AGV MiR100 ErmaSmart (with UR eSeries collaborative arm)
Automation of internal logistics flows

ErmaSmart #0

Description of the system

The ErmaSmart MiR100 AGV is a mobile robotic system for automating the movement of materials, components and finished goods in a workshop.
The MiR100 responds to calls from operators or production machines who need to supply or send parts.
The addition of a UR eSeries collaborative arm (Model UR5) to the MiR100 AGV allows robotic gripping of boxes or trays for loading/unloading from the AGV platform without human intervention.
At any time, the list of jobs assigned to the MiR100 can be accessed and modified by the production supervisor.

This **MiR100 ErmaSmart AGV** system is designed in the spirit of **Industry** 4.0 and meets the key requirements for intelligent and evolving production methods:

✓ **Scalability & Flexibility** with the possibility to redefine and modify internal logistic flows at any **time**

✓ **Mobile robotics** with the MiR100 AGV

✓ **Collaborative robotics** with Universal Robots

✓ **Vision & Smart Sensors** with vision-based part presence control and RFiD traceability

This automated system can be used independently to manage the flow of standard boxes of components, for example in conjunction with the **Dynamic Vertical Warehouse** (Ref: VL10).

It can also be integrated with the **ErmaSmart** flexible production line (see page 4).

This training system is mainly intended for **activities in driving, system control, industrial maintenance, robotics and automation**.

This product is accompanied by a technical and educational file in digital format.

**CAP CIP - Bac PRO PLP / MELEC / MSPC
BTS CRSA / Electrical engineering / MS
IUT - Universities - Engineering schools**

Main Themes
Industrial Maintenance
Production Control
Multi-technology Systems Design
Electrical Engineering, Automation & Robotics

Themes "Industry 4.0" addressed

| Scalability & Flexibility |
| Customisation |
| Simplified programming |
| Digital twin |
| Mobile Robotics |
| Collaborative Robotics |
| Efficient Actuators |
| CAPM & CMMS |
| Digital instructions & MES |
| Quality control "online". |
| Vision & Smart Sensors |
| IOT & Communications |
| Big Data, AI & Predictive Maintenance |
| Augmented reality |
| Virtual reality |
| Additive manufacturing for tooling... |

Highlights

- Real **industrial system** with **modern robotic technologies**
- **Easy programming of mobile and collaborative robots**
- Introduction to **production logistics flows** and **their optimisation**
- System that can be used in training courses in robotics, **industrial maintenance** and the **operation and management of automated production systems**
- Possible extensions to the ErmaSmart flexible production line

AGV MiR100 ErmaSmart with UR5 eSeries Collaborative Arm (Ref: AG10) in automatic operation with Ermasmart Dynamic Vertical Storage (Ref: VL10)

AGV MiR100 ErmaSmart (AG00)

The ErmaSmart MiR100 AGV consists of:
- ✓ A Mir100 mobile robot with 10 hours or 20 km autonomy
- ✓ A wired charger (100-230Vac 50/60HZ to 24V max 15A)
- ✓ An Intel® RealSenseTM 3D camera (ground camera) for obstacle detection up to 50 cm from the ground.
- ✓ An Intel® RealSenseTM 3D camera (top camera) for obstacle detection and protection of objects mounted on the Mir100.
- ✓ A shelf frame 760x440x700mm with a support for a shelf
- ✓ Two shelves 700x440x30mm
- ✓ A tablet

AGV MiR100 ErmaSmart with UR5 eSeries Collaborative Arm (AG10)

The ErmaSmart MiR100 AGV with UR5 eSeries collaborative arm consists of:
- ✓ A Universal Robots UR5 eSeries collaborative robot
- ✓ Siemens S7-1200 PLC
- ✓ A gripper for handling the objects in question
- ✓ A 450x420x10mm tray for the placement of handled objects (boxes, trays...)
- ✓ A pure sine converter (Input: 24Vdc / Output: 230Vac, 50Hz / 1200W
- ✓ A Mir100 mobile robot with 10 hours or 20 km autonomy
- ✓ A wired charger (100-230Vac 50/60HZ to 24V max 15A)
- ✓ A second Li-NMC battery, 24 V, 40 Ah
- ✓ An Intel® RealSenseTM 3D camera (ground camera) for obstacle detection up to 50 cm from the ground.
- ✓ An Intel® RealSenseTM 3D camera (top camera) for obstacle detection and protection of objects mounted on the Mir100.

IO-Link Master and RFiD IO-Link transceiver (AG11)

The Profinet IO-Link Master allows all types of IO-Link sensors (and digital sensors) to be connected and then simply exchange the data between the S7-1200 PLC and the IO-Link Master in PROFINET. The IO-Link RFID transceiver allows RFID tags to be read and written via this communication.

This technology will allow the RIM to **identify the product and or achieve continuity in your chain of custody.**

Features of the MiR100 mobile robot

The main features are :
- ✓ Payload: 100kg
- ✓ Towing capacity: 300Kg
- ✓ Autonomy: 10h or 20Km
- ✓ Speed: Forward: 1.5m/s - Reverse: 0.3m/s
- ✓ Positioning accuracy: +/- 50mm from position, +/- 10mm from mooring mark
- ✓ Battery: Li-NMC, 24V, 40Ah
- ✓ External charger: Input: 100-230Vac, 50-60 Hz / Output: 24V, Max 15 A
- ✓ Charging time: With cable ⮕ Up to 4.5 hours / With optional charging station ⮕ Up to 3 hours
- ✓ Communication: Wifi/ Bluetooth/Usb/ Ethernet

Features of the UR5 eSeries collaborative robot

The main features are :
- ✓ Payload: 5kg
- ✓ Range: 850mm
- ✓ Degrees of freedom: 6
- ✓ Speed: 1m/s
- ✓ Repeatability: +/- 0.03mm, under load, to ISO 9283
- ✓ Inputs / Outputs: 16 digital inputs / 16 digital outputs / 2 analog inputs / 2 analog outputs
- ✓ HMI: touch screen integrated into the robot
- ✓ Communication: Modbus TCP / ProfiNet / EthernetIP / USB
- ✓ Polyscope graphical user interface on a 12" touch screen.

MiR100 mobile robot

Collaborative robot Universal Robots

More information on www.erm-automatismes.com

Options UR12/UR13: Visor Robotic 2D vision sensor (Brand: Sensopart) monochrome/color at the end of the robot arm

These options allow the practical activities proposed to be put into practice through major industrial problems involving 2D vision (object detection, quality control, code identification, etc.)

It comes with a machine vision sensor 800x600 or 1440x1080 pixels monochrome or colour, 50 fps acquisition (frame per second). It is GigE compliant. The camera is equipped with a lens and a motorised focal length

Options UR18 "Vacuum gripper and Schmalz on-board vacuum generator for Cobot UR3 and UR5 eSeries".

This sub-assembly allows the gripping of parts (jars, cans, prisms...) on the work tray and allows the deposit of these parts in vertical mini-stores, on an evacuation conveyor... It is supplied with various suction cups and an OnRobot autonomous vacuum generator.

Options AG14 / AG15: Kit for using the Ermasmart AGV+Cobot "Mir100 + UR5 eSeries" (AG10) with the Ermasmart line in packaging / assembly mode

The AG14 kit consists mainly of a two-finger electric gripper with a 6mm stroke per finger, gripping jaws suitable for Ermasmart trays, and the necessary accessories

The AG15 kit can only be used in conjunction with the AG14 kit. It contains a set of jaws suitable for Ermasmart epicyclic gearboxes and the necessary accessories.

Option UR17: OnRobot's RG2 collaborative electric gripper

The RG2 gripper is an end-of-arm collaborative tool designed for seamless integration with Universal Robots' collaborative robot arms. Some technical features and benefits:
- ✓ No external cables
- ✓ Adjustable gripping force from 3 to 40N
- ✓ Adjustable gripping distance from 0 to 110mm
- ✓ Absolute reading of the width in mm, without initialisation
- ✓ Grip status indications
- ✓ Automatic depth compensation
- ✓ Automatic calculation of payload and central point of the tool (PCO)
- ✓ Multi-position mounting bracket
- ✓ Customisable fingertips

Options AG12: Kit for using the Ermasmart AGV+Cobot "Mir100 + UR5 eSeries" (AG10) with the Ermaflex Distribution Table (TD30)

This kit mainly consists of a two-finger electric gripper with a 6mm stroke per finger, gripping jaws adapted to Ermaflex jar/vial trays, a tray deposit plate to be fixed on the Ermaflex Dispensing Table, and the necessary accessories

Options AG13: Kit for using the AGV+Cobot "Mir100 + UR5 eSeries" Ermasmart (AG10) with Ermaflex Polyprod (PP30+PP38)

This kit mainly consists of a gripping tool for cap/lid transport containers, a tray for depositing trays to be fixed on the Polyprod Ermaflex and the necessary accessories

Functioning in relation to production systems and operators

Main operating characteristics :
- ✓ Connect to the robot interface from any computer or tablet to view the status of the robot and control it remotely
- ✓ Simple and easy to use graphical interface for any skilled operator, i.e. trained in the use of this robotic interface
- ✓ Ability to schedule multiple missions and then create a button on the interface to call up a specific mission and execute it
- ✓ Each mission may contain one or more tasks at the same time
- ✓ Possibility of calling up all the jobs, for example for a working day, and letting the robot execute them one by one until they are completed
- ✓ Ability to perform increasingly complex tasks involving calculations, logical operations (if, wait, while, ...) and data exchange through internal registers
- ✓ Execution of the Universal Robots collaborative robot programs in the "MiR100 + UR5 eSeries" configuration (Ref: AG10)
- ✓ Calculation of optimised paths when moving between different production machines and automatic obstacle avoidance
- ✓ Easy communication with other external equipment via Modbus TCP or Bluetooth through Wi-Fi routers
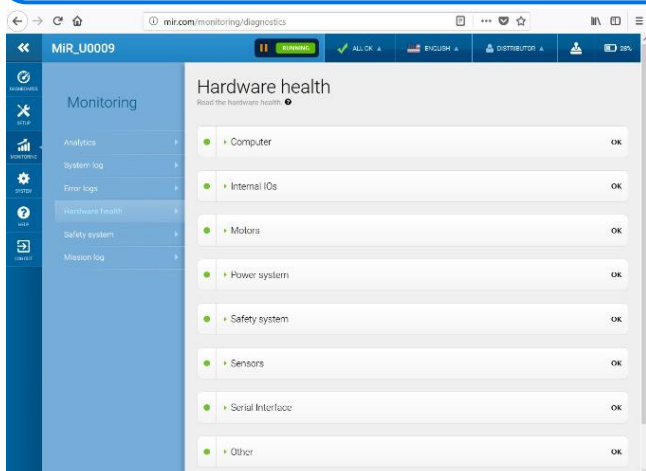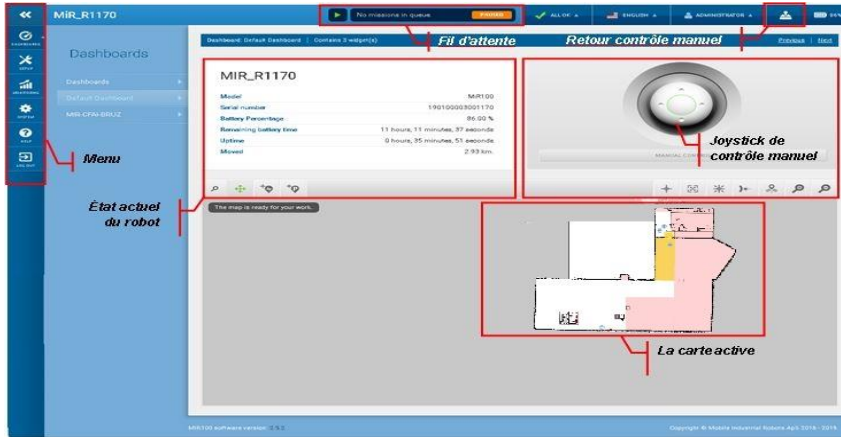
Robot Health" page
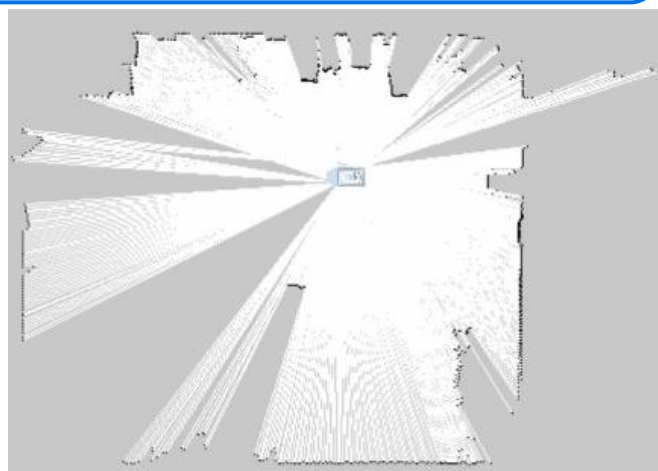
Mapping in progress by laser scanners

More information on www.erm-automatismes.com

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Mir100 programming interface

Main page
✓ A well-organised and easy-to-use interface
✓ Creation of several dashboards as required
✓ Ability to display multiple views at the same time
✓ Creation of several maps that correspond to the robot's working places

Adding the actions
✓ Creation of the missions to be executed by the robot
✓ Facilitate the scheduling of these missions according to your needs
✓ A single mission can contain an infinite number of actions depending on what the robot has to do
✓ Creation of complex programs using the different actions available (motion, logic, I/O module, ...)
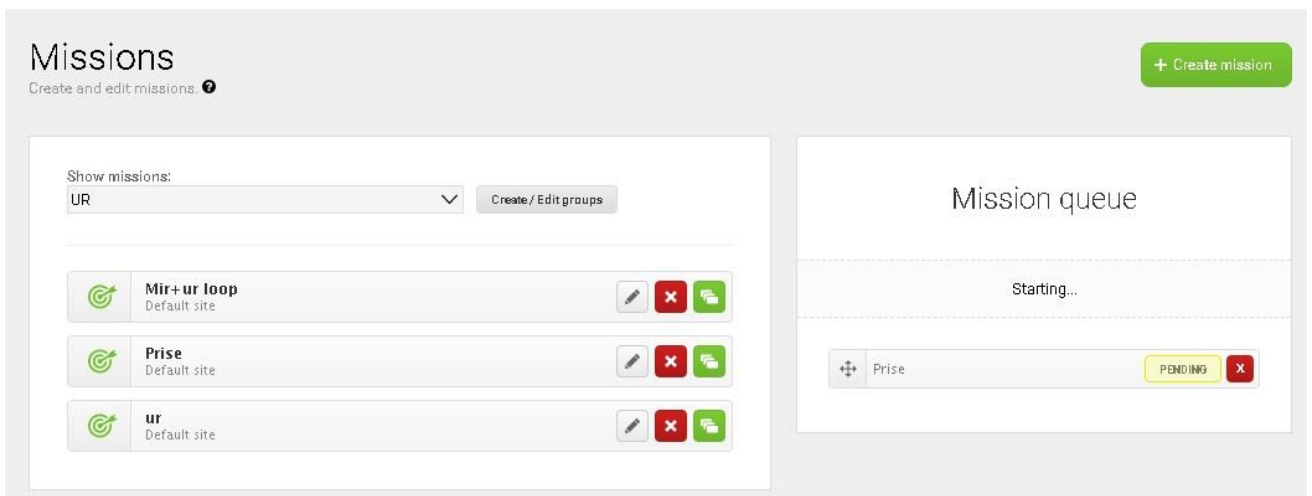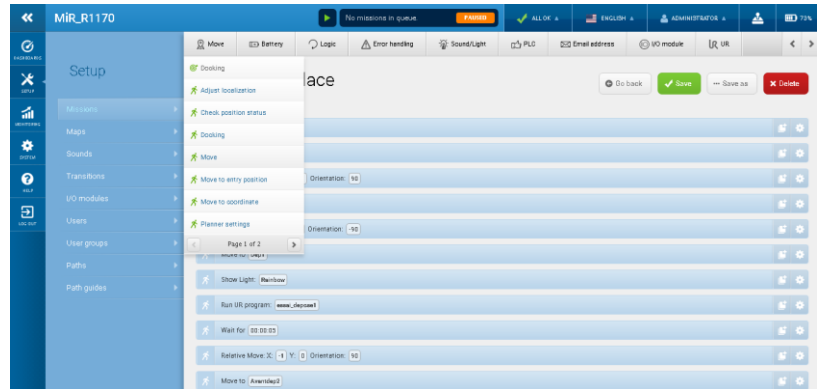
Execution and modification of missions
✓ Possibility to create several missions and to classify them according to their type and location
✓ All missions can be modified. Simply press the stylus symbol and add or change actions
✓ Simple execution of the tasks you want to perform at the touch of a button
✓ Ability to view all current and upcoming missions using the "Mission Queue"
✓ Reorganisation of the order of execution of missions or even abandonment of current or future missions

ERM AUTOMATISMES
Didactique | Robotique | Fab&Test | Energies

AGV MiR100 ErmaSmart (with UR eSeries collaborative arm)
Station 0 of the ErmaSmart flexible production line "Packaging

ErmaSmart Item 0 "Conditioning"

In the **ErmaSmart** context, the ErmaSmart MiR100 AGV (with UR eSeries collaborative arm) is used to automate the flow of raw materials and finished products into and out of the production line.

The ErmaSmart "Packaging" line consists of the following items:

- Station 1: The **2D Unscrambling & Screwing Robot**, 2D/3D jar/flask unscrambling and conveyor placement system (ref **UR03 or UR05 or ON10 and associated codes**)
- Item 2: The **Dosaxe**, automatic linear axis filling system (ref **DX10 and associated codes**)
- Station 3: The **Collaborative Capping & Assembly Robot**, capping system, custom over-capping and control (ref **MI00 and associated codes**)
- Item 4: The **XYZ Cartesian Pick&Place (**ref **XY10 and associated codes**)
- Item 5: The **Dynamic Vertical Store** (ref **VL10 and associated codes**)
- Station 6: The **manual order picking, packing and palletising station with RFID tracking** (ref **PM91**).

ErmaSmart Configuration "Conditioning"

In the ErmaSmart "Packaging" configuration, the MiR100 AGV feeds the 2D Unscrambling & Screwing Collaborative Robot with jars/vials, the Capping & Assembly Collaborative Robot with trays of caps and overcaps and the XYZ Cartesian Pick&Place with empty trays.
It can also collect the trays from the Dynamic Vertical Warehouse and take them to the manual packing and palletising station.
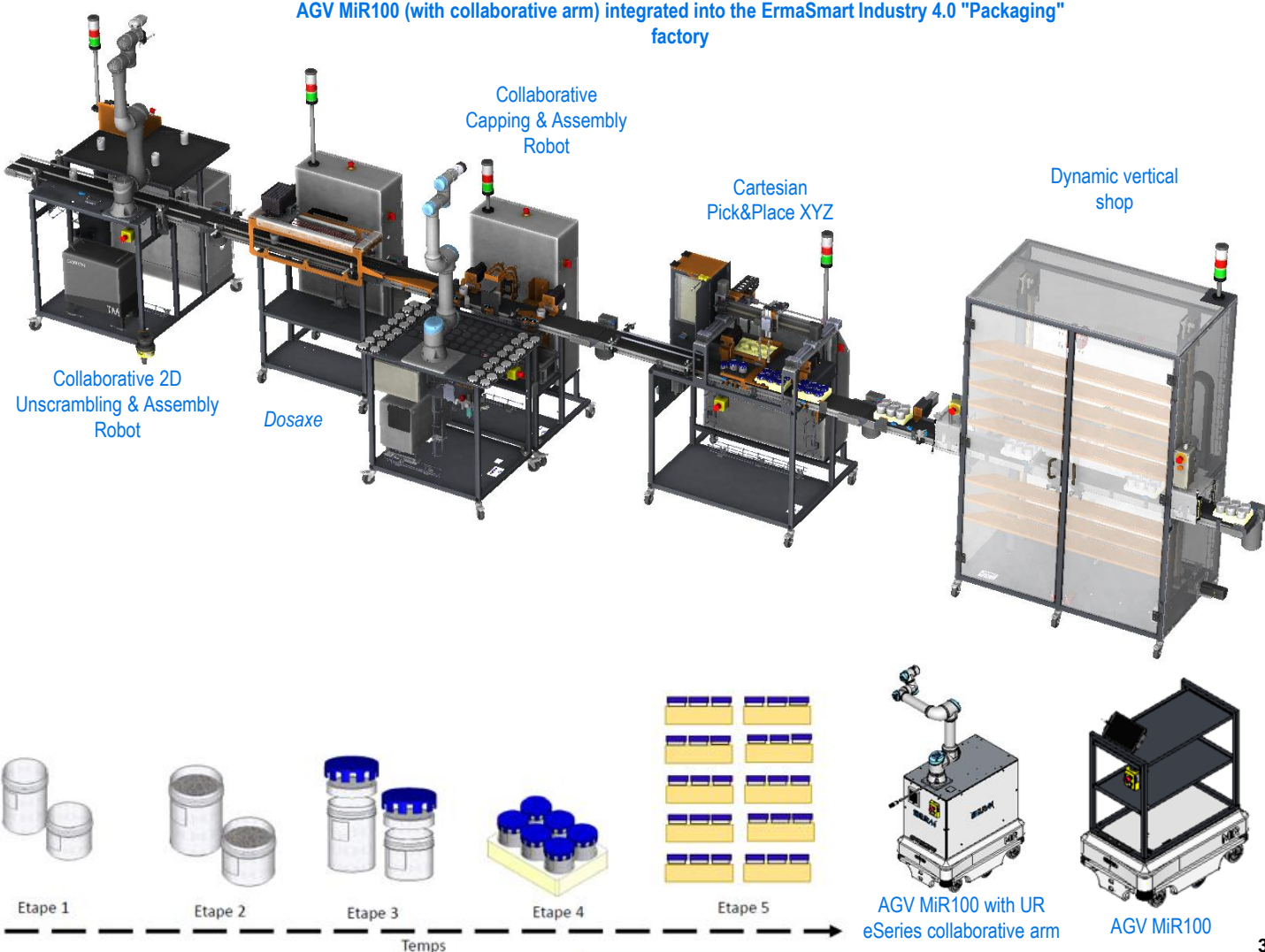
Combined operation with Dynamic Vertical Magazine

Ermasmart offers the combined use of the Dynamic Vertical Warehouse and the MiR100 AGV with UR eSeries collaborative arm.
These two systems communicate with each other so that the AGV+Arm can autonomously retrieve boxes/tray from an order at the exit of the conveyor or load the Dynamic Vertical Magazine with component boxes (Stand alone version).
If the AGV is not equipped with an arm, an operator will have to perform the handling operations between the AGV and the Dynamic Vertical Warehouse.

AGV MiR100 (with collaborative arm) integrated into the ErmaSmart Industry 4.0 "Packaging" factory

Collaborative Capping & Assembly Robot

Cartesian Pick&Place XYZ

Dynamic vertical shop

Collaborative 2D Unscrambling & Assembly Robot

Dosaxe

Etape 1
Etape 2
Etape 3
Etape 4
Etape 5

AGV MiR100 with UR eSeries collaborative arm

AGV MiR100

Temps

AGV MiR100 ErmaSmart (with UR eSeries collaborative arm)
Station 0 of the ErmaSmart flexible production line "Assembly

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ErmaSmart Station 0 "Assembly"

In the **ErmaSmart** context, the ErmaSmart MiR100 AGV (with UR eSeries collaborative arm) is used to automate the flow of raw materials and finished goods into and out of the production line.

The ErmaSmart "Assembly" line consists of the following items:
- Item 1: The **XYZ Cartesian Pick&Place (ref XY10 and associated codes)**
- Station 2: The **Collaborative Capping & Assembly Robot**, custom assembly system and control (ref **MI00 and associated codes**)
- Station 3: The **2D Unscrambling & Assembly Screwing collaborative robot**, assembly and screwing system (ref **UR03 or UR05 or ON10 and associated codes**)
- Item 4: The **Dynamic Vertical Store** (ref **VL10 and associated codes**)
- Station 5: The **manual order picking, packing and palletising station with RFID tracking** (ref **PM91**).

ErmaSmart Configuration "Assembly"

In the ErmaSmart "Assembly" configuration, the MiR100 AGV feeds boxes/pallets and gearbox bases to the XYZ Cartesian Pick&Place, or trays of parts to be assembled to the Collaborative Plugging & Assembly Robot and the Collaborative 2D Unplugging & Screwing Robot.
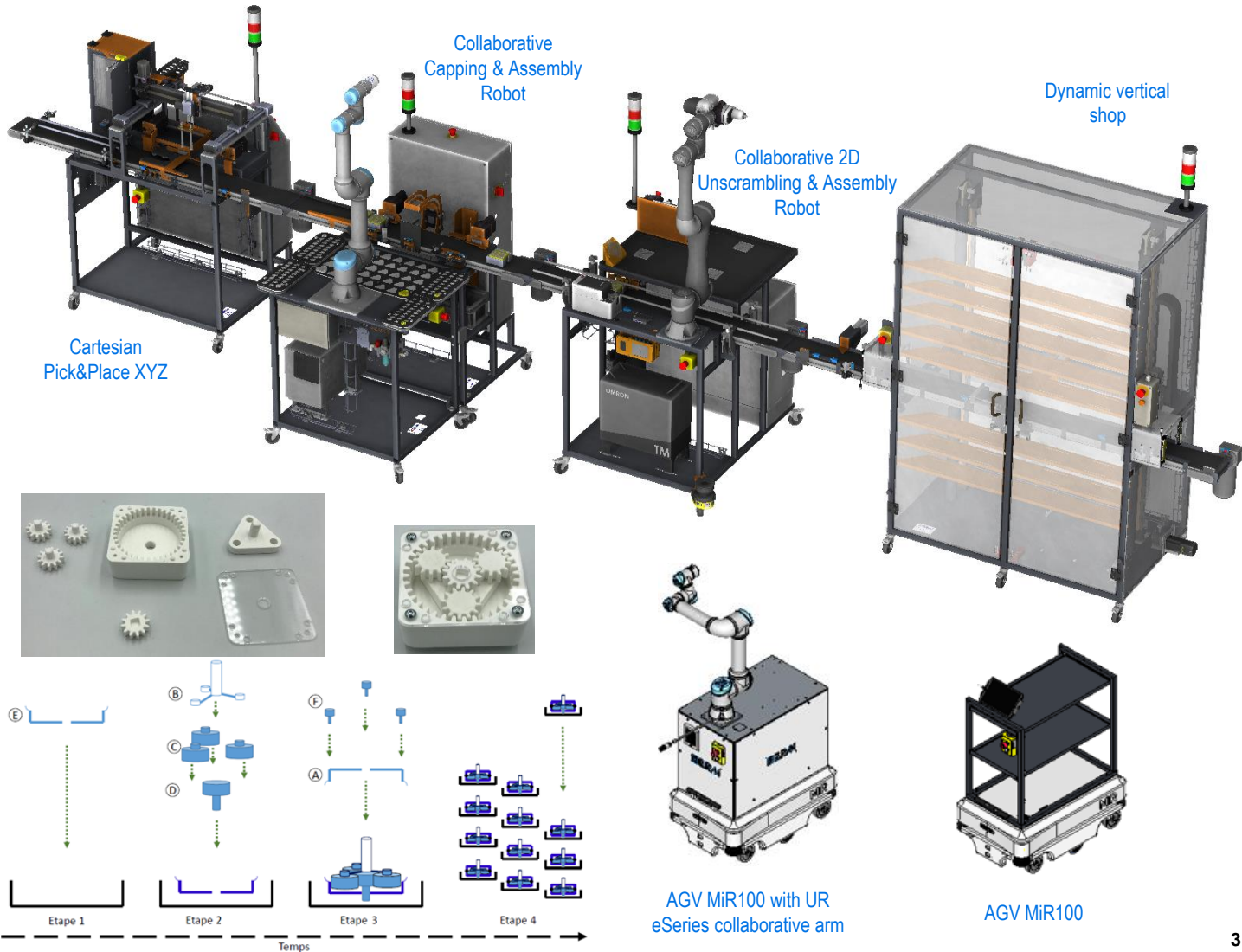It can also retrieve the boxes/pallets from the Dynamic Vertical Warehouse and take them to the Manual Packing and Palletising Station.

Combined operation with Dynamic Vertical Magazine

Ermasmart offers the combined use of the Dynamic Vertical Warehouse and the MiR100 AGV with UR eSeries collaborative arm.
These two systems communicate with each other so that the AGV+Arm can autonomously retrieve boxes/tray from an order at the exit of the conveyor or load the Dynamic Vertical Magazine with component boxes (Stand alone version).
If the AGV is not equipped with an arm, an operator will have to perform the handling operations between the AGV and the Dynamic Vertical Warehouse.

AGV MiR100 (with collaborative arm) integrated into the ErmaSmart Industry 4.0 "Assembly" factory

Collaborative Capping & Assembly Robot

Dynamic vertical shop

Collaborative 2D Unscrambling & Assembly Robot

Cartesian Pick&Place XYZ

AGV MiR100 with UR eSeries collaborative arm

AGV MiR100

Educational activities

The MiR100 ErmaSmart AGV (with UR eSeries collaborative arm) can be used to **perform the** following **educational activities, among others**

- ✓ **Automation & Robotics**
  - • **Functional** and **structural analysis** of the system
  - • **Robot programming with the intuitive dedicated software**
  - • **Scheduling of travel assignments**
  - • Programming of associated additional peripherals (vision, RFiD)
  - • Mobile robotics safety and risk analysis
- ✓ **Production control**
  - • Use of the AGV to transfer parts between two production stations
- ✓ **Industrial maintenance**
  - • **Preventive maintenance**
  - • **Improved maintenance** (modification of the gripping jaws and 3D printing,...)

References

AG00: AGV MiR100 ErmaSmart

AG10: ErmaSmart MiR100 AGV with UR5 eSeries collaborative arm

AG11: IO-Link Master and RFiD IO-Link transceiver

AG12: Kit for using the Ermasmart AGV+Cobot "Mir100 + UR5 eSeries" (AG10) with the Ermaflex Distribution Table (TD30)

AG13: Kit for using the AGV+Cobot "Mir100 + UR5 eSeries" Ermasmart (AG10) with Ermaflex Polyprod (PP30+PP38)

AG14: Kit for using the Ermasmart AGV+Cobot "Mir100 + UR5 eSeries" (AG10) with the Ermasmart line in packaging mode

AG15: Kit for using the Ermasmart AGV+Cobot "Mir100 + UR5 eSeries" (AG10) with the Ermasmart line in assembly mode (To mount AG15, AG14 is required)

UR17: OnRobot RG2 Collaborative Electric Clamp Option for Cobot Station

UR18: Option: OnRobot suction cup gripper and on-board vacuum generator for Cobot Station

UR12: Option 2D monochrome vision sensor Visor Robotic V10 (Brand: Sensopart) at the end of the robot arm, for Cobot Station

UR13: Visor Robotic V20 2D colour vision sensor option (Brand: Sensopart) at the end of the robot arm, for Cobot Station

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