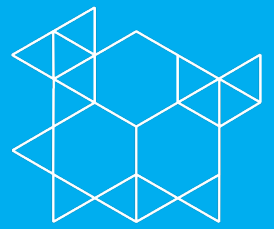
AGV Presentation

Introduction & Main References

SYSTEM Logistics

A MEMBER OF THE KRONES GROUP



AGV TECHNOLOGY

AGV: AUTOMATED GUIDES VEHICLES

Benefits

SHORT ROI

2/3 Years in case of multiple shift operation

REDUCED PRODUCT & FACILITY DAMAGE

- **No damages** to goods
- **No damage** to infrastructures
- **No** destination errors
- **No** delivery failures

COST EFFICIENCY

Feedbacks from the Customer after an AGV installation.
SAVINGS:

- NO personnel
- NO trade-unions
- NO absenteeism
- NO mistakes
- NO wastage
- NO stops in production lines
- NO extra-hours, easy to work on Saturday/holidays

FLEXIBILITY

- **Compatibility** to existing structures, transport of different material
- **Easy adoption** to layout-changes, to local and/or timewise speed leading to lower maintenance
- **Easy reconfiguration** of routes or addition of

SAFETY

- Avoid areas with high number of manual forkliftsSafety devices which allows the AGV to **stop instantly**
- Lights **alert and sirens** can be useful to advise workers oh the oncoming vehicle

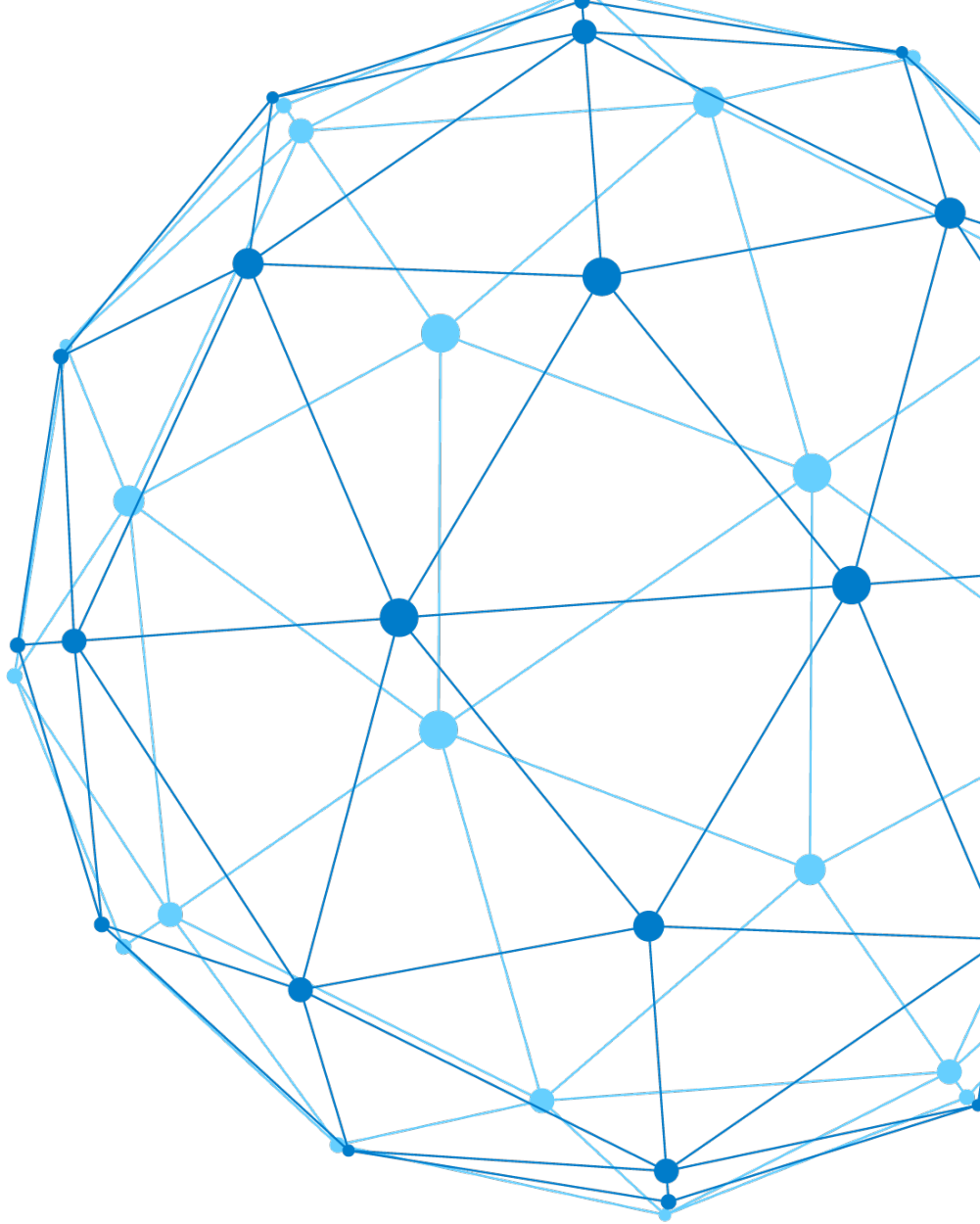
COMPLETE INVENTORY MANAGEMENT

- **Optimization of transport flows** in accordance with vehicle fleet, traffic and missions
- **Efficient a location**
- Better **inventory balance**
- Improved **stock management precision**
- Position and status of AGV are **constantly tracked and controlled** by a computer system
- AGV's control system can integrate with **Warehouse Management Systems (WMS)**

AGV: AUTOMATED GUIDES VEHICLES

General deliverables of a AGV system

- Vehicles
- Battery charging system
- Fleet management system
- Safety



PRODUCT RANGE

RANGE OF PRODUCTS

COUNTERBALANCED

OUTRIGGER

LIGHT

SHARK

CONVEYOR

SPECIAL VEHICLES

COUNTERBALANCED FORK VEHICLES

COUNTERBALANCED FORK VEHICLES

CP MAXI

3000 kg up to 2250 mm

2000 kg up to 8600 mm

CP MEDIUM COMPACT

1200 kg up to 9000 mm

CP MINI

1200 kg up to 2800 mm

CP VNA

1200 kg up to 10000 mm

CP MAXI SINGLE-DOUBLE

4000 kg up to 1400 mm

3000 kg up to 6600 mm

COUNTERBALANCED FORK VEHICLES

MAIN APPLICATIONS

- Manage End-Of-Production lines and raw material line infeed
- Over stacking of loading units, block storage and different types of rack storage
- Autonomous picker

ADVANTAGES

- Maneuvered in narrow spaces
- Suitable for Very Narrow Aisle Racks
- Used to handle different loading units at different height

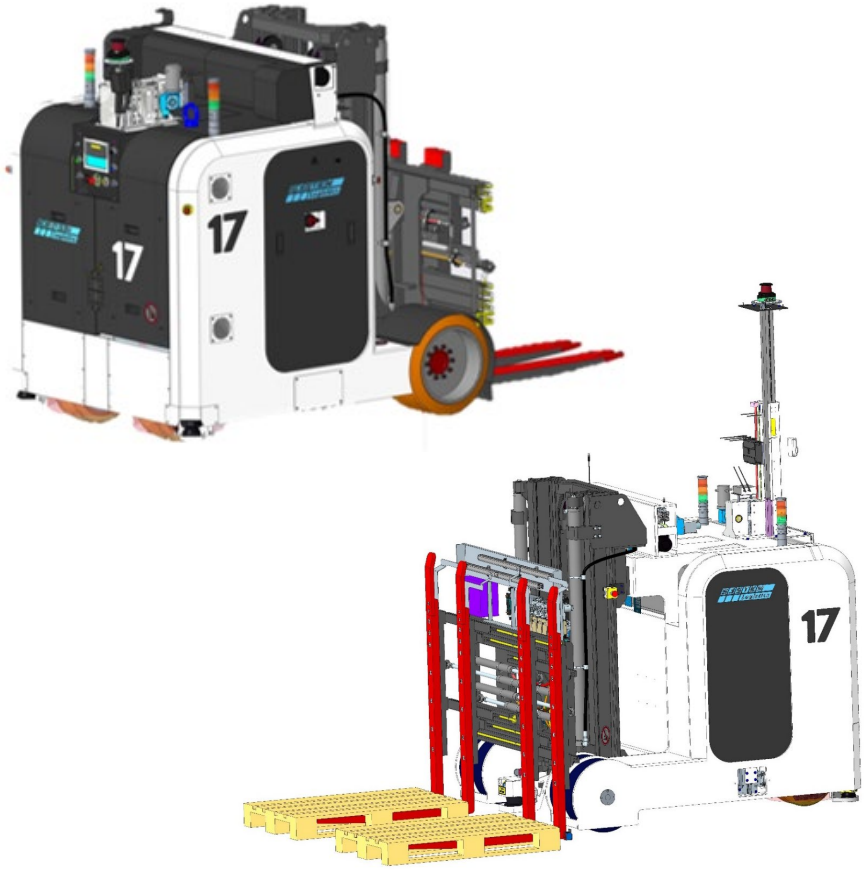
VERSIONS

- Single/Double pallet movement
- Equipped with different accessories based on the requirements
- Maximum load capacity of *4500 kg* and maximum lifting height of *10 m*

COUNTERBALANCED FORK VEHICLES

AGV ATL for automatic truck loading

Vehicle type	Counterbalanced
Capacity LU	6,600 lbs (2 x 3,300 lbs) 3,000 kg (2 x 1,500 kg)
Loading device	Single/Double Device attached (4 forks)
Maximum lifting elevation	157'' (4,000 mm)
Vehicle weight with battery	16,000 lbs (7,256 kg)
Minimum dock capacity	25,000 lbs (11340 kg) – only North America Trailers
Front / Rear / Lateral safety devices	PLS safety device
Guiding type	Laser Navigation
Battery type	Lithium-Ion Battery
Battery charging system	Opportunity Charging
Supported pallet types	CHEP, GMA 40'' x 48''
Loading patterns	Narrow-narrow (straight) – pin-wheeled

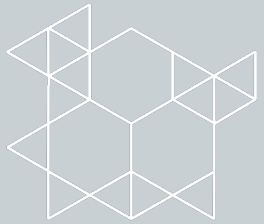


COUNTERBALANCED FORK VEHICLES

Plzensky Prazdroj a.s. (Asahi Breweries Europe Group) – Radegast Brewery Nosovice, Czech Republic
AGV block storage for beer producer

- 16 AGV
- 11.000 pallet locations
- IN/OUT 3.900/3.900
  IN/OUT pallet/day

FIND OUT MORE



OUTRIGGER VEHICLES

OUTRIGGER VEHICLES

OUTRIGGER MAXI

2500 kg up to 3200 mm

OUTRIGGER MAXI XL

4500 kg up to 4700 mm

OUTRIGGER VEHICLES

- **MAIN APPLICATIONS**
  - Connect different types of automation systems
  - Storage of heavy loading units
- **ADVANTAGES**
  - Reduced maneuvering spaces
  - Low transmitted load on the floor
  - Overstacking activities
- **VERSIONS**
  - Single, double or triple pallet
  - Equipped with different accessories based on the requirements
  - Maximum load capacity of *4500 kg* and maximum lifting height of *3,2 m*

CCHBC - Edelstal, Austria

Coca-Cola Hellenic Bottling Company

- Multiple depth for high turnover 12 m
- 15 F.R.S. shuttles with digisat
- 29,520 pallet positions
- 30 dock doors
- 6 single pallet entry/exit with lifts
- 9 SVL shuttles
- 10 AGVs for connection to production
- 1 Sequencing system for shipments
- 150+150 pallets/h IN+OUT

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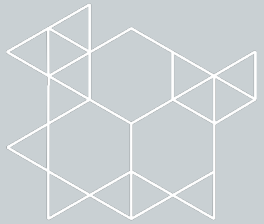


LIGHT VEHICLES

LIGHT VEHICLES

LIGHT

1200 kg up to 1200 mm

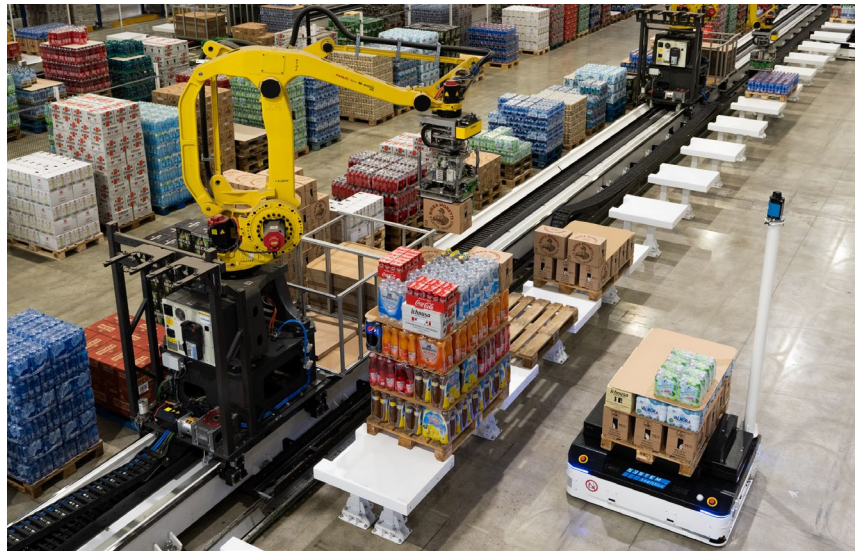
LIGHT VEHICLES

- **MAIN APPLICATIONS**
  - Management of different product on Euro pallet base (finished product, semi-finished product)
  - Delivery of raw materials to production lines with limited maneuvering space
  - Ground transfer of single-reference pallets to other systems
- **ADVANTAGES**
  - Reduced footprint and width
  - Low transmitted load on the floor
  - Fully electrical vehicle (no hydraulic components, less maintenance)
- **VERSIONS**
  - Single pallet
  - Maximum load capacity of *1200 kg* and maximum lifting height of *1,2 m*

Coca-Cola Hungary

Light Vehicles

- 2 AGV Light
- 2 AGV Shark
- 3 anthropomorphic robots
- 1 sled
- 450-600 Case/h (depends on order profile)
- 20 High Rotation SKUs

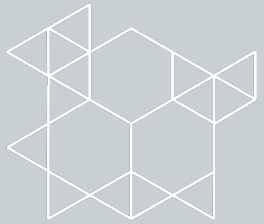


FIND OUT MORE

CONAD NORD-OVEST – Montopoli, Italy

Sortmate

- 240 stores
- ≈ 43,000 packages/day
- 4 sleds
- 12 Robots
- 20 AGVs



SHARK VEHICLES

SHARK VEHICLES

SHARK

1500 kg

SHARK VEHICLES

- **MAIN APPLICATIONS**
  - Connect the production lines with the automatic warehouse
  - Handle products between the various internal conveyor systems
  - Autonomous Picker
- **ADVANTAGES**
  - Handle loads without using fixed structures
  - Optimized maneuvering space
- **VERSIONS**
  - Equipped with roller tables, chains or lifting devices of various type
  - Maximum load capacity of *1200 kg* and maximum conveyor height of *550 mm*

ITALTRANS – Calcio, Italy

Stacker Cranes, Mini-load & PickMate

- 10 stacker cranes (30 meters height)
- 30.200 pallet locations
- 16 AGV Light
- 4 AGV Shark
- 9 anthropomorphic robots (3 sleds)

FIND OUT MORE

SHARK VEHICLES

SHARK: Automated Guided Vehicles

FIND OUT MORE

CONVEYOR DECK VEHICLES

CONVEYOR DECK VEHICLES

CONVEYOR DECK 2 LU

2x1500 kg

CONVEYOR DECK 4 LU

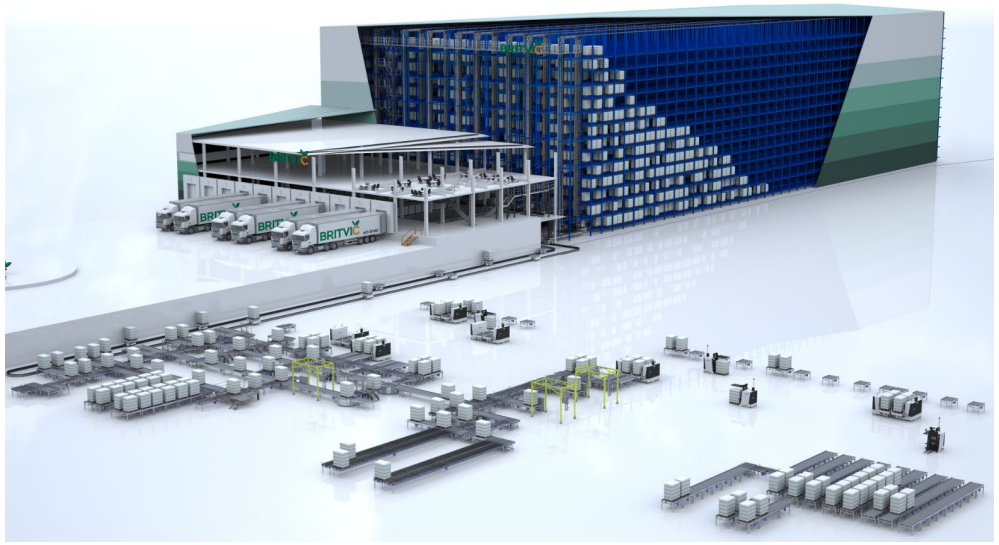
4x1500 kg

CONVEYOR DECK VEHICLES

- **MAIN APPLICATIONS**
  - Connect the operations between end-of-line handling and other system automations
  - Autonomous Picker
- **ADVANTAGES**
  - Capable of carrying loading units at the same time and feature a high operational capacity
  - Optimized maneuvering space
  - Provide high load stability
- **VERSIONS**
  - Multipallet movement (2/4)
  - Equipped with roller tables, chains or lifting devices of various type
  - Maximum load capacity of *6000 kg* and maximum conveyor height of *600 mm*

BRITVIC- Rugby, UK

- Single and Double Depth Storage 33,000 pallets
- 9 stacker cranes h= 32 m.
- 33 SVL
- 6 Quad AGV
- 4 CP Mini AGV



FIND OUT MORE

SPECIAL VEHICLES

SPECIAL VEHICLES

LIFT DECK

10 T 10000 kg | 15 T: 15000 kg

AGV 2 PALLET FORKED QUAD

2x1500 kg up to 1400 mm

AGV 1 PALLET FORKED QUAD

1500 kg up to 1400 mm

AGV 1 PALLET CONVEYOR DECK STEER DRIVE

1000 kg

AGV BILATERAL

CONVEYOR 1LU

SPECIAL VEHICLES

MAIN APPLICATIONS

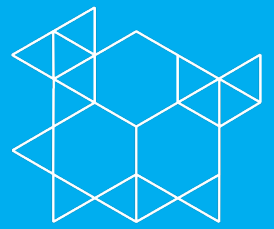
- Special application in food & beverage industry, tire industry, ceramic industry, glass industry, etc.
- Heavy load transportation
- LUs alternative from standard pallets (i.e.: coils, cages, container, carts,..)

ADVANTAGES

- Dedicated development based on customer's requirements
- Capability to move in narrow aisles/reduced spaces

VERSIONS

- Multipallet movement (1/2/4)
- Equipped with lifting devices of various type
- Maximum load capacity of *15.000 kg*



CHARGING SYSTEMS TECHNOLOGIES

OPPORTUNITY CHARGING WITH LITHIUM BATTERIES

Fast and maintenance free

- One battery/AGV with no battery replacement (charging area space optimized)
- Maintenance-free battery
- Zero gas emission battery
- Fast charging cycle (6-8%/hour) with high energy efficiency
- Extended life time (at least 5 years) for battery

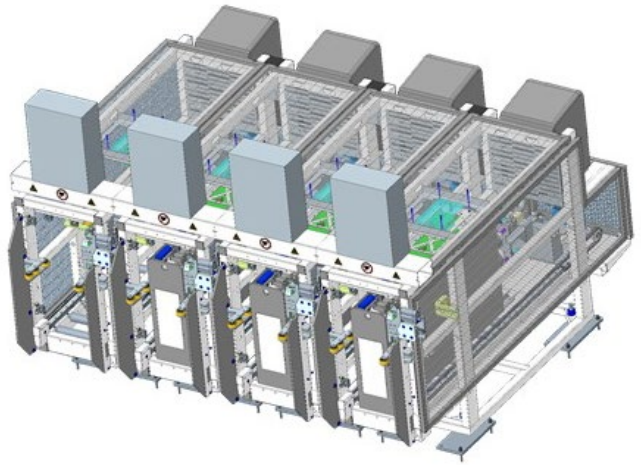
CASE HISTORY

MIN 1.20

AUTOMATIC BATTERY EXCHANGE WITH PURE LEAD BATTERIES

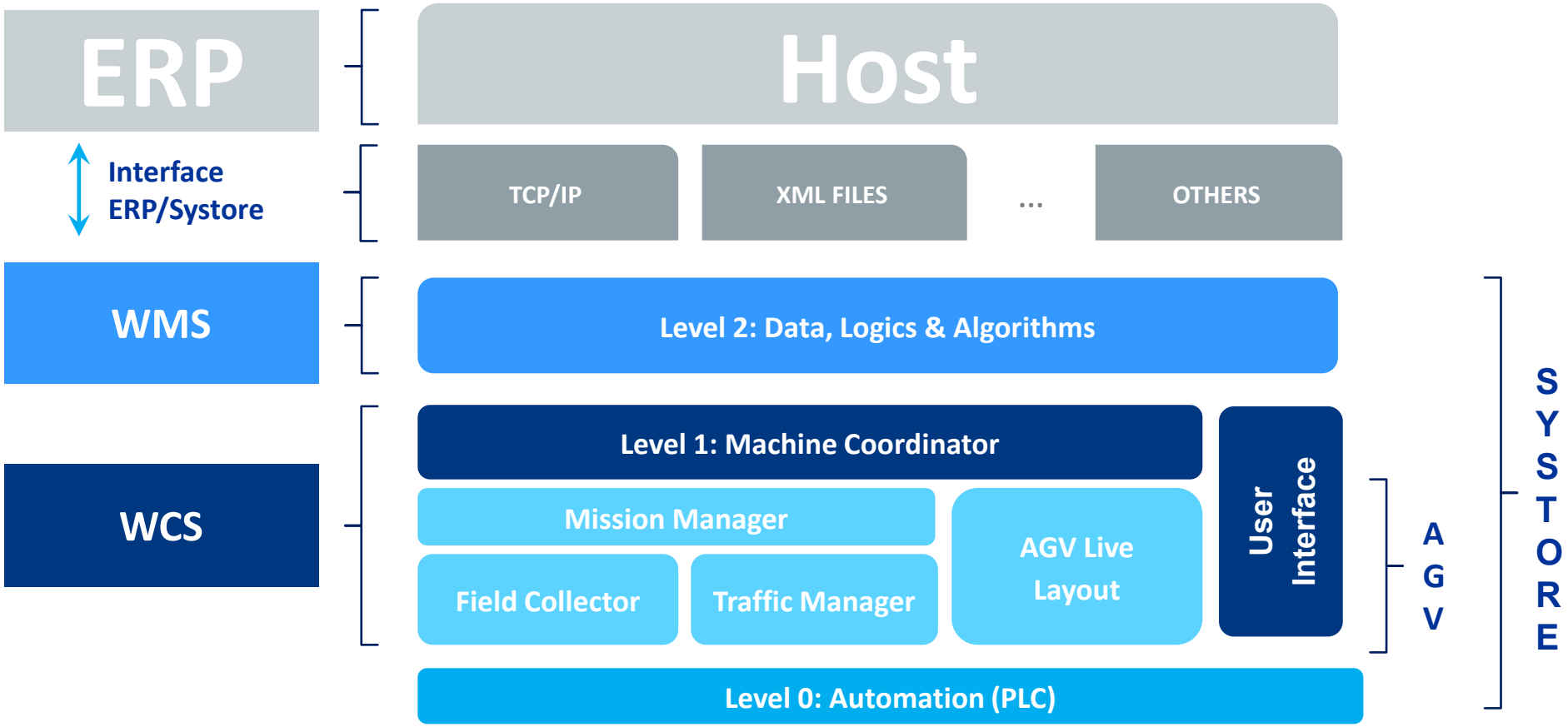
Fast and maintenance free

- Completely automatic system for battery exchange with no need of human intervention
- Reduced number of exchange operation (once over a shift)
- Maintenance free batteries
- Cheap solution compared with opportunity charging
- CASE HISTORY



SYSTORE® AGV

SYSTORE® AGV Architecture

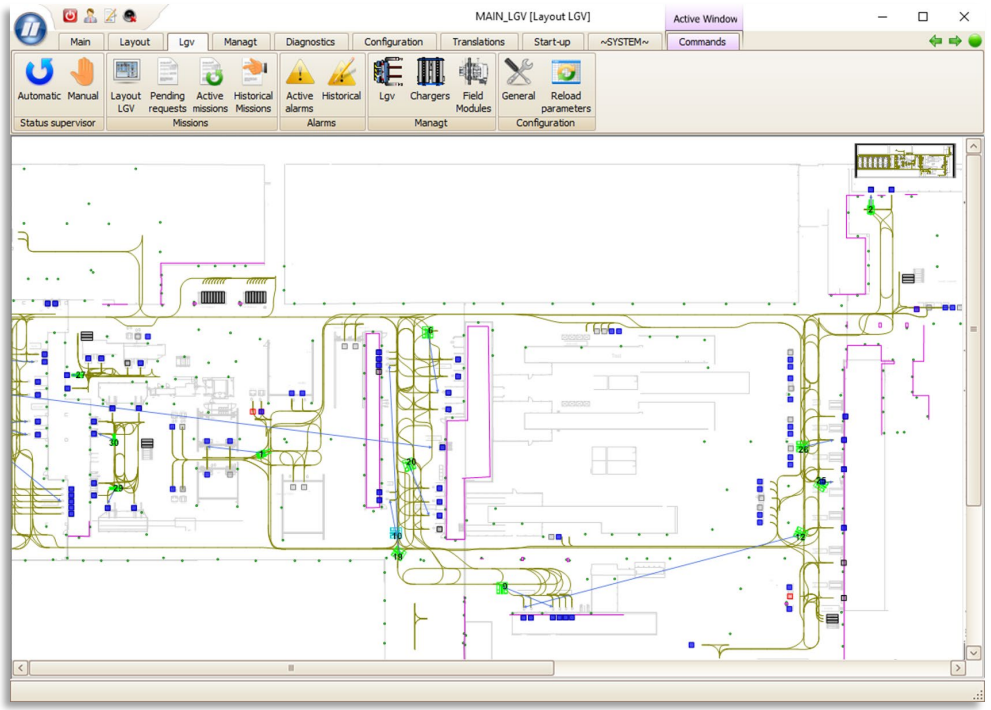


SYSTORE® includes dedicated AGV modules

AGV Live Layout | Mission Manager | Traffic Manager | Field Collector

All AGV functionalities can be accessed through the AGV Layout interface:

- Automatic and Manual mode
- Parameters configuration
- AGV routing and their status on real time (operations, alarms…)
- AGV machinery diagnostics (Battery Charger, lines…)
- Active and Historical information
- Alarms triggered by the AGVs during their operativity



SYSTORE® includes dedicated AGV modules

AGV Live Layout | **Mission Manager** | Traffic Manager | Field Collector

The Mission Manager is the main component of Systore AGV, capable to:

- Generate transport missions for AGVs
- Coordinate AGV movement (pick up, drop off…)
- Dynamically distribute vehicles workload and tasks
- Diagnose the automation machinery related to AGV system
- Set the automatic/manual mode

The Mission Manager can be integrated with Systore WMS or directly to external ERP systems (TCP/IP protocol).

SYSTORE® includes dedicated AGV modules

AGV Live Layout | Mission Manager | **Traffic Manager** | Field Collector

The Traffic Manager is a component of SYSTORE® AGV used to route and coordinate the AGV vehicles.

This module is capable to calculate the best route for each AGV, according to their position and availability (route optimization).

The Traffic Manager also analyzes the warehouse layout and paths to prevent deadlock situations.

Traffic Manager exchanges messages with each AGV vehicle in real time to track its position and status (battery charge, vehicle operations…).

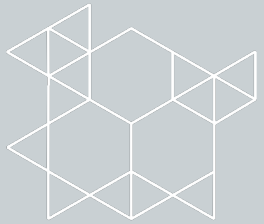
SYSTORE® includes dedicated AGV modules

AGV Live Layout | Mission Manager | Traffic Manager | **Field Collector**

The Field Collector is a SYSTORE® module capable to read/write data directly on automation PLC:

- AGV / line interface (pallet ready, line full, SSCC code…)
- Automatic doors management
- Traffic lights
- Fire alarms
- …

The Field Collector can be easily connected to the automation PLC, and it natively supports different PLC protocols (Omron, Siemens, Allen-Bradley…).



SAFETY

AGV SAFETY FEAUTERS

- SL AGV systems are designed to comply with or exceed the international safety standard requirements

ISO 3691-4:2020 “Industrial trucks — Safety requirements and verification — Part 4: Driverless industrial trucks and their systems”, on which is based the CE marking as per Machinery Directive 2006/42/EC

by means of:

- devices on vehicles,
- proper design and arrangement of operational components,
- customer staff training.

DESCRIPTION	RULE
The supply will bear the CE marking in accordance with the applicable EC Directives.	
Machine Directive	2006/42/CE
EMC Directive	2014/30/UE
“Electrical material intended to be used within certain voltage limits” and subsequent amendments and integrations."	2014/35/UE
In addition, particular attention was paid to the following documents:	
"Safety of machinery -- General principles for design -- Risk assessment and risk reduction"	EN ISO 12100
“Safety of machinery. Safety distances to prevent the danger zone being reached by the upper limbs”	EN ISO 13857
“Safety of machinery. Minimum spaces to prevent crushing parts of the body.”	EN ISO 13854
“Safety of machinery. Emergency stop devices, functional aspects. Design principles”	EN ISO 13850
“Safety of machinery – Safety-related parts of control systems - Part 1: General design principles.”	EN ISO 13849-1
“Safety of machinery – Safety-related parts of control systems - Part 2: Safety of machinery – Validation.”	EN ISO 13849-2
"Safety of machinery - Prevention of unexpected start-up"	EN ISO 14118
"Safety of machinery – Ergonomic design principles - Part 1: Terminology and general principles"	EN 614-1
“Safety of machinery -- Guards -- General requirements for the design and construction of fixed and movable guards”	EN ISO 14120
"Safety of machinery -- Interlocking devices associated with guards -- Principles for design and selection"	EN ISO 14119
"Safety of machinery. Electrical equipment of machines. Part 1: General Rules. "	EN 60204-1
"Stacker cranes – Safety requirements"	EN 528
"Safety of industrial trucks - Electrical/electronic requirements"	EN 1175
"Continuous handling equipment and systems – Safety and EMC requirements for equipment for mechanical handling of unit loads"	EN 619
"Basic requirements for the design and the specifications of pneumatic systems"	EN ISO 4414
"Basic requirements for the design and the specifications of hydraulic systems"	EN ISO 4413
"Safety of machinery - Human body measurements - Part 1: Principles for determining the dimensions required for openings for whole body access into machinery"	EN 547-1
"Safety of machinery - Human body measurements - Part 2: Principles for determining the dimensions required for access openings"	EN 547-2
"Safety of machinery - Human body measurements - Part 3: Anthropometric data"	EN 547-3
"Safety of machinery - Two-hand control devices - Functional aspects - Principles for design"	EN ISO 13851
"Safety of machinery — Positioning of safeguards with respect to the approach speeds of parts of the human body"	EN ISO 13855
"Robot e attrezature per robot - Requisiti di sicurezza per robot industriali - Parte 2:Sistemi ed integrazione di robot"	EN ISO 10218-2
"Driverless trucks and their systems"	EN ISO 3691-4
"Performance data of storage and retrieval machines, reliability, availability"	FEM 9.221
"Rules for the acceptance and availability of installations with storage and retrieval machines and other equipment"	FEM 9.222
"Rules for the design of storage and retrieval machines; Structures"	FEM 9.311
"Rules for the design of storage and retrieval machines; Mechanisms"	FEM 9.512
"Calculation principles of storage and retrieval machines – Tolerances, deformations and clearances in the high-bay warehouse"	FEM 9.831
"Basis of calculations for S/R machines, tolerances, deformations and clearances in automatic small parts warehouses (not silo design)"	FEM 9.832
"Performance data of storage and retrieval machines; Cycle times"	FEM 9.851

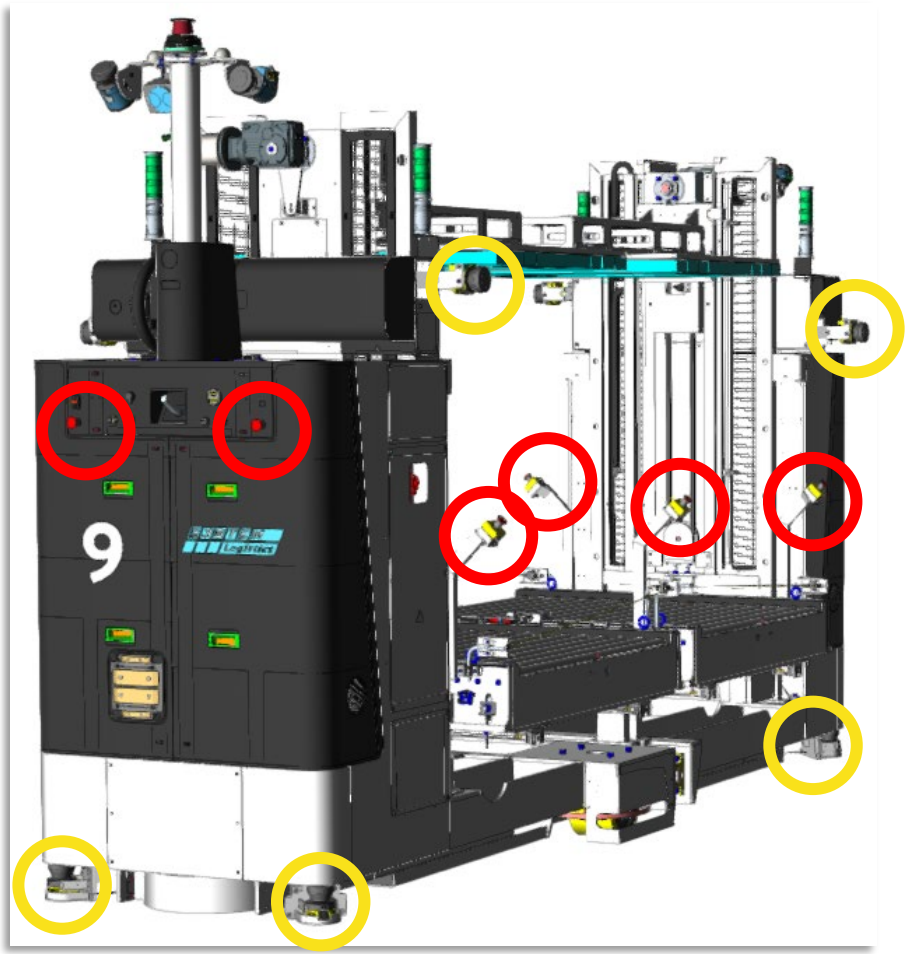
AGV SAFETY FEAUTERS

SAFETY SYSTEM

➢ They constantly monitor if something isn't working as expected in order to stop the AGV vehicle in a safe way when needed and prevent any collision with an object or a person.

➢ The main safety components in an AGV are:

- Safety PLC
- Braking system
- Path Control
- Safety Scanner
- Emergency Stop Buttons
- Warning Lights and Audible Warning/Alarm Signals



Picture as example, additional equipment included but not visible

Block Storage Solutions

Highlights

- Increasing safety
- Designed for brown field and green field
- Easily fit into industrial building
- No fixed infrastructures
- Maximize storage capacity
- Direct pick from production to shipping area
- Siple stacking and/or pyramid stacking
- Quick ROI

Performances & Numbers

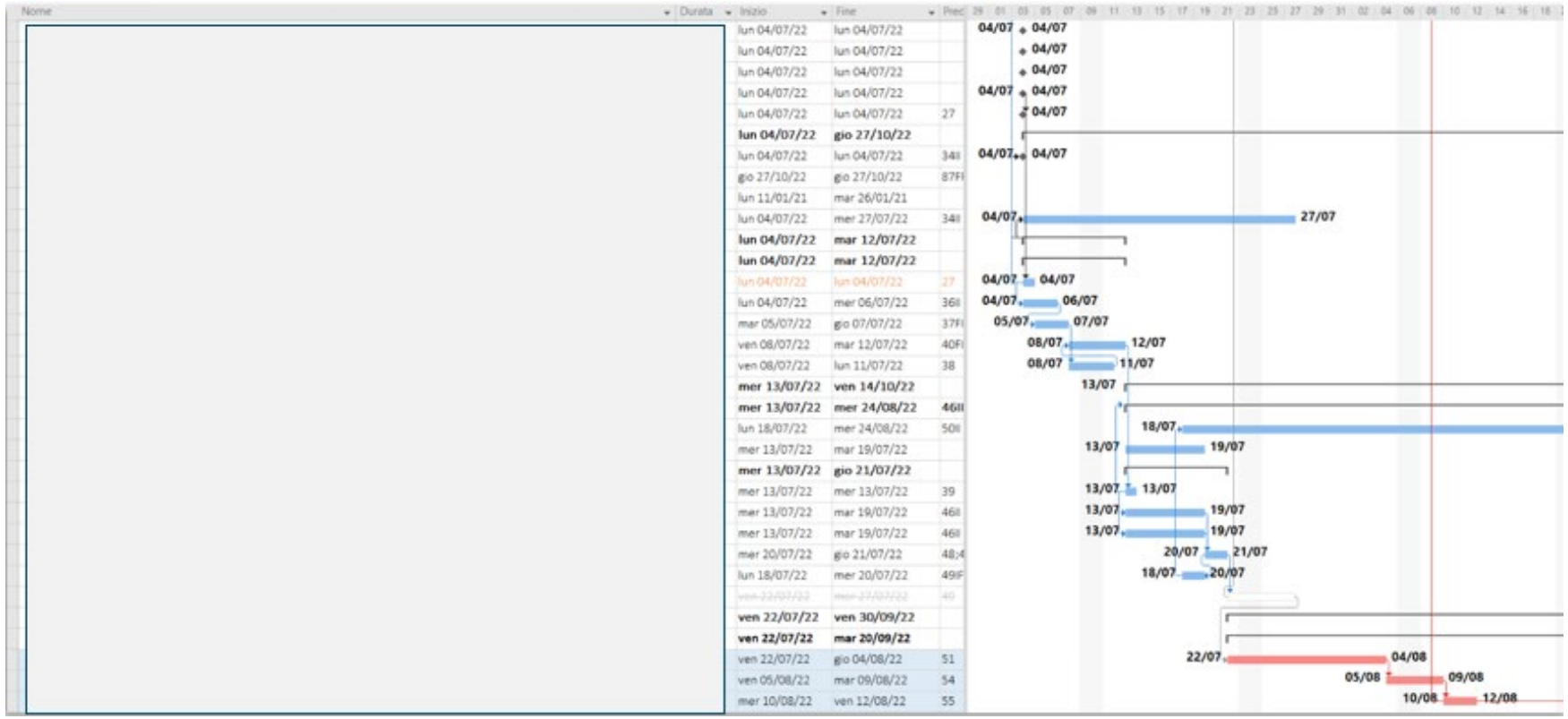
- Stacking up to 6 meters with finished goods
- Managing 100% of Raw Materials and Finished Goods
- No manual intervention

AGV INSTALLATION process

Project schedule | Installation & commissioning | Ramp Up system | Hand over customer

Before being executed, all projects are subjected to detailed planning of all the activities planned on site:

- Definition of the project team
- Technical kick off
- Definition of DOR for monitoring



AGV INSTALLATION process

Project schedule | **Installation & commissioning** | Ramp Up system | Hand over customer

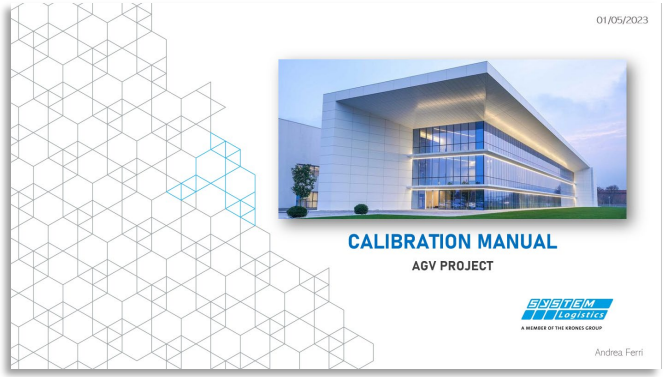
The main installation phases of AGV system are:

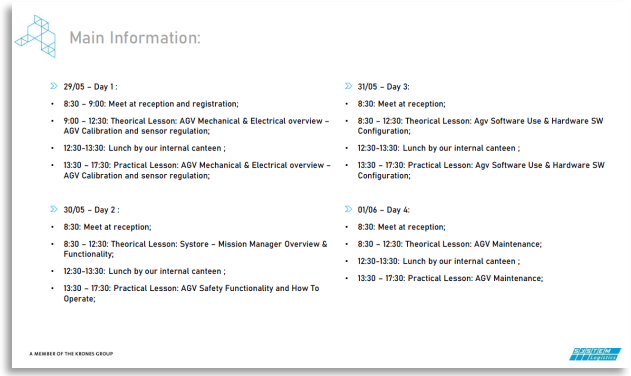
- Safety
- Installation of mechanical and electrical parts
- Fleet commissioning
- Path Control
- Software Testing SAT
- System security checks

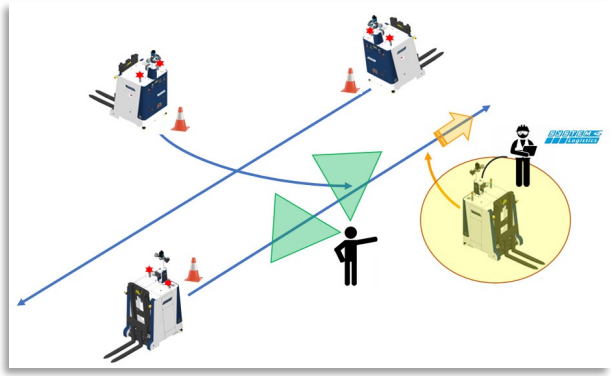
AGV INSTALLATION process

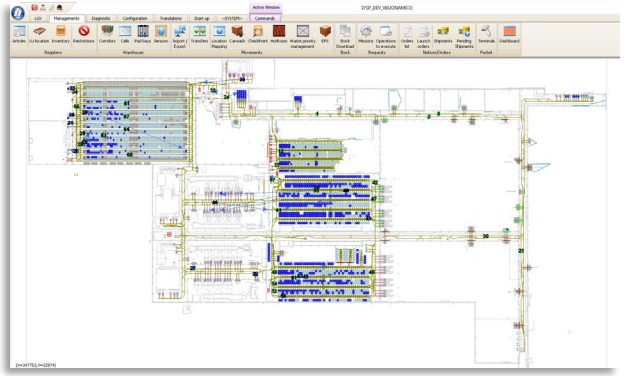
Project schedule | Installation & commissioning | **Ramp Up system** | Hand over customer

- Defined "ramp-up" plan to put the system into production
- Documentation and training operators
- Performance Test system
- Taking into use system customer









AGV INSTALLATION process

Project schedule | Installation & commissioning | Ramp Up system | Hand over customer

Acceptance phase:

Complete the functional performance testing, resolve outstanding issues

Embedded Engineer

- Is a highly-trained engineer optionally deployed on-site by the Contractor to set-up the local resource in terms of training and organization of the works
- Usually for a period ranging from 6 to 24 months
- The area of competence covers the whole equipment.

AGV INSTALLATION process – Customer Training

CUSTOMER TRAINING 1

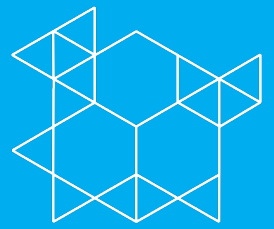
Training courses:

- Software training courses on-site and in System Logistics h.q.
- Maintenance personnel specific training courses
- Safety regulations enforcement and compliance
- Basic and advanced courses for any level of personnel

CUSTOMER TRAINING 2

Personnel and maintenance skills / performance evaluation:

- The complexity of some equipment delivered by the System Group and/or third parties requires for skilled personnel to be deployed in key-roles to ensure reliable and constant performance.
- The level of skills and training for specific tasks are part of contractual agreements with the Customer, as they heavily influence overall performance.
- Tasks and workflow planning for productivity improvement
- Evaluation of team performance according to contractual skills



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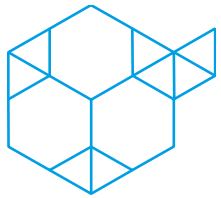

THE HEART OF INTRALOGISTICS

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