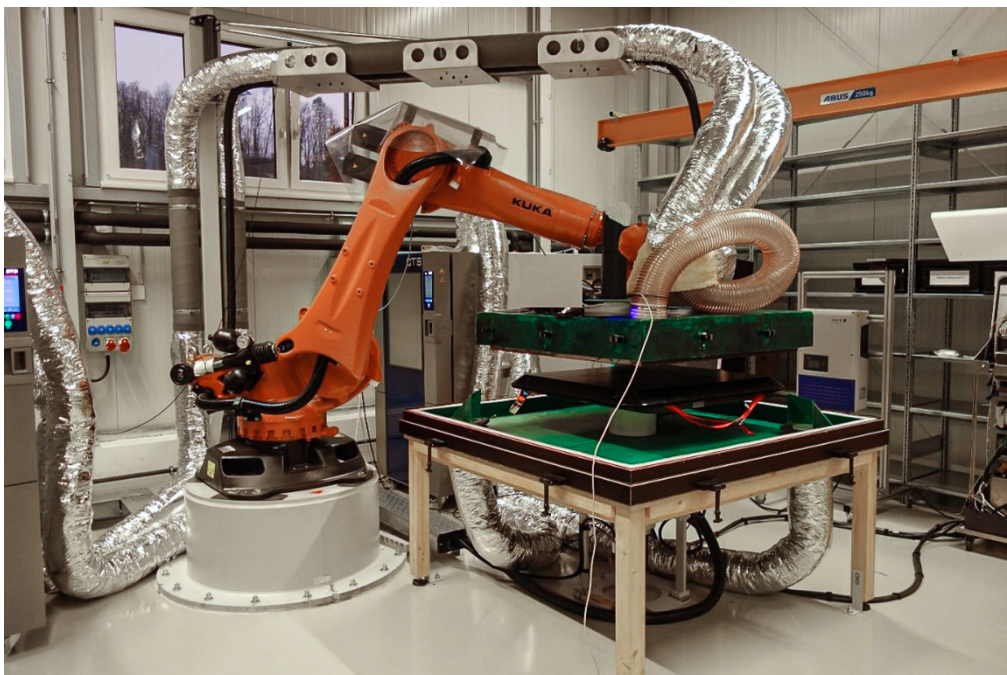


IRS SYSTEMENTWICKLUNG GMBH

Positioning with robot for inductive charger

Positioning and power tests while applying different temperature setups.

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Description

Inductive charging systems may be a very convenient and sophisticated version to charge the batteries of electrical vehicles. The charging electronic in the car must be placed quite exactly over the ground pad module in the parking lot. This position has a large impact on the efficiency factor and requires communication between car and ground pad module in order to assist and move the car into the correct place and establish a proper coupling. Furthermore, inductive charging may be a hazard to animals or heat metallic parts in the environment. Such interference must be detected by the charging system.

Thus, inductive charging systems must not only be tested on electrical parameters, but also on positioning and detection of intruding material or animals. IRS developed and built a complete solution for system test of both ground pad and car-module, including variable placement of the car-module or foreign material with a robot.

Key Facts

- Power tests up to 40kW
- Positioning tests in mm accuracy with 7 axis positioning
- Object detection tests
- Test at variable and different temperatures

Use Cases



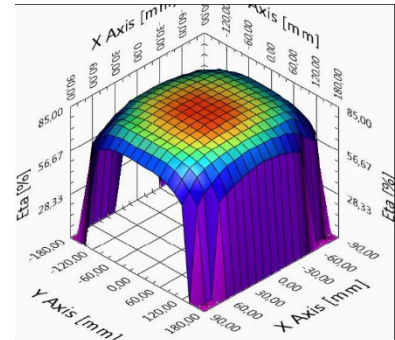
The focus of the system is the test of both ground pad- and/or car-pad-modules at variable power for cars or commercial vehicles.

Technical Description

Power tests

Efficiency is one crucial electrical parameter to be determined for inductive charging systems. It is calculated from the precisely measured consumed AC power from the grid or an AC-Source and the DC power on the battery simulation.

A precision power analyzer with proper sensing techniques provides enough accuracy to determine efficiency at different positions and situations.



Positioning tests

There are various positioning tests to be performed:

- coupling factor at different positions in millimeter accuracy
- parking situations in the range of up to $\pm 3\text{m}$ Both rotating ground pad and car-module allow approach from every direction

The robot positioning includes 6 axes for the car-module

- 3 axes determine the location in the 3D room (position in X, Y, Z)
- 3 axes determine the angles to the ground pad module (rotation in X-, Y-, Z-Axis)

Another 7th axis for rotation of the ground pad is available. With Rotating the ground pad module, parking situations from every direction can be simulated.

The software automatically calculates coordinates for different inertial systems, e.g. for car-view including different origin settings of the car.

Object detection tests

The robot setup may be changed to move either car-module or intruding objects. I.e. for object detection, the car-module is mounted on a fixed position, while the robot simulates intrusion of foreign objects connected on a non-metal rod. The charger must detect the object and enter a safe state. The coordinates of the object are automatically adjusted to this specific setup using a well-defined rod.

Separate Temperatures

One special feature of the inductive charger system test is the ability to apply different temperatures for both ground-pad and car-module. Both components may be placed into an isolated closed box. Each box is attached to a separate cooling system, connected by isolated hoses. This enables testing at different temperatures, e.g. the following situation can be simulated: The car approaches a heated garage in winter at -40°C . Thus, the car-module may be tempered to -40°C , the ground pad at $+20^{\circ}\text{C}$.



Since every metal object near the charger will influence the performance, all components of the housing had to be designed without using any metal and wires had to be located accordingly.

Safety

Last, but not least, safety is a critical issue when designing systems including robots and higher voltages, where both mechanical and electrical hazards are present. IRS has profound experience together with its partners for machinery to design and install safe equipment at the customer's location.

Technical Data

	Min	Typ	Max	Unit
DC voltage range	0		1000	V
DC power	0		40	kW
positioning accuracy		3	10	mm
positioning range	-3		3	m
approaching angle	-180		180	$^{\circ}$
car-module weight		10	40	kg