Vehicle Trend Maker

FUTRONIC

Ver 2021.02.26 (R6)

www.futronic.co.kr

Index

1. Company General Overview

Company Information

Company Name

FUTRONIC CO., LTD

CEO & President

Jinho Ko

Employees

300 persons

Plant Area

10,461㎡ / Land (27,934㎡ / Building)
Facility Occupancy Rate : 65%

Main Product

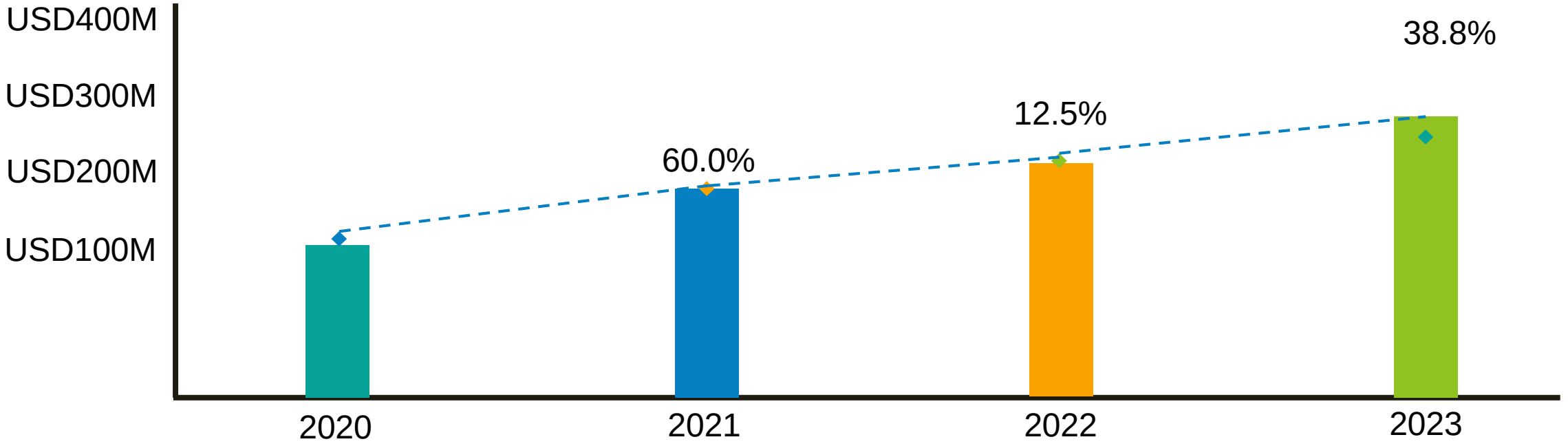
100% ICE & EV Automotive Parts & Solution
(T/C & PTU Actuator, Solenoid Actuator, PLA, EPB Motor, EPS Motor, E Water & Oil Pump, E Compressor, Traction Motor, EV Charger, EV Charging Infra Solution)

HQ & Plant Location

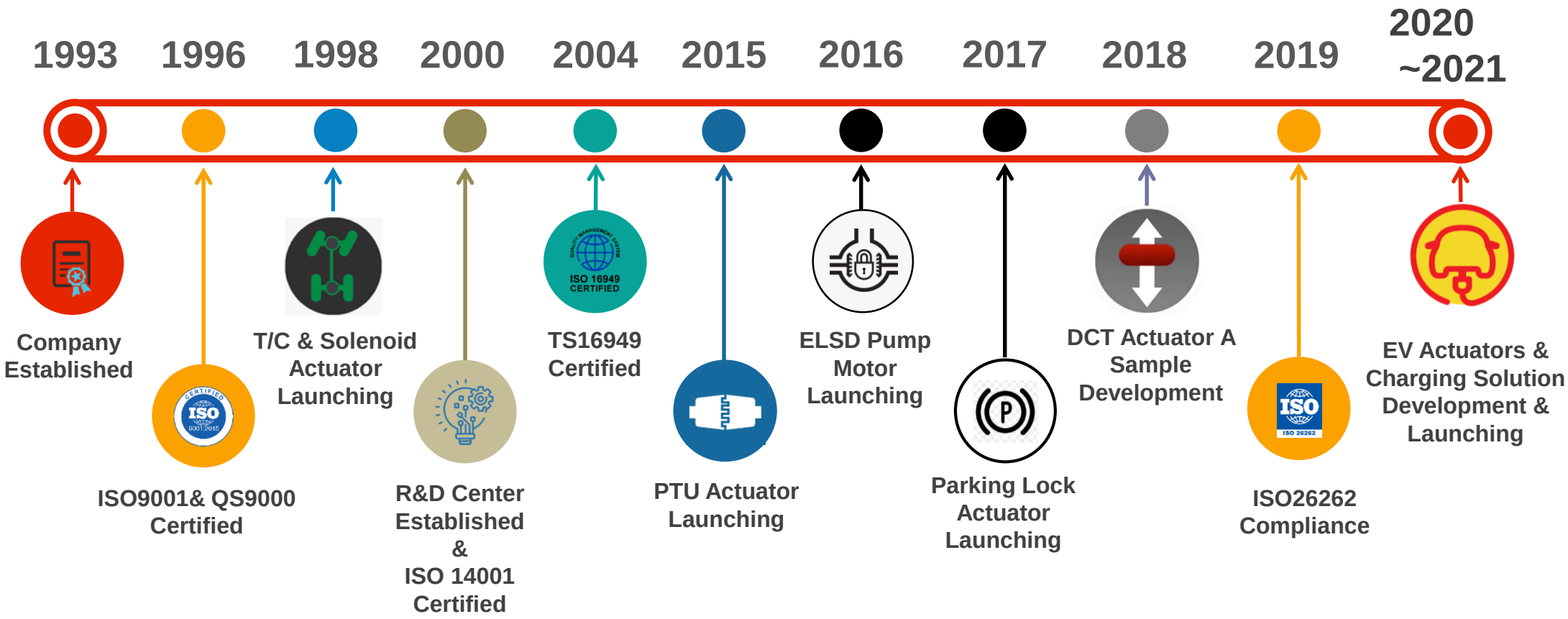
66-21 Bansong-Ro, 513 Beon-Gil, Haeundae-Gu, Busan, 48002 South Korea

Annual Sales Turnover

2020	2021	2022	2023
$100M	$160M	$180M	$250M



Company History



2. Current Business Overview

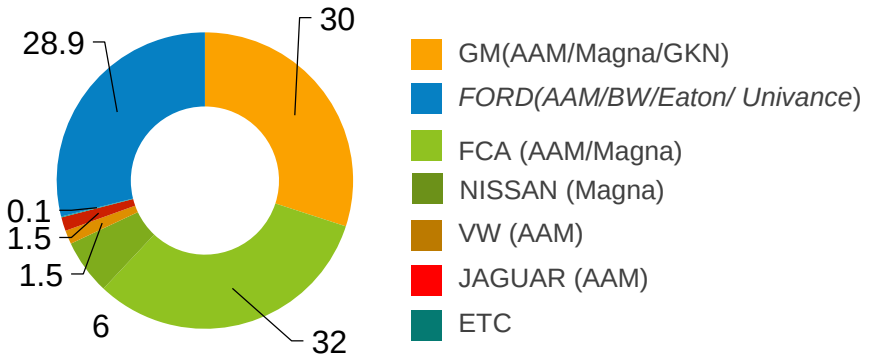
Who We Are Working?

We Create
New Vehicle Trend with own mechatronics technology

Global vehicle OEM & Tier 1 prefer to select Futronic as their mechatronic component suppliers based on our high quality performance, cost competiveness, on time delivery and shortest development lead time with robust design and plenty of experience in Mechatronic parts such as Actuators and Controllers section.

Where we deliver the product?

Who we are working with Tier 1 & OEM?



Actuator
(ICE Powertrain and Driveline)

FUTRONIC Hard & Software Technology

Transfer Case Actuator

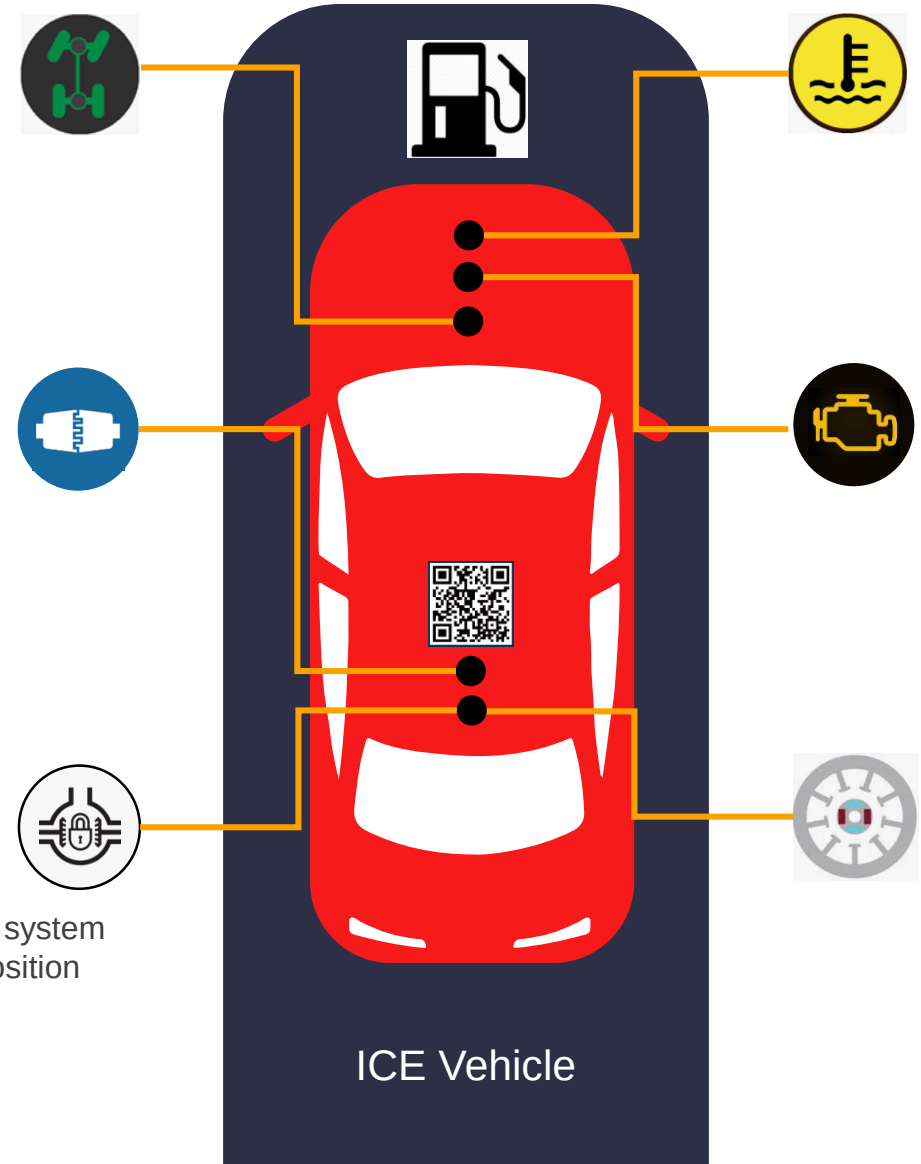
- Transfer case actuator for 4 wheel drive shifting
- Brake and Non brake option inside actuator

PTU Actuator

- PTU actuator for 4 wheel drive engage and disengage drive system
- Single and Dual position sensor to engage and disengage the system

Locking Differential Actuator

- E locking differential actuator for vehicle traction system
- Optional position sensor for detection engage position



Cooling Fan Actuator

- Electronic viscous cooling fan actuator for heavy commercial trucks with oil valve position sensor

Sensors

- Speed, EGR and Position Sensor

ELSD Pump Motor / Oil Pump Motor

- ELSD pump motor for locking slip differential system
- Oil pump motor for transmission and shifting system

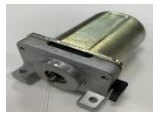
Actuator and Controller (EV Powertrain and Driveline)

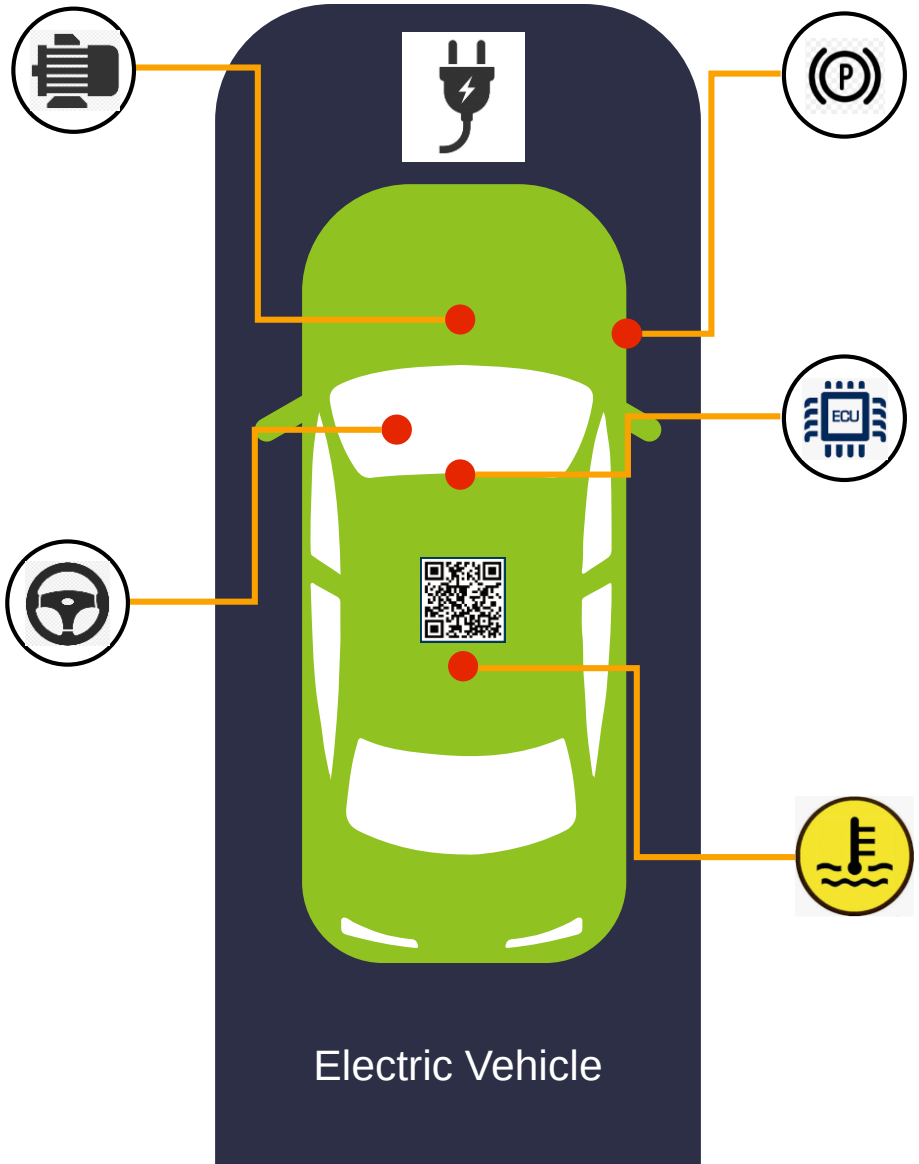
Traction Motor & Inverter (EV Powertrain)

- IPM traction motor design for EV
- Max power 210kw, 5,500rpm (& Various)
- Magnet optimization for weight reduction
- High power density design
- Inverter Design to fit with traction motor


EPS Motor (EV & AV Steering System)

- IPM motor design and high power efficiency
- Magnet optimization for weight reduction
- Faster response time to communicate with the own developed ECU
- Rack/Pinion/Column EPS
- Improved driving and steering



PLA / EPB Motor (EV Braking System)

- Operation sound improvement and
- Reduction sound radiation level and vibration level
- IPM motor design for low weight and high power efficiency




Controller / Software Programming

- Controller for BLDC and Main ECU
- Software programming to comply with ISO26262 safety requirement and fit with the actuator and the system


E Compressor Motor (EV Heat Pump System)

- Motor integrated with pump
- IPM motor design and high power efficiency
- ECU integrated with motor
- Self flow detection and control the speed


Motor and Controller
(Automotive and Robot and Industrial)

FUTRONIC Hard & Software Technology

BLDC Motor & Controller

- 10w ~ 100kw Line-up
- There is no brush, so there is less electrical and mechanical noise.
- It is semi-permanent, does not require maintenance
- Does not interfere with high-speed rotation as there is no wear on the brush.

Stepping Motor & Controller

- 10w ~ 1kw Line-up
- Directly open-loop control with digital signals
- System-wide Simple
- Generate rotational speed proportional to the frequency of the pulse signal
- It is easy to start, stop, reverse, and shift, and has excellent response characteristics.

DC Motor & Controller

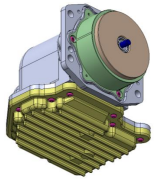
- 10w ~ 1kw Line-up
- Speed control, reverse rotation is easy
- Instantaneous stop is possible
- Start torque is large.
- Output is larger and more efficient than AC motor of the same output.

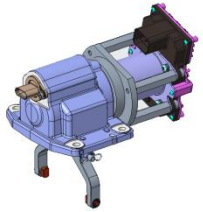
Servo Motor & Controller

- 10w ~ 100kw Line-up
- Provides accurate location control
- There is no brush and so maintenance is not necessary
- Noise is low, Structure is robust
- Environmental resistance is excellent.

Smart Actuator

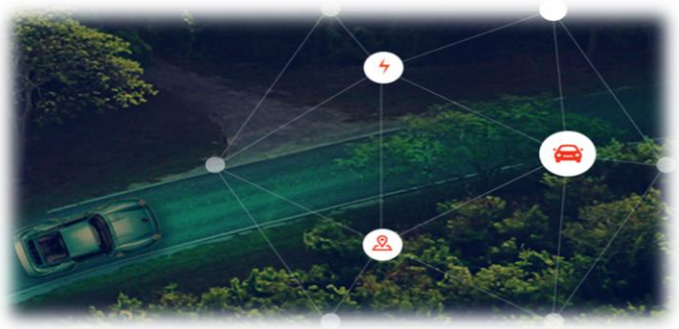
- 10w ~ 10kw Line-up
- There are rotational and linear movements
- Motor, decelerator, controller, sensor all together.
- It's a small lightweight.
- It's accurate speed and position control.





EV Charger
& Charging Infra Solutions

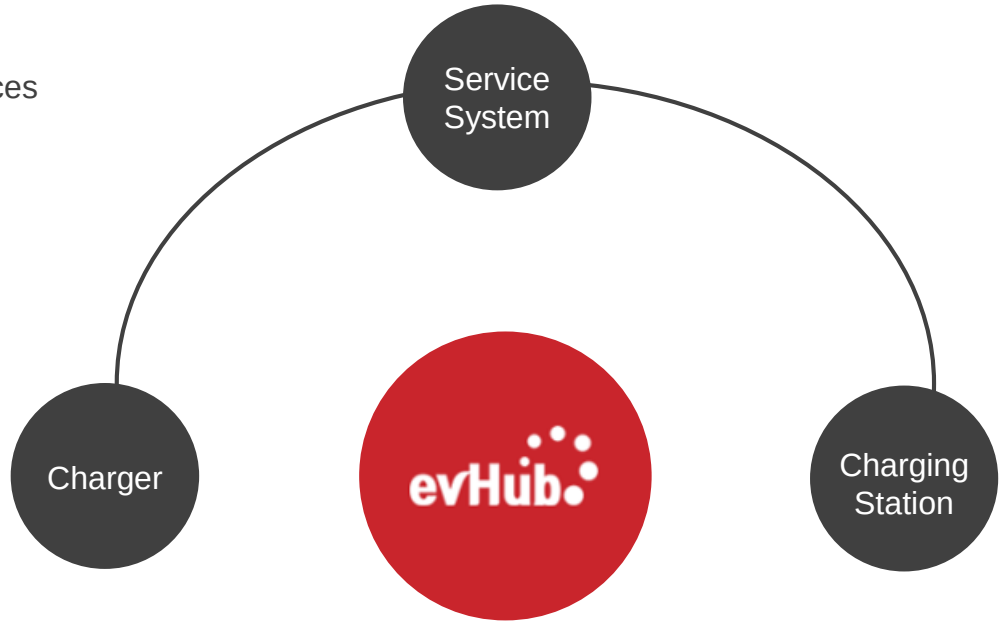
FUTRONIC
Hard & Software Technology



www.evhub.co.kr

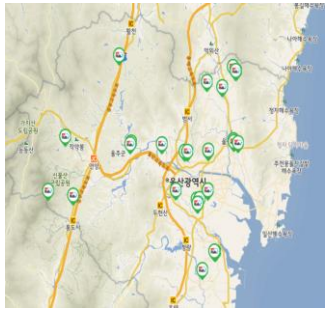
AC and DC Fast Charger

- Various sizes and designs to fit with places for installation
- Voltage : AC/DC
- 50kw&7kw Capacity
- Billing, Payment system and program integrated with charger



EV Charging Total Infra Service

- Total service is available while vehicles charged
- Membership service can be linked and shared with evhub® network



3. Development Capability

How We Make
a Robust Design

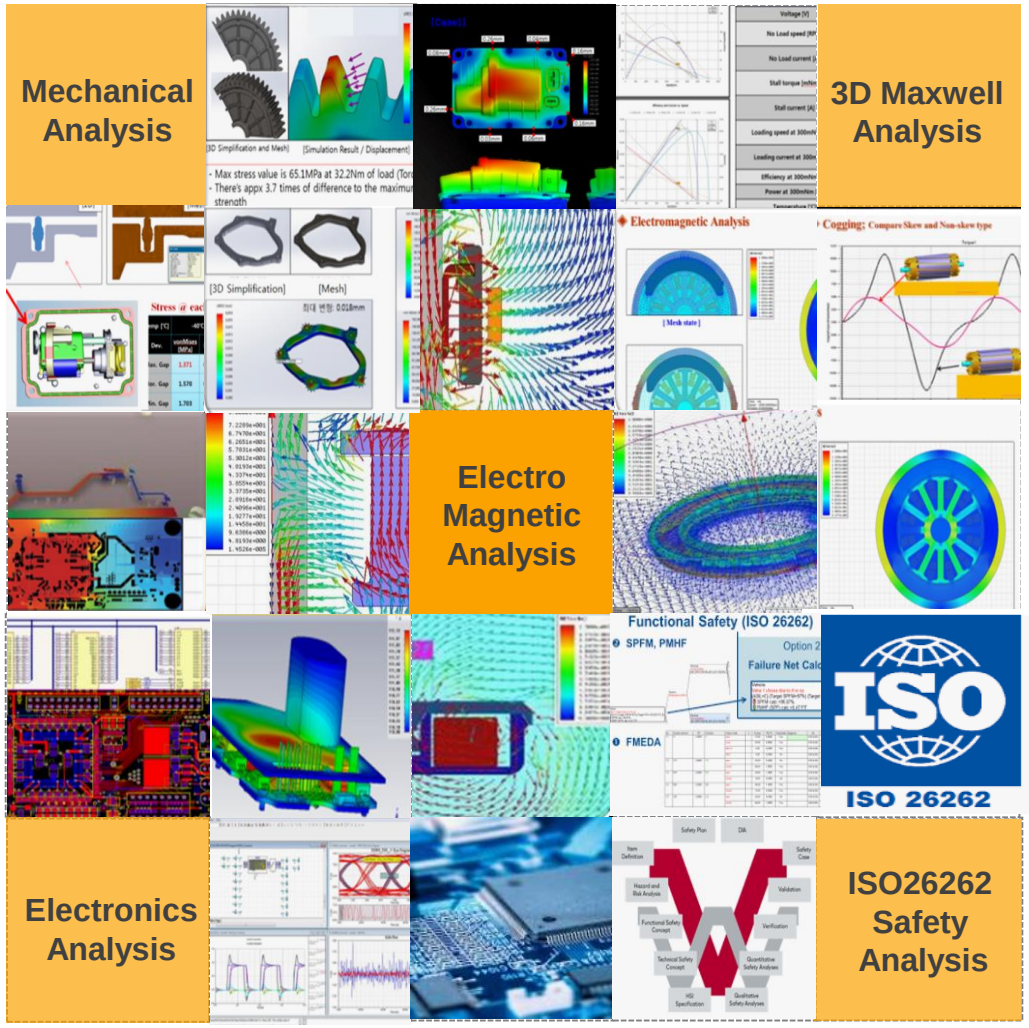
Futronic verifies every design through professional design analytical tools. Through this kind of study we can provide perfect design of product without any potential quality risk in the field.

Mechanical Analysis
- Seal Stress Analysis
- Gear Stress Analysis
- Metal Strain Analysis
- Thermal Expansion Analysis

Magnetic Analysis
- 2D/3D Flux Analysis
- Magnetic Field Analysis
- Magnetic Force Analysis
- Demagnetizing Simulation

Electronics Analysis
- PCB Signal Integrity
- Running The Analysis
- Thermal & 3D Layer Analysis
- Current Density Plot

Safety Compliance
- ISO26262 FMEDA
- C++ Complier Debugging
- Codesonar / Medini Analysis



Smart Production!

4. Manufacturing Technology

Automatic Armature Assembly Line

Full automatic armature assembly lines
with latest manufacturing execution system
with MES

Injection Over-molding Line

Complicated plastic and key characteristic component such as gear and over-molding
by Vertical and horizontal types of injection machine in own shop

Automatic Actuator Assembly Line

Each exclusive assembly line manufactures various types of actuator with our own designed automation system with MES

SMT Line

PCB and ECU assemblies
by latest SMT equipment in own shop

Machining Shop

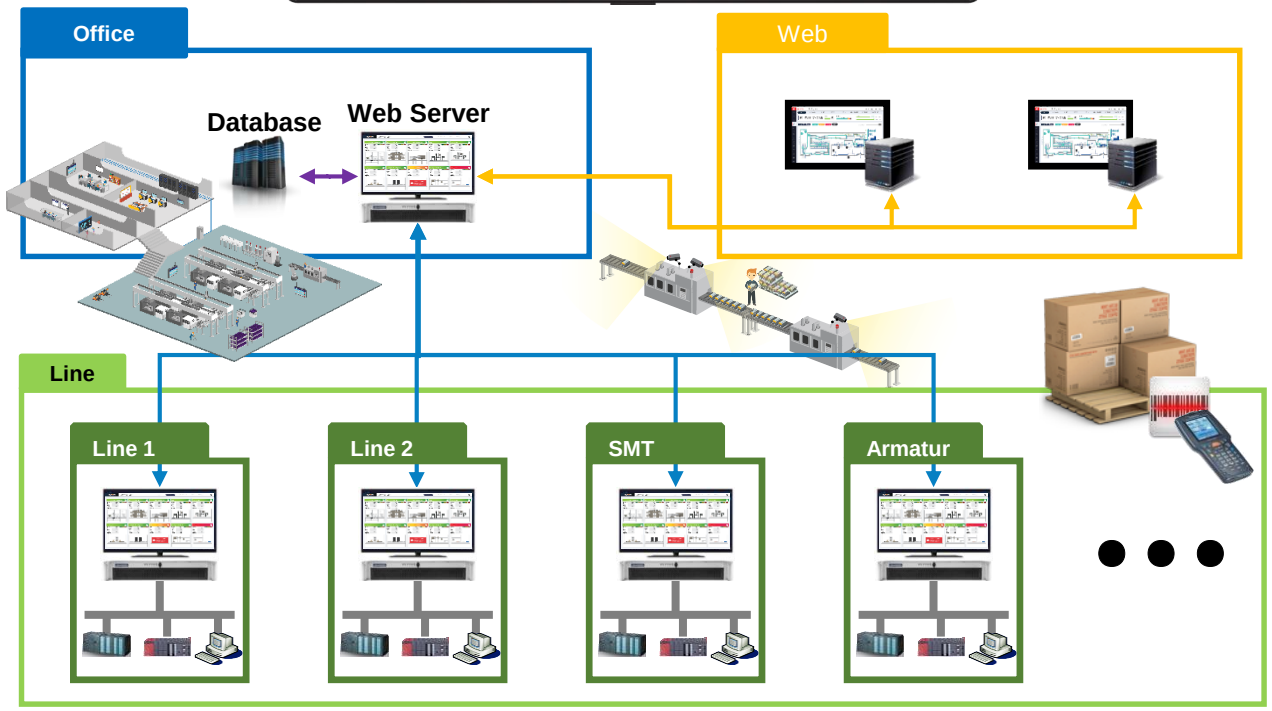
Steel and Aluminium components
by MCT and CNC in own machining center

SMART FACTORY

- ✓ **Monitoring the status of real-time production and equipment operation.**
- ✓ **Monitoring the status of real time inventory of production line for input & output material.**
- ✓ **Managing production efficiency and performance through real-time data collection.**
- ✓ **On time delivery through MES.**
- ✓ **Traceability management.**

Monitoring

FUTRONIC Hard & Software Technology



Excellent Quality Control

- ✓ **Product Development with a Robust Design**
- ✓ **Incoming components guarantee by measuring tools**
- ✓ **Stable and Fool proof Automatic assembly line with MES**
- ✓ **Full validation in development stage and periodical validation during production**
- ✓ **Systematic approach with Futronic own IATF 16949 system**

Inspection

FUTRONIC Hard & Software Technology

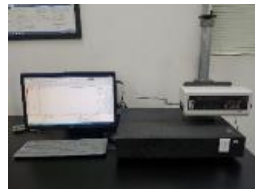
3D Measuring Instrument (Contact-type)

3D Measuring Instrument (Non Contact-type)

VMS

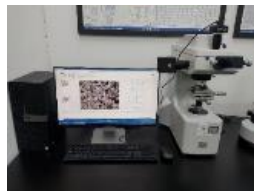
Roundness Meter

Profile Tester



Illuminance Meter

Vickers Meter



Rockwell Hardness Tester

UTM

Validation

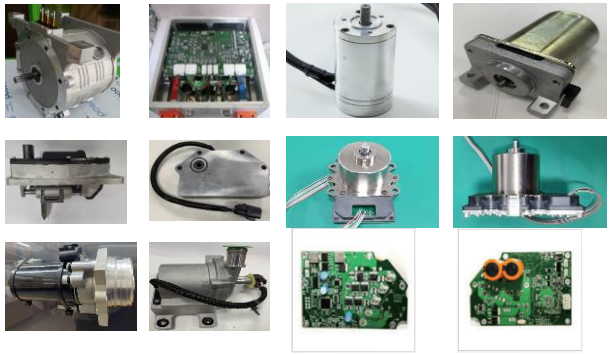
Environment Testing Room I

Environment Testing Room II

Cleanliness Measuring Room

5. Vision

2019-2020



- **Smart BLDC Actuator**
- **Parking Lock Actuator**
- **EPB Actuator**
- **EPS Actuator**
- **Traction Motor**
- **e Compressor Actuator**

Futronic successfully developed actuators and controllers included software to various types of EV system. Our innovative technology realize the dreams of lower weight and high efficiency actuator

2021-2025

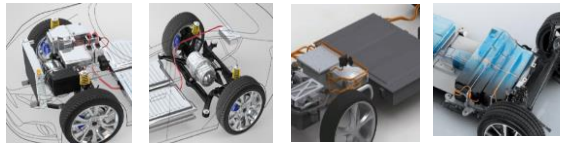
- **EV Heat Pump System**
- **Next Generation EV Charger and Charging Solution**

Next generation of charging technology and concept are under development. As well as new technology of EV heating and cooling system will be introduced
(Robot charger / Wireless charger etc)

2026-2027

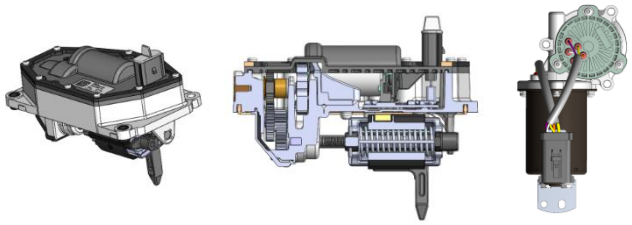
- **EV Driving and Control System**

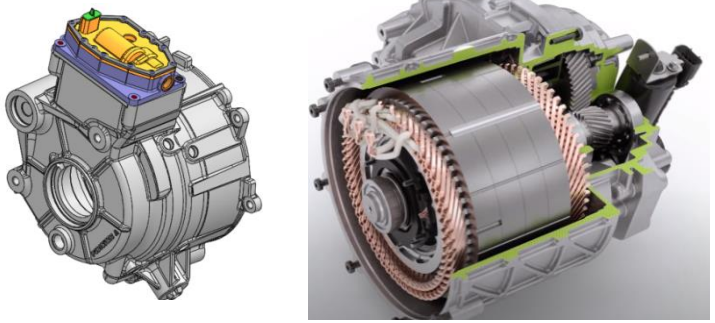
Advanced R&D team is researching V2X and V2V autonomous traffic control system with sensing, signal and software technology



6.Products Introduction

Electric Parking Lock Actuator





*** Application**

– Provides a mode shift between park locked and free driving condition on a front electric drive unit of EV.

– Electrically interface to the electric drive management system and react to commands from the system.

*** Electronics**

– Actuator with non-contact position sensor (Hall IC).

– High resolution analog or PWM sensor output signal for position feedback to ECU.

– Integrated ECU control the operation of actuator and communicate with vehicle ECU

– Robust Design with EMC/EMI protection.

– ISO 26262 / ASIL grade

*** Environmental conditions**

– Temperature : -40℃ ~ 150℃

– Protection : IP6K9K

– Installed on gear box of electric drive unit.

*** Motor / Performance**

– Actuator using brushed DC Motor or BLDC((brushless).

– Actuation time : < 1 sec.

*** Sensor**

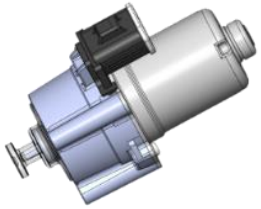
– The actuator internally controls the actuator's command state position through non-contact sensing.

*** Gear**

– Powder metal sintered gear or reinforced plastic gear

Electric Shift Actuator for Transfer Case










*** Application**

– Used to part time, full time and on-demand transfer case for 4WD vehicle.

– Provides a mode shift from 2-HI to 4HI and 4-Low for added vehicle traction.

*** Electronics**

– Actuator with programmable non-contact position sensor (Hall IC) or non-contact sensor & pulse sensor.

– High resolution electric feedback analog or PWM sensor output signal.

– Robust Design with EMC/EMI protection.

– ISO 26262 / ASIL grade

*** Environmental conditions**

– Temperature : -40℃ ~ 150℃

– Protection : IP6K9K

– Installed on transfer case housing.

*** Motor / Performance**

– Actuator using brushed DC Motor or BLDC((brushless).

– Torque : 1.5 Nm ~ 35 Nm range

– * Incremental Pulse Sensor

– The dual-channel Hall-effect sensor IC is ideal for use in speed and direction sensing applications.

*** Position Sensor**

– The sensor used programmable angular position sensor (360° Rotation)

– Sensor accuracy & Linearity variation within ±1%

*** Brake**

– Use a solenoid to engage / disengage the brake to prevent an unintentional shift during vehicle moving.

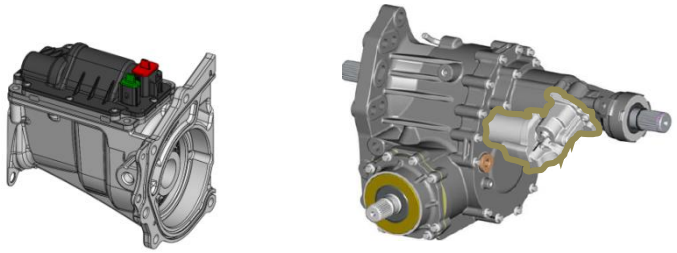
– Brake is normally closed.

– Response time : < 20 ms

*** Gear**

– Powder metal sintered gear or reinforced plastic gear

AWD PTU Disconnect Actuator



*** Application**

– PTU(power transfer unit) disconnect actuator for an active on demand AWD(all wheel drive) vehicles.
– PTU is to transfer power from the differential of the front transaxle to the propshaft.
– Disconnect actuator disconnect the propshaft and RDM(rear drive module) from the transaxle in 2WD mode.
– Provide the primary motion to move the PTU disconnect system.
– Used usually for front wheel drive based AWD.

*** Electronics**

– Actuator with programmable linear or angular non-contact position sensor (Hall IC).
– Communicate with RDM (rear drive module) and VCU(vehicle control unit)
– Integrated electronic control module combine power control, switching and position indication.
– High resolution electric feedback analog or PWM sensor output signal for positional feedback to ECU.
– Robust Design with EMC/EMI protection.
– ISO 26262 / ASIL grade

*** Environmental conditions**

– Temperature : -40℃ ~ 150℃
– Protection : IP6K9K
– Installed on power transfer unit of front axle

*** Motor / Performance**

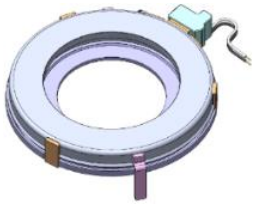
– Actuator using brushed DC Motor or BLDC((brushless).
– Torque : 1.5 Nm ~ 35 Nm range

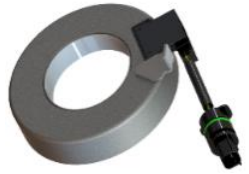
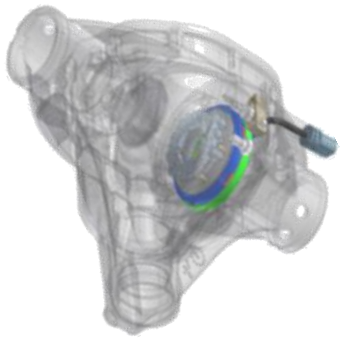
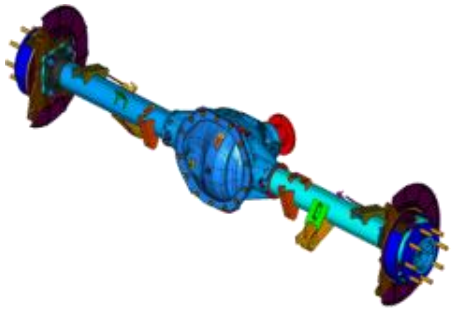
*** Position Sensor**

– The actuator internally controls the actuator’s command state position through non-contact sensing.
– The sensor used programmable Hall I/C
– Generate output signals relatives to the magnet positions

Electric Locking Differential Actuator



*** Application**

– Used in a locking differential system.
– Provides normal axle differentiation in normal driving conditions.
– Provides increased traction for off-road and slippery conditions.
– Electronically provides a mode shift from un-locked to locked

*** Electronics**

– Linear position sensor provides positional feedback to ECU.
– Operate independently from ABS control..
– High accuracy armature position with noncontact programmable hall sensor.
– Design with EMC/EMI protection.
– Dual linear positional feedback for diagnostic capability w/redundant sensor

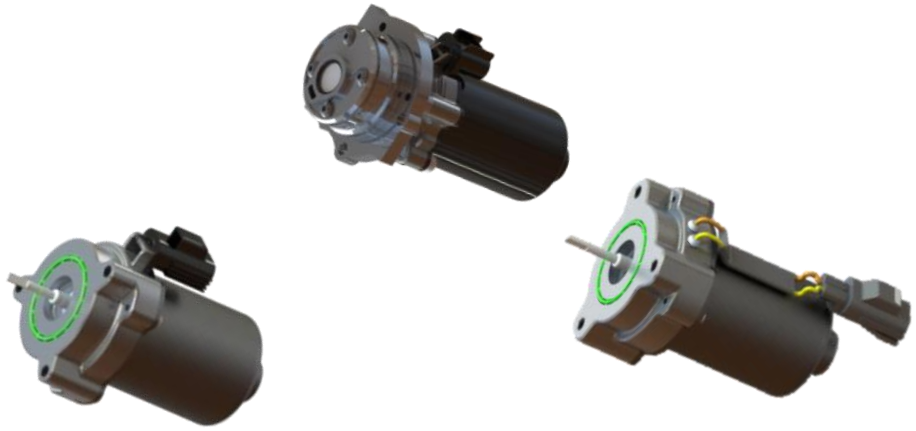
*** Environmental conditions**

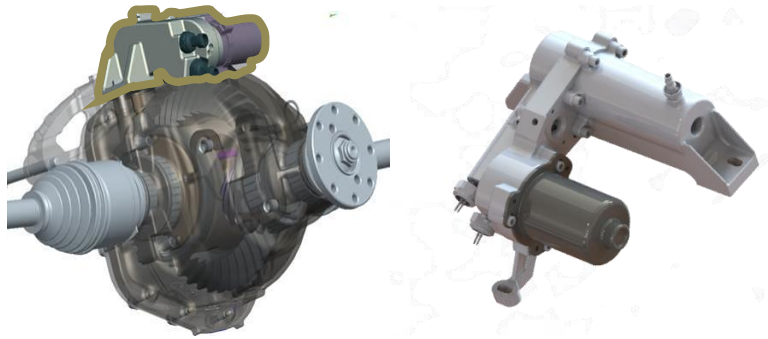
– Temperature : -40℃ ~ 170℃
– Installed inside of front / rear differential of front or rear axle.

*** Performance**

– Armature/ Plunger Stroke : 2.5 ~ 6.0mm
– Sensor accuracy & Linearity variation within ±1%
– Actuation time : < 300 ms

Electric Limited Slip Differential Actuator





*** Application**

– Motor drives hydraulic pump that builds pressure in accumulator for use in electric limited slip differential device to lock both axle.

– Used usually for SUV & pick-up truck RDM (rear drive module).

*** Electronics**

– Design with EMC/EMI protection.

*** Environmental conditions**

– Temperature : -40℃ ~ 150℃

– Protection : IP6K9K

– Installed on RDM (rear drive module) of rear axle.

– Require sealing of rotor shaft.

*** Motor / Performance**

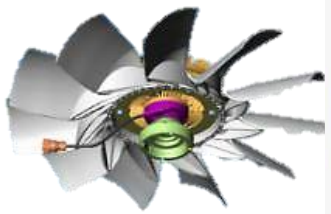
– Brushed DC Motor or BLDC((brushless).

– Torque : 1.0 Nm ~ 2.0 Nm range

Electric Cooling Fan Clutch Actuator








*** Application**

– Engine temperature control for commercial vehicle (heavy truck, excavator or agricultural vehicle).
– Improve fuel economy.
– Reduce emission

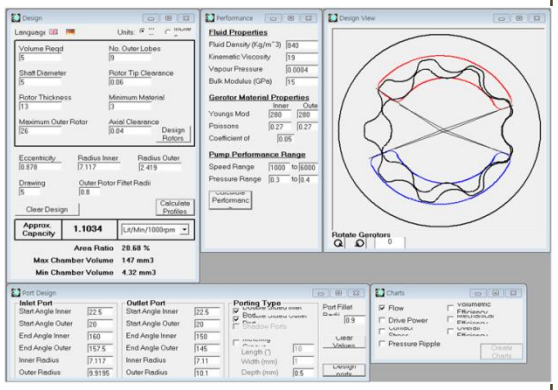
*** Electronics**

– Electronically control solenoid valve
– PWM signal out put with hall sensor to control real time fan speed.

*** Environmental conditions**

– Temperature : -40℃ ~ 170℃
– Protection : IP6K9K
– Actuator is located on cooling fan in front of engine.

Pump Motor



* Application

– Motor & gerotor pump assembly provide the hydraulic fluid flow / pressure to the system.
– Used usually in eLSD for SUV & pick-up truck RDM (rear drive module).

* Motor / Pump / Performance

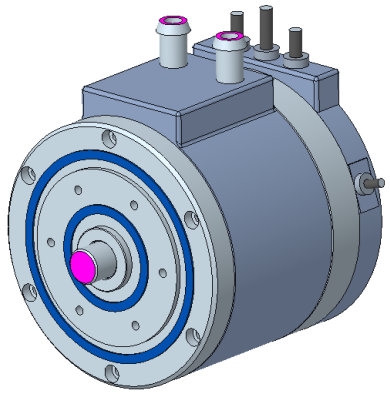
– Brushed DC Motor or BLDC((brushless).
– Gerotor pump type
– Motor Torque : 1.0 Nm ~ 2.0 Nm range
– Gerotor pump supply sufficient flow / pressure to clutch pack system electronically controlled.
– Operating pressure : -100 ~ 1300 kPa
– Operating flow rate : -3000 ~ 6000 ccm

* Environmental conditions

– Temperature : -40℃ ~ 150℃
– Protection : IP6K9K
– Installed on RDM (rear drive module) of rear axle.
– Require sealing of rotor shaft.

BLDC Motor

EGR Pump Motor



Application

- Heavy Duty on-highway commercial vehicle powertrain

Performance

– Rated Torque : 5.5Nm, Rated Velocity : 5,000rpm

– Output : 3KW

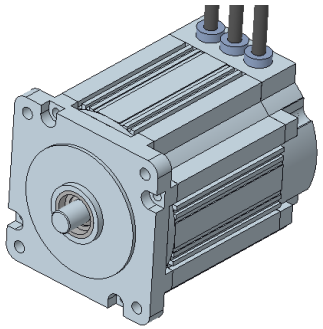
– Voltage : 42 ~ 60V

Environmental conditions

– Temperature : -40℃ ~ 110℃

– Protection : IP6K9K

Fresh Air Pump Motor



Application

- Heavy Duty on-highway commercial vehicle powertrain

Performance

– Rated Torque : 1.75Nm, Rated Velocity : 7,000rpm

– Output : 1.25KW

– Voltage : 18 ~ 32V

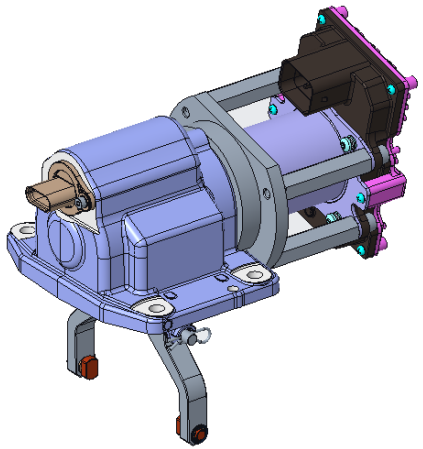
Environmental conditions

– Temperature : -40℃ ~ 90℃

– Protection : IP6K9K

Smart Actuator

Synchronizer Shift Actuator (SSA)



Application

– remote control of a Shift Collar Pad(s)'s position in a vehicle's transmission/gearbox

Performance

– Force : 700N, Stroke : 22.5mm

– Voltage : 9 ~ 16V

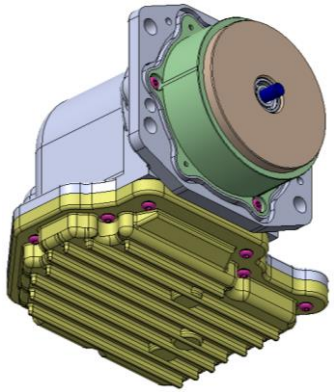
– Operating time : 150ms

Environmental conditions

– Temperature : -40℃ ~ 125℃

– Protection : IP6K9K

Electric Clutch Actuator (ECA)



Application

- electronically controlled clutch actuator that is part of an automated truck transmission

Performance

– Rated Torque : 2.5Nm, Rated Velocity : 2,000rpm

– Output : 520W

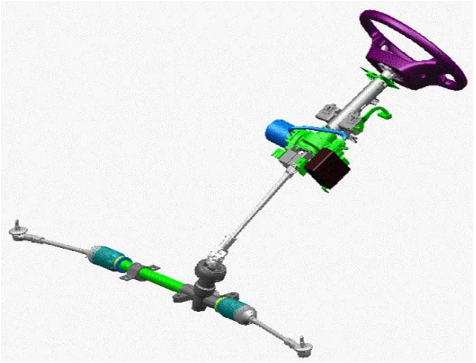
– Voltage : 12 / 24V

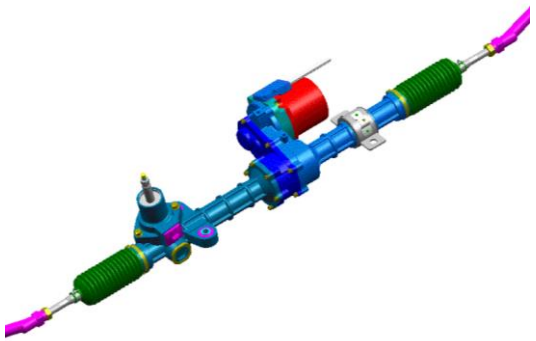
Environmental conditions

– Temperature : -40℃ ~ 150℃

– Protection : IP6K9K

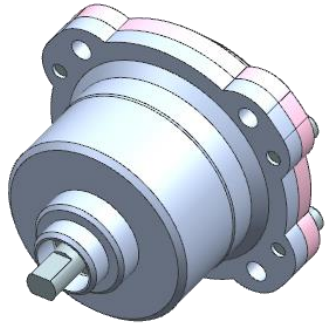
EPS Motor

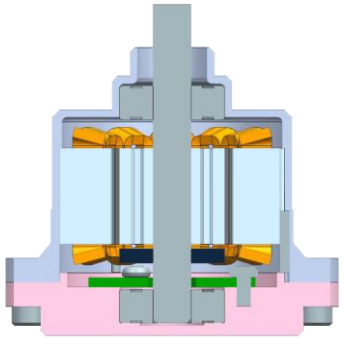


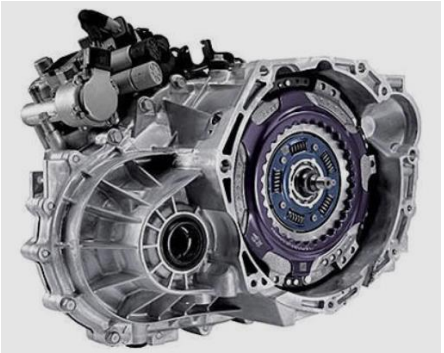


- ✓ **Motor Type : Brushless DC Motor**
- ✓ **Number of Stator Slot : 9**
- ✓ **Number of Rotor Pole : 6 (Skewed)**
- ✓ **Core Material : S18**
- ✓ **Magnet Material : Nd-Fe-B Sintered Magnet (Grade : N38SH)**
- ✓ **Circuit Type : Y – Connection**
- ✓ **Dimensions : Stator O.D. Φ 85 mm**
  Stator/Rotor Length 60 mm
  Magnet Thickness 4.5 mm
- ✓ **Coil Spec. : O.D. Φ 1.7mm , 14 Turns (Parallel Branches : 3)**
- ✓ **Terminal Resistance : 12.56 mΩ**

DCT Motor



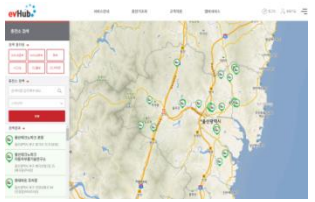




- ✓ **Shaft Diameter : ₵ 8.00 mm**
- ✓ **Input Voltage : 11.0 DC**
- ✓ **Nominal Torque: 840mNm**
- ✓ **Output Power : 150 W**
- ✓ **Current : 1.2 A**
- ✓ **Maximum Efficiency : 77%**
- ✓ **Weight : 820 g**
- ✓ **Operation Temperature: -40 ~ 120 ℃**
- ✓ **Storage Temperature : -40 ~ 140 ℃**
- ✓ **No Load Speed : 3500 rpm**
- ✓ **Leak** Protection : IP6K9K

EV Charger & Charging Infra Solutions

Product Specifications				
Charger Type		SLOW 7kW	FAST 50kW	
Model		FC7K-EV-C1	FC50K-EV-C1	
Item		AC Charger	DC Charger	AC Charger
Size(mm)		W320 * D231 * H1370	W710 * D902 * H1635	
Weight		50kg	450kg	
AC Input	Voltage	AC 220V ac±10%	AC380V ±10% (3 phase)	
	Frequency	50/60 Hz	50/60 Hz	
DC Ouput	Max Voltage	220V ac	400V (DC)	380V (AC)
	Max Current	30A	120A	63A
	Max Power	7kW	50 kW	43kW
Efficiency		95%	95%	
Operating Temperature		-25℃ ~ 45℃	-25℃ ~ 45℃	
Display		8" LCD touch screen	8" LCD touch screen	
Protection		IP44	IP44	
Payment		RFID, NFC, Credit card	RFID, NFC, Credit card	
Certification		KC	KC	
Plug Type		AC 5 Pin	CHA / CCS1 / AC3	



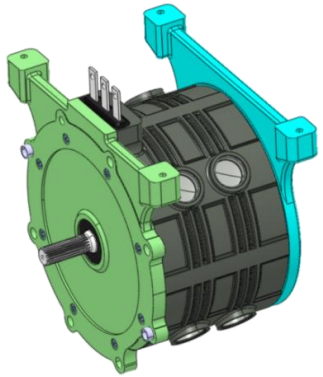
EV Charging Station Map

Admin – Charging Statistics

Member – 1:1 QnA

Admin – Charger Management

Traction Motor & Invertor

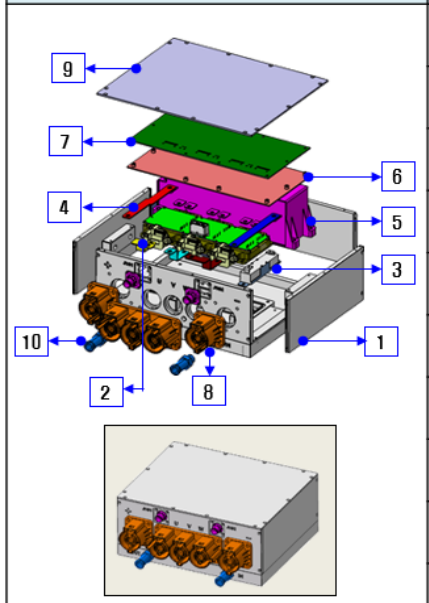


[Motor Design Shape]

[Motor Shape]

[Invertor]

Traction Motor		
Items		Specification
Type	–	IPMSM
Continuous Power	kW	193
Max Power	kW	210
Max Torque	Nm	1,000
Continuous Torque	Nm	920
Max RPM	RPM	5,500
System Voltage	Vdc	650Vdc
Max Current	A	500(RMS) ↓
Torque ripple	Nm	15 ↓
Volume	mm	Minimum Size
Power density	kW/Kg	3
Cooling	–	Coolant Liquid
Insulation grade	–	N or H
Efficiency	%	92

Inverter part list	No.	Part name	Function
	1	HOUSING	Inverter internal protection and coolant flow path function
	2	CURRENT SENSOR	Phase current sensor
	3	IGBT	Powering the motor to the switching element
	4	BUS BAR	High current induction
	5	DC LINK CAPACITOR	Voltage and current ripple reduction
	6	GATE BOARD	Pass in command signal IGBT
	7	CONTROL BOARD	Control logic realization, PWM signal output
	8	HIGH VOLTAGE CONNECTOR	Inverter I/O connector
	9	COVER	Inverter internal protection
	10	NIPPLE	Coolant IN/OUT

Position & Speed Sensors

*** Application**

– 4WD electric shift control sensors
– EGR V/V position sensors
– Throttle position sensors
– Speed sensors
– Seat position sensors

*** Sensor Type**

– Rotary position sensors (contact & non-contact type)
– Linear position sensors (contact & non-contact type)
– Inductive speed sensors.
– Hall IC type speed sensors
– Programmable linear or angular position sensor
– Analog or PWM signal output
– Send an electric signal to ECU for positional feedback.

*** Environmental conditions**

– Temperature : -40℃ ~ 170℃
– Protection : IP6K9K

FUTURE MECHATRONICS

Thank You

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