

# 創新經濟 · 樂活台灣

電動節能 ⊕ 智慧駕馭

Green EV ⊕ Smart Driving



2011.04.14~04.17

台灣國際電動車展-TARC主題館

Taiwan International Electric Vehicle Show-  
Taiwan Automotive Research Consortium Pavilion



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# 台灣車輛研發聯盟(TARC)簡介

## Brief Introduction of Taiwan Automotive Research Consortium (TARC)

為了促進台灣汽車工業與國際交流合作，經濟部技術處於2005年5月30日推動成立台灣車輛研發聯盟(Taiwan Automotive Research Consortium; TARC)，目前6個成員包括：車輛研究測試中心(ARTC)、工研院機械與系統研究所(MSL/ITRI)、工研院材料與化工研究所(MCL/ITRI)、金屬工業研究發展中心(MIRDC)、中山科學研究院(CSIST)及華創車電技術中心股份有限公司(HAITEC)等。

台灣車輛研發聯盟(TARC)的主要任務包括：

1. 推動及拓展車輛及其零組件產業，建立研發整合平台。
2. 建立促進及拓展車輛及其零組件學術及技術之交流平台。
3. 協助台灣各大專院校發展車輛及其零組件等相關產業之研究創新計劃平台。

由此三個平台發展出以車輛智慧化、電動化為重點技術升級，並將之整合於高承載車輛平台(High Occupancy Vehicle, HOV)，建立智慧電動車自主工業所需之系統關鍵技術，從而帶動關鍵零組件產業成長，加強研發技術，協助業者提供及時與整合的支援，提升台灣零組件產業的水準及國際競爭力，使台灣智慧電動車能夠順利進軍世界舞台，並邁向成為全球研發及零組件供應中心之目標。

The automotive industry in Asia experiences in rapid growth for the last few years, meanwhile Taiwan automakers gradually cooperated with international automakers to grab market share in Asia with excellent performance. However the key automotive components still depend on the supply of the large foreign automakers. To combine the industrial, official, academic and research sectors and jointly facilitate the development of the automotive industry, the Department of Industrial Technology, Ministry of Economic Affairs (DOIT/MOEA) urged the 4 most important research institutes to establish Taiwan Automotive Research Consortium (TARC) on May 30, 2005. Up to now 2010 there are 6 members of TARC including Automotive Research & Testing Center (ARTC), Mechanical & System R· research Laboratories of Industrial Technology Research Institute (MSL/ITRI), Material & Chemical Research Laboratories of Industrial Technology Research Institute (MCL/ITRI), Metal Industries Research & Development Centre (MIRDC), Chung-Shan Institute of Science & Technology (CSIST) and Hua-Chuang Automobile Information Technical Center. The main targets of TARC include:

1. Establish the integrated platform for automotive technology research and development,
2. With international cooperation and technology transfer, assist the domestic industry to set up the concurrent engineering design platform,
3. Collaborate the local universities and colleges to establish the talents cultivation and innovative research platform.

These three platforms will be integrated by technical capabilities of TARC and put into development step by step. The integration combines the intelligent and electrified modules technology, TARC completes HOV (High Occupancy Vehicle) platform as research benchmarking to demonstrate the independent capabilities of intelligent and electrified vehicle design and manufacturing in Taiwan. TARC hopes to lead the local suppliers to upgrade their international competitiveness. And sincerely hope to bring its advantages into full play and create new business opportunities so that Taiwan will move toward the R&D and key components supply center of worldwide Intelligent and electrified vehicle makers.Co., Ltd.(HAITEC) etc.

# TARC主題館展品導覽

The Exhibits overview of Taiwan Automotive research Consortium Pavilion

## 智慧電動附件 Smart Electronic Components

- 全自動停車系統  
Automatic Parking System, APS
- 車用電動空調系統  
Electric Automatic Air-Conditioning System
- 防撞雷達與影像整合系統  
Anti-Collision Radar and Vision Integrated System
- 應用多光路截取技術之多功能影像警示系統  
Multi-Function drive assistant system by multi-path image capture technique
- 電動車用節能LED車燈系統  
Energy-saving LED Headlamp System for Electric Vehicle
- 全周影像無縫接合系統  
Seamless Around View Monitoring System
- 立體視覺之市區碰撞預防系統  
Stereo Vision Collision Avoidance System, SVCAS
- 車用智慧型追跡系統  
Intelligent Tracking System for Vehicle

## 電能模組 Battery Module

- 電動車充電系統  
EV Charging System
- 微電網綠能儲電系統  
Bidirectional DC/DC Converter
- 電池能量偵測管理技術  
Battery Management System
- 電動車電能系統模組  
EV Energy and Power Modules
- 高安全STOBA-Inside 40Ah鋰電池  
High Safety 40Ah Lithium Ion Battery – STOBA Inside

- 電動車行車監控與服務平台  
Monitoring & Service Platform of Electric Vehicle
- 台灣電動車產業聚落交流平台  
Taiwan Electric Vehicle Industry Clusters Website



- 薄型馬達動力輪  
Slim and Light Motor
- 電動車動力馬達控制器  
EV Motor Controller
- 高功率感應馬達驅動器  
High Power Induction Motor Driver, HPIMD

## 服務平台 Service Platform

- 輕量化轉向機柱  
Lightweight Steering Column
- 整合式電子駐車車系統  
Integrated Electric Parking Brake, IEPB
- 齒輪式電動輔助轉向系統  
Pinion Electric Power Steering, Pinion-EPS
- 輕量化後懸結構模組  
Lightweight Rear Suspension Structure Module
- 彈性化電動車專用底盤平台  
Flexible Electric Vehicle Chassis Platform

## 動力模組 Dynamic Module

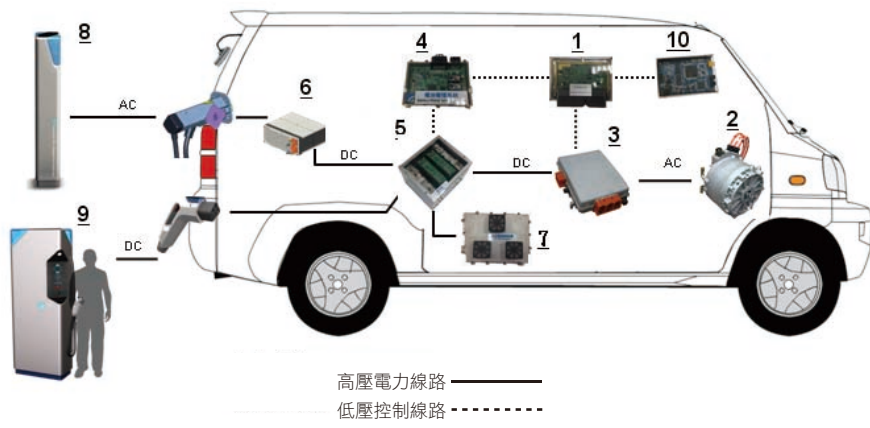
- 車用線傳控制平台  
Drive-by-Wire Platform for Vehicle
- 電動車空調座椅  
Air-condition seat system for light electric vehicle
- 混合動力源之電力管理與系統控制  
Electronic management and system control of Hybrid power
- 電動車自動手排變速箱動力模組  
A Powertrain of EV with Clutchless Automatic Manual Transmission ( CLAMT)
- 智慧型輕量化移動載具跨領域專案計畫簡介  
Cross-disciplinary Research Program on Key Technologies of Intelligent Light Mobility

## 電動車底盤 Chassis for EV

## 前瞻研究 Prospective Research

# 電動車輛平台

## Electric Vehicle Platform



### »» 系統模組 Subsystems

- |              |                               |
|--------------|-------------------------------|
| 1. 整車控制器     | Vehicle Control Unit          |
| 2. 永磁電動馬達    | Traction Motor                |
| 3. 馬達驅動器     | Motor Controller              |
| 4. 電池管理系統    | Battery Management System     |
| 5. STOBA儲能模組 | STOBA Battery Pack            |
| 6. 車載充電器     | On-Board Charger              |
| 7. 直流電壓轉換器   | DC-DC Converter               |
| 8. 交流充電柱     | AC Charger                    |
| 9. 直流充電柱     | DC Charger                    |
| 10. 全周監視系統   | Around View Monitoring System |

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# 電動車行車監控與服務平台

## Monitoring & Service Platform of Electric Vehicle

### >>> 特色 Features

本系統提供電動車輛完整的車隊管理功能，可提供多個車隊使用，各車隊並可依目的劃分為不同群組，除了可以在地圖上顯示車輛位置、即時車況外，並可依電動車輛特性，分別檢視各子系統(電能模組、電池、動力模組)運作之狀況，或觀察不同數據的趨勢圖。當故障發生時，可提供警示及維修建議，監控中心且可以簡訊即時通知駕駛人，事後可以提供異常報表及資料下載以進行更深入的工程分析。本系統以ASP.NET技術開發，故只要有網路連線及瀏覽器，即可不限時地使用本系統。

Our system provides a full set of fleet management for electric vehicles, it can be used for multi-fleets, and each fleet can be divided into groups by their own purpose. Besides locating vehicles on map, showing their real-time status, it can also explore the functions of subsystems including energy modules, cells, and powertrain in electric vehicles by showing the up to date data or even trend chart. When an error occurs, the system will come with warning and maintenance suggestion, the control center may send short messages to the driver through our system, abnormal reports can be provided and system datas are available to download for the advanced engineering analysis. The system is built as a web application using ASP.NET technology, so with network connection and a browser application, it can be accessed anywhere, anytime.

### >>> 規格 Specifications

執行環境：.NET Framework 4.0	Runtime environment：.NET Framework 4.0
傳輸格式：HTTP 協定	Format：HTTP protocol
內容：車隊即時車況、管理功能	Content：Fleet real-time monitoring with full management
載具：具備瀏覽器(IE、Google Chrome...)之可上網裝置	Device：Compatible for device with web browser (IE, Google Chrome...)



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# 台灣電動車產業聚落交流平台

## Taiwan Electric Vehicle Industry Clusters Website

### >>> 簡介 Introduction

經濟部技術處為帶動國內電動車產業的發展，特別責成台灣車輛研發聯盟(TARC)推動「電動車產業聚落交流平台」，並分為驅動馬達與控制模組、附件系統、儲能系統與電源管理系統、其他電動車關鍵技術與系統整合、利基電動車五大產業聚落，藉由此平台的成立，期望能夠結合產、官、學、研的資源，促進產業聚落的形成及技術交流，以引領業界提升整體研發能量，帶動產業快速轉型，拓展國際商機。

In order to lead technological R&D and advance domestic electric vehicle industrial development, the Department of Industrial Technology (DoIT) of the Ministry of Economic Affairs (MOEA) who particularly instructed Taiwan Automotive Research Consortium (TARC) to establish Website and promote the "Taiwan Electric Vehicle Industry Clusters". And it is classified into five major categories, including: motor and control module, auxiliaries, battery & energy storage system, system Integration & other Technologies and niche electric vehicle.

We have expected to combine the resources of industry, government, academia and research institutes through the establishment of "Taiwan's Electric Vehicle Industry Clusters Website" to Integrate Supply chain of electric vehicle and enhance opportunities of business cooperation.

### >>> 特色 Features

- 產業聚落
- 產品資訊

The main functions as follows :

- Industry Clusters : Information of Taiwan Electric Vehicle Five Industry Clusters compaies.
- Product : Information of Taiwan main electric vehicles and components.



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# 薄型馬達動力輪

## Slim and Light Motor

### >>> 特色 Features

- 厚度30mm，薄50%
- 採用軸向磁通設計，磁通面積大
- 高佔槽率設計，扭力密度高
- 側掛式設計，易裝卸
- 30mm thickness, 50% thinner than traditional hub Motor.
- Axial-flux design, large flux area.
- High slot fill ratio windings, high torque density.
- Side-mount design, easy setup.

### >>> 規格 Specifications

馬達扭力(Max. Torque)	18 Nm
馬達重量(Motor Weight)	2.5 kg
馬達體積(Motor Dimension)	Φ20 cm × 3.0 cm
操作電壓(Operate Voltage)	24V/36V
最大功率(Max. Power)	250W@ 24V / 360W@36V
馬達轉速(Motor Speed)	250 rpm@24V / 400 rpm@36V
操作分貝(Operate Decibel)	<65 dB
扭力密度(Torque Density)	8 Nm/kg
效率(Efficient)	>80%



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# 電動車動力馬達控制器

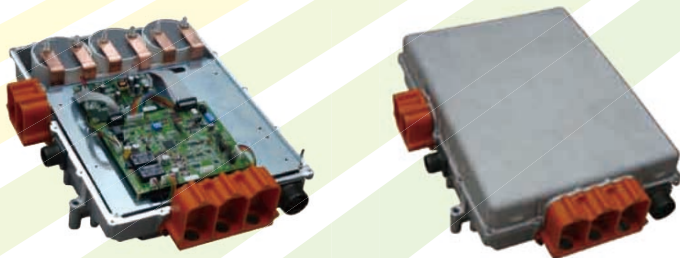
## EV Motor Controller

### >>> 特色 Features

- 50kW最大功率及92%最高效率馬達驅控應用，具弱磁控制最大定功率轉速域延伸(Max. 8000rpm)、正反轉驅動控制及剎車回充功能
- 雙模態磁滯切換驅動控制，具低速高扭力及高速高效率
- 電動馬達系統安全保護與動力診斷技術
- 50kW max. power/ 92% max. efficiency control with extended speed range to Max. 8,000rpm for maximum constant power, CW&CCW driving control, and brake regeneration.
- Dual mode control with large torque at low speed and high efficiency at high speed.
- Diagnostic technique for electrical propulsion system.

### >>> 規格 Specifications

直流鏈電壓/範圍(DC Link nominal voltage/range)	310V (220V to 380V)
最大相電流限制(Max. phase current limit)	350A
最大/連續輸出功率(Peak/continuous output power)	52kW/35kW
PWM頻率(PWM frequency)	12kHz
控制方式(Control method)	BLDC/BLAC
通訊/診斷介面(Communication/ Diagnosis interface)	CAN, RS232, I/O Signal
數位訊號處理單元(DSP unit)	TMS320F2808PZQ
保護功能(Protection functions)	Voltage/Current/Speed/Temperature/resolver/ R/D converter fault
控制電壓範圍(Control voltage range)	9V to 18V dc
冷卻方式/重量/尺寸(Cooling/Weight/Dimension)	Liquid cooling/ 12Kg/327mm×425mm×134mm



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# 高功率感應馬達驅動器

## High Power Induction Motor Driver, HPIMD

### >>> 特色 Features

高功率感應馬達驅動器由中科院(Chung-Shan Institute of Science & Technology, CSIST)自主研發，可應用於電動車輛之感應馬達動力系統，本設計採用馬達磁場導向控制演算法(Field Oriented Control, FOC)，可依據車輛行駛模式在不同轉速及負載下，達到最佳的輸出效能。

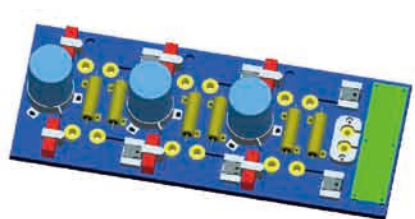
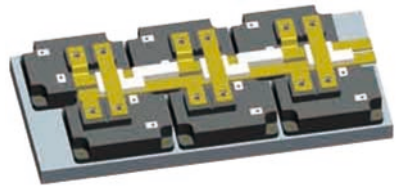
- 以IGBT元件配合高效能控制晶片構成的高功率感應馬達驅動電路。
- 內建突波吸收電路(Snubber)，有效降低電路突波。
- 採用差動式PWM驅動方式，有效對抗共模雜訊。
- 高功率電源端使用特殊設計架構，降低模組內的雜散電容與電感。
- 內建控制核心，可透過CAN、LIN或RS232/422等介面與車輛控制單元(VCU)通訊。
- 可透過RS232/422或USB介面即時傳輸控制狀態(電壓、電流、溫度等)。
- 可搭配氣冷或液冷散熱裝置。

HPIMD is developed by CSIST. It can be applied to the induction motor power system of EV. The controller is implemented with FOC algorithm. The optimal performance can be achieved according to the different driving mode with different speed and load.

- An IGBT-based induction motor drive integrated with high performance micro control unit.
- Built-in snubber to absorb surge in the circuit.
- Differential PWM driving signal to IGBT to eliminate common mode noise.
- Unique design for high power circuit arrangement to reduce stray inductance and capacitance.
- Interfaces like CAN, LIN, and RS232/422 available for vehicle control unit (VCU).
- Real-time monitoring through RS232/422 or USB to PC or notebook.
- Optional compulsive air or liquid cooling design.

### >>> 規格 Specifications

額定功率 (Rated Output Power)	35 kW
最大電流 (Peak input current)	283 A rms (400 A p-p) (118 kW @ 420 V)
電源需求 (Power requirement)	Battery : 100-420 V Control : 9-36 V, 40 W
工作溫度 (Operation temperature)	-10°C to 85°C
控制法則 (Speed Control Algorithm)	FOC
通訊介面 (VCU Interface)	Standard : RS232 Optional : CAN, LIN, RS422 (Design on demand)
診斷介面 (Monitoring Interface)	Standard : RS232 Optional : RS422, USB (Design on demand)
冷卻系統 (Cooling System)	Compulsive air or liquid cooling (Design on demand)



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# 微電網綠能儲電系統

## Bidirectional DC/DC Converter

### 特色 Features

發展微電網綠能儲電系統的應用，改變傳統漏感能量釋放設計形式的面貌，同時扮演零電壓切換、低導通損失及高效率電能轉換的優點。其主要特色為：

- 開關少、架構簡單。
- 具有柔性切換及同步整流功能。
- 高昇降壓比特性。
- 高電源轉換效率。

A bi-directional DC/DC converter structures application of the development as well as changed to design in traditional leak inductance release circuit. Advantage of the converter is presented to real testing conditions (less conductive loss, zero voltage switching and high energy convert efficiency), via microprocessor. These main characteristics as follows:

- Simple structure and less switching components.
- Possessed of the soft switching and synchronize rectification functions.
- High step-up and step-down ratios.( reach to 7.5 times)
- High energy converting efficiency (Up to 95%)

### 規格 Specifications

- 低壓側電壓 > 48V
- 高壓側電壓 > 360V
- 最大功率 > 2kW
- 雙向充放電功能
- 最大轉換效率 > 95%
- Low-Voltage side voltage is greater than 48V.
- High-Voltage side voltage is greater than 360V.
- Maximum power is greater than 2kW.
- Possessed of the Bi-direction charging and discharging functions.
- Maximum efficiency is greater than 95%.



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# 電池能量偵測管理技術

## Battery Management System

### >>> 特色 Features

電池能量偵測管理技術主要是運用電化學數值建模智慧型運算，可準確估測電池電量狀態，同時亦可估計電池最大可放電功率，可精簡電池設計，延長電池壽命，為本技術開發之總體目標。

The sophisticated battery state of charge (SOC) estimating technology is based on the dedicated mathematic models developed through fully understood cell electro-chemical behaviors. A battery management system with the SOC estimator integrated is capable of predicting the battery performance precisely, hence shrink the safety factor for battery capacity, improve battery life, and return with cost-down in system manufacturing and maintenance.

### >>> 規格 Specifications

電池模組監控電路：

- 4串電池芯等化功能(最大等化電流0.1A)及電池電壓量測功能(±20mV)
- 4組溫度量測(±2°C)
- 2階段電池保護機制：過高電壓/過低電壓，保護警示與錯誤訊息傳送功能。
- 電池模組資料傳輸速度：UART 19200 bps
- 工作電壓：8V~18V，工作時平均電流<10mA，待命電流<1mA

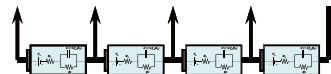
電池組控制電路：

- 電池組電流估測(±2%)及總電壓估測(±1%)
- 電池電量(SOC)估測誤差 < 5% (依客戶需求)
- 過溫度保護
- 過電流保護(外部短路)：250A.
- 傳輸介面：CAN 2.0B 250kbps (PCU)，UART 19200bps (BMU)
- 電池組參數、故障、使用歷程資訊記錄
- 開機自我診斷功能
- 最大可連接之BMUs：255

Battery Control Unit



Battery Monitor Unit



Battery Monitor Unit, BMU：

- Balance (maximum current 0.1A) and cell voltage measurement capability (±20mV) for four (4) batteries connected in series.
- Four (4) channels temperature measurement (±2°C).
- Duel stage (alarm and error) battery protection：Over-voltage, Under-voltage.
- Communication between BMUs and BCU: UART 19200 bps.
- Electricity：8V~18V, less than 10mA (avg, working), less than 1mA (stand by).

Battery Control Unit, BCU：

- Current (±2%) and pack voltage (±1%) measurement.
- State of charge (SOC) estimation with error less than 5% (customer optional).
- Over-temperature protection (cell dependent).
- Over-current (external short circuit) protection：250A.
- Communication：CAN 2.0B 250k bps (PCU); UART 19200 bps (BMU).
- Battery biography records.
- Self-diagnostic upon start-up.
- Maximum connectable BMUs：255

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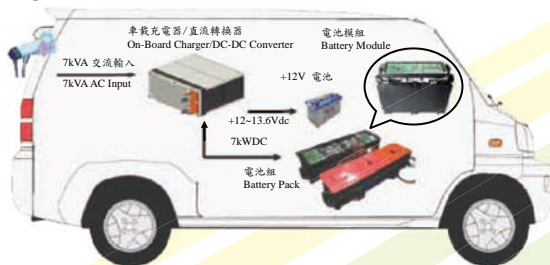
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# 電動車電能系統模組

## EV Energy and Power Modules

### >>> 特色 Features

- 提供電能轉換及儲存用之車載充電器、直流轉換器、電池模組
- 7 kW車載充電器及1.35 kW直流轉換器一體化，簡化電能轉換設計
- 交錯無橋式結合軟切換技術提升切換效率，降低熱耗，縮小充電器裝置體積
- 電池芯結合STOBA，提供電池模組內部短路及高溫燃燒安全性保護
- 電池模組結合電池監控單元具CAN網路連結，電池組模組化設計
- On-board charger, DC-DC converter, and battery module for EV energy storage and conversion.
- 7 kW on-board charger and 1.35 kW DC-DC converter integrated as one device to simplify energy conversion design.
- Interleaved bridgeless with soft-switching technique used to improve switch efficiency and heat consumption and designs On-board charger as compact device.
- STOBA inside cell to provide battery module security protection on internal short and high-temperature burn.
- Module combined with battery monitoring unit and CAN communication to make battery pack modular design.



### >>> 規格 Specifications

7kW車載充電器 (7kW On-board Charger)	交流輸入電源(AC Power in)	85-265VAC @45-65 Hz
	交流最大電流(Max. AC Current)	12Arms(110VAC)/32 Arms(220VAC)
	功率因數(Power factor)	≥ 99%@110VAC ; ≥ 98%@220VAC
	直流輸出電源(DC Power Output)	250-450 VDC@22A max. ; 302.4V(nominal)
	電能效率(Efficiency)	≥ 95%
	功率密度(Power density)	>530 W/kg
	參考介面標準(Interface standard)	SAE J1772
	環境保護(Environmental protection)	IP 66
1.35kW直流轉換器 (1.35kW DC-DC Converter)	安全(Safety)	UL 2202 ; UL2231-1 ; UL2231-2 ; IEC 61851-21, IEC 60068-2
	直流輸入電源(DC Power in)	250-450Vdc ; 300Vdc(nominal)
	輸出電源(DC Output Voltage)	13.5Vdc@100A(Continuous) / 200 A(Peak)
電池模組 (Battery Module)	模組容量(Module Capacity)	70Ah/12V STOBA-inside
	最大連續輸出電流 (Maximum Continuous Output Current)	280A DC
	電池管理(Battery Management)	Battery monitoring Unit Connected with Battery Control Unit through CAN.
	監控安全保護(Monitoring and Safety Protection)	high-voltage insulation 、over-voltage 、over-temperature

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# 電動車充電系統

## EV Charging System

### >>> 特色 Features

- 無人化管理：遠端充電監視、診斷與控制
- 智慧電力管理：無需卸載個別充電機的充電網電力負載總量
- 保安與安全防護：身份識別、連接器與插座保全裝置與充電操作狀態監控
- 小型：高效率直流充電機-諧振電路與高頻隔離
- Unmanned management-charging management system functioning remote monitor, diagnosis, and control.
- Intelligent electric power management-power demand control for charger network, without load-shedding.
- Security and safety protection-user identification, security mechanism for plugs and sockets, as well as charging status monitor.
- Compact-efficient DC charger-resonance circuit and high-frequency isolation for DC-DC stage.

### >>> 規格 Specifications

交流充電柱 (AC Charger)	充電柱輸出電壓(Charger Output Voltage)	Single phase 110VAC/220VAC
	最大輸出電流(Maximum Output Current)	12A(110VAC)/80 A(220VAC)
	參考介面標準(Interface standard)	Taiwan Standard; SAE J1772
	安全(Safety)	Taiwan Standard; UL 2594; UL2231-1
	環境保護(Degrees of protection)	IP 54
直流充電柱 (DC Charger)	功率因素(Power Factor)	> 0.98
	效率(Efficiency)	> 90%
	最大輸出功率(Maximum Charger Output Power)	30kW
	充電器輸出電壓(Charger Output Voltage)	50VDC to 500VDC
	最大輸出電流(Maximum Output Current)	120A DC
	參考介面標準(Interface standard)	CHAdemo/GB
	安全(Safety)	UL 2202; UL2231-1
環境保護(Degrees of protection)	IP 54	



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# 高安全STOBA-Inside 40Ah鋰電池

## High Safety 40Ah Lithium Ion Battery – STOBA Inside

### 特色 Features

大型電池設計可提昇電池系統可靠度及能量密度，但單顆電池芯容量大，相對危險性高，且散熱不易，量產製作較困難。本款電池採用多組薄型極板並聯，將內部熱量經由機構導出，外型為方型橢圓，端子設計於端面；並引入創新獨特的奈米結構分子級寡聚物材料(STOBA)，提供鋰電池內部奈米級所組配特殊的電化學及材料界面設計之安全保險絲防護機制，大幅提昇鋰電池運用的機制性能與安全性，能有效抑制鋰電池因內短路產生高熱及燃燒爆炸的意外發生。

Lithium-ion battery is considered the key component of electric vehicle. Comparing with small cell, large format cell design has better system assembly reliability and hence higher system energy density, however, it could be more dangerous by carrying much more energy in a single cell, the heat dissipation is also an issue. This 40Ah prismatic cell with oval shape on two sides and terminal on two end surface has unique heat dissipation design, adopts high energy density cathode material with STOBA inside, targeting to be very safe and reliable to be used in EV and PHEV.

STOBA (Self Terminated Oligomers with hyper-branched Architecture) is a nano-grade high-molecular material, which is added to a lithium battery to form a protection layer on the surface of the active material. When a lithium battery experiences overheating or puncturing, STOBA instantly suppresses thermal runaway and prevent battery explosion caused by internal short-circuiting. It is a high safety material provides a secondary safety protection function other than the traditional separator. That can be integrated into the electrochemical and interfacial design between the cell components. Consequently, the performance and safety character of the cell are significantly improved.

### 規格 Specifications

- Capacity : 40Ah
- Specific Energy : 120Wh/Kg
- Specific Power : 480W/Kg
- Nominal Voltage : 3.8 V
- Maximum Discharge Current : 200A
- Cycle life>1000@80% Cap.



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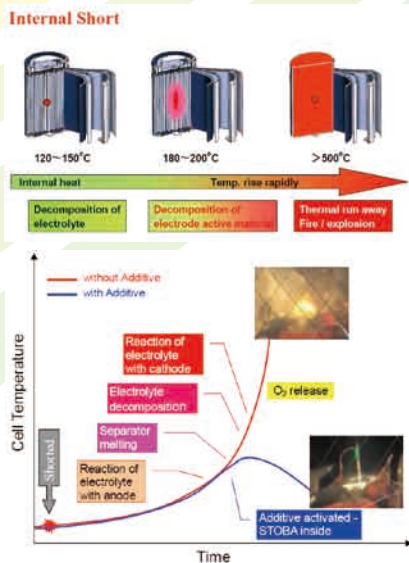
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# 車用電動空調系統

## Electric Automatic Air-Conditioning System

### >>> 特色 Features

車用電動空調系統以電動馬達取代內燃引擎帶動壓縮機，大幅減少內燃引擎廢氣排放造成的污染，並且藉由具備馬達變頻控制及恆溫功能之空調系統控制器，能依照乘坐人員設定溫度、電池殘電量及外部環境參數適時改變電動壓縮機轉速，使空調系統同時滿足乘坐人員舒適性要求以及節能之表現。其主要特色為：

- 車廂內熱負載估測
- 車廂定溫控制功能
- 依電池殘電量自動調整空調運轉效能

The electric automatic air-conditioning (EAAC) system is driven by an electric motor instead of an internal combustion engine, which can significantly reduce the engine exhaust pollution. The EAAC system is controlled by the developed controller, which includes the variable-frequency motor controller and thermostat function controller, according to the preset temperature, state of charge (SOC) and the environment parameters. Therefore, the EAAC system can simultaneously meet the passenger comfort requirement and the energy-saving performance. These main functions are as follows:

- Cabin heat load estimation
- Constant temperature controller
- Automatic AC performance adjustment according to the SOC

### >>> 規格 Specifications

壓縮機冷房功率 4.2kW/7000rpm	Compressor cooling ability 4.2kW/7000rpm
驅動馬達功率 2.3kW/7000rpm	Motor power 2.3kW/7000rpm
驅動電壓/電流 400V/30A	Driven voltage/current 400V/30A
具過電流、過溫失效保護	Over-current and Over-temperature protection
適用於小型房車	Suitable for small passenger car



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# 防撞雷達與影像整合系統

## Anti-Collision Radar and Vision Integrated System

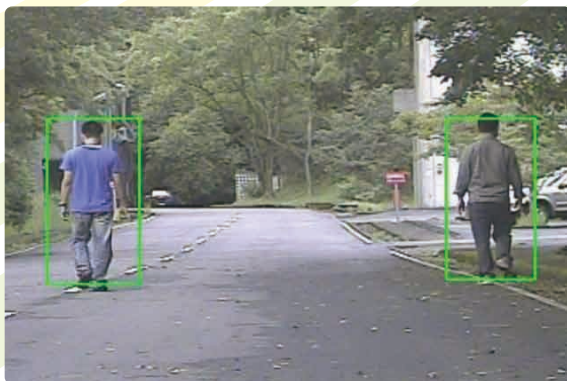
### >>> 特色 Features

防撞雷達與影像整合系統採用前方行人偵測技術分析前方影像並辨識行人，搭配防撞雷達擷取前方目標物(行人、前車)之相對距離、速度及角度，經由車用網路CAN Bus來整合影像系統與雷達系統資訊。當危險發生時，此系統能夠提供駕駛者警示訊號，進而降低事故發生之機率。

The pedestrian detection technique is applied to analyze the image from the front camera in order to recognize the pedestrian, and the dynamic information from radar, included the relative distance, the relative speed and the angle of the pedestrian, also be integrated by our system. All information is communicated through CAN bus. The warning signal can be provided by the system to alarm the driver while the dangerous situation is happened and such the risk of accidents can be reduced.

### >>> 規格 Specifications

最遠目標偵測距離：≥ 100m	Maximum target detection range：≥ 100m
涵蓋方位角度：20°	Field of view：20°
系統辨識率：90%以上	Identification rate：above 90%
資料更新率：即時系統	Data update rate：Real-Time System
工作溫度：-40°C~85°C	Operation temperature：-40°C~85°C
具CAN Bus 2.0B及RS232通訊介面	Communication：CAN Bus 2.0B & RS232



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# 應用多光路截取技術之多功能影像警示系統

## Multi-Function drive assistant system by multi-path image capture technique

### >>> 特色 Features

本系統採用多光路影像截取技術，最大特色在於有效減少攝影鏡頭使用數目，並可客製化搭配不同影像警示功能選項，例如前方碰撞警示、側向碰撞警示、車道偏移警示系統等。整合後具有全視野零死角的影像觀察空間，並同步降低成本，使產品具競爭力。

產品優勢：

1. 具有日夜間攝影功能，可在低光度環境下運作。
2. 無需光路切換架構，可降低產品開發成本，提升消費者採購意願。
3. 無機械式旋轉或移動元件，增加系統之可靠性並減少耗電能源需求。
4. 可依光學鏡組與影像擷取單元尺寸規格不同之需求，進行產品體積縮裝。
5. 低驅動電壓與耗電功率，電路設計簡易，無需複雜之操作與設計。
6. 影像強度可控制，各影像亮度具平衡功能，減少影像亮度顯示差距。
7. 客製化，依據實際安裝需求進行修改設計。

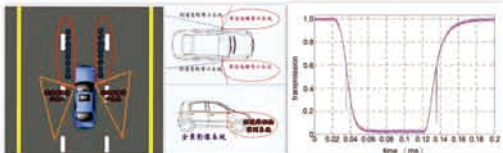
The multi-path image capture technique is applied to reduce the amount of CCD camera. The FCW(front collision warning) system, LCW(Lane collision warning) system and LDW(Lane Departure Warning) system can be integrated by customer demand.

With the applying of our technology, the CCD based warning system of Panoramic-View & Multi-Function and low cost can be achieved simultaneously. Of course, the competitiveness would be raised.

1. Camera can operation well even in low Lux. environment.
2. Lower the cost of products without the change of the light path.
3. No rotating or moving mechanic components. Higher reliability and lower energy consumption
4. The volume of system can be reduced by customer demand.
5. Low driving voltage and electric power. Simple circuit design and operation.
6. The recognition of the vision can be controlled by voltage and the brightness of vision can be balanced with the optical paths and the gap of the vision can be reduced.
7. It can be customized and used in any vehicles.

### >>> 規格 Specifications

- 尺寸：長22cm、寬6cm、高13cm。
- 重量：500公克
- 影像切換速度：小於50ms
- 影像擷取模組：CCD/CMOS感知器
- 視野角度：前方碰撞警示系統60度、側向碰撞警示90度、車道偏移警示68度、後方景物觀察150度。
- 視頻訊號：NTSC
- Size：(L) 22cm/(W) 6cm/(H) 13cm。
- Weight：500g
- Change tempo of Image：50ms
- Image Model：CCD/CMOS sensor
- Angle of Image：CW 60 degree LCW 90 degree - LDW 68 degree View of rear 150 degree
- Output of Video：NTSC



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# 電動車用節能LED車燈系統

## Energy-saving LED Headlamp System for Electric Vehicle

### >>> 特色 Features

當前國際汽車廠相繼推出各類型概念車中，最引人注目的便是白光LED車燈。LED頭燈在壽命、亮度、低耗電與多變造型方面，具備傳統白熾燈與鹵素燈等照明設備無法相比擬的競爭優勢。ARTC車輛光學設計中心可輔導車燈業者建立LED光學、散熱與電路設計能力，協助車燈業者LED燈具產品的開發，以及提供LED車燈系統設計之技術諮詢。

其主要技術為：

- 光學技術
- 電路技術
- 散熱技術

The international vehicle manufacturers nowadays are all designing new concept cars to fascinate their consumers. One of the most impressive products is the white light LED headlamp. LED headlamps have the advantages of faster response, longer life, lower power consumption, and design flexibility is better than traditional bulbs and HID lamps. Automotive Optic Design Center of ARTC can assist lamp manufacturer to establish the LED optical design, thermal design, and electronic design abilities and to develop LED lamp product. Besides, we also provide technical guidance in system design of LED headlamp.

These main technology as follows:

- Optical design.
- Electronic design.
- Thermal design.

### >>> 規格 Specifications

產品1：LED頭燈 (LED Headlamp)

- 近燈：21W
- 遠燈：20W
- 驅動器：切換式直流-直流轉換器；  
降壓、升壓、升降壓型
- Lowbeam：21W
- Highbeam：20W
- Drive：Switched-mode DC-DC converters;  
Buck, Boost, Buck-Boost types

產品2：LED霧燈 (LED Foglamp)

- 霧燈：7W
- 驅動器：切換式直流-直流轉換器；  
降壓、升壓、升降壓型
- Lowbeam：7W
- Drive：Switched-mode DC-DC converters;  
Buck, Boost, Buck-Boost types



LED 頭燈(LED Headlamp)



LED 霧燈 (LED Foglamp)

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# 車用智慧型追跡系統

## Intelligent Tracking System for Vehicle

### >>> 特色 Features

本系統提供駕駛者抬頭預警功能，當發現危險目標物時，立即予以偵測顯示。其主要特色有：

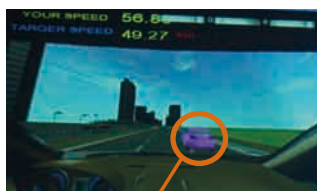
- 以撓性機構設計取代傳統剛體機構設計，具有一體成型，微型化，輕量化，製造簡單與低成本之目的。
- 可融合各式車用感知器資訊，並搭配軌跡估測方法，有效提高目標物定位與追跡精確度。
- 未來關鍵技術發展為撓性史都華平台。

An intelligent tracking system of vehicle provides the head-up warning function. When the dangerous targets are detected, the system displays the information on windshield of vehicle. The features are summarized as follows :

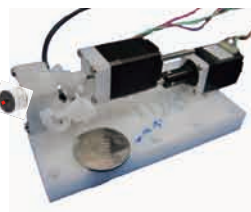
- The compliant mechanism is used to replace the traditional rigid-body mechanism. The advantages of compliant mechanism are monolithic, miniaturized, lightweight, simplify manufacturing and reduce the cost.
- The system can fuse the information from various sensors. The system combines with the trajectory estimation method can enhance the accuracy for target location and target tracking.
- The compliant Stewart platform is suggested as future research.

### >>> 規格 Specifications

旋轉模組致動器出力(Actuator force for pan module)	3N
傾斜模組致動器出力(Actuator force for tilt module)	10N
尺寸(Size)	Ø4×8cm
旋轉角範圍(Pan angle)	100°
傾斜角範圍(Tilt angle)	22°



Obstacle (Vehicle)



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# 全周影像無縫接合系統

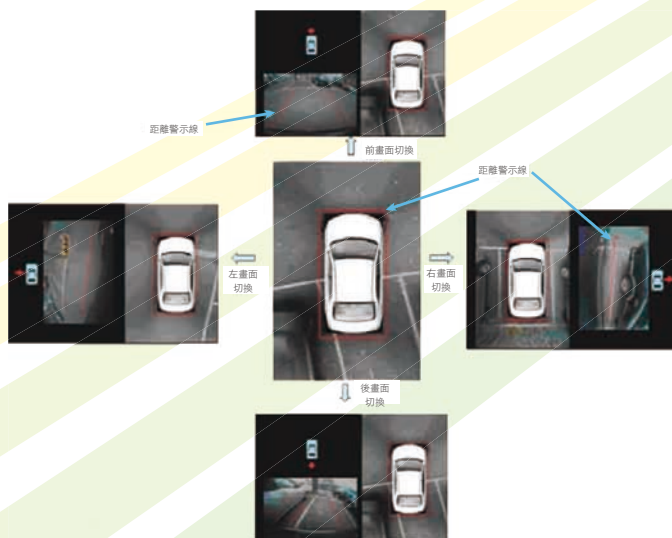
## Seamless Around View Monitoring System

### >>> 特色 Features

- 多張影像接合，達成無縫影像畫面，消除車周盲點區域
- 影像扭曲校正與色彩均勻化處理，產生真實鳥瞰影像
- 結合單一影像的切換機制，提供遠近雙重視野的距離顯示
- Stitching multiple images, to achieve seamless image display, eliminate the blind area of vehicle surrounding.
- Image distortion correction and color uniformity of treatment, resulting the real bird-view display.
- Switching mechanism with a single image, providing the distance information of dual vision.

### >>> 規格 Specifications

Input Voltage	6 ~ 30 VDC
Maximum current	350mA@12V dc
Standard	ISO 7637
Video output Format	NTSC
Video Input Format	NTSC /PAL
Dimension (mm)	120(L) × 75(W) × 15(D)
Operating Temperature	+40°C to +85°C



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# 立體視覺之市區碰撞預防系統

## Stereo Vision Collision Avoidance System, SVCAS

### >>> 特色 Features

SVCAS主要是利用立體視覺攝影機偵測前方車輛或行人等障礙物之距離，當車距小於安全範圍內，則發出警示訊號並主動煞車減速，避免與前方車輛發生碰撞，提昇行車的安全性。

主要用到的技術有：

- 立體視覺障礙物偵測技術
- 警示判斷邏輯設計
- 主動煞車判斷邏輯設計
- 嵌入式硬體電路設計

The SVCAS detects the distance of vehicle or pedestrian. It issues early warnings are to alert driver and brakes actively when the distance is less than safety range. It avoids the collision and raises driving safety. The following techniques are provided :

- Stereo Vision Obstacle Detection Algorithm
- Warning Decision and Over-warning Prevention Logic Design
- Active Braking Decision Logic Design
- Embedded Hardware Design

### >>> 規格 Specifications

影像輸出頻率：5 frame/s以上	Processing rate : above 5 frame/s
嵌入式煞車控制：Microchip dsPIC系統； 操作頻率：120MHz	Embedded braking control : Microchip dsPIC ; Operating frequency : 120MHz
介面：CAN BUS(車速、方向燈)，NTSC或PAL (攝影機)，GPIO(警示燈)	Interface : CAN BUS(speed, indicator), NTSC or PAL(camera), GPIO(LED)
適用車速：≤30 km/hr	Permitted speed : ≤30km/hr
操作溫度：-40°C~85°C	Operating temp : -40°C~85°C
操作電流：12V，500mA	Operating current : 12V, 500mA
最大煞車力驅動電流：≤0.6A	Driving current of maximum braking force : ≤0.6A
前方偵測距離：5公尺到50公尺	Detection distance from 5 to 50 m (based on camera)
警示方式：LED警示燈	Warning mode : LED Warning



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# 全自動停車系統

## Automatic Parking System, APS

### >>> 特色 Features

本系統結合超音波與影像之智慧感測技術，可導引駕駛者尋找停車空間、偵測鄰近的障礙物，並進行多轉向路徑規劃與電動輔助轉向控制，只要One Touch遙控模組，車子就能自動的控制方向盤轉向、排檔、煞車直至停妥目標停車空間。停車模式支援平行停車、倒車入庫與斜角停車，可有效縮短所需之停車空間長度，並幫助駕駛者更安全、有效率地完成停車動作。主要關鍵技術如下：

- 停車環境偵測(超音波停車空間掃描與倒車攝影機影像定位)
- 路徑規劃與追蹤技術
- 車輛方位推算技術
- 電動輔助轉向控制
- 主動式排檔、煞車控制
- 無線傳輸模組

APS can assist a driver to find a suitable parking space and detect obstacles by ultrasonic sensing and image recognition technologies, and a remote module allows you to control the steering wheel, gear shift, and braking automatically to make the host vehicle to the expected parking space by path tracking control of multi-turns mode with Electric Power Steering (EPS). The parking mode includes the parallel, back-in and angle parking. The length of required parking space is reduced and the parking maneuvers will be executed safer and easier. The main technologies are as follows:

- Parking environment recognition (utilizes ultrasonic sensor and camera)
- Path planning & tracking
- Vehicle localization
- Electrical steering control
- Active gear shift and braking control
- Remote control module

### >>> 規格 Specifications

嵌入式硬體電路：DSP 系統；操作頻率：600 Mhz	Embedded hardware：DSP based; Operating frequency：600 MHz
介面：CAN BUS(轉角感知器、超音波感知器)、CVBS(攝影機和 LCD panel)、TTL(輪速感知器)與PWM (EPS馬達控制)	Interface：CAN BUS(steering angle sensor, ultrasonic sensor), CVBS (camera and LCD panel), TTL (wheel sensor), PWM (EPS motor control)
操作溫度：-40°C~85°C	Operating temp：-40°C ~85°C
操作電流：12V，65A以下	Operating current：12V, Maximum 65A
平行停車最小停車空間：車長1.28倍	Required minimum parking space for parallel parking is 1.28 times length of vehicle

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# 彈性化電動車專用底盤平台

## Flexible Electric Vehicle Chassis Platform

### >>> 特色 Features

本平台設計概念為「彈性化電動車專用底盤」，可彈性化搭配不同規格之電池模組與動力系統，應用於不同級距之電動車底盤，如City Car EV, Sedan EV, SUV EV等車型，透過彈性化之設計概念，可大幅減少車廠對電動車底盤之開發成本。其主要特色為：

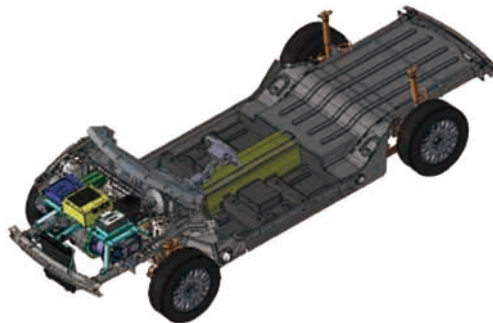
- 彈性化軸距設計。
- 彈性化電池模組匹配設計。
- 彈性化動力系統匹配設計。
- 可拆卸式電池盒結構設計。
- 底盤電池盒結構一體化/輕量化設計。

This platform proposed a concept of “Flexible EV Chassis Design.” The main design concept is to develop a flexible chassis platform suitable for different EV products such as City Car EV, Sedan EV, SUV EV, etc. This concept could help OEM dramatically reduce the EV development cost. The main features are as follows :

- Flexible wheelbase design.
- Flexible battery module packaging design.
- Flexible powertrain/motor packaging design.
- Detachable battery box structure design.
- Integrated, lightweight design of the chassis and battery box structure.

### >>> 規格 Specifications

彈性化軸距設計：2500~2800 mm	Wheelbase : 2500~2800 mm
彈性化電池匹配設計：18~36 kWh	Battery Capacity : 18~36 kWh
彈性化動力系統匹配設計：50~150 kW peak	Motor Capacity : 50~150 kW peak
高強度鋼/鋁合金材料應用，減重10%以上	Application of High Strength Steel/Aluminum, lightweight $\geq$ 10%



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## 輕量化轉向機柱

### Lightweight Steering Column

#### >>> 特色 Features

因應汽車輕量化趨勢需求，輕量化轉向機柱開發，可協助業者導入輕量化製程與輕金屬材料包括：產品設計、結構分析、雛形件試作及性能測試驗證，建立自主研發能量並提高產品競爭力。其主要特色為：

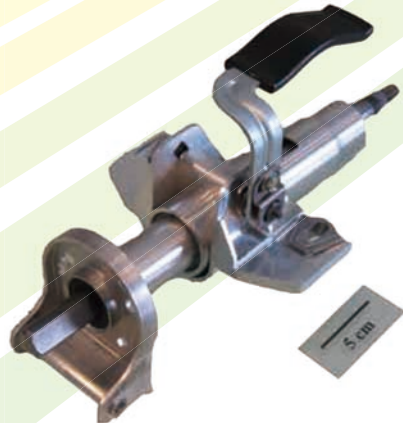
- 輕量化轉向機柱重量1.87kg較原始轉向機柱減重28.6%。
- 減少零件數量，達4件。
- 潰縮設計，潰縮距離達50mm。

The main purpose of developing the lightweight steering column is to response the lightweight trend of automobile and to assist Taiwan car components makers to have the easy access to involve in the lightweight manufacturing process and its material as well. This lightweight steering column development includes product design, structure analysis, proptype fabrication and product testing. By using this, we can concentrate research energy and enhance product competitiveness. Features of this lightweight steering column are as follows :

- Lightweight steering column is 1.87 kg in weight and has a 28.6 % mass reduction compare to that of the original steel one.
- Reduce 4 parts
- Offer more space for car crashing condition, the distance of the space is 50 mm

#### >>> 規格 Specifications

- 材料：AA6061-T6
- 重量：1.87kg
- 尺寸：390×170×170mm
- 垂直剛性 > 392 N/mm
- 側向剛性 > 196 N/mm
- Material：AA6061-T6
- Weight：1.87kg
- Size：390×170×170mm
- Vertical stiffness > 392N/mm
- Lateral stiffness > 196N/mm



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# 輕量化後懸結構模組

## Lightweight Rear Suspension Structure Module

### >>> 特色 Features

輕量化後懸結構模組設計，材料採用先進高強度鋼(抗拉強度440MPa以上)。導入管件液壓成形製程技術，利用一體型鋼管取代傳統沖壓件之拖曳臂設計。整組重量由31kg降為26.8kg，減重13.5%以上；零組件數由22件減為20件。

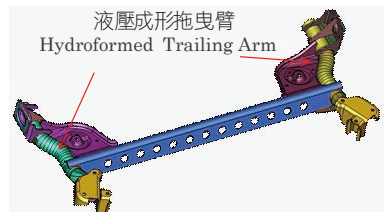
配合CAE結構分析技術，強度/剛性/及疲勞性能皆滿足原本設計性能要求。並實際通過耐久測試，行程±40mm下進行300,000負載週次無損壞。

Lightweight structure analysis of the rear suspension with the application of high strength steel of T.S $\geq$ 440MPa. The hydroforming technology is also applied to make an one-shape steel tube substituting traditional stamping design of the trailing arm. The total weight decreases from 31kg to 26.8kg, the efficiency reaches 13.5% and also the total component is decreased from 22 parts to 20 parts.

Using CAE structure analysis technology to check all performances could meet the requirement. The fatigue test is also conducted with  $\pm$ 40mm loading travel for 300,000 cycles.

### >>> 規格 Specifications

- 一體型液壓成形拖曳臂設計。
- 高強度鋼材料應用，抗拉強度440MPa以上。
- 重量由31kg降為26.8kg，減重13.5%以上
- 在行程±40mm 之條件下，通過疲勞耐久測試達300,000負載週次。
- One-shape design of hydroformed trailing arm
- Application of high strength steel material with tensile strength of 440MPa
- Weight of structure decreases from 31 kg to 26.8 kg, the efficiency reaches 13.5%
- Pass the fatigue testing reaches 300,000 cycles with  $\pm$ 40mm loading travel



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## 整合式電子駐煞車系統

### Integrated Electric Parking Brake, IEPB

#### >>> 特色 Features

傳統的駐煞車系統是由駕駛以手拉駐車拉柄或腳踏駐車踏板，藉由鋼索傳遞機械力達成駐煞車功能，整合式電子駐煞車系統則透過控制單元使馬達驅動減速機、自鎖機構與煞車卡鉗，使駕駛可透過按鈕即可完成駐煞車，且由於本系統作動時間甚短，因此具備實現Auto Hold功能。其主要特色為：

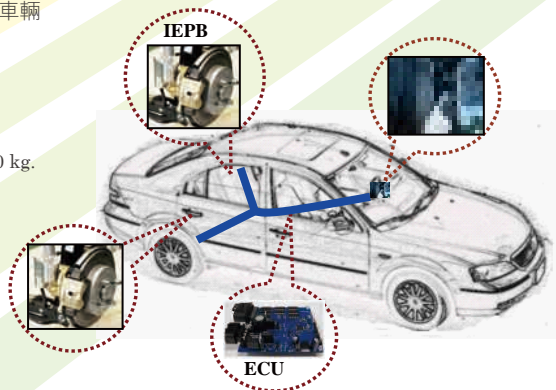
- 停車熄火自動駐煞車。
- 車輛起步自動釋放駐車。
- 停車自動維持。
- 防止斜坡起步下滑。
- 確保提供足夠駐車力。
- 無駐煞車踏板或手拉柄。

Instead of pushing a pedal or yanking on a handle to set the parking brake, the IEPB system is driven to work the parking brake by a finger-operated switch on the dashboard panel. The system consists of the control unit and an electric motor which actuate the combined gear reducer / self locking component and caliper brake, and also can execute the "Auto Hold" function due to the enough short activated time. These main functions as follows:

- Automatically activated when the ignition key is removed.
- Automatically released when the vehicle is started up.
- Hold Automatically when the vehicle is stopped.
- Easy starting and not roll backwards on hills.
- Just the right amount of application force is generated every time.
- No foot pedal or hand lever.

#### >>> 規格 Specifications

- 致動器出力 > 1200kgf
- 可用於車重2000kg以下級距車輛
- 電流量限制：15A
- 致動時間 < 0.5 sec
- 釋放時間 < 0.3 sec
- Actuator force >1200 kgf.
- For vehicle weight under 2000 kg.
- Current limit : 15A.
- Apply time < 0.5 sec.
- Release time < 0.3 sec.



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# 齒輪式電動輔助轉向系統

## Pinion Electric Power Steering, Pinion-EPS

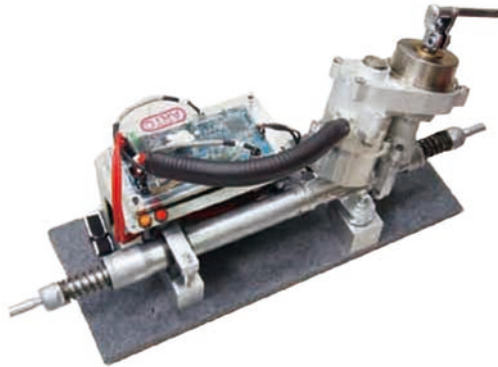
### >>> 特色 Features

電動輔助轉向系統直接使用電動馬達提供駕駛轉向所需力量的輔助，藉由感測器傳遞轉向與車況訊息至電子控制單元，達到智慧化之轉向力控制。ARTC Pinion-EPS將馬達、減速機和扭力感測器與車輛之齒條齒輪轉向機構以模組方式整合，有利彈性應用於不同車型；減速機採用行星齒輪機構，有效提高傳動效率。

Electric power steering is a power steering system directly assisted by an electric motor. Sensors detect the torque on the steering wheel and the vehicle speed, and an electronic control unit receives the signals to provide variable steering assistance. ARTC's Pinion-EPS integrates the motor, the reduction gear, and the torque sensor with the rack-and-pinion steering gear as a module. It can be easily applied to different vehicles. Moreover, the reduction gear is comprised of planetary gearing to provide higher efficiency.

### >>> 規格 Specifications

- 齒條出力可達5 kN
- 馬達：12V、永磁同步馬達、向量空間調變控制
- 減速機：行星齒輪型式
- 控制邏輯：基本輔助、阻尼、回正、慣性和衝擊補償控制
- Rack force up to 5 kN
- Motor : 12V, Permanent magnetic synchronous motor, Space vector modulated control
- Reduction Gear : Planetary gearing
- Control Logic: Basic assistance, damp, return, inertia and impact compensation control



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## 智慧型輕量化移動載具跨領域專案計畫簡介

### Cross-disciplinary Research Program on Key Technologies of Intelligent Light Mobility

本計畫「智慧型輕量化移動載具」係由國科會補助，以誘發式產學合作為定位，並以環保、節能、安全、舒適、在地化為宗旨，進行跨領域之前瞻技術研發。計畫執行前必須由工程團隊與設計團隊結合，針對未來之應用情境共同發想、規劃，並需考慮法人或業界承接的可能性。計畫可由學術界單獨或與法人共同進行執行，成果技轉法人或業界，以進行後續之商品開發。本計畫於執行期間成功地融合產業界計畫管理之精神與方法，並配合學術研究的本質，整合計畫內14個團隊並分成三大領域執行：1. 智慧機器人看護載具（IRW）；2. 輕型電動載具（LEV）；3. 個人載具（IPLEV）。透過共同研發，期望於結案時產出具有價值的專利、裝置及系統，並技轉法人或業界。

The research program of Intelligent Light Mobility sponsored by National Science Council has the features of cross-discipline, advance, and mission-orient targeting environmental protection, energy conservation, safety, comfort, and localization. This program requires the interested professors with expertise in engineering and design to form teams aiming at the scenario of future applications of intelligent light mobility. In addition, the teams are also requested to transfer the results to industries or research organizations. The initial evolution of the related devices and systems can be conducted by universities alone or by joint force from academia and industries. It is followed by technology transfer of the corresponding research achievements to the research organizations or the industries for the follow-up developments. Moreover, the participated 14 teams are successfully integrated into three main areas based on the types of key technologies and applications: 1. Intelligent Robotic Wheel-chairs (IRW), 2. Light-weight Electric Vehicles (LEV), and 3. Intelligent Personal Light-weight Electric Vehicles (IPLEV). The scenario-driven essential IPs, devices and systems attained from this program are expected to both compete in international invention exhibitions and transfer to the research organizations and industries.

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# 車用線傳控制平台

## Drive-by-Wire Platform for Vehicle

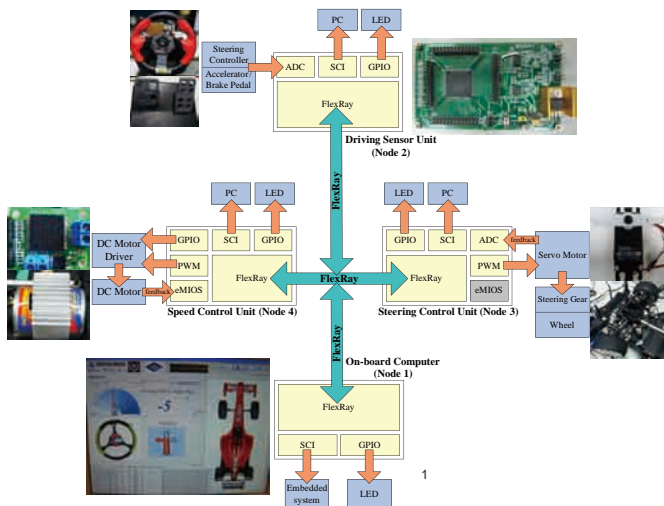
### >>> 特色 Features

隨著通訊網路技術和電子科技的快速發展，車輛之傳統機械構造已逐步被成熟的電子技術所取代。其中，以X-by-wire為概念之車用線傳電子式剎車(Brake-by-wire)取代傳統的機械式油壓剎車可大幅降低移動載具之體積與重量以達到輕量化的目的。然而，為了提高電子系統的可靠度以及資料傳輸速度，本計畫採用FlexRay之線傳技術以提高系統的容錯能力，使得車用線傳電子式剎車能符合國際的安全規範。

Due to the fast growth of electronic devices, the advanced technologies in communication and computer engineering have been considered to be applied to the control of vehicle systems. Among the critical components of vehicle system, an X-by-wire electronic braking scheme (brake-by-wire) can substitute for the traditional hydraulic mechanical braking device to achieve a goal of weight reduction in vehicle device. However, such designs in commercial usage are highly dependent on the requirements of system reliability. In this project, a FlexRay communication protocol based monitoring platform has been developed for brake-by-wire in vehicle control to meet the safety criteria.

### >>> 規格 Specifications

FlexRay最大傳輸速率10M bps	FlexRay - Baud rate up to 10M bps
星型拓撲冗餘通訊架構	Active Star Topology and Redundant Channels Structure
互動式人機圖控	Interactive Human-Machine Interface
車用12V電源供應	DC 12V Power Supply



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# 電動車空調座椅

## Air-condition seat system for light electric vehicle

### >>> 特色 Features

現行車輛採用全車廂空調系統，除人體發熱外，還面對進入車廂之龐大熱量，如：換氣熱量、傳導熱及輻射熱等，因而造成空調負載大增。為避免全車廂空調浪費大部分能量在空間之散熱上，針對小型電動車或工程機械，特研發出本項創新之空調座椅。其主要特色為：

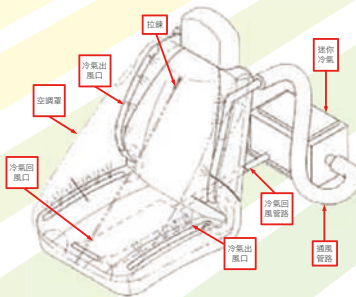
1. 空調管路設於座椅，外罩覆蓋於管路外側，形成小型空調空間，以較低能源達到極佳空調效果。
2. 本空調座椅可裝置於車體，減少消耗車體之動力輸出，使乘客有最好的舒適度。
3. 本空調座椅之構造簡單，易於裝設，適用於代步車、輕量化電動車或工程機械等載具，極具產業應用價值。

The current electric vehicles adopt whole-cabin air-conditioning system, so the air conditioner load is significantly increased due to large quantity of heat getting inside the cabin (such as ventilation heat, conduction heat and radiation heat) as well as heat released from human body. To avoid the shortcoming that whole-cabin air conditioner must waste most energy for spatial heat dissipation, this study particularly devises an innovative air-condition seat for small-size electric vehicles. The main functions as follows:

1. The invention of air-condition seat has a small air space by the jacket cover on the outside of pipe. The excellent air-conditioning can be achieved by use of lower energy consumption rate.
2. The air conditioning seat is suitable for installation in the vehicle, then the vehicle will reduce the consumption of power output, while allowing the passenger has the best comfort.
3. The structure of air conditioning seat is simple and easy to install, which can be applied to scooter, lightweight electric vehicles and construction machinery.

### >>> 規格 Specifications

耗電量: 140W	Power consumption : 140W.
最大冷凍能力: 250 kcal/hr或290W	Maximum cooling capacity : 250 kcal/hr or 290W.
冷氣系統尺寸: 24×13×25 cm	Size of the air-conditioner : 24×13×25 cm.
冷氣系統總重量: 9kg	Total weight of the air-conditioner : 9kg.



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# 混合動力源之電力管理與系統控制

## Electronic management and system control of Hybrid power

### >>> 特色 Features

- 快速充電控制法則可經由直流/直流升壓轉換器達成高效率充電，最高轉換效率達97.7%及平均轉換效率達95%以上。
- High-speed electrical charging could be accomplished with D.C-D.C. Boost Converter. The maximum conversion efficiency could reach the peak of 97.7% and an average of 95%.

### >>> 規格 Specifications

- 產品1：實驗用鋰鐵電池單電池規格

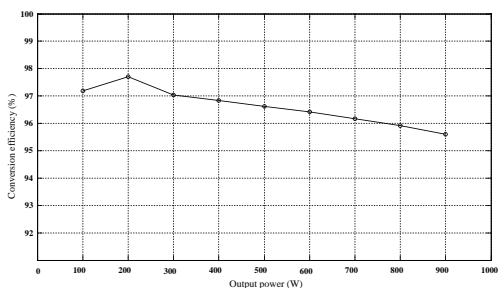
製造廠商：動能科技	Manufacturer：EXA Energy Technology Co.
型號：AL20078153A-001	Model：AL20078153A-001
容量：10Ah	Capacity：10Ah
放電電壓：3.3V	Discharging voltage：3.3V
截止電壓：2.0V	Cut off voltage：2.0V
最大充電電流：5C	Max recharging current：5C

- 產品2：實驗用鋰鐵電池模組規格

總容量：10Ah（採16串型式）	Capacity：10Ah
總瓦時：10Ah × 51.2V =512Wh	Watt-hour：10Ah × 51.2V =512Wh
放電電壓：51.2V	Discharging voltage：51.2V
充電電壓：58V	Recharging voltage：58V



充電控制電路實體照片



轉換效率

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 Yuan Ze University / Fuel Cell Center



實驗用鋰鐵電池單電池

## 電動車自動手排變速箱動力模組

### A Powertrain of EV with Clutchless Automatic Manual Transmission (CLAMT)

#### 特色 Features

AMT (Auto Manual Transmission) 稱為自動手排變速箱，它是一種不用踩放離合器，而具備高傳動效率的自動排檔變速箱。汽車必須具備低速高扭力輸出以及高速的特性，電動車的主要動力為馬達，雖然馬達已經具備變速功能，但此一特性只能滿足如小機車的小動力車輛的需求，若運用於一般高動力需求的電動車，一般的馬達加上單級變速箱無法勝任，必須重新開發高性能的電動車專用馬達，在技術上必須有所突破，且成本高；本設計將一般工業用的馬達搭配無離合器式AMT，可以滿足電動汽車低速高扭力輸出以及高速的需求，具備低成本、體積小、重量輕之特色。其主要特色為：

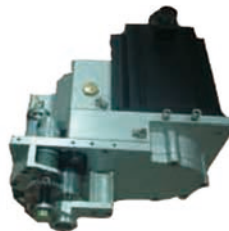
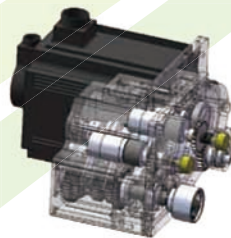
- 一般工業用的馬達搭配無離合器式AMT機構之設計，效率高、重量輕、且成本低。
- AMT自動換檔的最佳檔位設計，可以保持馬達在高效率點操作。
- 兩套CLAMT模組可以構成四輪傳動動力系統，利用依序換檔策略與動態驅動力分配之設計，可進行滑動率控制，並提升換檔舒適性。

This is a power module for EVs. The module is basically a combination of a 5kw DC brushless motor with a special design of clutchless automatic manual transmission (CLAMT). The AMT can either automatically shift gears using appropriate actuators mounted on manual transmission (MT) according to driver's power command and driving conditions, or in accordance with driver's gear command through shift lever. Conventional AMT for vehicles powered by internal combustion engine (ICE) requires an electronic controlled clutch to separate/engage engine power for gear change smoothly, because of high inertia of the ICE. This complicates the system and thus with high cost. The development of clutchless automatic manual transmission is efficient, light and with cost-down. The features of this module are as follows:

- The development of clutchless automatic manual transmission is efficient, light and with cost-down.
- The optimal gear shifting strategy can keep the motor operating within an efficient area.
- The sequential-shift strategy and power-split strategy applied to the 4WD that combined two CLAMT modules. The performance can increase comfortableness and stability on EV.

#### 規格 Specifications

模組重量：37kg	Weight：37 kg
模組輸出最大扭矩：143Nm	Max. torque：143Nm
模組輸出最高轉速：2000rpm	Max. speed：2000rpm
馬達額定功率：5kw	Motor rated power：5kw
馬達額定電壓：288V	Motor rated voltage：288V
變速箱規格：5段變速	Transmission：5 speed
AMT驅動器：24V直流馬達	AMT actuator：24V DC motor



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# 2011台灣國際電動車展-TARC主題館

Taiwan International Electric Vehicle Show-Taiwan Automotive Research Consortium Pavilion



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Department of Industrial Technology, Ministry of Economic Affairs, DOIT/MOEA

承辦單位：  台灣車輛研發聯盟  
Taiwan Automotive Research Consortium, TARC

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Chung-Shan Institute of Science & Technology, CSIST

 工業技術研究院  
Industrial Technology Research Institute, ITRI

 金屬工業研究發展中心  
Metal Industries Research & Development Centre, MIRDC

 車輛研究測試中心  
Automotive Research & Testing Center, ARTC

 華創車電技術中心股份有限公司  
Hua-Chuang Automobile Information Technical Center Co., Ltd., HAITEC

協辦單位： 智慧型輕量化移動載具前瞻技術跨領域專案計畫  
Cross-disciplinary Research Program on Key Technologies of Intelligent Light Mobility