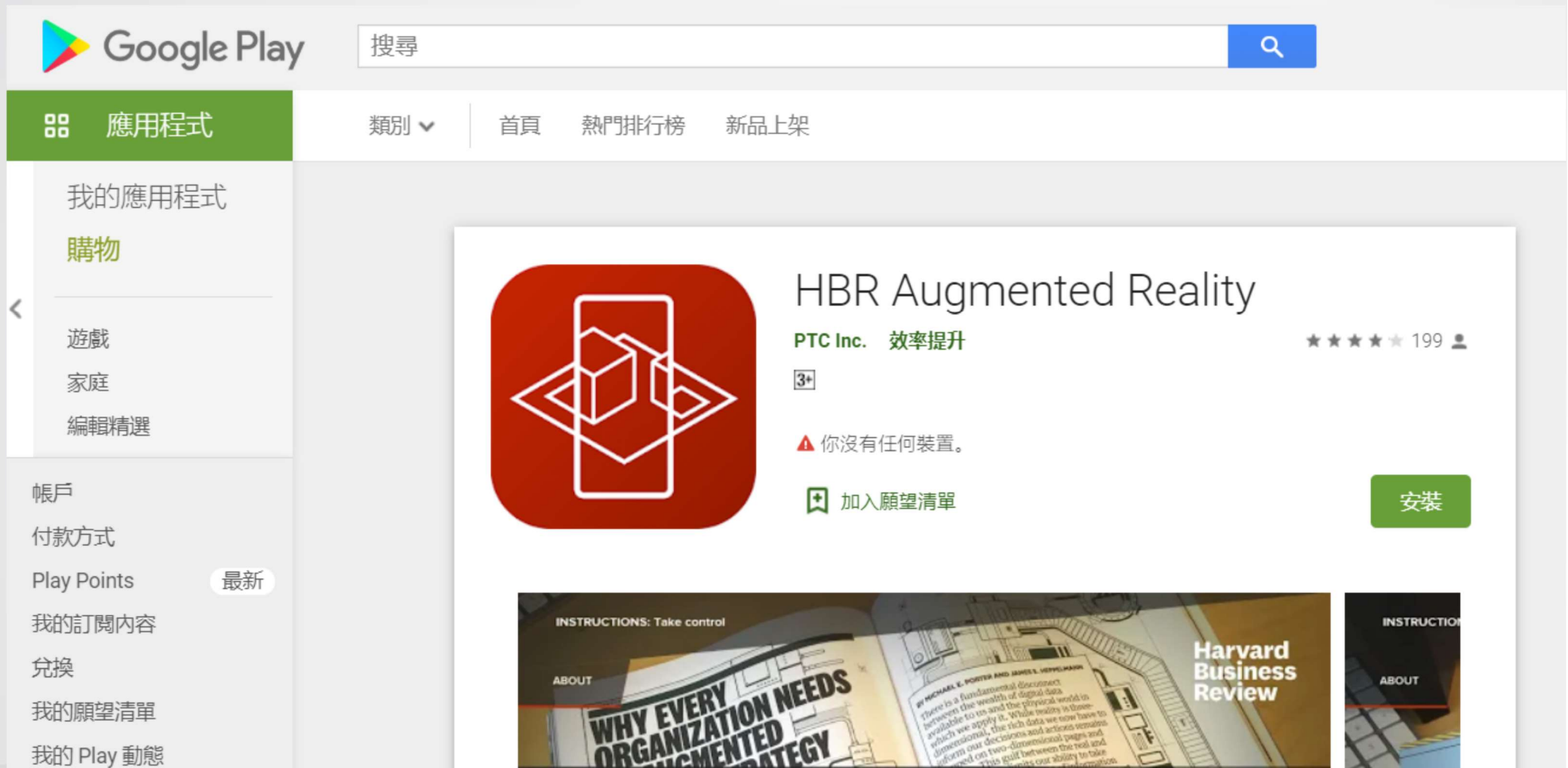


中華電信和網聯科技完成合作簽約，共同推出  
「TANGRAM x AR」服務，結合5G特性與工業物  
聯網應用平台





# 可在手機下載 APP 進行體驗



The screenshot displays the Google Play Store interface. At the top, the Google Play logo is on the left, and a search bar with the text '搜尋' is on the right. Below the search bar, there are navigation options: '類別' (Categories), '首頁' (Home), '熱門排行榜' (Top Charts), and '新品上架' (New Arrivals). The left sidebar contains a menu with options: '我的應用程式' (My Apps), '購物' (Shopping), '遊戲' (Games), '家庭' (Family), '編輯精選' (Editor's Choice), '帳戶' (Account), '付款方式' (Payment Methods), 'Play Points' (with a '最新' badge), '我的訂閱內容' (My Subscriptions), '兌換' (Redeem), '我的願望清單' (My Wishlist), and '我的 Play 動態' (My Play Activity).

The main content area shows the app 'HBR Augmented Reality' by PTC Inc. The app icon is a red square with a white geometric design. The app title is 'HBR Augmented Reality', and the developer is 'PTC Inc. 效率提升'. The app has a rating of 4.5 stars from 199 reviews. A warning icon indicates '你沒有任何裝置。' (You have no devices). There is a green '安裝' (Install) button and a '加入願望清單' (Add to Wishlist) button. Below the app information, there is a preview image showing a document titled 'Harvard Business Review' with the headline 'WHY EVERY ORGANIZATION NEEDS AUGMENTED STRATEGY'.







HBR AR



vuforia™



# 體驗擴增實境

啓動這個互動示範，觀看擴增實境目前的主要能力。

## 視覺化

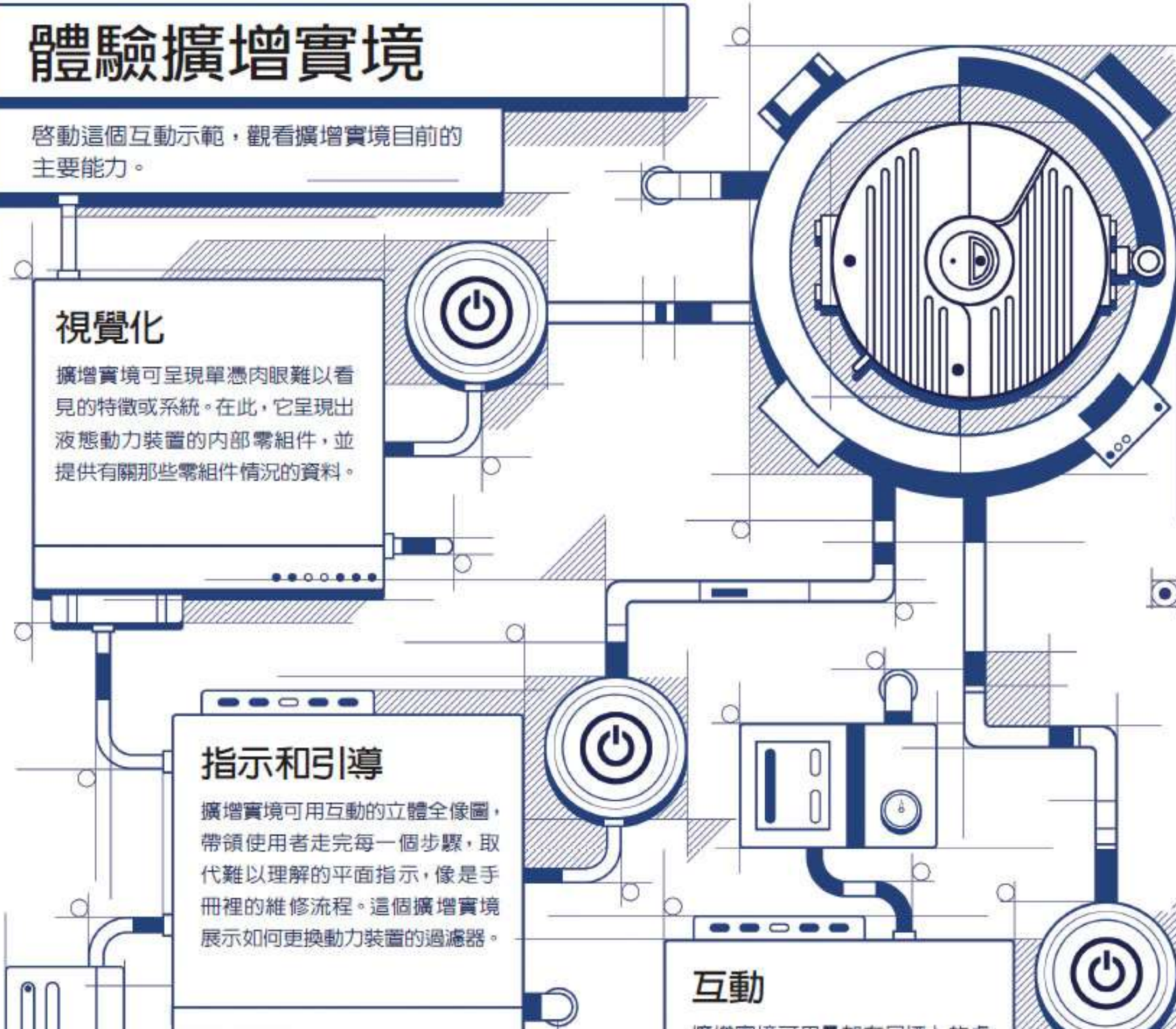
擴增實境可呈現單憑肉眼難以看見的特徵或系統。在此，它呈現出液態動力裝置的內部零組件，並提供有關那些零組件情況的資料。

## 指示和引導

擴增實境可用互動的立體全像圖，帶領使用者走完每一個步驟，取代難以理解的平面指示，像是手冊裡的維修流程。這個擴增實境展示如何更換動力裝置的過濾器。

## 互動

擴增實境可呈現動態的3D模型，



說明結束，歡迎蒞臨 雲科智慧製造研究中心

**Welcome to Smart Manufacturing Research Center**

