ErmaFlex #11

Robotic palletising unit

Robotic palletising cell designed around a KUKA 6-axis industrial robot

Robotic palletising unit at a glance

The Robotic Palletising Unit is an industrial palletising training system. This cell can be **used alone** or in conjunction with other systems in the Ermaflex line, for example downstream of the Polyprod (multi-format dosing/capping unit) and the Regrouping (cartoning unit).

This training system is mainly intended for **system operation and maintenance** activities. For advanced design and development/programming activities, we propose instead the "6-axis Robotic Development Cell" **reference: RO20. The functions of the Robotic Palletising Unit** are :

- ✓ **Convey cartons/tray to** the robot pick-up station
- ✓ **Read the RFID tags** on the boxes/tray to match them to the correct pallet
- ✓ **Filling the pallets with cartons/tray according to the palletising plan** (Operation carried out by the robot)
- ✓ **Place a cardboard divider between each layer of** cardboard on the pallets (This is done by the robot)

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

- ✓ HTML site with activities, projects, answers and resources
- ✓ Programming sources, Block diagrams
- ✓ Component data sheets
- ✓ Proposal for educational organisation

Bac PRO PLP and MSPC
BTS CRSA and MI - IUT
Universities - Engineering schools

Themes addressed

Industrial Maintenance
Production Control
Multi-technology Systems Design
Industrial Automation and Robotics

Highlights of the Robotic Palletising Unit

- ✓ Genuine industrial system, totally secure and adapted to technological and vocational education
- ✓ Analysis and learning of more and more widespread industrial solutions (6-axis palletizing robot, RFID traceability, etc.) with high added value
- ✓ Parameterisation and programming of a 6-axis robot on interfaces similar to those used in industry.
- ✓ Carrying out **production control** and **industrial maintenance** activities on a real robotic workstation

6-axis robot

Robot controller

Control panel and parameterisation

References

- **UP10**: 6-axis robotic palletising unit
- **UR13 :** Visor Robotic V20 2D colour vision sensor (Brand: Sensopart) fixed, for Cobot Station and Robotic Cell
- **UC13**: Supervision Mini Ermaflex: supervisory control including (For one Ermaflex machine) :
  - PC software Vue 32 Educ Mini Development+Runtime (250 variables)
  - PC/Monitor/Keyboard/Mouse
  - A single communication protocol
- **UC90:** Option: Fault box for electrical cabinet, remotely configurable on a tablet (Not supplied)
- **UC41:** Siemens Remote Desk Option on iPad (Included)
- **UC51:** Option: Visual instructions & Monitoring of production indicators on the Tulip open application environment and touch tablet, for a production operator (with a 3-year subscription to Tulip Pro, €1170 excl. tax per year beyond that)
- **UC52**: Visual instructions option on the Tulip open application environment and touch pad, for a production operator or maintenance technician (with a 3-year subscription to Tulip Standard, €570 excl. tax per year thereafter)

KUKA's **training offer** will allow users to develop their expertise in industrial robotics:

- ✓ Level 1 on-site training (ref: RO40)
- ✓ Two training sessions at KUKA France (Offered by KUKA)

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Functional architecture

6-axis robot sub-assembly

It consists mainly of:

- ✓ A 6-axis industrial robot with a 2010mm range
- ✓ Integrated pneumatic valves on the arm
- ✓ Gripper head (suction cups for gripping dividers, gripper for gripping cartons/trays)
- ✓ The robot controller with industrial communication board to PLC and (Profinet network)
- ✓ The manual setting panel
- ✓ The axis calibration case

Sub-assembly "Power box and electrical control".

It consists mainly of:

- ✓ A **PLC** communicating with the 6-axis robot (Siemens S7-1200 type - Other models on request)
- ✓ An operator interface touch panel (Siemens KTP700 type)
- ✓ A variable speed drive to control the conveyors
- ✓ Electrical protection of the various actuators

Safety Enclosure" sub-assembly

It consists mainly of:

- ✓ A painted welded steel frame with grid walls
- ✓ A light curtain and an operator access request button
- ✓ A pneumatic supply unit (FRL...)

This type of safe enclosure is required by the standards for the automatic operation of 6-axis robots.

Sub-assembly "Conveyor for feeding cartons or trays".

It consists mainly of:

- ✓ A conveyor belt for feeding the cartons/tray (4 container sizes) to the pick-up station by the robot
- ✓ A carton/tray presence sensor in the robot gripping position
- ✓ A carton/tray presence sensor at the beginning of the conveyor
- ✓ A combination of light curtain and inhibition sensors
- ✓ RFID and IO-Link read/write head
- ✓ A communicating IO-Link master

Pallet filling area" sub-assembly

It consists mainly of:

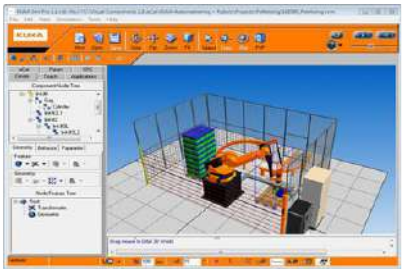
- ✓ Two pallet slots with positioning template
- ✓ One pallet presence sensor per pallet location

Software tools

The following tools are supplied with the robotic cell:

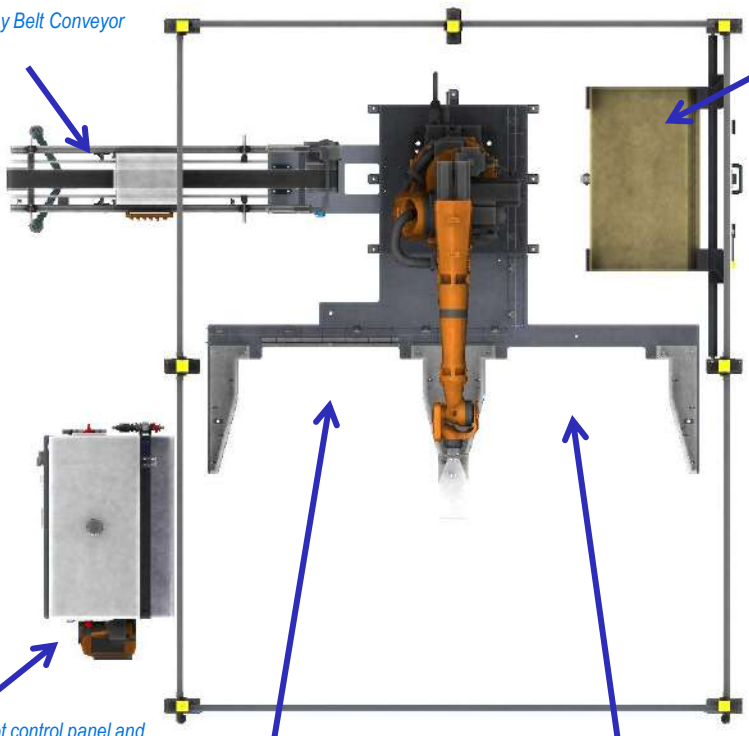
- ✓ Software suite required to implement the robot

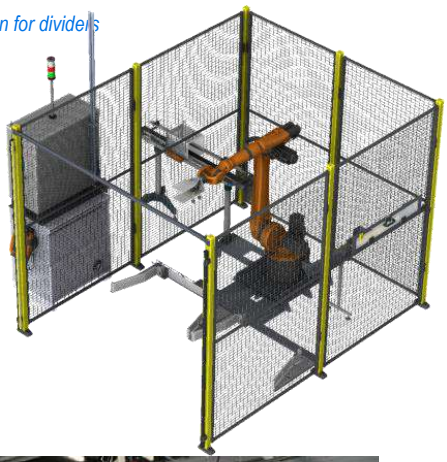
Robot software suite



Carton/Tray Belt Conveyor

Pick-up station for dividers





KUKA robot control panel and touch panel

Palletizing station 1

Palletizing station 2

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RFID read/write head sub-assembly

This read/write head reads the traceability information (batch number, type, production date, etc.) from the RFID tag associated with the boxes/trays and transmits it to the IO-Link master, which in turn provides the information to the PLC. This technology allows to approach the procedures of traceability and logistic follow-up.

IO-Link RFID transponder (Read / Write)

IO-Link Master

2D colour vision sensor option (UR13)

This option recognises the type of carton/tray at the end of the conveyor and palletises it onto the correct pallet, so that two different formats can be palletised simultaneously.

It is supplied with an 800x600 pixel monochrome or colour machine vision sensor, 50 fps (frames per second) acquisition. It is GigE compliant and PoE compatible. The camera is equipped with a lens and a motorised focal length

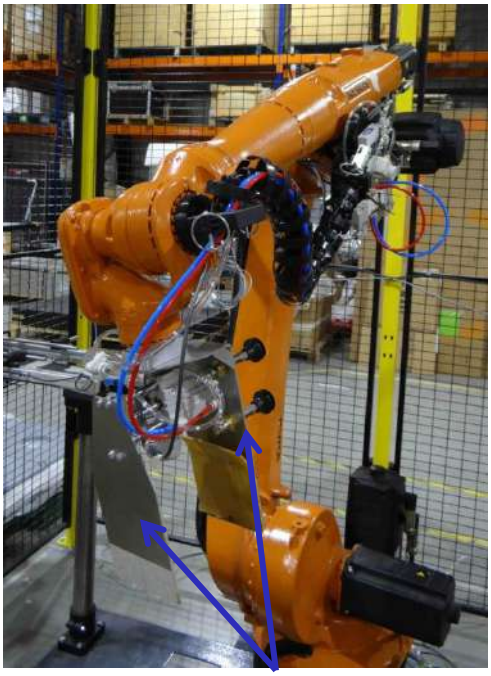
Industrial Supervision Option (UC13)

This option allows the operating information of the Robotic Palletising Unit to be obtained on a PC:

- ✓ Remote control of the robot
- ✓ 6-axis robot operating data
- ✓ Number of cartons/pallets palletised and throughput (number of cartons/minute)
- ✓ Machine running time and downtime
- ✓ Visualisation of grafcets

The supervision is based on the Ethernet IP protocol.

Power and control box & robot control cabinet



Gripper with clamps for cartons/tray And suction cups for dividers

Example of integration on an assembly line

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Educational activities

The Robotic Palletising Unit allows the following **educational activities to be carried out:**

- ✓ Functional analysis and study of robotics technologies
- ✓ **Constructive studies** of industrial robotic systems (mechanical assemblies for gearbox and arm+handle with Solidworks files)
- ✓ **Production control (parameterisation of palletisation plans)**
- ✓ Production optimisation (**Management**, **organisation** and **improvement** of manufacturing **processes:** cycle time calculation, profitability analysis)
- ✓ Establishment of a **production traceability**
- ✓ Change of production campaign (robot tool settings, conveyor settings...)
- ✓ **Preventive maintenance on the 6-axis robot** (axis recalibration, manufacturer's maintenance, etc.)
- ✓ **Corrective maintenance** (e.g. modification of a trajectory...)
- ✓ **Improved maintenance** (e.g. design of a new robot tool...)
- ✓ Programming and simulation of the robot cycle and associated peripherals (conveyors, palletising)
- ✓ Programming of the operator interface

Practical work available

TP1: Re-learning the basics at the Intercalary station:

- ✓ Study of the infill item
- ✓ Analysis of the problem
- ✓ Solving the problem by basic relearning
- ✓ Functional testing

TP2: Corrective maintenance of the vacuum switch

- ✓ Study of the pneumatic circuit and the robot cycle
- ✓ Fault diagnosis
- ✓ Correction of the defect

TP3: Corrective maintenance of clamp pressure regulator

- ✓ Study of the pneumatic circuit and the robot cycle
- ✓ Fault diagnosis
- ✓ Correction of the defect

TP4: Conveyor Speed Signal Monitoring

- ✓ Study of the electrical architecture and the robot cycle
- ✓ Manual conveyor control
- ✓ Definition of the equation in the API
- ✓ Update of the PLC program and functional tests

TP5: Analysis of the robot safety loop

- ✓ Analysis of electrical diagrams: main safety loops
- ✓ Analysis of the robot's safety interface
- ✓ Identification of safety devices on the machine
- ✓ Make a hypothesis and test it

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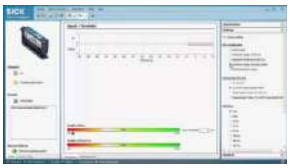
RELATED & COMPLEMENTARY PRODUCTS

Sick TDCE Smart IoT Gateway & Smart Sensors Kit for Ermaflex and Unbundler (Ref: SK20)

The Sick TDCE Smart IoT Gateway & Smart Sensors Kit for Ermaflex and Unbundler (Ref: SK20) contains :
- 1 Sick Smart IoT Gateway TDC-E200EU
- 1 IO-Link Master communicating with Node-RED to create a dashboard and dashboard and generate alerts
- 1 USB IO-Link Master Kit for setting up IO-Link components
- 1 IO-Link photoelectric sensor
- 2 TOR photoelectric sensors
- 2 Temperature sensors with IO-Link signal conditioners
- 1 Vibration sensor
- 1 IO-Link compressed air meter (for leak detection)
- 1 MODBUS TCP electrical energy meter

SICK
Sensor Intelligence.



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Thanks to the detailed operating procedures proposed for each machine below, the activity of deploying Industrial IoT monitoring on an industrial system is accessible from the Bac PRO level.

Smart IoT Sick TDCE & Smart Sensors Case (SK00)

The Smart IoT Sick TDCE & Smart Sensor Gateway Toolkit contains several industrial smart sensor application cases.

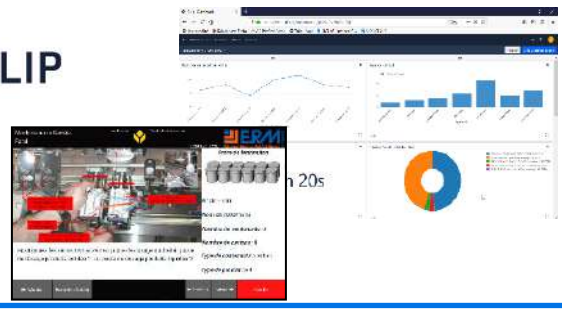
SICK
Sensor Intelligence.

www.erm.li/sk00

Visual instructions & Monitoring of production indicators (UC51-UC52)

Tulip is a web-based environment for creating applications on tablets and touch screens designed to digitalise workstations
- ✓ Visual 0-paper intervention procedures
- ✓ Supervision of machines by OPC-UA to retrieve production data
- ✓ Declarations of production stoppages and defects
- ✓ Suggestions for continuous improvement by operators
- ✓ 0-paper control thanks to connected tools (Scale...)
- ✓ Dashboards for monitoring production indicators (OEE, output, etc.)
- ✓ Easy to modify applications and create new ones (100% graphical)
- ✓ Implementation of lean manufacturing concepts (Andon, 5S...)

TULIP



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