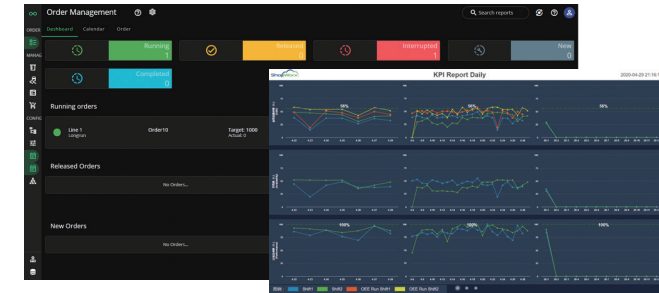


Digital Management System for Fuel Cell Production Line

As a One-stop Smart Manufacturing Solution expert, ruhlamat not only provides flexible manufacturing solutions, but also provides ShopWorx digital platform suitable for production process and workshop management, to help customers build digital production lines and workshops.

Features



Production Management

To make the production process transparent, high efficient and traceable by configuring with the digital modules such as MES system, intelligent dashboard, intelligent report etc.

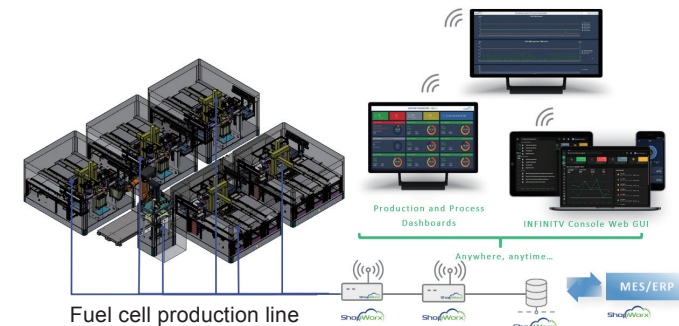
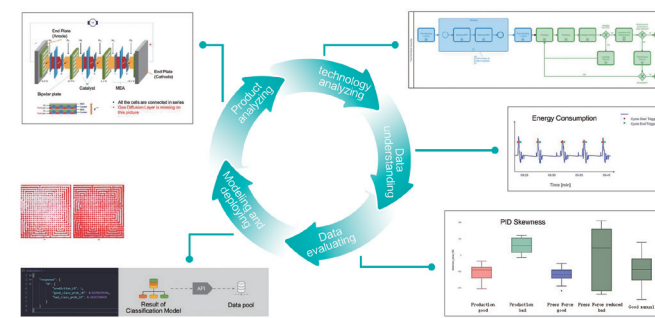
Data Analysis

By following CRISP-DM analysis method, combine with big data and machine learning, to analyze the key process parameters and equipment parameters during fuel cell production.

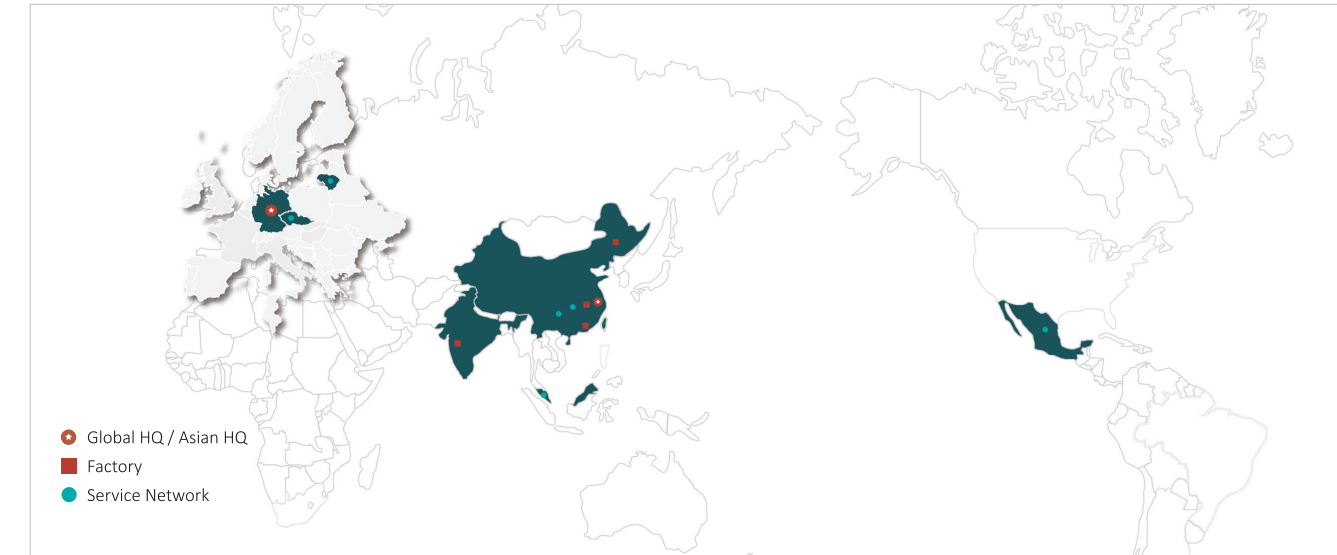
Machine Learning

Analyze the key process parameters and equipment parameters during the fuel cell production by leveraging the machine learning.

- Testing the advantages and disadvantages of manufacturing process
- Optimizing product design and production process
- Preventing the defective products be launched to market
- Reducing safety hazards
- Reducing material cost



One-stop Smart Manufacturing Solution Provider



Originating from the traditional watch and machine factory "Uhren- und Maschinenfabrik Ruhla", our German ruhlamat headquarters was founded in 1991. With many decades of experience in mechanical engineering, ruhlamat has become a leading supplier of assembly and automation systems. It has locations in Germany, China, India, Mexico, Czech and Malaysia with a combined total of approximately 1,200 employees. The strategically placed locations and employees allow ruhlamat to provide professional products and services to customers around the world, therefore resulting in an annual turnover of 120 million euro.

ruhlamat Automation Technologies (Suzhou) Co., Ltd. was founded in 1998 as the regional headquarters for the Asia-Pacific area. With a total of around 700 employees (more than 200 engineers), delivers about 120 Auto/Semi auto production line per year. With seven locations (production workshops and service centers), ruhlamat is able to supply products and services to customers in nearly 20 countries and regions around the world, leading to an annual turnover of over 84 million euro. This progress has helped ruhlamat Asia become partners with many top 100 automotive parts suppliers in the industry.

ruhlamat Asia, a global One-stop Smart Manufacturing solution provider, business covers combustion engine vehicle auto parts, NEV auto parts, healthcare, 3C, household application and other industry products. ruhlamat Asia has four brands – ruhlamat, EaglAI, Vario and ShopWorx



– that provide solutions in different areas such as Customized Automation and Testing solution, AI Machine Vision system, Standard products such as Servo Press, Profile and Conveyors, and the Smart Factory IIoT Platform. With a positive attitude and a desire to seek innovative products and technical solutions in the intelligent and digital fields, ruhlamat Asia is committed to supporting the industry development and transformation and upgrading.

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Automated Solutions for Fuel Cell Assembly

- BoP Components
- Fuel Cell Stack
- Fuel Cell System
- Type 4 Hydrogen Tank

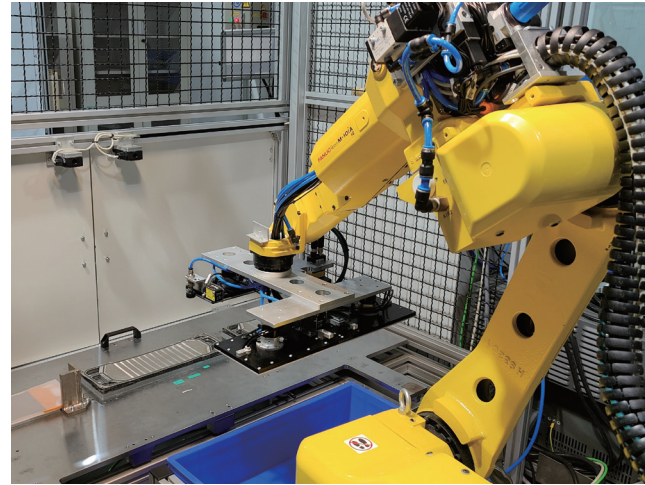
ruhlamat Automation Technologies (Suzhou) Co., Ltd.

New energy vehicles - electric vehicles and hydrogen fuel cell vehicles have obviously become the key measures to achieve low carbon. ruhlamat Asia dedicates to customized automation solutions for auto parts for more than 20 years, and actively invests in research and development, provide innovative automated solutions for customers in the new energy automobile industry, helping customers reduce costs, expand output and accelerate transformation.

Fuel cells are in the early stages of reducing production costs to the level that it can be used on a large scale.

ruhlamat is cooperating with a consortium of experts from the world's leading institutions to develop the mass production solutions for fuel cell stacks, systems and hydrogen tank.

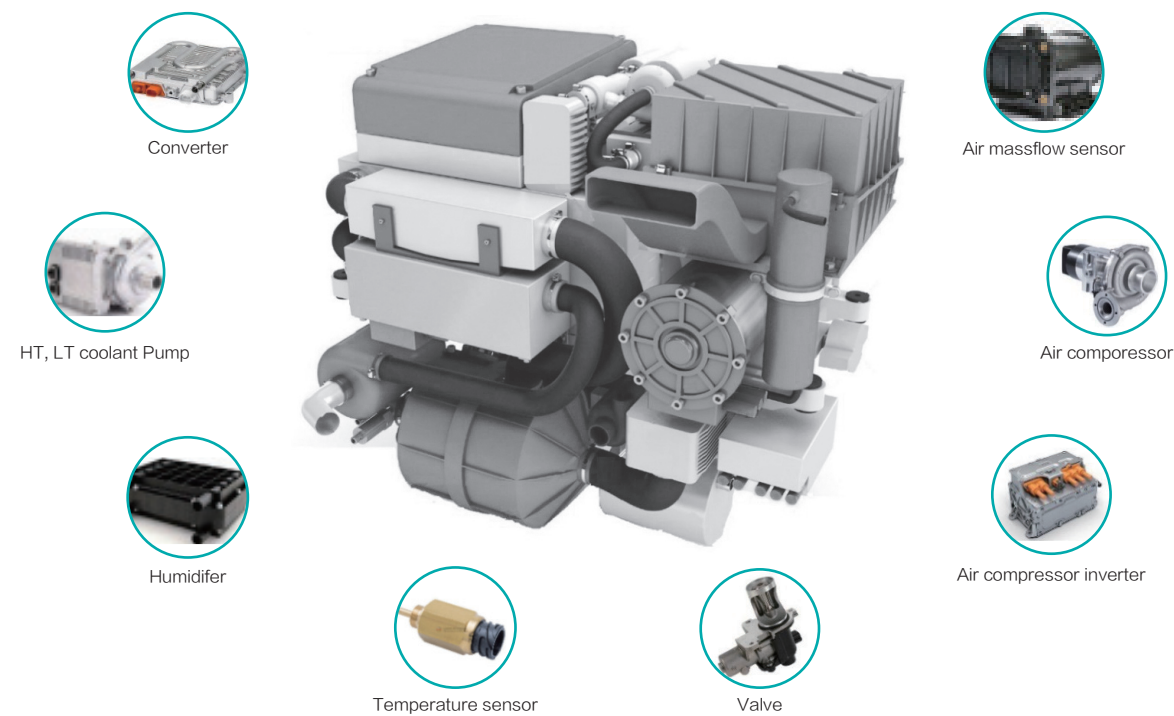
ruhlamat solutions are with flexible, traceable and scalable features, to ensure the high efficient production and reasonable cost controlling.



BoP Components Assembly Solutions

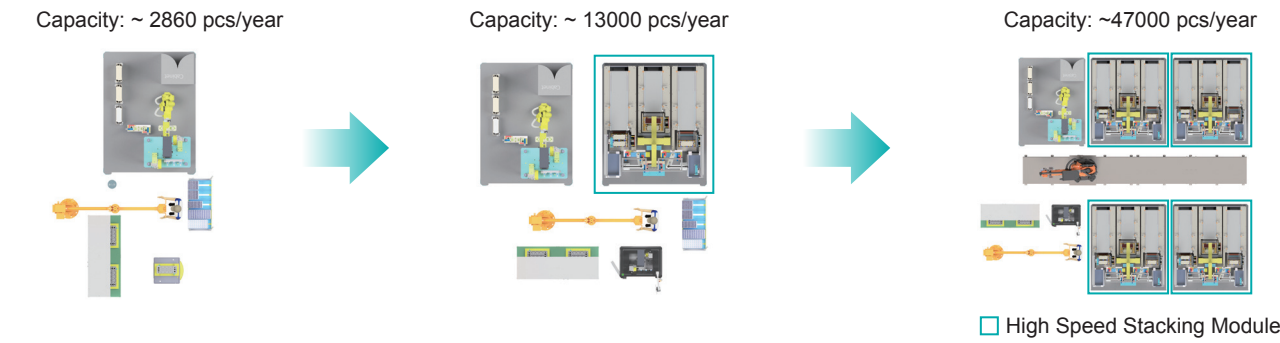
"Balance-of-Plant" (BoP) summarizes all components of a fuel cell system except the stack itself, this includes pumps, sensors, heat exchanger, gaskets, compressors, recirculation blowers or humidifier etc.

ruhlamat leverage its extensive automation experience in auto parts industry to provide the automated solutions for the BoP components production.



Fuel Cell Stack Assembly Solutions

ruhlamat provides high scalable solutions to meet customer's needs in different scenarios



Features

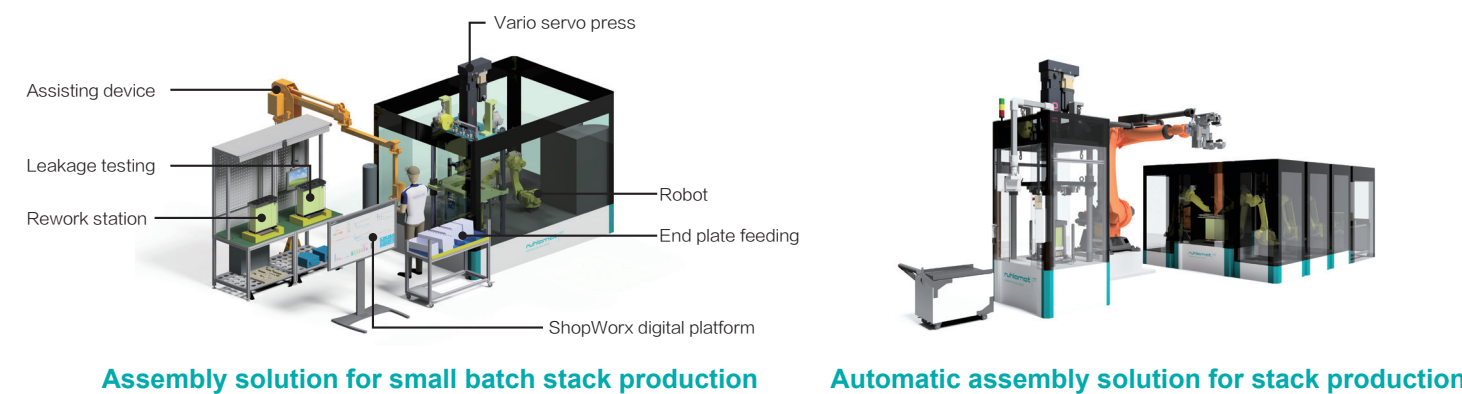
- Be able to meet automatic assembly requirements for the small batch stacks production
- Automatic stacking with automatic deviation correction system to ensure the consistency of stack manufacturing
- Flexible and scalable modular design to reduce the investment cost
- Configured with ShopWorx digital platform to build the data bridge from simulation, prototype assembly to performance test to provide the key parameters of process, so as to optimize the design and improve performance of stacks
- Finish the single cell assembly in 3s by the High Speed Stacking Module (Full automatic assembly solution for stack)
- High Speed Stacking Module design features high scalable, to enable equipment OEE improving (Automatic assembly solution for stack)

Main Process

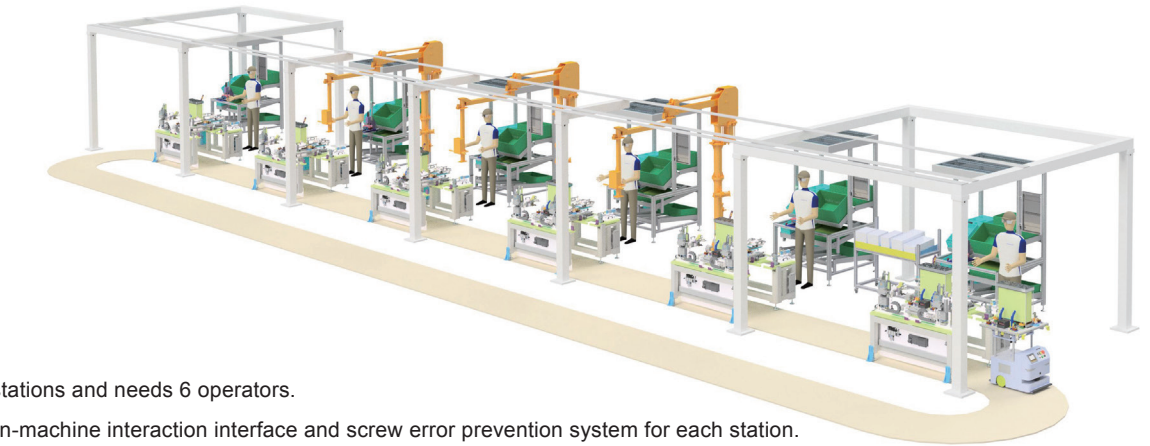
- Robot loading & unloading
- Vision system alignment
- Robot stacking
- Screws tightening/ strapping
- Pressing by servo press
- Leakage testing

Main Parameters

Main parameters	Small batch assembly solution	Automatic assembly solution
Cycle time	66 min/stack (based 100kW 330 pcs BPP, MEA)	4 min/stack (based 100kW 330 pcs BPP, MEA)
Daily production capacity	13 pcs (16 hours/day, 90% OEE)	216 pcs (16 hours/day, 90% OEE)
Annual production capacity	2860 pcs (based 220 day/year, 90% OEE)	47520 pcs (based 220 day/year, 90% OEE)
Operator	1	1



Fuel Cell System Assembly Solutions



Features

- Cycle time: 2h/pcs
- The line includes 6 stations and needs 6 operators.
- Equipped with human-machine interaction interface and screw error prevention system for each station.
- Equipped with AGV transmission and tooling of 360° manual rotated positioning, so as to operate easily.
- Configured with digital solutions to collect and analyze parameters in assembly process, and be with machine learning and other expansion functions.

Main Stations

- Stacks loading and frame assembling
- End plate assembling
- Air compressor, water pump and intercooler assembling
- Hydrogen circulating pump and DCF assembling
- Pipeline and electric plug assembling
- Testing

Type 4 Hydrogen Tank

Machine description: New Type 4 hydrogen tank liner assembly line

Main Process

- Robot automatic loading hydrogen tank liner
- Sensor measuring dimension
- Plasma cleaning
- Gluing

