



Fronius International GmbH

As a technology leader, Fronius discovers, develops and implements innovative methods to monitor and control energy for welding technology, photovoltaics and battery charging. The proprietor-owned company, headquartered in Pettenbach, Austria, was established in 1945 and has 37 subsidiaries on five continents. In 2022, the company employed 6,100 people worldwide. Along with their headquarters in Pettenbach and further locations in Wels, Thalheim, Sattledt and Steinhaus, the company also has a production location in the Czech Republic.

At their Sattledt location, Fronius manufactures industrial welding systems, inverters for photovoltaic systems and battery charging for industrial trucks. In 2022, the existing production hall was expanded by 28,000 m² (301,000 ft²) with the addition of another hall. Fronius selected an autonomous transport solution by KNAPP, the Open Shuttles, to serve as the connecting link to the new hall.



Location	Sattledt, Austria
Application	Autonomous mobile robots supply check stations and production cells
System	Open Shuttle and Open Shuttle Fork (11 Open Shuttle robots transport to the check stations, 16 Open Shuttle Fork robots transport pallets)
Paths traveled	~ 400 km/day (250mi/day) with the Open Shuttle Fork fleet
Check stations	40
Pallet locations	409
Software	KiSoft FCS
Implementation	2022

We selected an automated transport solution because we wanted to eradicate errors, stabilize processes and increase standardization.

Peter Hubl
Team Leader, Logistics Automation Maintenance
Fronius International GmbH



Open Shuttle Fork optimally supplies production with pallets

The challenge

At the Sattledt location, the existing production hall of 41,000 m² (441,000 ft²) was expanded by a 28,000 m² (301,000 ft²) hall. The company wanted a solution to connect the new hall and to flexibly supply the production cells with pallets. Additionally, they wanted an automated connection between the production cells and goods-in and goods-out.

The solution had to fulfill the following requirements:

- ★ Transport pallets weighing up to 1,000 kg (2,200 lb)
- ★ Supply the production cells with pallets
- ★ Connect the halls, which are separated by fire doors
- ★ Connect goods-in with the production cells and the central shipping warehouse
- ★ Handle high traffic volume
- ★ Company can make their own changes for the location and when expanding the production cells
- ★ Scalable solution

New flexibility for pallet transport

The compact construction and agile maneuverability of the Open Shuttle Fork were prime factors in the decision to use the autonomous mobile robots. Their design made it possible to reduce the width of aisles, gaining additional space for manufacturing.



16 Open Shuttle Fork robots form the connecting link between goods-in, the production cells and goods-out. They transport load carriers such as EUR-pallets, plastic pallets and trash containers weighing up to 1,000 kg (2,200 lb).

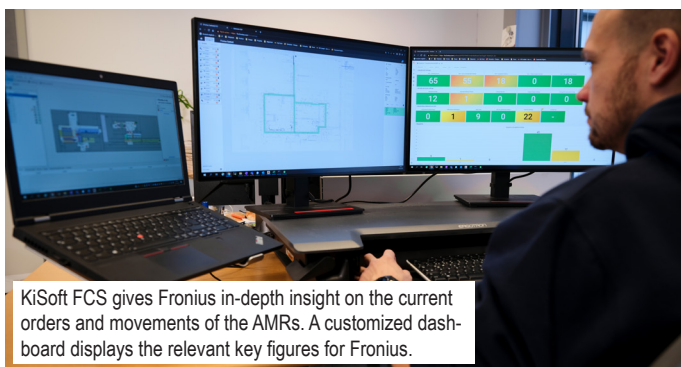


KiSoft FCS controls the entire fleet of Open Shuttle Fork robots. The orders are booked in and out using an order management system at the pallet stations.

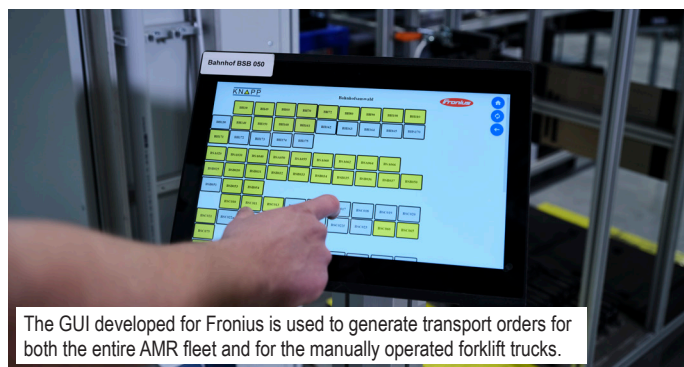
The KNAPP solution at a glance

Innovative software for automated pallet transport

The software KiSoft FCS (Fleet Control System) provides centralized control of the robots. It connects to the customer system through an interface and controls the fleet, managing the storage and retrieval movements of the pallets as well as the supply to the production cells. Thanks to KiSoft FCS, Fronius is able to adapt their paths and add stations. This includes a dashboard that visually depicts all the key transport figures and means that Fronius always has an overview of all the robots in operation.



KiSoft FCS gives Fronius in-depth insight on the current orders and movements of the AMRs. A customized dashboard displays the relevant key figures for Fronius.



The GUI developed for Fronius is used to generate transport orders for both the entire AMR fleet and for the manually operated forklift trucks.

Tablets for generating orders

From the central warehouse, production orders are picked to pallets and placed in the pickup station, where the pickup job for the pallet is entered on a stationary tablet. The tablets feature a GUI that was developed by KNAPP especially for Fronius. The Open Shuttle Fork picks up the pallet and brings it to manufacturing.

Management of automated and manual orders in one system

KiSoft FCS and its user interfaces are not just limited to automated pallet transport; the forklift drivers also have tablets and can book and accept orders in the same system. This provides extremely flexible coordination between automated and manual transport activities.



The forklift trucks are equipped with tablets.



Since we've been using the Open Shuttle 100 for a few years, we decided to add the Open Shuttle Fork because they can both run together on the same paths. We are now able to supply materials to production much more efficiently.

Peter Hubl
Team Leader, Logistics Automation Maintenance,
Fronius International GmbH

Automated pallet transport

The Open Shuttle Fork robots handle a wide variety of transport jobs at Fronius. Not only do they supply the production cells with materials and semi-finished products, they also transport the finished products to the goods-out warehouse and handle special jobs.

1. Transport from goods-in to the production cells

Goods coming from the central warehouse are put down in the pallet station in the existing hall and pickup orders are then booked in the system. The autonomous mobile robots then pick these pallets up and transport them to production.



1. Transport jobs of all types are handled by the 16 Open Shuttle Fork robots.

2. Onward transport of parts to the next production cell

Pallet storage locations are located right next to the individual production cells. The Open Shuttle Fork picks up the semi-finished products and transports them to the next production step.

3. Transport of finished parts to goods out

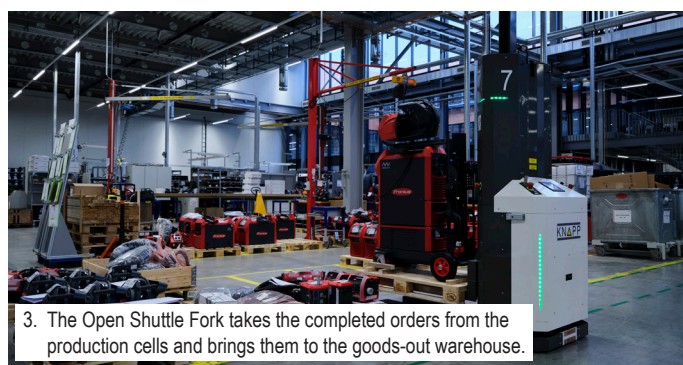
The completed machines and devices are also supplied on pallets to the pickup locations. The Open Shuttle Fork transports them to the goods-out warehouse, where they are put down, packed and then stored in the automated pallet warehouse.

4. Transport of trash containers

The Open Shuttle Fork also handles special transport jobs, such as transporting the trash containers to their storage location.



2. Delivery to pallet flow racks is also possible.



3. The Open Shuttle Fork takes the completed orders from the production cells and brings them to the goods-out warehouse.



4. At Fronius, trash containers are transported automatically.



The finished inverters are run through a series of short-term and continuous load tests before they are packaged. Thanks to the mobile robots, these transport movements are timed perfectly and carried out fully automatically.

Open Shuttles for perfectly timed transport of inverters

Since 2020, the Open Shuttles have played an integral part in producing the latest generation of Fronius inverters. They handle the timed transport of the inverters to the check stations and packing lines and provide Fronius with a high degree of flexibility.



Smart just-in-time order management

The orders are assigned to the Open Shuttles by the smart fleet management system. The system makes sure that an Open Shuttle is always available for the transport job when an inverter is completed or when a check process is completed. If the inverter does not pass the test, a special transport to the next work station is arranged automatically.

11 Open Shuttles connect directly with the production lines, the check stations and the packing lines. The Open Shuttles supply the check bays with inverters from the production lines for short-term and continuous load tests and bring them to the packing line once the tests have been successfully passed.

Timed transport processes

1. From the production line to the short-term test

The inverters are produced on the production lines and mounted on carrier plates. When an inverter is completed, it is picked up from a short conveyor by an Open Shuttle and transported to a free bay for automatic short-term testing.

2. Transport between the test bays

After the short-term test is successfully completed, the Open Shuttle receives a transport order to pick up the inverter on its carrier plate and bring it to the test bay for continuous load testing.

3. Transport from the testing bays to the packing line

Once the inverter passes the continuous load test, the Open Shuttle picks up the inverter and automatically brings it to the packing line. There the inverter is dismantled from the carrier plate and packed in cartons. The completed inverters are picked to shipping pallets before being picked up and transported to the goods-out warehouse.

4. Transport of empty carrier plates to the manufacturing line

The return of the empty carrier plates is also carried out automatically by the Open Shuttles. They pick up the carrier plates at the packing line and return them to the production line.

5. Transport to the reworking station

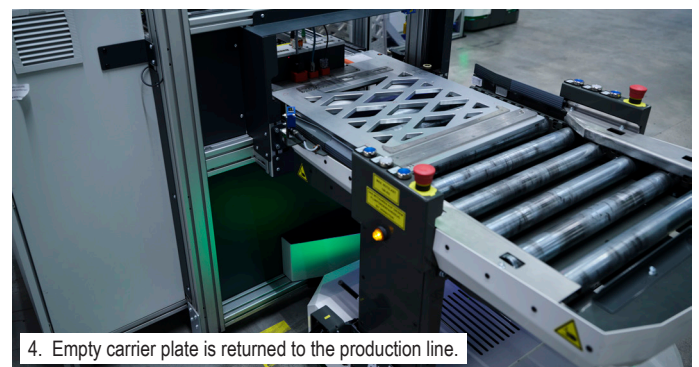
If any inverters do not pass short-term or continuous load tests, they are automatically transported to the reworking station for work and are finally picked up again and sent to testing.



3. After being packed, inverters are picked onto pallets, picked up and transported to the goods-out warehouse.



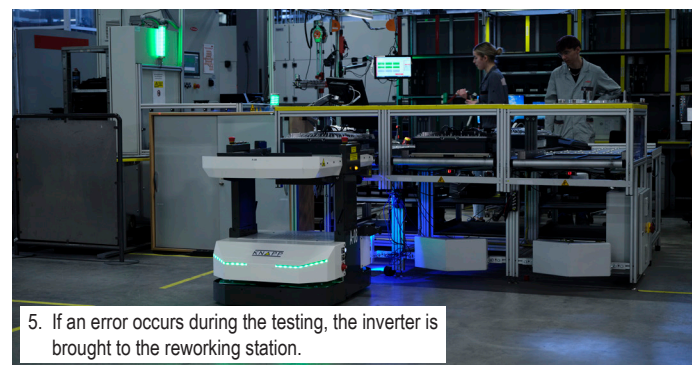
1. Transfer of the inverter into the testing bay for short-term tests.



4. Empty carrier plate is returned to the production line.



2. The Open Shuttles supply 40 testing bays.



5. If an error occurs during the testing, the inverter is brought to the reworking station.

Another great feature of the system is the efficient battery management. The Open Shuttles charge their batteries when there are no transport jobs. The charging device for the Open Shuttles is naturally a Fronius product, reflecting the long-standing partnership between the two companies.

Peter Hubl
Team Leader, Logistics Automation Maintenance
Fronius International GmbH

Best partner for a development project

KNAPP and Fronius have worked together as partners over the long term. For some years now, Fronius charging devices have been used for the Open Shuttles. With this new project, the two Austrian companies have again proved that putting their technological expertise together is a winning combination. The first commissioning of the Open Shuttle Fork is a break-through for both companies in terms of automated transport. *"We are thrilled to have implemented the first Open Shuttle Fork project with a company focused on sustainability and involved as a supplier in the production of photovoltaic systems. Fronius is also the first customer to have their employees trained by KNAPP to be able to install the Open Shuttle Fork themselves,"* states Christian Brauneis, Vice President, KNAPP Industry Solutions.

Fronius is planning to connect their automated high-bay racking system for pallets with the Open Shuttle Fork in the near future. Further uses for the Open Shuttles in production are being tested.



The rechargers for the Open Shuttles are a Fronius product.



Efficient energy management means that the AMR automatically moves to the charging station when there are no immediate transport jobs.



We chose KNAPP because their system allows us a very high level of autonomy. The new automation system sets us up for making changes at our location independently, as well as being able to expand our production cells. This makes us faster and more cost-efficient in our overall operation than other systems.

Peter Hubl
Team Leader, Logistics Automation Maintenance,
Fronius International GmbH

Main advantages of the Fronius solution

1. Use in mixed traffic of automated and manual vehicles

Open Shuttles integrate easily and quickly into the existing infrastructure. Even when traffic is heavy with people and manual and automated vehicles, they navigate safely through the warehouse and production areas.

2. Easy adaptation of routes and processes

The KiSoft FCS fleet control system allows Fronius to manage routes, processes and stations quickly and easily. Additional AMRs are also easy to integrate.

3. Space-effective transport solution

The special construction of the Open Shuttles makes them quite agile, able to turn on a dime and move sideways. This also means they can be used without adapting the infrastructure.

4. Efficient energy management

When there's nothing to do, the Open Shuttles kick back and use the time to recharge. The robots can work up to 8 hours on one charge.

Get insights into
the solution in
this video



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