



## ELECTRIC DRIVE

### Electric Drive Technology for Automotive Students & Trainees

The Electude Electric Drive curriculum consists of a complete range of interactive lessons that are designed specifically for instructing today's generation of automotive learners about hybrid and electric vehicle technology.

- **Over 20 state-of-the-art interactive lessons, tests and simulations**
- **Learning Management System that allows results tracking, testing and customizing classes & courses.**
- **Covers battery technology**
- **Can be used to study hybrid and/or electric only technology**
- **Loved by students because it is based on gaming principles**
- **Budget friendly**



Users will develop a comprehensive understanding of the terms, components, and global operation of hybrid or electric vehicles.

With this knowledge, the user can divide the vehicles into various categories and lay out the configurations. Once this is understood, users learn about the different parts used in hybrid or electric vehicles and about the operation of the most common systems. In addition, there are also lessons on system safety and how to work on hybrid vehicles.



# THE ELECTRIC DRIVE LESSONS

## Introduction

Electric Drive: Introduction – Introduction

Electric Drive: Introduction – Energy Efficiency

Electric Drive: Introduction – Configuration

Electric Drive: Introduction – Categories

Electric Drive: Introduction – Operation

## COMPONENTS

Electric Drive: Cables

Electric Drive: BMS

Electric Drive: CVT with push belt

Electric Drive: CVT with planetary gear set

Electric Drive: CVT (Honda – eCVT)

Electric Drive: DC-DC converter

Electric Drive: HV-battery

Electric Drive: Inverter – Introduction

Electric Drive: Inverter – Step-up booster

Electric Drive: Induction motor

Electric Drive: Charging

Electric Drive: Resolver

Electric Drive: Synchronous motor with permanent magnets

Electric Drive: Systems

Electric Drive: Working on hybrids

## OTHERS

Rotating magnetic field

Safety – Certified tools

Safety – Working with high-voltage

Electric Drive: Working on hybrids

Insulation resistance

The diagnostics tester has read an error code, indicating that there is a problem with the insulation of the cables between the inverter and the electric motor.

You are going to use an insulation resistance tester to locate the problem.

Use the insulation resistance tester to measure the resistance between the W cable and the inverter.

Click Test to perform the measurement.

What is the insulation resistance?

MΩ

Submit

Electric Drive: Working on hybrids

On the inside, a hybrid vehicle can be identified by:

- the inverter: often under the bonnet
- HV battery: in the boot or in the base/floor of the vehicle
- the cables: orange cables are used

Senj and full hybrid vehicles do not have a charging connection.

You are going to look under the bonnet.

How can you identify a hybrid vehicle without a charging connection?

By the alternator.

By the orange cables.

By the inverter.

Electric Drive: Resolver

Stationary

The position of the rotor can be accurately determined by using two sensors.

With this sensor, the input is called reference; the two outputs are sinusoidal and cosine.

The sensor cannot see any difference when the rotor is rotated 180°.

This is the signal of a resolver with an additional sensor at a different angle.

How many terminals does this sensor have?

3

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Electric Drive: Charging

Connector sockets

There is a number of different connectors to charge vehicles.

- Type 1: North America
- Type 2: Europe
- Type 3: France and Italy

These connectors have multiple power pins:

- L1 = phase one
- L2 = phase two
- L3 = phase three
- N = neutral
- PE = earth

There are two signal pins for the communication between the charging station and the vehicle:

- CP = contact pilot
- PP = plug present

Communication between charging station and vehicle.

Checks whether a charger is connected.

There are also different quick chargers. These operate with:

- CHAdeMO: worldwide
- Type 1 combo: North America
- Type 2 combo: Europe

Find the signal pins on this connector.

Activation

Before starting to charge:

- The check for the correct cable cross-section.
- The charging station vehicle readiness to be charged.

The height of the PWM signal provides information regarding the charging process status:

- 12 V: ready to charge
- 9 V: vehicle is connected
- 6 V: vehicle is being charged
- 3 V: charging with ventilation

The duty-cycle of the PWM signal indicates how much current should be used for charging:

- 60%: 16 A
- 25%: 16 A
- 50%: 32 A

Lock at the test.

What charging current can flow if the PWM signal is 25%?

16 A

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