

Electric Vehicle Training System VKS 1050



BLDC CONTROLLER

CONTROL PANEL

This trainer provides students and instructors with the opportunity to demonstrate, investigate, and fault-find a simulation of an Electric vehicle system. The trainer is designed to allow access to a simulation of the mechanical operation as well as provide a mimic of the electrical power flow. The panel also includes test points at a safe voltage level to allow for the investigation of electrical circuits. To facilitate the development of techniques in diagnostics and fault-finding skills, the panel includes a range of fault-insertion options to simulate typical real-world system malfunctions.

List of Experiments:

- Block Diagram analysis and parts identification
- Study of Schematic diagram of electric vehicle
- Study of different types of motors & motor drivers
- Study of battery management system
- Study of Power conversion system
- Study of battery charging system
- Study of braking systems
- Study the N-T (Speed -Torque) characteristic of BLDC Motor.
- Study the different Sensors of EV
- Study of working of BLDC motor and Hall sensor with real time waveform analysis
- Study of running, reversing & braking of BLDC motor.
- Study of speed control of BLDC motor using PWM method.
- Study of BMS and measure voltage across each battery along with packed battery voltage
- Study of Discharging Characteristic of BMS
- Study of Charging Characteristic of BMS
- Study of Cell Balancing phenomenon of BMS
- To understand the overall functioning of lead-acid and Li-ion batteries.
- To study the charging and discharging characteristics of lead-acid and Li-ion batteries.

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SPECIFICATIONS:

DIMENSIONS

Overall Length (mm) : 2800 Width (mm) : 1200
Height (mm) : 1200 Wheel Base (mm) : 2200

ELECTRIC MOTOR

Electric Motor Type : BLDC
Rated Power (W): 3000
Peak Power (W): 5000
Max. Torque (Nm) :14
Rated Speed: 4200 RPM

HIGH-VOLTAGE BATTERY

Battery Capacity (Ah):125 Battery Type: Li-Ion
Charger Connection Type : Type-2 Plus CCS Range
In Single Charge (km) : 20km

TRANSMISSION

Transmission : Automatic

TYRE

Tyre & Wheel :215/55 R17 Alloy Wheel

BRAKES

Front & Rear Brakes : Drum

SUSPENSION

Front : MacPherson Strut Rear : Torsion Beam

CONTROLLER

- Sinusoidal field oriented control Sensorless three shunts
- MCU: RL78/G14 (16-bit, 41DMIPS)
- On-board inverter power stage: MOSFETs RJK0654 (LFPK, 30A/60V, $R_{th} = 2.27^{\circ}\text{C}/\text{W}$, $L = 1.1\text{nH}$, $R_{DS(on)} = 6.5\text{m}\Omega$)
- Available CPU time: 30% [86 μs used for FOC algorithm calculations]
- Switching frequency: Up to 24KHz Sampling frequency: Up to 8KHz
- Communication: USB
- connection: RL78.G14 GUI, Isolated programming and IAR debugging interfaces

BATTERY MANAGEMENT SYSTEM

Safety Control

- Enable high battery pack safety with multiple fail-safe detection functions
- Built-in self-diagnostic functions using an integrated MCU and AFE
- Ultra-low power storage mode
- Over/Undervoltage
- Overcurrent
- Over/Under temperature
- FET control during failure
- Fuse blow

Capacity Calculation

- Up to 12-cell voltage monitors, support Li-Ion CoO₂, Li-ion Mn₂O₄, and Li-ion FePO₄ chemistries
- Cell voltage measurement accuracy $\pm 10\text{mV}$
- 13-bit cell voltage measurement
- Pack voltage measurement accuracy $\pm 180\text{mV}$
- 14-bit pack voltage and temperature measurements
- Cell voltage scan rate of 19.5 μs per cell (234 μs to scan 12 cells)