ERM AUTOMATISMES

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# Equipment and solutions for technical education and vocational training

CATALOGUE 2017



ERM AUTOMATISMES
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# About us

ERM provides technical systems and services in the fields of education, robotics, manufacturing laboratories (FabLabs), energy and industry. Founded in 1990 in southern France, ERM first focused on industrial automation. Overtaken by its educational culture, ERM quickly became the precursor of introducing industrial production lines within technical training institutions. Upon request by these educational institutions, ERM then extended its offer to other areas, such as electronics, electrical engineering, power engineering and renewable energy.

Today, ERM has become a market leader in didactic solutions and systems for technological and vocational training in France, and is developing its export markets.

More than 1500 academic institutions are equipped with ERM technical teaching equipment in France: Secondary schools for vocational training, Vocational training centers, Universities, Universities of Technology, Major engineering schools, etc.

Abroad, many vocational training institutions are using our systems:

- French overseas territories: Guadeloupe, Guyana, Reunion, Martinique, Mayotte, New Caledonia, French Polynesia, Wallis & Futuna
- Africa : Algeria, Burkina, Cameroun, Gabon, Ivory Coast, Morocco, Mauritania, Senegal, Tunisia, …
- Asia : Vietnam, Korea…
- America : Mexico, Colombia…
- Europe : Belgium, Luxembourg, Romania, Hungary, Slovakia, Switzerland…

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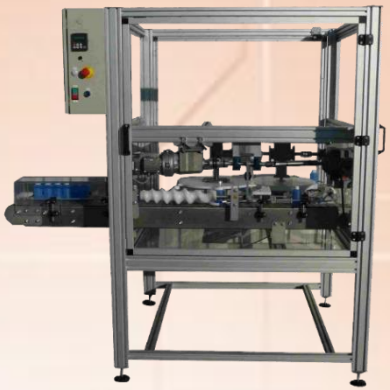
# Maintenance & Production Control
## Mechanics, Pneumatics & Hydraulics

**Ermaflex:** Automated production, packaging and palletizing line (multi-product and multi-format)

*Instruments and tools for maintenance: See pages I1 to I9*

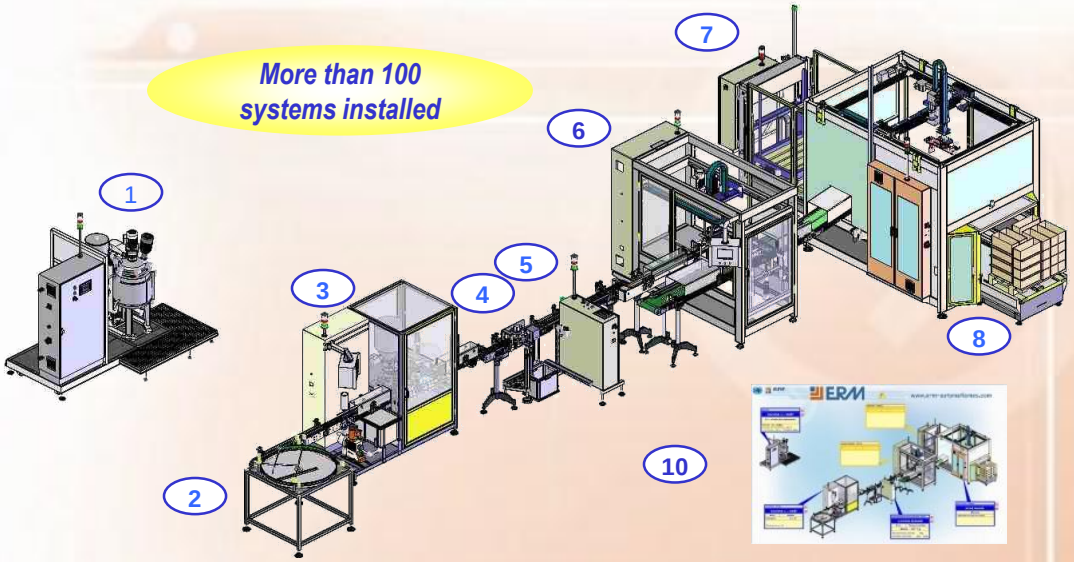
**ERMAFLEX 6-axis robotic cell**



**Divider** - Industrial training system for alignments and transmissions maintenance

**ErmaPompes** – Study, maintenance and testing bench for industrial pumps

# Maintenance & Control: ERMAFLEX systems




**Ermaflex:** Automated production, packaging and palletizing line (multi-product and multi-format)

➢ *What is Ermaflex?*

- Ermaflex is an didactic production line with autonomous and modular units that may be operated independently or be interconnected to simulate a complete production line.
- Each training center may compose its own production line according to its needs and budget.
- These systems come with **many sub-systems** in order to have several workstations.
- Ermaflex integrates **electrical, pneumatic, hydraulic and mechanic** technologies.
- Ermaflex covers both **production control** and **industrial maintenance.**

➢ *Key points:*

- Adaptation to the problems faced in every sector of production
- Reliable systems (mechanically-welded base and industrial parts) allowing **assembly, disassembly** and **format changing** many times
- **Line** with **upgradeable** structure (integration of peripheral systems and parts) and consumables (sizing of jars and bottles…)
- Use of several products (pellets, liquids, pastes) and several formats (jars, bottles, carton boxes)
- **Multi-technologies** environment: electricity, pneumatics, hydraulics, proportional hydraulics and mechanics
- Possible packaging of water and pellets, to avoid any cleaning operations of the equipment before and after use
- Easy preparation of activities due to **instant start-up**
- Works with **recyclable consumables**

➢ *Training activities:* Many training activities have been developed around 5 main activities:

❶ **Analysis** (action and acquisition chains, control…)
❷ **Design** (programming, 3D constructive solutions, system extension...)
❸ **Control** (production control, re-dimensioning the production line after a format change, supervision on Ethernet)
❹ **Maintenance** (assembly, disassembly, adjustments, wiring, diagnostics, prevention, improvements…)
❺ **Production management** (scheduling, control, Lean SixSigma…)

➢ *The 10 systems of the Ermaflex line:*

**1- Process:** Manufacturing of liquid, paste and semi-pasty products
**2- Rotary Table:** Distribution of jars or bottles
**3- Polyprod:** Multi-format packaging (filling, dosing and capping of liquids and pellets in jars and bottles)
**4- Jars and bottles weight control unit:** Weight control of jars and bottles and discarding of the faulty ones
**5- Labeling unit:** Applying self-adhesive labels on jars and bottles
**6- Collating and case packing unit:** Jars or bottles are collated, grouped and packed into cartons
Or **Packing robotic cell**
**7- Multitec:** Stacking and unstacking of 800 x 600 pallets
**8- Palletizer:** Stacking cartons onto a pallet
Or **Manual palletization** with an operator
**9- Case packer**
**10- Supervision:** Total or partial control of the ERMAFLEX manufacturing line

➢ *Peripheral products of the Ermaflex line:*

- **CMMS** softwares (Computerized Maintenance Management System)
- Virtual Indus : Virtual system dedicated to industrial training
- Sub-systems for Polyprod, Collating unit, Multitec…
- Digital 3D simulator

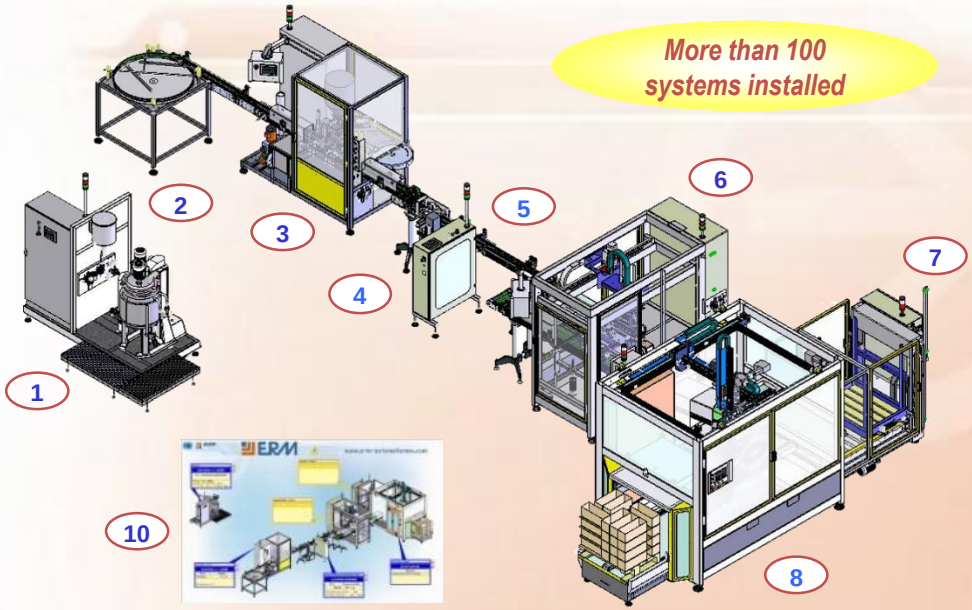
➢ *Solutions techniques abordées:*

- PLC (**Schneider** & **Siemens**)
- Process (**triple walled stainless steel tank**)
- Conveying (slat band chain, roller conveyors, 2 or 3-axis transfer systems)
- Packaging (**dosing** and **capping** heads) and gripping (**gripper**, **suction cup**)
- Industrial Communication (**Ethernet, ASi**) and supervision
- Interface Homme Machine
- Electrical energy (low-voltage switchgear, **speed drives**, asynchronous and **brushless** motors)
- **Pneumatics** (compressor, distributors, actuators)
- **Hydraulics** (hydraulic unit, distributors, actuators)
- Movement conversion (connecting rod, crank, bearings…)
- Sensors (temperature, pressure, Reed switch, photoelectric, mechanical, inductive…)
- Safety (**non-contact safety barrier**)

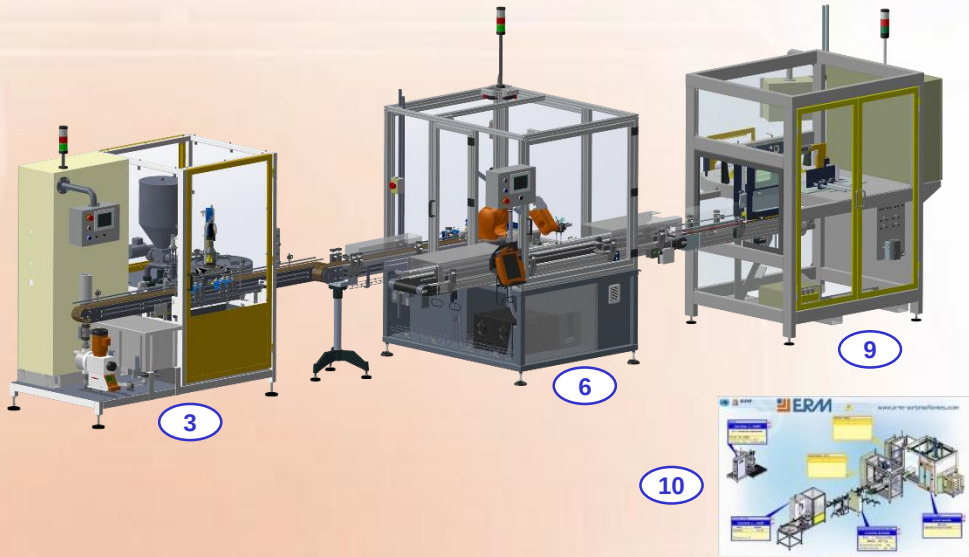
Units may be operated independently or be interconnected

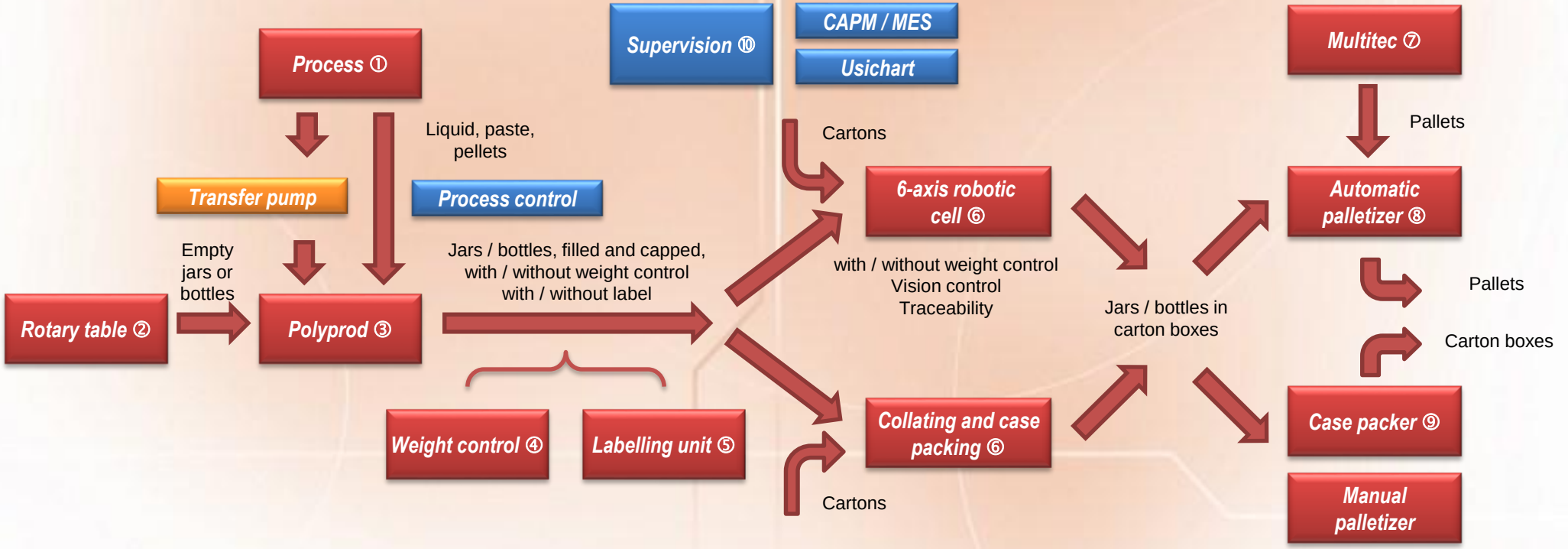
# Maintenance & Control: ERMAFLEX systems

More than 100 systems installed




Units may be operated independently or be interconnected




**Automated production line, modular, evolving for a multi-product and multi-format production**

# Automated production line Ermaflex R

➢ *Key points:*

- **4 training stations** and many options and sub-systems
- Latest industrial technologies: 6-axis robot, vision, RFID traceability RFID, digital weighing, touchscreen displays,…
- Many training activities: from line control to maintenance


**Supervision** – Production control and maintenance

**Production line 1**

**Workstation 1**

**Polyprod** - Multi-format packaging (filling, dosing and capping of liquids and pellets in jars and bottles)

**Workstation 2**


**6-axis robotic cell** – Packing robotic cell 6-axis industrial robot

**Workstation 3**

**Case packer** - Packing of several types of trays

**Workstation 4**

**Manual palletizing** – Palletizing various trays and paperboards for dispatch

***Units may operate independently or can be interconnected***

## Many complementary systems / sub-systems / options

**Process:** Manufacturing liquids, pastes and semi-pasty products

➢ *Key points:*

- Easy to clean industrial equipment (cleaning ball for the tank)
- Manufacturing of many recipes (day cream, shower gel…)
- System similar to those used in cosmetics and pharmaceutical industries
- May be connected to the **Polyprod** system

**Rotary Table:** Distribution of jars and bottles

➢ *Key point:*

- 2 functions : Distribution / Accumulation

**Weight control unit:** Weight control of jars and bottles

➢ *Key points:*

- **Quality control** (ejection of the non-compliant packaging)
- May be connected to the Polyprod and 6-axis robotic cell

**Labeling unit:** Applying self-adhesive labels on jars and bottles

➢ *Key points:*

- Production **traceability**
- Upgradeable to **barcode printing**, …
- May be connected to Polyprod/6-axis robotic cell

**Collating and case packing unit:** Packing jars / bottles into cartons (alternative to the 6-axis robotic cell)

➢ *Key points:*

- **Real industrial system**
- 2 types of containers, 2 gripping heads, 2 types of carton boxes

**Multitec:** - Stacking and unstacking of 800 x 600 pallets

➢ *Key points:*

- **Real industrial system**
- **3 different technologies** (Electrical, Pneumatics, Hydraulics)

**Palletizer:** Stacking cartons onto a pallet

➢ *Key points:*

- **Real industrial system**
- **Production changes** (paperboard separator et 2 types of palletization)
- **Different technologies** (Mechanics, Electrical, Pneumatics, Hydraulics)

**Virtual Indus:** Virtual system dedicated to industrial training
**Usichart:** Control of production process on a tablet
**CAPM / MES:** Management of production and maintenance

# Maintenance & Control: ERMAFLEX systems

## Process - Manufacturing liquids, pastes and semi-pasty products

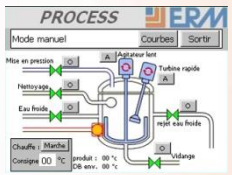
### Ermaflex 1

➢ *Features:*
- PLC and HMI (color display touch screen operator panel)
- Manufacturing (**triple walled stainless steel tank**, controlled heaters)
- Sensors (temperature, pressure, position)
- Industrial communication (**Ethernet**) and **supervision**
- Electrical energy (low-voltage switchgear, motor)
- Pneumatics (solenoid valves)

➢ *Training activities:*
- Functional analysis and studying the technologies used
- **Quality control** of pH, viscosity…
- Programming and **Process control**
- **Production** and **Adjustments**
- **Corrective maintenance** (eg: on drain valve)
- Operation and supervision

➢ *Key points:*
- **Easy to clean** industrial equipment (cleaning ball for the tank)
- Manufacturing of many recipes (day cream, shower gel…)
- System similar to those used in cosmetics and pharmaceutical industries

➢ *References:* **FA30+FA32** Process - **QF10:** Manufacturing process control tool case (Optional) - **UC13:** Supervision




*Touchscreen*


**Option for Process**

**Manufacturing process control tool case** (QF10)

→ Ideal for process control
→ Includes: viscosimeter, densitometer, pH meter, thermometer, scale, test tubes and pH standard solutions.

### Ermaflex 2

## Rotary Table - Distribution of jars and bottles

➢ *Features:*
- Conveying (slat band chain)
- Electrical energy (asynchronous motors)

➢ *Training activities:*
- Functional analysis and studying the technologies used
- **Assembly, disassembly and adjustments** (eg: side guides)
- Maintenance
- 3D mechanical design on Solidworks

➢ *Key point:* Distribution and accumulation mode

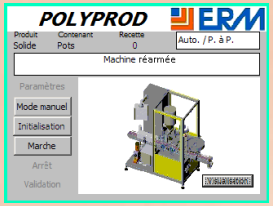
➢ *Reference:* **TD30:** Rotary table

## Polyprod - Multi-format packaging (filling and capping of liquids and granulates in jars and bottles)

### Ermaflex 3

➢ *Features:*
- PLC and HMI (color display touch screen operator panel)
- Conveying (slat band chain)
- Liquid packaging (**diaphragm pump**) and pellet packaging (**worm gear dispenser**)
- Gripping (**gripping/screwing head**)
- Industrial Communication (**Ethernet, ASi**) and supervision
- Electrical energy (low-voltage switchgear, speed drive, motor)
- Pneumatics (venturi valve, air treatment system, ASi distributors, pneumatic motor, cylinders…)
- Sensors (Reed switch, inductive, photoelectric, capacitive, optical fiber)

➢ *Training activities:*
- Functional analysis, studying the technologies used and constructive solutions (3D-modeling on Solidworks)
- **System operation** and **format change**
- System performance analysis
- Assembly, disassembly and adjustments of the operating part
- Designing and updating a **maintenance operations file**
- Partial or total programming of the operating cycle
- Preventive and corrective **maintenance** (electrical and mechanical troubleshooting)




*Touch screen operator panel*

➢ *Key points:*
- **Heavy duty system** (mechanically-welded steel base…)
- Centralized pneumatic adjustments
- Study of the dosing of **liquid, paste, semi-pasty and granulate products** on a single system

➢ *References:* **PP30+PP38:** Polyprod – **UC13:** Supervision – **PP34:** ASi programming case – **PP35:** Wiring kit for Asi detection and alarm – **PP33:** Maintenance parts for the rotary table and the granulate filler – **MN11:** Polyprod programmable 3D simulator – **AE10:** PLC Schneider M340 with Asi bus and touch screen operator panel

**Optional kits for Polyprod**

**ASi Programming Case** (PP34)

**Wiring kit for ASi detection and alarm** (PP35)

**Maintenance parts for the rotary table and the granulate filler** (PP33)

**PLC Schneider M340 with ASi bus and touch screen** (AE10)

→ Automation platform using part of the Polyprod control architecture

→ Ideal for programming activities

**Page D3**

**Polyrod programmable 3D simulator** (MN11)

→ Programming with a virtual or real PLC, and simulation on 3D operating part

→ Ideal for leaning PLC programming

**Page C10**

# Maintenance & Control: ERMAFLEX systems

## Jars & bottles weight control unit – Weight control of jars and bottles, and ejection of the non-compliant packaging

**Ermaflex 4**

➢ *Features:*
- PLC and HMI (color display operator panel)
- Conveying (slat band belt, **star wheel**)
- Industrial Communication (Ethernet) and **supervision**
- Electrical energy (low-voltage switchgear, speed drive, Motor)
- Pneumatics (distributors, ejection cylinders)
- Sensors (**strain gauge**, photoelectric)

➢ *Training activities:*
- Functional analysis and studying the technologies used
- Control and supervision
- **Programming, calibration and settings**
- **Quality control** and **statistics**
- 3D mechanical design on Solidworks

➢ *Key points:* Statistical analysis of production output

➢ *References:* **PF30:** Jars & bottles weight control unit – **UC13:** Supervision – **MN12**: Weight control programmable 3D simulator

### Systems related to the Weight control unit

**PLC Siemens S7-200 with weighing gauge, digital weighing and touch-screen operator panel (AE11)**

→PLC using part of the control architecture of the Jars & Bottles Weight control unit

→Ideal for programming activities

Page D3

**Weight control programmable 3D simulator (MN12)**

→Programming with a virtual or real PLC, and simulation on 3D operating part

→Ideal for learning PLC programming

Page C10

## Labeling unit – Applying self-adhesive labels on jars and bottles

**Ermaflex 5**


➢ *Features:*
- Control unit and HMI (operator panel)
- Electrical energy (low-voltage switchgear, speed drive, **asynchronous motor** for the backing roller and **step-by-step motor** for labeling process…)
- Sensors (proximity detector)

➢ *Training activities:*
- Functional analysis and studying the technologies used
- **Settings and configuration**

➢ *Key points:* Upgradeable to **barcode printing**

➢ *Reference:* **EQ20:** Labeling unit

## Collating and case packing unit – Packing jars / bottles into cartons

**Ermaflex 6**

➢ *Features:*
- PLC and HMI (color display touch screen operator panel)
- Conveying (**belt** conveyor, **slat band chain** conveyor, **dual-axis** transfer system)
- Gripping (**vacuum** head, **gripper** head)
- Industrial communication (Ethernet) and **supervision**
- Electrical energy (LV switchgear, **speed drive**, asynchronous motors)
- Pneumatics (venturi, distributors 5/2 and 5/3, cylinders)
- Sensors (optical fiber, reed switch, photo-electric, incremental encoder)

➢ *Training activities:*
- Functional analysis and constructive solutions (Solidworks)
- Study of positioning
- **System control** and **format change**
- System **performance analysis**
- Assembly, disassembly and adjustment of the operating part
- Partial or total **programming** of the operating cycle
- Preventive and corrective **maintenance** (electrical and mechanical failure diagnostics)

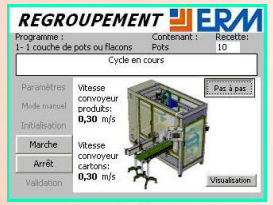
➢ *Key points:*
- Heavy duty **system also used by industries**
- 2 types of containers, 2 gripping heads, 2 types of carton boxes

➢ *References:* **RE50+RE51+RE52+RE53:** Collating and case packing unit with gripper and vacuum heads – **UC13:** Supervision

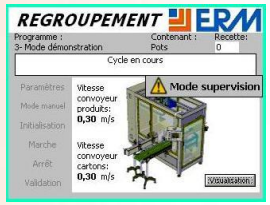

*Supervision display*

### Systems related to the Case Packer


*Configuration display*




*Production follow-up*




*Operation with supervision*

**PLC Schneider: M340 with incremental encoder, high-speed counter card and touch screen operator panel (AE12)**

→PLC using part of the control architecture of Collating and Case packing unit

→Ideal for programming activities

Page D3

**Collating and Case Packing programmable 3D simulator (MN13)**

→Programming with a virtual or real PLC, and simulation on 3D operating part

→Ideal for PLC programming learning

Page C10

# Maintenance & Control: ERMAFLEX systems

New

## ERMAFLEX 6-axis robotic cell – Packing robotic cell with a KUKA 6-axis industrial robot

Ermaflex 6

*5-year guarantee for the robot*
*3-week training offered by KUKA*


KUKA

*Kuka Agilus Robot*

➢ *Topic coverage:*

- 6-axis industrial robot (**Kuka Agilus reaching 700 mm**)
- PLC and HMI (color touchscreen operator panel)
- Conveying (**belt** conveyor, **slat band chains**)
- Handling (**vacuum** and **gripper** heads)
- **Industrial communication** (Ethernet, Profinet) and **supervision**
- Electrical energy (low-voltage switchgear, **speed drive**, asynchronous motors)
- **Pneumatics** (venturi valves, 5/2 and 5/3 distributors, cylinders)
- Sensors (optical fiber, reed switch, photoelectric)
- Quality control (**weighing gauge and module**, **machine vision** sensor)
- **Traceability and logistics** (RFID reading/writing)

➢ *Training activities:*

- Functional analysis and studying robotics technologies
- **Constructive analysis** of industrial robot systems ("reduction gear" and "arm + wrist" mechanical systems on 3D SolidWorks )
- **Production control** (campaign configuration) and **quality control by sampling**
- Production optimization (**management**, **organization** and **improvement** of **manufacturing processes:** cycle time calculation, profitability analysis)
- Configuration of **quality control by vision** and by **weighing**
- Setting up **production traceability**
- **Production campaign change** (change of robot tools, conveyor adjustment, etc.)
- **Preventive maintenance** of the 6-axis robot (axis recalibration, belt tension verification, etc.)
- **Corrective maintenance** (e.g., Change of a trajectory)
- **Updating maintenance** (e.g., Designing a unique handling tool)
- Robot cycle programming and simulation and associated equipment (conveyors, weighing, vision)
- **Operator interface programming**

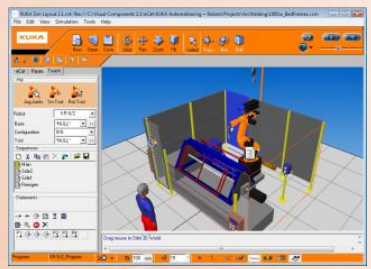
*Implementation example:*
*Polyprod with rotary table*
*Robotic cell with weight control and traceability*
*Automatic palletizer*

➢ *Key points:*

- **Strong need of robotics capabilities in the industry**: working with the "Ermaflex 6-axis robotic cell" is truly a benefit for your learners
- **Many training activities developed for control and maintenance**
- Ideal system for **training in control and maintenance of a 6-axis robotic cell**
- Complete industrial training system for packing (**packing operation, quality controls and traceability**)
- **10 licenses Kuka.Sim** (Kuka 3D simulation software) are supplied
- Strong partnership between Kuka and ERM in education: **Organization of builder trainings** (**3-week offered**), etc.
- **5-year guarantee for the Kuka Robot**

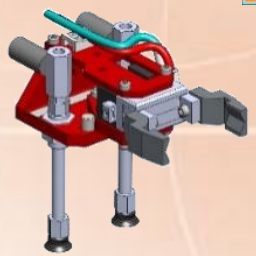
➢ *References:* **RO10:** ERMAFLEX 6-axis robotic cell with calibration kit for the axes of the Kuka Agilus robot - **RO11:** Weight control (Optional) - **RO12:** Machine vision control (Optional) - **RO13:** RFID traceability and logistics (Optional) - **RO14**: Industrial supervision (Optional) - **RO00**: "Industrial robot arm + wrist" mechanical system - **RO01:** "6-axis robot reduction gear" mechanical system

*System software*



*Simulation & Virtual programming*

*Calibration kit*



*Gripper and vacuum head for handling*

*Machine vision sensor*

*RFID traceability*

*Weighing gauge and module*

# Maintenance & Control: ERMAFLEX systems

## Multitec - Stacking and unstacking of 800 x 600 pallets

**Ermaflex 7**

➢ *Features:*
- PLC and HMI (switches or operator panel)
- Displacement (vertical axis, roller conveyor)
- Gripping (cleat)
- Industrial Communication (Ethernet) and **supervision**
- **Electrical** energy (low-voltage switchgear, motor)
- **Pneumatics** (filter and regulator, distributor, cylinders)
- **On/off hydraulics** (power pack, distributors, cylinders)
- Sensors (reed switch, linear position sensor)

➢ *Training activities:*
- Functional analysis, studying the technologies used and constructive solutions (3D-modeling on Solidworks)
- Adjustments and **automatic or manual system control**
- Assembly, disassembly and **changing the vertical axis technology** (**3 kits**)
- Connecting actuators and sensors
- Developing and updating a maintenance operations file
- Programming and studying Grafcet/SFC
- Preventive and corrective **maintenance** (electrical and mechanical failure diagnostics)
- **Improvements** (e.g.: Integrating components)
- System performance analysis, **static or dynamic tests**

***Best seller***

***Multi-technology system: Elec, Pneu, Hydro***

➢ *Key points:*
- Heavy duty system also used by industries
- **3 different technologies** covered on a single system (Electrical, Pneumatics, Hydraulics)

➢ *References:* **OM50+AC51:** Mechanical unit and test panel – **AC60:** Standard control cabinet (Schneider version) – **AS60:** Standard control cabinet (Siemens version) - **KE50:** Electrical kit - **KP50:** Pneumatic kit - **KH50:** Hydraulic kit - **UC13:** Supervision

*Gearmotor with hollow shaft*

*2 double-acting cylinders connected in tandem*

*Single-acting cylinder + hydraulic unit*

**Instruments used with Multitec**

**Oil analysis kit (HY10)**

**Oil filtration unit (HY12)**

**Hydraulic measuring kit (HY11)**

**Multitec programmable 3D simulator (MN10)**

→Programming with a virtual or real PLC, and simulation on 3D operating part

→Ideal for learning PLC programming

## Multitec vertical axis unit - Multitec lifting sub-system

➢ *Features:*
- Displacement (vertical axis)
- **Electrical** energy (low-voltage switchgear, motor)
- **Pneumatics** (filter and controller, distributor, cylinders)
- **On/off hydraulics** (power pack, distributors, cylinder)
- Sensors (reed switch, electromechanical)

➢ *Training activities:*
- Functional analysis, studying the technologies used and constructive solutions (3D-modeling on Solidworks)
- **Adjustments and system operation**
- Connecting actuators and sensors
- Assembly, disassembly and changing the vertical axis technology (3 kits)
- Preventive and corrective **maintenance** (electrical and mechanical failure diagnostics)

➢ *Key points:*
- Heavy duty system (mechanically-welded steel base)
- **3 technologies** covered on a single unit (**electrical, pneumatics, hydraulics**)
- An easy way of using **the Multitec kits**

➢ *References:* **OS50:** Multitec vertical axis unit – **OS51:** Pneumatic distribution - **KE50:** Electrical kit - **KP50:** Pneumatic kit - **KH50:** Hydraulic kit

## Transfer table with motorized rollers - Roller conveyor for pallet transfer from Multitec

➢ *Features:*
- Displacement (roller conveyors)
- Electrical energy (asynchronous motor)

➢ *Training activities:*
- Functional analysis, studying the technologies used and constructive solutions (3D-modeling on Solidworks)
- **Assembly, disassembly (e.g.: Disassembling the gear motor, replacing the roller conveyor) and electrical connection**
- **Mechanical adjustments** (e.g.: Rails adjustment for the pallet entry and exit)

➢ *Key points:* Possible connection to the Multitec to **change the situation scenario**

➢ *Reference:* **TM50:** Transfer table with motorized rollers

## Hydraulic lifting unit - Hydraulic training system with variable loads

**Page C18**

→ Ideal for an introduction to hydraulics: the most common components at a competitive price

→ Possibility of using the Multitec's hydraulic power unit and cylinder

→ Reference: **HD10**

## Palletizer – Stacking cartons onto a pallet

**Ermaflex 8**

➢ *Features:*
- PLC and HMI (color display touch screen operator panel)
- Displacement (**XYZ axes**, belt conveyor and **bi-chain**)
- Gripping (**gripper** and **vacuum** heads)
- Industrial communication (Ethernet) and **supervision**
- Electrical energy (low-voltage switchgear, **speed drive**, Asynchronous and Brushless motors depending on the version)
- **Pneumatics** (venturi, distributors, rotary and linear cylinders, Vacuum cup)
- **Hydraulics** (lifting table)
- Sensors (reed switch, photo-electric, inductive, potentiometric, incremental encoders)
- Operators' security (**non-contact safety barrier system**)

➢ *Training activities:*
- Functional analysis, studying the technologies used and constructive solutions (3D Solidworks)
- Axis positioning study
- **Mounting, dismounting, format changing, adjustments and system control**
- Designing and updating a maintenance operations file
- Programming and studying Grafcet/SFC
- Preventive and corrective **maintenance** (electrical and mechanical failure diagnostics)
- **Improvements** (e.g.: Integrating components) and system performance analysis

➢ *Key points:*
- Heavy duty system also used by industries
- **3 technologies** covered on a single system (**electric, pneumatics, hydraulics**)
- **Automatic tool change** (for inserting a separator)

➢ *References:* **PM90:** Palletizer with brushless motor and Schneider PLC – **UC13:** Supervision

**Systems related to the Palletizer**

**Palletizer programmable 3D simulator (MN13)**

→Programming with a virtual or real PLC, and simulation on 3D operating part

→Ideal for learning PLC programming

Page C10

## Case packer - Packing of several types of trays

**Ermaflex 9**

➢ *Features:*
- Low-voltage switchgear and PLC
- Driving power (three-phase asynchronous motors and **speed drives**)
- Local display (**operator panel**) and **Supervision**
- Sensors
- Pneumatics (4 cylinders and distributors…)

➢ *Training activities:*
- **Assembly, disassembly** and mechanical **adjustments**
- Diagrams and electrical wiring on removable plates
- **Measurements**
- 3D mechanical design on Solidworks
- Programming on PLC...

*Bare removable mounting plate*

➢ *Key points:*
- **Format change** (carton boxes / trays)
- **More wiring workstations** with the cabinet's **removable plates**
- System suited for Maintenance and Electrotechnics sections

➢ *References:* **EB30:** Case packer – **EB22:** Electrical plate in kit (Optional) for conveyor's engine start – **PA10**: Bare removable mounting plate

## Manual palletizing – Palletizing various trays and paperboards for dispatch

➢ *Specifications:*
- **RFID** transceiver and tags for paperboards and/or pallets
- PC with printer for **delivery note printing**
- **Manual film/stretch wrapper**
- 6 EUR-pallets
- 6 EUR-6-pallets
- 6 stretch film rolls

***Used in packing area***

➢ *Training activities:*
- Client order preparation
- Ensuring RFID control/traceability of paperboards and/or pallets
- Paperboard placing and organizing, pallet stretch wrapper control
- Collecting information for dispatch and traceability
- Preparing the client delivery note and dispatch

➢ *Key points:*
- Preparing and palletizing client orders based on the production scenario
- Connectable to the Case packer

➢ *Reference:* **PM91:** Manual order preparation station with RFID traceability

# Supervision / CAPM : Ermaflex line

## Supervision – Total or partial control of the ERMAFLEX production line

**Ermaflex 10**


➢ *Features:*
- Industrial communication (**Ethernet**)
- Supervision (**PCView 1000 variables** with development key)

➢ *Training activities:*
- Remote control of Ermaflex line using **animated block diagrams**
- **Logging output rate** and **monitoring breakdown**
- **Recording of events** that occurred during production
- Supply management
- **Dynamic display of the grafcet/SFC**

➢ *Key point:*
- Easy-to-use industrial software (PCView) for internal developments

➢ *References:* **UC20:** PCView Supervision – **UC30:** WinCC Flexible Supervision
**IP10:** IP Camera & industrial Supervision (PoE protocol)

## Usichart – Tablet apps for production control and improvement

New

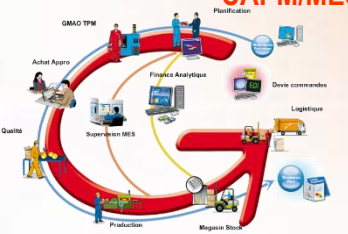
➢ *Features:*
- **Production control on a tablet**
- **Lean manufacturing & Six Sigma**

➢ *Training activities:*
- Production control with the **analysis of indicators and parameters** (eg.: weight control, hourly production tracking)
- Choosing and **combine operating modes** to face situations and qualify an intervention
- Analyzing the **reasons for stoppages** and proposing **improvements and ideas to solve problems**

➢ *Key points:*
- Friendly and pedagogical tool for the production control
- **Interactive and instant control on the tablet interface**
- **Application adjustable to any type of production and control (ready to use with the Ermaflex line)**

➢ *Reference:* **US//Usichart:** Usichart tablet application for production control and improvement

## CAPM/MES – Production management software and MES




➢ *Features:*
- **CAPM and MES** (Manufacturing Execution System)
- **Data and production management in a manufacturing company**

➢ *Training activities:*
- **Simulating the operation of a manufacturing company:** Order management, Production management and control, Maintenance control, Stocks, Traceability…

➢ *Key points:* **Ready to use with the Ermaflex line** (integrated to the supervision, pedagogical scenarios, database)

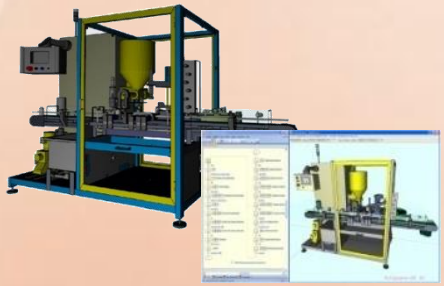
➢ *Reference:* **IN//GPAO-MES:** CAPM and MES software

# Programmable 3D simulator: Ermaflex line

## Ermaflex programmable 3D simulator
Dynamic 3D simulator for Ermaflex systems

➢ *Training activities:*
- Designing **Grafcet** (sequential function chart) and **GEMMA** with the integrated editor
- PLC programming (virtual or real)
- PLC program test
- System control via the operator panel

*Process*

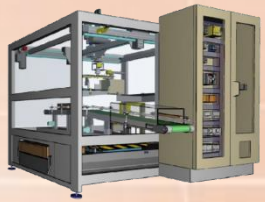


*Polyprod*

*Multitec*

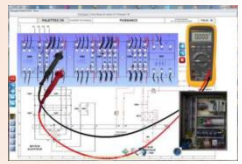
*Weight control*

*Collating and case packing*



*Palletizer*

➢ *Key points:*
- Designed for learning PLC programming
- **Multiple workstations without damaging the equipment**
- Training resources manager, making the real system discovery easier
- **Programming with a virtual or real PLC,** and simulation on a 3D operating part
- **Site license** (unlimited number of workstations)



*Maintenance module*

➢ *References:* **MN10:** Multitec programmable 3D simulator (Pallet stacking / unstacking) – **MN11:** Polyprod programmable 3D simulator (Dosing and capping) – **MN12:** Weight Control programmable 3D simulator – **MN13:** Collating and Case Packing programmable 3D simulator– **MN14:** Palletizer programmable 3D simulator - **MN15:** Process programmable 3D simulator

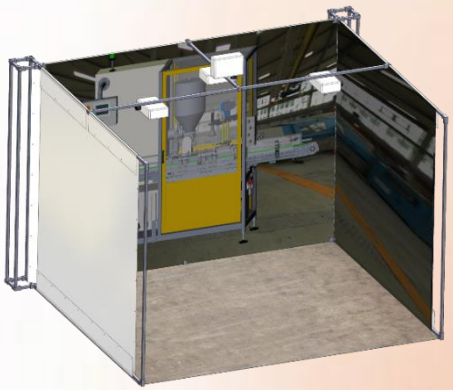
# Ermaflex simulator

New

## Virtual Indus – Virtual system dedicated to industrial training (production monitoring, maintenance, electrotechnics, energetics, etc.)

➢ *ERM virtual reality:*

- Designed for **professional training** with **acquisition and consolidation of professional skills**, while moving **back and forth between virtual and real** environments
- Scalable solutions, from the immersive headset to the 3D room
- Enhancing library of the 3D training scenarios
- Topic coverage: industrial maintenance (including electrical, mechanical and instrumentation and controls), production monitoring, electrotechnics, energetics, process operation, sampling, etc.
- 3D scenarios developed in cooperation with experts in technological training, within the educational framework



➢ *3 solutions:*

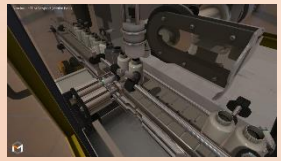
- **Virtual reality headset**
  - Virtual reality headset (oculus) for 3D scene immersion
  - Joystick for moving in the 3D scene
- **Virtual intervention zone: Virtual Indus Premium**
  - U-shaped projection area with three 3x3x2,5m screens and three professional video projectors (replacing the large tilting screen)
  - The other hardware is identical to Virtual Indus Standard
- **Evolutions**
  - Possibility to integrate more complex objects depending on the scenarios (vibrations, force feedback, etc.)
  - Second PC for 2 students simultaneously

➢ *Key points:*

- Customized offer to match with any requirements and needs
- Complex scenarios in complete safety and autonomy
- Realistic virtual experience (head and hands tracking, virtual objects)
- Integrated Learning Management System
- **Individualized training**

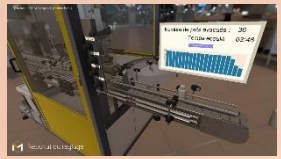
➢ *References:* **VI06:** Virtual reality headset – **VI00**: Virtual Indus Premium (virtual intervention zone)

*Optimum operation*



*Zoom on caping / screwing*

*Adjusting the proportioning pump*



*Variation of production*

*Operation in degraded mode*

***Other systems and scenarios available soon, Contact us***

➢ *Key points:*

- **Realistic design** of the simulation (3D factory)
- Possibility to **review the scene** in order to understand one's behavior and learn
- **Student's work in full autonomy**
- Mistakes are possible with **no risk for students and equipment**

➢ *Other references:* Contact us

## Polyprod 3D Scenarios: Production control interventions

➢ *Scenarios:*

- **Process operation and change of proportioning parameters** (analyzing technical functions, sampling jars and weighing them on a virtual scale, filling in the control chart, reporting a deviation and adjusting the parameters of the proportioning pump to restore production) → **ref: VS010-01**
- **Production and operation in degraded mode** (analyzing the functions, performing quality control and reporting a non-conformity in jar cap tightening, deciding to continue production without the caps with the line controller, removing the screwing head for the maintenance technician, configuring production without the caps, producing, reassembling the screwing head after the technician's intervention, organizing time periods to reprocess the capless jars and fill in the production sheet) → **ref: VS010-02**
- **Learning procedures of production commissioning and qualification** (setting parameters for a production campaign, adjusting, qualifying the production) → **ref: VS010-03**

## Air Handling Unit 3D Scenario: Maintenance and electrical accreditation interventions

➢ *Scenarios:*

- **Replacing a contactor in the electrical cabinet** (analyzing the technical functions, checking and putting on PPE, demarcating the work area, blocking the switching device, shutting the system, replacing the contactor, re-commissioning, validating operation and filling in the intervention sheet) → **ref: VS00-01**
- **Replacing pulleys and ventilation belt** (analyzing the technical functions, checking and putting on PPE, demarcating the work area, shutting the system down, replacing the pulleys and belt, aligning the pulleys, checking belt tension, re-commissioning the system, validating operation and filling in the intervention sheet) → **ref: VS00-02**

# Automated mechanical systems

## Ermatest - Endurance test for bellows and springs

➢ *Features:*
- PLC and HMI (**operator panel**)
- Industrial Communication and supervision (**embedded web server**)
- Electrical energy (low-voltage switchgear, **communication-capable speed drive**, asynchronous and brushless motors)
- **Pneumatics** (filter and controller, distributor, cylinder, **blocker**)
- **Proportional hydraulics** (60-bar hydraulic unit, distributor and proportional amplifier, double-acting cylinder)
- Movement conversion (**connecting rod / crank**)
- Sensors (temperature, pressure, capacity, reed switch, wire potentiometric, mechanical)

***Multi-technology system: Elec, Pneu, Hydrau***

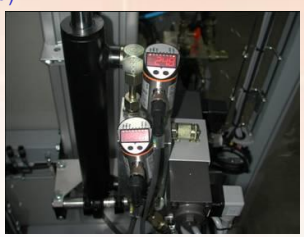
➢ *Training activities:*
- Functional analysis, studying the technologies used and constructive solutions (Solidworks 3D-modeler)
- **Adjustments and configuration** of the system depending on the series of tests (e.g.: Dialogue & communication function)
- Laying and removal (**format change** is possible for the operating part)
- Preventive and corrective **maintenance** (electrical and mechanical failure diagnostics)
- **Dismounting, mounting and adjustments** (bearings, ball bearing guiding outfit, blocker, reduction gear...)

- Programming
- Control, local and remote monitoring to help with maintenance
- **Improvements** (e.g.: setting up a clogging indicator on the hydraulic circuit)
- Speed control (connecting rod / crank rotation) and position control (cylinder)
- System performance analysis (**overheating, vibrations**...)
- Developing and updating a maintenance operations file
- Setting up a geared brushless motor with positioning and axis card

➢ *Key points:*
- Compact system composed of **heavy duty industrial parts**
- Studying **3 different technologies** (electrical, pneumatics, proportional hydraulics)
- Observation of events related to continuous operation of the system (**vibrations**...)

➢ *References:* **BM10+BM12+BM13:** Ermatest bellows testing bench (electro-pneumatic motor) **BM10+BM14+BM15:** Ermatest springs testing bench (hydraulic motor) **BM10+BM12+BM13+BM14+BM15:** Bellows and springs testing bench (both electro-pneumatic and hydraulic motor) - **BM11:** Supervision (Optional) – **BM19:** Upgradeable kit to a brushless motor - **BM18:** Equipment for tutorial work (insulation controller and IP Camera)

*Control cabinet with embedded web server and proportional card*



*Instrumented hydraulic cylinder*

*Proportional hydraulic unit*

### Cases related to Ermatest

**Gear motor & Connecting rod case** (BM16)

→ Assembly, disassembly of the gear motor and connecting rods
→ Solidworks 3D mechanical design

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**Pneumatic blocker & Hydraulic cylinder case** (BM17)

→ Assembly, disassembly of the pneumatic blocker
→ Cylinder gasket replacement
→ Solidworks 3D mechanical design

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### Instruments related to Ermatest

**Oil analysis kit (HY10)**

Page I3

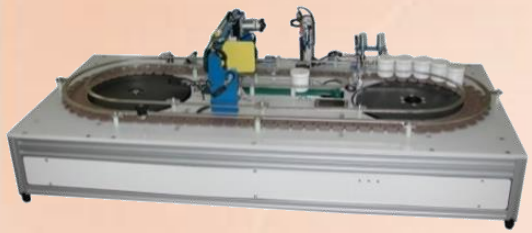
**Oil filtration unit (HY12)**

Page I3

**Hydraulic measuring kit (HY11)**

Page I3

## Automated bottle sorting unit – Studying industrial control techniques, HMI and sensors



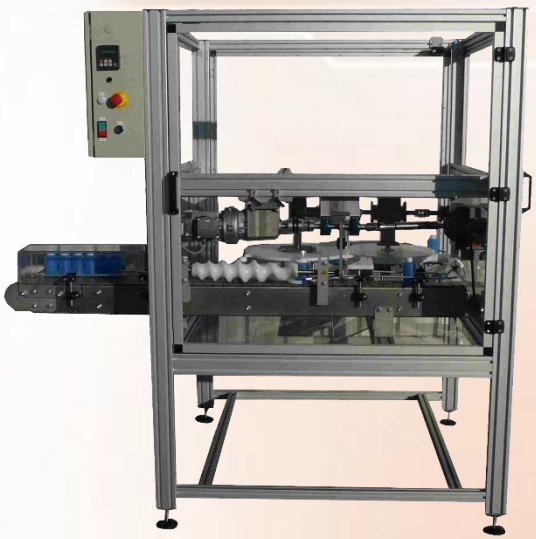
➢ *Features:*
- **PLC and HMI** (operator panel)
- Displacement (slat band conveyor)
- **Industrial communication** (ASi)
- Electrical energy (low voltage switchgear, DC motor, electromagnets)
- Sensors (**optical fiber, photoelectric, inductive, capacitive, electromechanical, analog**)

➢ *Training activities:*
- Programming and using the PLC and operator panel
- Connecting sensors and operating tests
- **Studying the different technologies of sensors**
- **Troubleshooting and diagnostic**
- System improvement

➢ *Key points:*
- Compact and economical set for studying sensors and automation
- PLC and operator panel provided with cables and programming software

➢ *References:* **TP10:** Automated bottle sorting unit (operating part) – **TP11:** Automated bottle sorting unit (control cabinet and PLC) – **TP12** ASi upgrade (Optional)

# Divider - Industrial training system for alignments and transmissions maintenance



➢ *Features:*

- Movement conversion (**angle transmission, bearings, gears, belts, chains, pulley**…)
- Electrical energy (low voltage switchgear, **speed drive**, asynchronous motor)
- Sensors (photo-electric)
- PLC
- Mechanical measuring instrumentation (vibration, alignment)

➢ *Training activities:*

- Ideal for maintenance activities of alignment and mechanical transmission
- **Assembly, disassembly and adjustments** of couplings and transmission shafts
- Fault diagnostics using industrial measuring instruments
- Observation of the impact of a misalignment on the system
- Dynamic tests for mechanical operations done by the students

- **Use of industrial instrumentation** for shaft alignment and vibration study
- Functional analysis, studying the technologies used and constructive solutions (3D-modeling in Solidworks)
- Studying the kinematics and dimensioning of the main components
- Electrical wiring and automation activities with the separate control cabinet

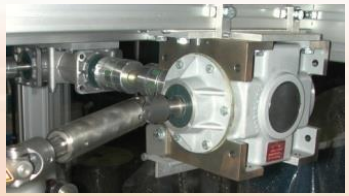
➢ *Key points:*

- Training bench based on an industrial system (dividing a flow of bottles in a manufacturing line) to introduce students to the problems related to alignment of transmission shafts, pulleys, gears and strain of belts and chains
- Huge variety of mechanical parts

➢ *References:* **DE10:** Divider with power unit – **DE11:** Separate control cabinet for DE10 automation – **DE30:** Divider with power unit and control cabinet with 3 removable plates for wiring the motor starter – **DE19:** Short conveyor in kit (Optional) – **DE18:** Specific tools for angle transmission

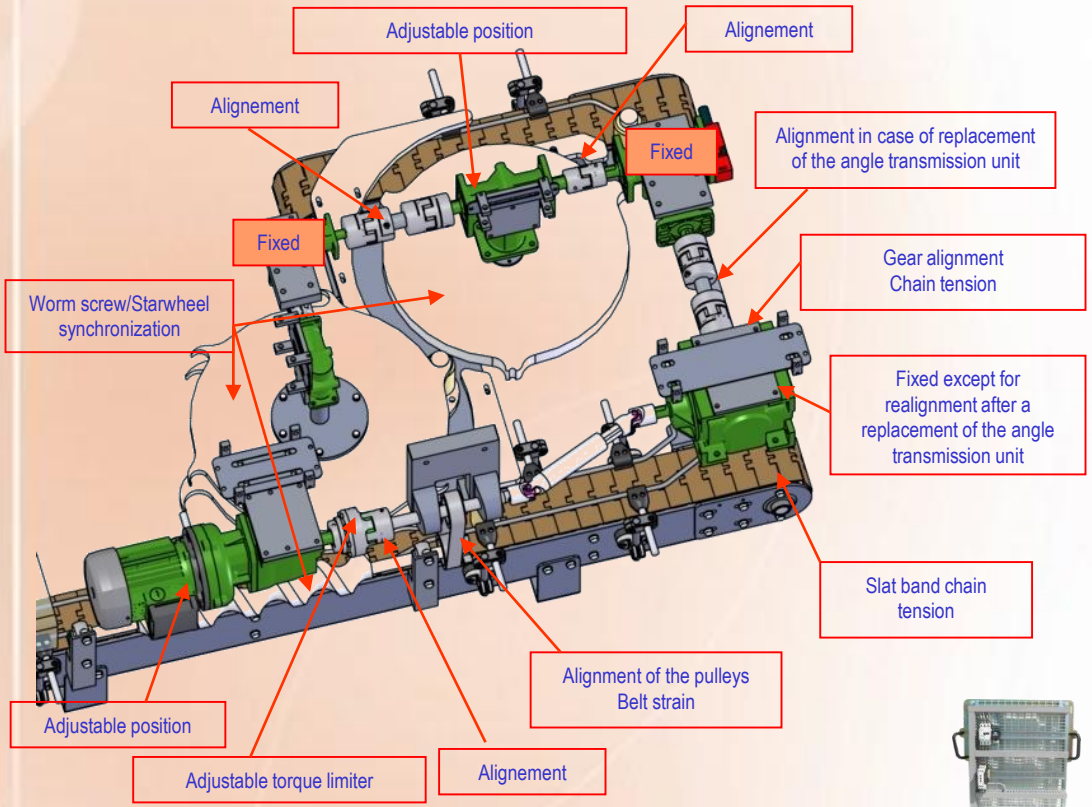
## System related to the Divider

**Angle transmission case (DE13 and DE21)**



→ Assembly / disassembly / adjustments (gasket and bearings replacements)
→ Constructive solution analysis and Solidworks 3D mechanical design (Kinematics…)
→ References: DE13: Angle transmission case (drainable) – DE21: Angle transmission case, without constraint

**Page C17**




## Instruments used with the Divider

**Transmission shaft alignment tool with jauge set** (DE14)

**Vibration analyzer** (DE15)


**Pulley alignment and belt tension tool** (DE16)

*Pulley alignment (worm screw rotation)*

*Gear alignment (shaft conveyors)*

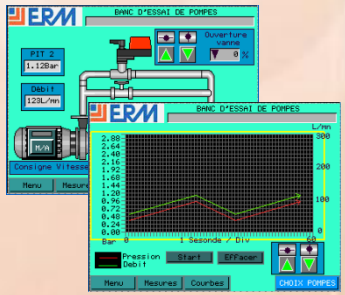
*DE30 with control cabinet and 3 removable plates for wiring*

# Automated mechanical systems

New

## ErmaPompes – Study, maintenance and testing bench for industrial pumps

➢ *Features:*
- Industrial **pumps** (centrifugal, lobe, sewage, etc.)
- **Control valves** (solenoid valves)
- Sensors and measures (**flow, pressure, torque**, voltage, current)
- Control and command (**Web server controller, speed drive**)




*HMI screens*

***Pumps may also be purchased without the bench***



*Several pumps are available*

➢ *Training activities:*
- Functional analysis, studying the technologies used and constructive solutions (3D-modeling on SolidWorks)
- Hydraulic connection, commissioning, **tightness testing** and pump performance testing (flow/pressure, vibration, acoustics, etc.)
- **Assembly, disassembly and adjustments** (e.g., Shaft alignment of standard centrifugal pump, cleaning, etc.)
- Controlling mechanical stress and **heavy handling** (e.g., Laying/removing pumps on/from the test bench)
- Monitoring, **inspections**, **diagnostics**, **corrective maintenance** and **improving maintenance**
- (Direct or speed drive) motor starter **wiring**
- Studying the **speed drive configuration** and performance
- **Energy consumption** and **efficiency** study (with / without speed drive)
- **Analysis of the test device (information chain)** and **controller and embedded Web supervision programming**

➢ *Key points:*
- The product is adapted for trainings in **electrotechnics**, **control and maintenance**
- **Automatic curve of the pressure/flow characteristics** of industrial pumps
- Unique support for maintenance training in water-related trades and process industries
- **Spare parts are supplied with each pump**
- **Mechanical operations can be validated** through functional testing
- Multiple workstations: **One test bench for several pumps**

➢ *References:* **PO20:** Maintenance and tightness testing bench – **MV11:** Workshop crane (Optional) – **PO21:** Standard centrifugal pump – **PO22:** Multistage horizontal centrifugal pump – **PO23:** Sewage pump – **PO24:** Displacement pump – **PO25:** Diaphragm dosing pump – **PO15:** Mechanical tool kit – **PO16:** Maintenance measuring tools

## Mainelec2 – Roller conveyor for maintenance and electrotechnics training

➢ *Features:*
- **Motors and reduction gears** (asynchronous brake motor, spiral bevel reduction gear, parallel reduction gear, etc.)
- Electrical energy (low-voltage switchgear, **speed drive**)
- Sensors (photoelectric)
- **Automatism** (PLC function of the speed drive)

➢ *Training activities:*
- **Preventive maintenance and TPM** (visual inspection, lubrication, adjustments, chain tension, component replacement, reduction gear draining, etc.)
- **Control cabinet modification** (cycle modification with sensors, adding a security component, inserting variation elements)
- **Mechanical corrective maintenance** (replacement of the motor, the reduction gear, a roller)
- **Electrical corrective maintenance** (equipment lockout, continuous and operational troubleshooting, algorithmic approach)

➢ *Key points:*
- Modular product (**3 types of control cabinets, 2 types of reduction gear**)
- **Useful in both maintenance and electrotechnics training**
- Many maintenance tool cases and activities

➢ *References:* **MA10**: Base frame of Mainelec 2 (without electrical cabinet or motor) – **MA11**: Electrical cabinet with electromechanical logic – **MA12**: Electrical cabinet with Digidrive SK speed drive – **MA13**: Empty electrical cabinet for student wiring – **MA15**: OT gear motor with spiral bevel reduction gear and brake – **MA16**: CB31 gear motor with parallel reduction gear and brake – **MA19**: Electrical and mechanical maintenance kit

New

## Dosaxe – Brushless axis dosing machine

➢ *Topic coverage:*
- Motorization (**asynchronous** for the conveyor, **brushless** for the filling head, **cylinder** for opening/closing)
- Electrical energy (low-voltage switchgear, **speed drive**)
- Sensors (photoelectric, on/off)
- **Automation** (Siemens PLC and touchscreen console HMI )

➢ *Training activities:*
- Functional and structural system analysis
- Adjustments for format change (jars/bottles)
- Making of electrotechnical breadboards
- HMI and PLC programming
- Preventive, corrective, improving maintenance

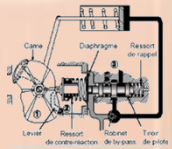
➢ *Key points:*
- **2 modes of operation** (jar filling on standstill or moving conveyor with **brushless axis synchronization**)
- **The system is useful for maintenance and electrotechnics training**
- **Change of production formats**

➢ *Reference:* **DX10:** Dosaxe, brushless axis dosing machine

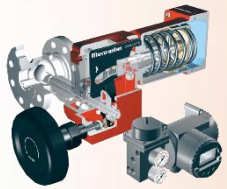
## MaintiValves – Test bench for maintenance and tightness of industrial valves

➢ *Features:*
- Pneumatic energy (pneumatic and electro-pneumatic positioners)
- Movement conversion (**cam, spring, shaft**)
- Sensors (flow)
- Materials (materials suitable for air-tightness and fluid flow)

➢ *Training activities:*
- Functional analysis, studying the technologies used and constructive solutions (3D Solidworks)
- **Pneumatic connection**, **commissioning** and **tightness testing**
- Controlling mechanical stress and **heavy lifting** (eg.: Installation / removal of the 50kg valve on the test bench)
- **Preventive maintenance** (eg.: Maintenance of the positioner and the sealing joint)




- **Corrective maintenance** (eg.: Fault detection on the positioner)
- **Improvement maintenance** (eg.: Changing the tightness class)
- **Assembly, disassembly and adjustments** (eg.: Change of the valve's position, Adjustment of actuator's coupling, Change of actuator's action…)



***3-inch Camflex Rotary valve (Regulating valve)*** (MV12)

***3-inch single seat valve (Regulating valve)*** (MV13)

***1.5-inch diaphragm valve with electric servo motor (on/off valve)*** (MV18)

***1.5-inch manual diaphragm control valve (on/off valve)*** (MV16)

***1.5-inch pneumatic rotary valve (on/off valve)*** (MV19)

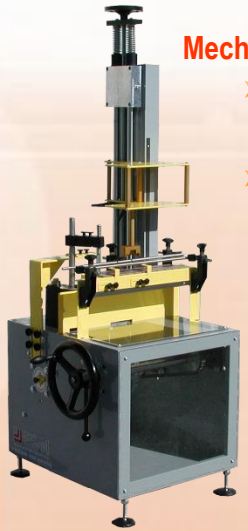
***1.5-inch manual pneumatic diaphragm valve (on/off valve)*** (MV17)

➢ *Key points:*
- Many **mechanical activities** on a **very heavy duty system**
- Valves with **spare parts**
- Possibility of **verifying mechanical operations** with tightness test
- Multiple workstations: **One test bench for several valves**

***Valves may be ordered alone (without bench)***

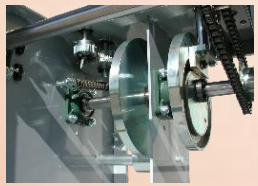
➢ *References:* **MV10:** MaintiValves test bench for maintenance and tightness testing – **MV12:** 3-inch Camflex Rotary valve (50kg) – **MV13:** 3-inch Single seat valve (100kg) – **MV16:** 1.5-inch manual diaphragm valve (on/off valve) – **MV17:** 1.5-inch manual pneumatic diaphragm valve (on/off valve) - **MV18:** 1.5-inch pneumatic diaphragm valve with electric servo motor and repair kit (on/off valve) – **MV19:** 1.5-inch rotary valve with repair kit (on/off valve) – **MV11:** Workshop crane

## Mechanical capper unit - Mechanical part of a screw capper

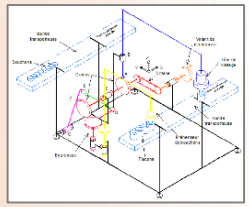


➢ *Features:*
- Packaging (Pick & Place and screwing head)
- Movement conversion (**cams, rollers, gears, cones, springs**…)

➢ *Training activities:*
- **Assembly, disassembly and mechanical validation** (cam synchronization, adjusting movement range for gripping, centering the gripping head, height adjustment of the screwing head and adjustment of the chain tension, clearance adjustment…)
- **Kinematic study** and diagrams design
- Analysis of **technological solutions** and Solidworks 3D mechanical design
- Analysis and **cam calculation**



*Cams*



*Capper kinematics*

➢ *Product strengths:*
- **Part of the screw capper** of the Ermaflex line (complete documentation is provided)
- Reliable unit suited for **frequent assembly and disassembly**
- The system is instrumented with **rulers** and **protractors** for kinematic studies
- Spare parts are supplied

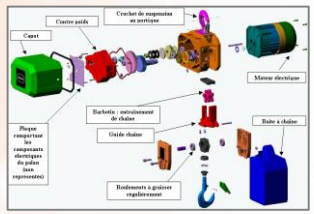
➢ *Reference:* **MB10:** Mechanical capper unit

## MaintiHoist – Lifting hoist maintenance and test bench

➢ *Features:*
- Movement conversion (**bearings, gears**…)
- Electrical energy (low voltage switchgear, asynchronous motor)

➢ *Training activities:*
- Identifying the components of a mechanical system
- Analyzing a mechanism, its operation and kinematics (eg.: identification of iso-kinematic groups)
- Schematic diagrams
- **Writing up a disassembly chart**
- Assembly and disassembly (eg.: replacement of bearings)
- Adjustments (eg.: torque limiter)
- **Mechanical intervention on the dynamic and stress test bench**

***Hoist may be ordered alone (without bench)***



➢ *Key points:*
- Possibility of validating the mechanical operations due to stress test
- Multiple workstations: one bench for several hoists

➢ *References:* **MP10:** Test bench with 1.5-ton dynamometer – **MP11:** Hoist

## Slat band chain conveyor

➢ *Features:*
- 3-phase asynchronous motor, contactor, speed drive, etc.
- Conveying (slat band chain conveyor with adjustable guide rails)
- Sensors (photo-electric, inductive and capacitive)

*Control station (CE50)*

*Control cabinet (CE52)*

➢ *Training activities:*
- Assembly, disassembly and adjustments of the conveyor and gear motor
- Studying **motor starters** and the different technologies used in **sensors**
- Wiring of the motor starter

➢ *Key points:*
- Operating part may be connected to a control cabinet or a wiring workstation (mounting plate for wiring)

➢ *References:* **CE50:** Slat band chain conveyor with control station – **CE51:** Slat band chain (operating part) – **CE52+PA10+PA11:** Separate control cabinet with removable mounting plate

## Conveyor belt – Studying sensors and motor start techniques

➢ *Features:*
- Low-voltage switchgear
- Bi-directional conveyor (belt conveyor with adjustable rails)
- **Motor starters** (three-phase motor, contactor, speed drive…)
- **Sensors** (close-up photoelectric, inductive, capacitive)

➢ *Training activities:*
- Wiring of the motor starter on removable plates
- Studying **different sensor technologies and motor starters**

➢ *Key points:*
- Operating part can be connected to the control cabinet
- **Wiring workstations** with the **removable mounting plate** of the control cabinet

➢ *References:* **CV10-CV11-CV12** Conveyor belt with control cabinet - **CV10** Conveyor belt without control cabinet – **CV11** Control cabinet with mounting plate – **CV12** Components for direct motor start (assembled) – **CV13:** Components for direct motor start (assembly kit) – **CV15** Components for motor start with speed drive (assembly kit) – **CV16** Components for motor start with progressive starter (to be assembled) – **PA10** Bare removable mounting plate

## Sensor test bench

→ **11 different sensors** (photoelectric, capacitive, inductive, ultrasonic, pressure, mechanical)

→ **SE//CAP11N:** Sensor test bench

**Page D4**

## Orthogonal gear motor maintenance case with specific tooling – Maintenance of bearings and of an orthogonal reduction gear

➢ *Case content:*
- **Complete orthogonal gear motor**
- Specific mounting/dismounting tools

➢ *Training activities:*
- Shaft line extraction and **bearing replacement**
- Mounting, **adjustment and blocking** of the conical housing
- Mounting of the intermediate line
- Measurement of conical housing and case **dimensions**
- Conical and intermediate axes **assembly** in the case
- Checking for **backlash in the toothing** of the conical housing and **torque loss measurement**
- **Complete mounting** of the reduction gear and **motor coupling**
- Testing of the running gear motor

➢ *Key point:* Gear motor used in the Mainelec2 system (technical file **provided**)

➢ *Reference:* **MM13:** Orthogonal gear motor maintenance case with specific tooling – **MM14:** Wear part kit of the OT32 orthogonal reduction gear – **OT32I:** Standalone reduction gear

## Orthogonal reduction gear bearing mounting case – Mounting/dismounting of bearings and constraint adjustment

➢ *Case content:*
- 6 identical sets of OT 3233 reduction gear parts (bearings, spiral bevel gear axes, intermediate axes
- 2 sets of specific tools

➢ *Training activities:*
- Mounting of the **conical housing** (parts: conical gear, bearings, key, spacer, rings)
- **Adjustment and blocking** of the conical housing
- **Mounting of the intermediate line** (parts: gear, bearings, key, bevel gear, rings)

➢ *Key point:* Several students can work simultaneously (6 sets of parts and 2 sets of tools)

➢ *Reference:* **MM11:** Orthogonal reduction gear bearing mounting case – **MM14:** Wear part kit of the OT32 orthogonal reduction gear

## Orthogonal reduction gear mounting and blocking case – Mounting/dismounting and blocking of a reduction gear

➢ *Case content:*
- Case and pre-mounted reduction gear assemblies
- Set of specific tools

➢ *Training activities:*
- Measurement of conical housing and case dimensions
- Conical and intermediate axes assembly in the case
- Checking for backlash in the toothing of the conical housing and torque loss measurement

➢ *Key point:* Gear motor used in the Mainelec2 system (technical file provided)

➢ *Reference:* **MM12:** Orthogonal reduction gear mounting and blocking case – **MM14:** Wear part kit of the OT32 orthogonal reduction gear

## Constraint-free orthogonal reduction gear case – Mechanical study and constraint-free mounting/dismounting of an orthogonal reduction gear


➢ *Case content:*
- **Set of orthogonal reduction gear parts** adjusted for dismounting/mounting without tools

➢ *Training activities:*
- Complete constraint-free mounting of the reduction gear
- Mechanical study of the reduction gear

➢ *Key point:* Gear motor used in the Mainelec2 system (technical file provided)

➢ *Reference:* **MM10:** Constraint-free orthogonal reduction gear case

## Constraint-free orthogonal reduction gear case – Mechanical study and constraint-free mounting/dismounting of an orthogonal reduction gear


➢ *Case content:*
- **Complete parallel reduction gear**
- Specific mounting/dismounting tools

➢ *Training activities:*
- **Mounting of bearings** and wheels on axes
- Mounting of the reduction gear (**Axes assembly in the case**)
- Output shaft **extraction** and **key and bearing replacement**
- Intermediate shaft extraction and key and bearing replacement
- Input shaft extraction and bearing replacement

➢ *Key point:* Gear motor used in the Mainelec2 system (technical file provided)

➢ *Reference:* **MM16:** Parallel reduction gear maintenance case with specific tooling

## Constraint-free parallel reduction gear case – Mechanical study and constraint-free mounting/dismounting of a parallel reduction gear


➢ *Case content:*
- **Set of parallel reduction gear parts** adjusted for dismounting/mounting without tools

➢ *Training activities:*
- Complete constraint-free mounting of the reduction gear
- Mechanical study of the reduction gear

➢ *Key point:* Gear motor used in the Mainelec2 system (technical file provided)

➢ *Reference:* **MM15:** Constraint-free parallel reduction gear case

## Brake motor case – Mechanical study and maintenance of a brake motor


➢ *Case content:*
- Brake motor, as separate parts and mounted sub-assemblies
- Two additional lining carrier fans
- Innerspring unit and additional keys
- Tools needed for mounting and torque measurement

➢ *Training activities:*
- Study and maintenance of a brake motor
- Study, calculations and measurements on an electric motor brake

➢ *Key point:* Gear motor used in the Mainelec2 system (technical file provided)

➢ *Reference:* **MM17:** Brake motor case

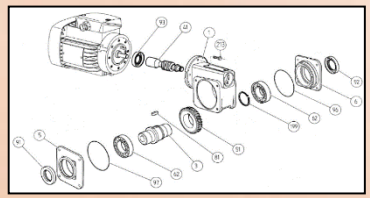
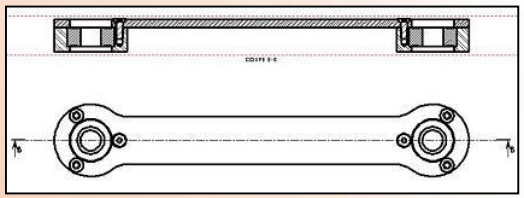
## Rod & Gear motor case

➢ *Features:*
- Movement conversion (Rod crank)

➢ *Training activities:*
- Constructive solution analysis and Solidworks 3D mechanical design
- Assembly / disassembly of the gear motor
- Assembly / disassembly of the crank rod

➢ *Key points:* Sub-unit of Ermatest system provided with spare parts (gaskets…) and technical documentation of Ermatest to make the link with the complete system.

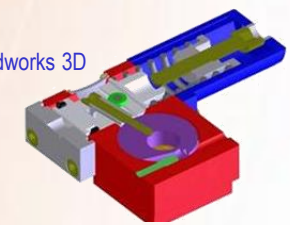
➢ *References:* **BM16** Rod and Gear motor case (Ermatest)

## Pneumatic blocker & Hydraulic cylinder case

➢ *Features:*
- **Pneumatics** (blocker)
- **Hydraulics** (double-acting cylinder)
- Movement conversion (rack)

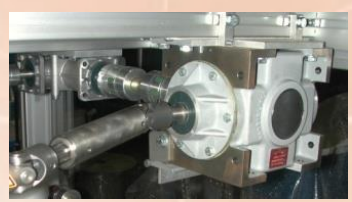
➢ *Training activities:*
- Constructive solution analysis and Solidworks 3D mechanical design (kinematics…)
- **Assembly / disassembly** of the pneumatic blocker
- Cylinder joint **replacement**


*3D Pneumatic blocker*

➢ *Key points:* Sub-unit of Ermatest system provided with spare parts (gaskets…) and technical documentation of Ermatest to make the link with the complete system.

➢ *Reference:* **BM17:** Pneumatic blocker & Hydraulic cylinder case (Ermatest)

## Angle transmission case, drainable or without constraint



➢ *Features:*
- Movements conversion (gears)

➢ *Training activities:*
- Constructive solution analysis and Solidworks 3D mechanical design (kinematics…)
- Assembly / disassembly
- Adjustments (gasket replacement)

➢ *Key points:* Component of the Divider, with technical documentation

➢ *References:* **DE13**: Angle transmission case (drainable) – **DE21**: Angle transmission case, without constraint

## Hydraulic trainer - Modular hydraulic trainer, On/Off and/or Proportional

➢ *Features:*
- Hydraulic unit (constant flow pump, variable flow pump)
- Hydraulic actuators (single and double-acting cylinders, servo-cylinder, hydraulic motors)
- On/Off distribution (pressure and flow limiters, 4/2 and 5/3 distributors, proportional distributor…)
- Hydraulic control (proportional control of pressure, flow and position)
- Sensors (pressure, flow, temperature)

➢ *Training activities:*
- Hydraulic and electric connections
- Studying hydraulic parts : on/off, proportional and servo-controlled
- Studying different hydraulic loads
- Hydraulic measurements (temperature, flow, pressure, position)

➢ *Key points:*
- Modularity makes the trainer suitable for both beginners and advanced users
- Several upgrades from the basic structure to proportional hydraulics
- Possibility of operating several hydraulic parts
- Two types of hydraulic pumps (axial piston pump and gear pump)

➢ *References:* **HB20:** Hydraulic on/off trainer – **HB25:** Proportional hydraulic trainer – **HB26:** Proportional distribution for on/off trainer (Optional) – HB20 and HB25 trainers may be complemented or modified according to requirements and needs (more than 50 modular parts: flow, pressure, cylinder and motor actuators, etc.

## Hydraulic lifting unit - Hydraulic training system with variable loads

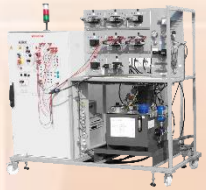
➢ *Features:*
- Hydraulic unit (on/off 60-bar power pack)
- Hydraulic actuators (single & double-acting cylinder)
- **On/Off Distribution** (pressure and flow limiters, distributors 4/2 and 5/3, check valve…)
- Sensors (manometer, position)

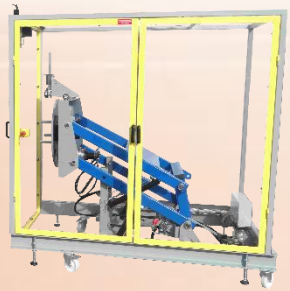
➢ *Training activities:*
- Electrical and hydraulic connections
- **Studying hydraulic components**
- Analyzing **vertical variable loads**
- **Hydraulic measurements** (temperature, flow, pressure, contamination)

➢ *Key points:*
- Ideal for hydraulics fundamentals, common parts at a competitive price
- Possibility of **using the Multitec hydraulic unit and cylinder**
- Possible subsequent addition of more complex parts (easy replacement)
- May be connected to a PLC unit for **operation cycles programming**

➢ *References:* **HD10:** Hydraulic lifting unit (without Multitec's hydraulic unit / cylinder) - **HD10-KH50:** Hydraulic lifting unit (with Multitec's hydraulic unit and cylinder) - **HD11:** Set of hydraulic parts for additional experiments

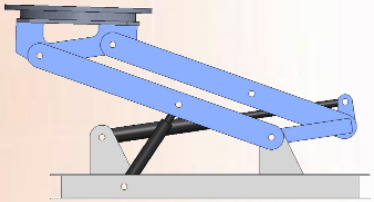
## 2 or 3-axis Positioner & Hydraulic bench – 2 or 3-axis hydraulic welding positioner





➢ *Features:*
- **Hydraulic actuators** (double-acting cylinders, motor)
- **Hydraulic distribution** (4/3 distributors, 4/2 distributor, flow controller, pressure controller)
- Hydraulic storage (**accumulator, circuit closing device**)
- **Hydraulic measurements** (pressure, flow, temperature, level)
- Hydraulic generation (**hydraulic unit with gear pump**)
- **Sensors** (table rotation speed with encoder)
- **Electrical energy** (low-voltage switchgear, speed drive)
- Electrical and hydraulic safety (safety relay, valves…)

➢ *Training activities:*
- **Functional analysis,** studying the technologies used and constructive solutions (3D SolidWorks)
- **Mechanical handling and blocking**
- Hydraulic and electrical connecting and wiring
- **Adjustments of the hydraulic systems**
- **Preventive, corrective and upgrading** hydraulic maintenance
- Hydraulic and mechanical mounting/dismounting
- **System performance analysis**, static or dynamic tests
- Studying hydraulic components: on/off, proportional
- Studying different **hydraulic loads**
- **Hydraulic measurements** (temperature, flow, pressure, level)



*Hydraulic unit*

*Hydraulic trainers and fixed hydraulic components*

*Rear view of the rotary table*

➢ *Key points:*
- **Many technical and kinematic solutions** of the operating part
- Modularity in designing hydraulic circuits

➢ *References:* **PX15**: Operating part - 3-axis (elevation, tilt, rotation) hydraulic positioner – **PX16**: Operating part - 2-axis (tilt, rotation) hydraulic positioner – **PX10**: Hydraulic bench controlling the Hydraulic positioner – **PX11**: Hydraulic accumulator and circuit closing device – **PX12**: Additional components for maintenance activities – **PX13**: Double-acting hydraulic cylinder (200mm stroke) for maintenance activities – **PX14**: Additional components for advanced hydraulic activities (digital flowmeter and pressure sensor, two hydraulic component trainers for 2 additional hydraulic scenarios)

# Aeronautical maintenance

## Aeronautical hydraulic test bench

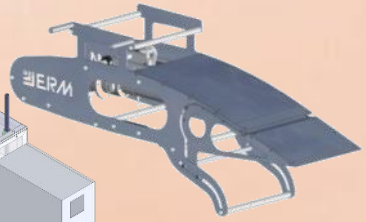
➢ *Features:*
- Hydraulic unit (constant flow pump, accumulator, hand operated pump)
- Hydraulic actuators (double acting cylinder, servo-cylinder, hydraulic motor)
- Hydraulic distribution (pressure and flow limiters, 2/2 and 4/3 distributors, servo-distributor…)
- Sensors (pressure, temperature)

➢ *Training activities:*
- Hydraulic connections, test on hydraulic hose and cylinders
- Operating hydraulic parts (landing gear, flap, aileron) with kinematics identical to real ones
- Hydraulic measurements (temperature, flow, pressure)
- Hydraulic maintenance (filter replacement)
- Simulation of hydraulic breakdown (main circuit, emergency circuit, accumulator, hand operated pump)

➢ *Key points:*
- Study of a **realistic hydraulic system (redundancy…)**
- **3 different operating parts (landing gear, flap, aileron)**

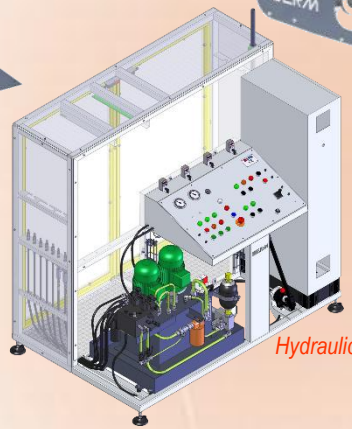
➢ *References:* **HA10:** Aeronautical hydraulic test bench (with cylinder test sub-system only) – **HA11:** Landing gear sub-system with On/Off cylinder – **HA12:** Aileron sub-system with servo-cylinder – **HA13:** Flap sub-system with hydraulic motor

*Aileron (HA12)*



*Flap (HA13)*

*Landing gear (HA11)*



*Hydraulic and control units*

# Maintenance tools

**Transmission shaft alignment tool with adjusting wedges** (DE14)

Page I2

**Vibration analyzer** (DE15)


Page I2

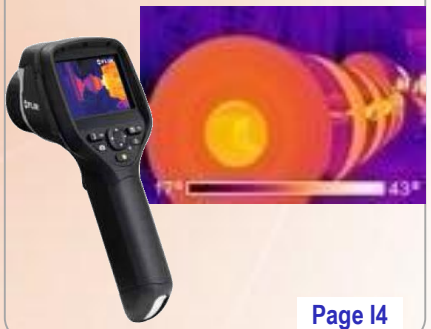
**Pulley alignment and belt tension tool** (DE16)


Page I2

**Ultrasonic leak detector**
(Leakshooter)

Page I3

**Thermal infrared camera**
(Flir Ex and Exx)



Page I4

**Oil analysis kit**
(HY10)

Page I3

**Oil filtration unit**
(HY12)

Page I3

**Hydraulic measuring kit**
(HY11)

Page I3

**In and off-line particle counter**
(iCount iOS)

Page I3

New

## CTA Compact – Air handling system with energy recovery, recycling, heating, cooling, humidifying and industrial supervision

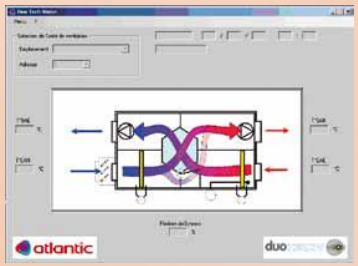
➢ *Features:*

- **Blowing and extraction**
- **Mixing and heat recovery** (plate heat exchanger)
- **Filtration** (medium, high efficiency)
- **Heating** (hot water or electric coil)
- **Cooling** (cold water coil)
- **Heat recovery** (plate heat exchanger)
- **Steam humidification**
- **Sensors** (temperature, pressure, hygrometry...)
- **Centralized Energy Management** system (CEM)

*Control and configuration box*

➢ *Training activities:*

- Analyzing the functions of a air-handling system
- Study of **PLC and communication network** in a building (CEM)
- **Commissioning** & **Configuration**
- Climatic and electrical **maintenance**
- Analysis of the **refrigeration, electrical and air flow circuits**
- Energy balance and calculation of the **performance ratios**
- Forecasting the operating conditions




*Configuration and supervision software*

➢ *Key points:*

- **Professional equipment** used in collective buildings
- **Customized measurements**
- Easy-to-use and friendly supervision software
- Open system to main communication protocols (**Ethernet, LonWorks, BACNet, Modbus, KNX**)

➢ *References:* **CC00** High-performance Double-flow air-handling system with: Exchanger 90%, CC motors with low-consumption electronical commutation (Flow up to 1000m³/h), Filtration G4+F7 on blowing and filtration G4 on return, Bypass, Power box with communication capable PLC and temperature & pressure sensors, Control and configuration box, configuration and supervision software on Modbus local network – **CC15** Flexible connection (6 m. long, diam. 315mm), from the Air-handling unit to an external wall – **CC10** Electric coil for pre-heating 3.6kW and post-heating 6kW – **CC11** Water coil for post-heating or cooling – **CC12** Mixing case with antifreeze register and one-way motorized shutters – **CC13** Steam humidification case – **PC30** Air/Water reversible inverter 10kW chiller – **CC01** CO2, hygrometry and presence sensors for advanced control – **CC02** KNX gateway (supervision application not provided) – **CC04** Modbus TCP/IP Module on PLC – **CC05** BACNET IP Module on PLC – **WM01/WM02** Measuring instruments (see CTA Flex references)

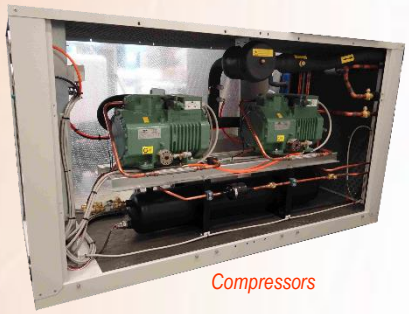
New

## Commercial/Industrial refrigeration unit – Multi-compressor system supplying several refrigeration units

➢ *Features:*

- **Refrigeration unit** (dual-compressor refrigerating group using R404A, suction accumulator, oil separator, fluid reservoir, filter dryer, etc.)
- Condenser (air-cooled) and evaporator (air-cooled)
- Refrigeration applications (cold room, display case, ambient air volume)
- Expansion valves (thermostatic, electronic) and evaporation pressure control valves
- Control (**PLC for the refrigeration unit, controllers for display cases, cold rooms and room temperature**)
- Sensors (pressure, temperature)
- **Communication** and supervision
- Fluidic and electrical circuits and their equipment
- **Hydraulic circuit** components (hot water production by **heat recovery**)

*Carel Plantwatch Web Supervision*



*Compressors*

➢ *Training activities:*

- Introduction to **refrigeration units**
- Electrotechnical measurements
- Hands-on training with refrigeration components
- **Refrigeration measurements and enthalpy chart design**
- **Refrigeration and electrical** troubleshooting and **maintenance**
- **Commissioning & configuration**
- **Energy balance** and computation of performance ratios

*Measurement console*

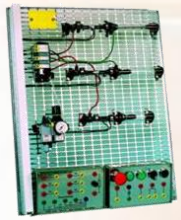
➢ *Key points:*

- **Real-life situations and actual sizing** (e.g., Mini-market refrigeration unit with cold room, refrigerated display case and ambient cooling)
- Resistance for **simulation of temperature variations** in the cold room
- **More display cases, cold rooms and "free" evaporators may be added**
- Hot water production by **energy recovery** (option)

➢ *References:* **CF10:** Dual-compressor Inverter refrigeration unit with remote air-cooled condenser and helical fan – **CF12:** Display case with thermostatic expansion valve – **CF13:** Negative cold room with thermostatic and electronic expansion valves, and ambient evaporator with thermostatic expansion valve – **CF15:** Heat recovery unit producing hot water – **PC22:** 4-channel thermometer with PC acquisition and display (delivered with 8 thermocouple probes and PC acquisition software)

# Hydraulics & Pneumatics Fundamentals

## Parker Pneumatic and Electro-Pneumatic Trainer – Grid board



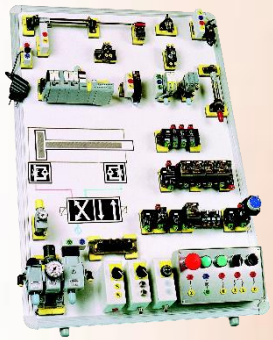
➢ *Features:*
- Actuators and pre-actuators (cylinders, distributors, valves…)
- Sensors (limit switch, pressure drop…)
- Control and data processing (button box, Indicator lights, emergency stop…)

➢ *Training activities:*
- Commissioning of pneumatic and electro-pneumatic parts

➢ *Key points:*
- Pneumatic and electro-pneumatic versions

➢ *References:* **P//PMBE61:** Parker Electro-Pneumatic Trainer on grid board - **SC//MD1AE125:** Schneider Zelio PLC - **P//PMBP51:** Parker Pneumatic Trainer on grid board - **P//PMX4SMA12:** Pneumatic sequencer - 4 modules (Optional) - **P//PMXkit02:** 30 extra connecting cables

## Didaflex Parker Pneumatic and Electro-Pneumatic Trainer - Magnetic board



➢ *Features:*
- Actuators and pre-actuators (cylinders, distributors, valves…)
- Sensors (limit switch, pressure drop…)
- Control and data processing (button box, indicator lights, emergency stop…)

➢ *Training activities:*
- Commissioning of pneumatic and electro-pneumatic parts

➢ *Key points:*
- Use of magnetic symbols and parts
- Flexible and quick set-up (no tools required)

➢ *References:* **P//PMXE611:** Didaflex Parker Electro-pneumatic Trainer on magnetic board - **SC//MD1AE125:** Schneider Zelio PLC - **P//PMXP511:** Didaflex Parker Pneumatic Trainer - **P//PMX4SMA12:** Pneumatic sequencer - 4 modules (Optional) - **P//PMXkit02:** 30 extra connecting cables

## Hydraulics AutomationXpert – Theoretical and practical knowledge base in Hydraulics

➢ *Contents:*
- Theoretical and practical courses extensively covering topics in industrial hydraulics

| | |
|---|---|
| Theory of hydraulics | Flow devices |
| Pressure Equipment | Hydraulic diagrams |
| Locking devices | Filtration |
| Hydraulic power packs | Pipes and fittings |
| Hydraulic fluids | Motors |
| Pumps | Cylinders |

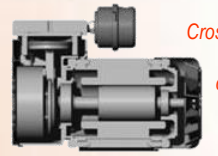

➢ *Key points:*
- 479 pages, 600 pictures and images, 125 animations
- Guide meets the requirements of all levels: technical and vocational training basic and continuing education
- Site license (unlimited number of stations)
- e-learning sessions configurator and multiple choice quiz maker

➢ *Reference:* **PO//GdH:** Hydraulics AutomationXpert

## Compressor test bench – Studying a compressor and pneumatic components

➢ *Features:*
- **Pneumatic** energy (compressor, tank, distributor, double-acting cylinder, pressure manometer)

➢ *Training activities:*
- **Measurements and diagnostics**
- **Assembly / disassembly** on the second compressor
- Studying the connections between parts and **air-tightness**
- Analyzing **kinematic diagrams**
- Solidworks 3D mechnical design



*Cross-sectional view of the compressor*

➢ *Key points:*
- Supplied with a **second compressor in kit** for mechanical studies
- May be used with pneumatic trainers

➢ *Reference:* **CM10:** Compressor test bench

# Other Fundamentals & Softwares for training in Maintenance

## Siemens PLC – Studying and programming the Siemens S7-1200 and S7-1500 PLCs and touch-screen

→ **SI//PackS7-1200:** Trainer pack Siemens S7-1200

→ **SI//PackS7-1500:** Trainer pack Siemens S7-1500

→ **SI//KTP400**: Trainer pack touch-screen operator panel KTP400 with programming and supervision software

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## Schneider PLC - Studying and programming Schneider PLCs (Zelio, Twido, M340)

→ **SC//MD1AE125:** Schneider Zelio trainer

→ **SC//MD1AE120:** Schneider Twido trainer

→ **SC//MD1AE150:** Schneider M340 trainer

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## AutomationXpert – Theoretical and practical knowledge base

➢ *Contents:*
- Theoretical and practical courses extensively covering topics in automation

| | |
|---|---|
| Human/Machine interface | Pneumatic actuation chain |
| Air conditioning | Electrical actuation chain |
| Acquisition chain | Command part |
| Link Operation-Command | Hydraulics |

- Speed drive simulator
- Circuits simulator in electrotechnics, pneumatics and Grafcet

➢ *Key points:*
- 785 pages, 1080 pictures and images, 419 animations
- Guide meets the requirements of levels: technical and vocational training
- Site license (unlimited number of stations)
- e-learning sessions configurator and multiple choice quiz maker

➢ *References:* **PO//GdST**: AutomationXpert - **PO//GdH:** Hydraulics AutomationXpert

ERM AUTOMATISMES

Didactique | Robotique | Fab&Test | Energies

561, allée Bellecour 84200 Carpentras-France
Tél : +33 (0)4 90 60 05 68 / Fax : +33 (0)4 90 60 66 26
contact@erm-automatismes.com

www.erm-automatismes.com

*Follow us on :*

## Contact :

**Patrick Mestre** p.mestre@erm-automatismes.com
✆ + 33 (0)6 84 72 41 17

**Cyril Liotard** c.liotard@erm-automatismes.com