Interreg
Austria–Hungary
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SIF-400 - Industry 4.0 teaching and learning factory

T5.2.1 Training and demonstration modules developed

PBN advanced management

am-LAB advanced manufacturing

What is Industry 4.0?

- The fourth industrial revolution is the era of smart devices based on the devices of Industry 3.0 (computers, controllers, automated assembly lines, electronics, etc)

- An industry 4.0 system can autonomously gather information and control the system without human interaction

- Our SIF-400 factory moves a bit forward with custom product manufacturing
  - Customized product selection is allowed to customers

Industrial components

- Programmable Logic Controllers (PLCs)p
- Sensors (infrared, optical, level, pressure, etc)
- Electric actuators
- Pneumatics (air-based devices)
  - Valves
  - Cylinders
- Human-Machine Interface (HMI)

Source: www.smctraining.com

SIF-400 – The training system for Industry 4.0

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- This system simulates an automated smart factory with Industry 4.0 technologies.
- Highly modular
  - Manual and integrated mode
  - Non-sequential stations
  - Logical layout could be different from the physical

Source: www.smctraining.com

- Assembly process with solid materials
- SIFMES-400
  - Manufacturing Execution System
  - Control, supervision, management and monitoring software solution

SIF-401 - Pallet and container feeding station

- This station feeds containers and pallets to the system.
- Two types of containers:
  - Cylindrical (round)
  - Quadrangular (square)
- All palletts have an RFID chip for
  - Identificaiton
  - Traceability

Source: www.smctraining.com

SIF-402 - Container filling station - solid

- The station fills containers with solid raw material.
- Raw material
  - 3 colours: red, blue, yellow
    - and their mix in different doses
- Quality measurement
  - The filled amount of material is checked.

Source: www.smctraining.com

SIF-405 – Capping station

- The corresponding cap is fitted on the containers at this station.
- Two types of containers -> two types of caps:
  - Cylindrical (round)
  - Quadrangular (square)
- Machine vision with camera
  - Verification of correct fitting

Source: www.smctraining.com

SIF-406 - Container warehouse station

- This station acts as a warehouse for
  - finished or
  - semi-finished products
- It can store up to 50 containers.
  - With their corresponding pallets.
- The warehouse allows the containers to be introduced, extracted and moved internally according to the needs of the process.

Source: www.smctraining.com

SIF-407 - Container labelling and dispatching station

- The station has 2 functions:
  - Prints QR labels to stickers
  - Dispatching the correctly finished products
- Machine vision
  - QR code inspection
  - Label placement

Source: www.smctraining.com

SIF-400 – Common operation (manual)

- In order to start operation in manual mode at first check if the system has power (HMI is on, LEDs on the PLC are lighting) and the pressure is in green at the valve.

- Check the elements of the station:
  - Feeders have enough materials
  - Gates and cylinders are in normal position
  - The conveyors are empty

Source: www.smctraining.com

SIF-401 – Operation (manual mode)

- After the common module checking the module specific operation could begin
- On the HMI choose the desired product type:
  - Round container
  - Square container
  - Empty palette
- Pushing the green START button starts the production

Source: www.smctraining.com

SIF-402 - Operation (manual mode)

- After the common module checking the module specific operation could begin
- Place a palette with a canister on the conveyor*
- On the HMI scroll to the „Launch a proudct” screen :
  - Choose the canister matching the placed canister
  - Choose the color and the amount of desired solids
- Scroll back to home screen
- Pushing the green START button starts the production

Source: www.smctraining.com

**Before the right gate, on the closer conveyor. (Viewpoint is in front of the module, in front of the HMI.)*

SIF-405 – Operation (manual mode)

- After the common module checking the module specific operation could begin
- Place a palette with a canister on the conveyor*
  - Could be empty or filled
- Choose the desired cap type:
  - Square lid
  - Round lid
- Pushing the green START button starts the production

Source: www.smctraining.com

**Before the right gate, on the closer conveyor. (Viewpoint is in front of the module, in front of the HMI.)*

SIF-406 - Container warehouse station

- After the common module checking the module specific operation could begin

- Place a palette with ot without a canister on the conveyor* for input
  - Press the Input button on the HMI
  - Then select an empty (white) bracket on the HMI
    - This is where the product will be placed
  - Finally press the green Play button to start the process

- For output, there is no need to place anything on the conveyor
  - Press the Output button on the HMI
  - Then select an occupied (orange) bracket on the HMI
    - From where you want to output the product
  - Finally press the green Play button to start the process

Source: www.smctraining.com

**Before the right gate, on the closer conveyor. (Viewpoint is in front of the module, in front of the HMI.)*

SIF-407 - Container labelling and dispatching station

- After the common module checking the module specific operation could begin

- If the HMI shows at least 3 pallettes, then press the Empty Bin button, remove the pallettes from the blue bin then follow the pop-up instructions.

- Place a palette with a canister on the conveyor*
  - Could be empty or filled
  - Must have a lid!!

- Two functions:
  - To print QR code press the Print Label button
  - To remove product press the Remove Product button

- Then press the Start button to start the chose process

Source: www.smctraining.com

**Before the right gate, on the closer conveyor. (Viewpoint is in front of the module, in front of the HMI.)*

Integrated (automatic) mode

- The whole system could work fully automated
- The MES (Manufacturing Execution System) has the capability to
  - create and manage orders
  - assign orders to customers
  - monitor stock
  - launch production depending on orders
  - etc.
- In the following we will create an order and launch it fully automated using the MES system.

Create order

- Login to the system*
- Under Management click on Order management
  - Click on + New order button to create a new order
  - Choose the customer, or turn the toggle switch to On
    - Only one option possible: if customer chose, then switch should be Off; if switch is On, then customer could not be set
  - At the bottom click on + Add new product to add a new product to the order
    - A pop-up windows appears, choose any article with desired quantity, the click on Save
    - This operation could be repeated for other types of articles
  - If we finished adding all the wanted products, click on Save

Create order

- Go back to Management page, then click on MO & EO management
- There are 2 options
  - New manufacturing order – create a product
    - If this option was selected, then the system shows all the created orders
    - Check the checkbox of the desired order(s), and click the + Add button
      - Repeat this operation if needed
    - Click on Save button
  - New expedition order – dispatch a product from the warehouse
    - Only the possible orders are listed (possible = available in stock)
    - The methodology is the same as the manufacturing order's

Turning the system into integrated mode

- To launch an order, turn the system into Integrated mode
- Click on Movement at the top
  - then click on System Status
- The system's logical layout appears
- In order to clear everything, at first click on Restart button
  - then if the state turns to Connected click on Reset
- Finally click on Integrated mode button
  - The conveyors should start moving

Launch orders

- To launch orders go back to Management, then click on Dispatcher
- The previously made orders appear here
- There are 3 type of orders
  - MTS – Manufacturing to Store
    - This order will go to Stock (warehouse)
  - MTO – Manufacturing to Order
    - This order will go to the ramp
  - Expedition
    - This order will also go to the ramp, but from the warehouse
- Select one (or more) order and click on Launch
  (on the pop-up Launch again)
  - The type of the selected orders could not be different!!
- Then the system will manufacture the product automatically

Teaching and Learning Factory - intelligent production simulation

https://www.youtube.com/watch?v=g7v_TCQ5nhU