

# EuroSkills Test Project

*Industry 4.0 + HP2*

Task A

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## List of Documents

No.	Document	Description
1	CP-L-EuroSkills-iDrill.zip16	TIA Portal V16 project archive for the CP Lab iDrill Station, prepared for Task A and Task B
2	CP-AM-iDrill_OPC-UA.projectarchive	CoDeSys V3.5 SP15 Patch 4 project archive for the CP Lab iDrill Station, prepared for Task A and Task B
3	Circuit_diagrams_CP-Lab.pdf	Electrical Schematics of the CP-Lab base module
4	Circuit_diagrams_iDrill.pdf	Electrical Schematics of the iDrill application module
5	Datasheet_CP-Lab.pdf	Datasheets of building blocks of the CP-Lab base module
6	Datasheet_iDrill.pdf	Datasheets of building blocks of the iDrill application module
7	Manual_CP-Lab.pdf	User manual of the CP-Lab base module
8	Manual_iDrill.pdf	User manual of the Drilling application module
9	OPCUA_CP-Lab.pdf	List of most important OPC-UA variables of the CP-Lab base module and Drilling application module
10	FESTO_CECC_2014-03a_8036062g1.pdf	Manual of the PLC of the Drilling module
11	et200sp_cpu1512sp_1_pn_manual_en.pdf	Manual of the PLC of the CP-Lab Conveyor

# Introduction

Your task will be to retrofit the given CP-Lab station from the level Industry 3.0 to Industry 4.0.

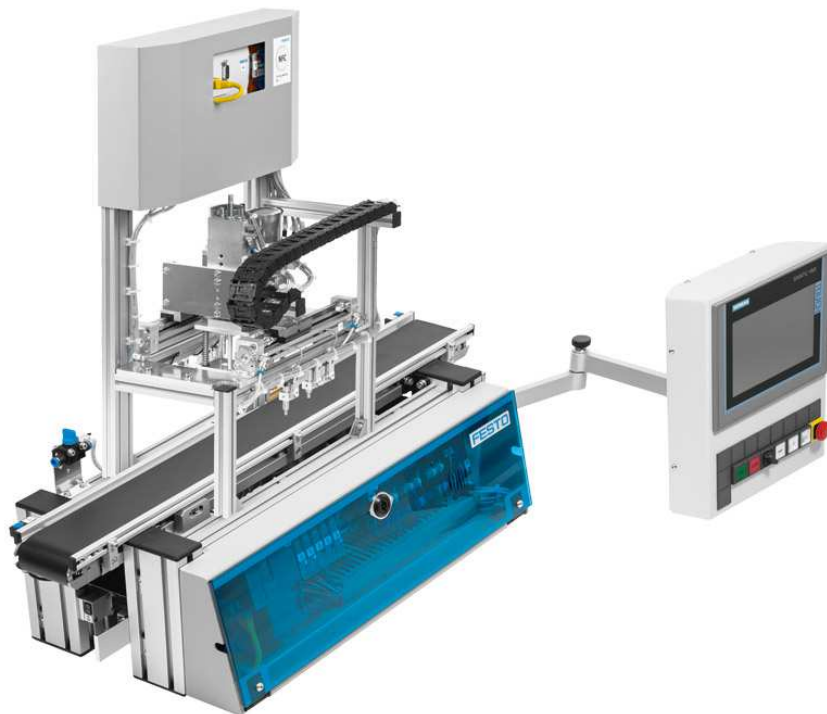
The customer would like to update one of its already existing system to have a more efficient production and access to crucial data of it. In order to reach this goal, your task will be to update a manual drilling workplace with automated process. The drilling module hardware and the required software update for each controller is provided. The process must be defined and controlled via the MES4 software, running on the server computer of the factory.

The customer also would like to have a dashboard, hosted on the server computer, where data of the material flow and the drilling process is observable via a web browser. Additionally, error and warning messages, what are already shown on the webserver of the CP-Lab Conveyor controller, should be shown on this dashboard as well.

Finally, all work and updates what has been carried out must be properly documented.

# Description of project and tasks

## Retrofit from Industry 3.0 to Industry 4.0

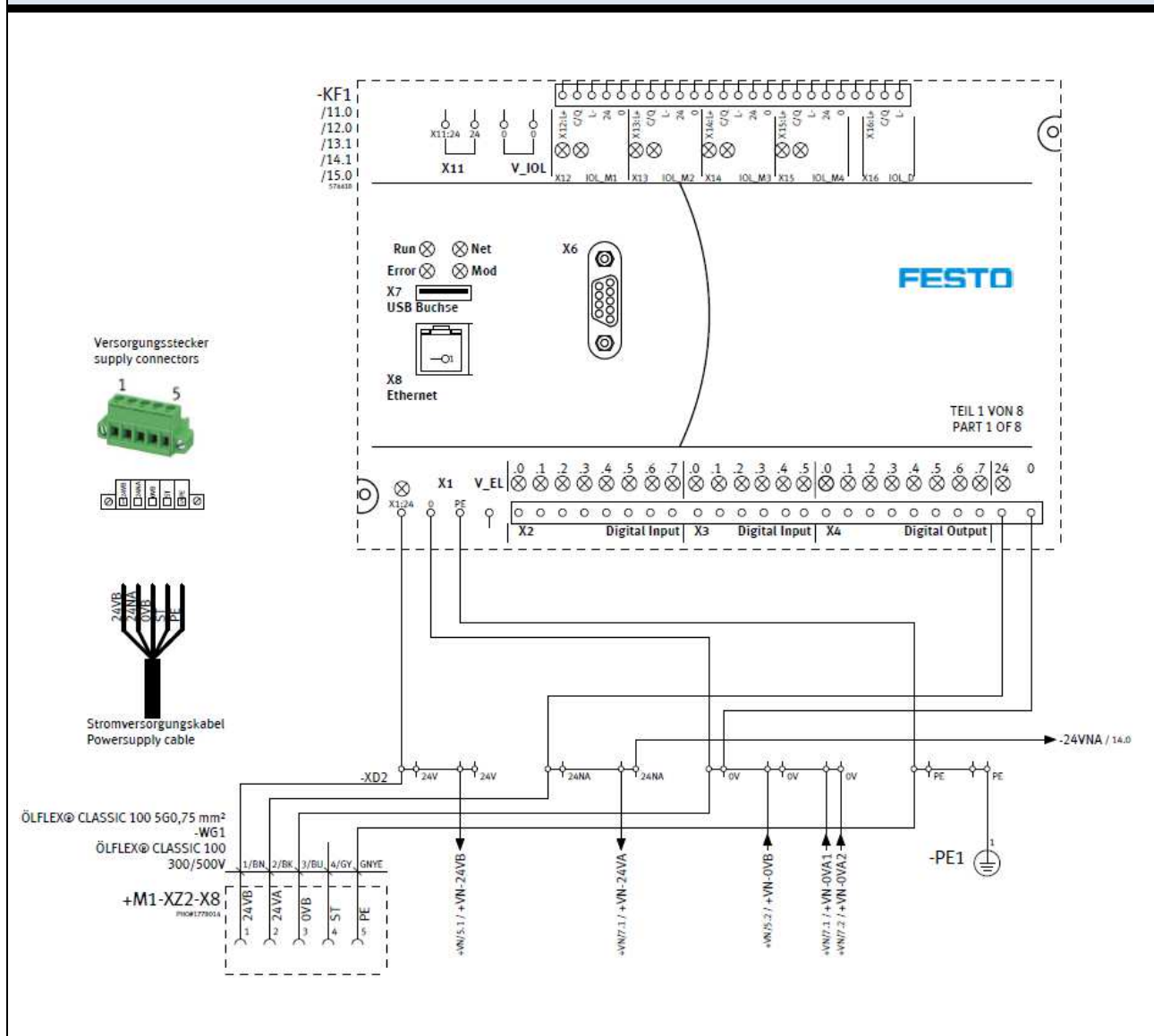


Your task will be completed when:

1. The iDrill application module is assembled on the CP-Lab module and functioning
2. The necessary software update and network setup for each controller is carried out
3. The MES4 software is correctly configured on the MES Server PC as described below
4. A dashboard is available, hosted on the MES Server PC and accessible via a web browser
5. The error and warning messages of the CP-Lab Conveyor controller are visible on the same dashboard
6. All updates and changes are documented.

## Electrical connection of CP-Lab Conveyor and iDrilling application module

### CPU overview\*



### Wiring of main power cord of Drilling module:

- 24VA – Main Power
- 24VB – Emergency Power

### Material detection:

- BG8: 1 - Back cover already available
- BG4: 1 - Front cover available
- BG3: 0 - Front cover right orientation

\*Detailed information is available in the provided electrical schematics and manuals in the “Documents”

## Software Update

No.	Item description	Value / Type
2.10	CP-Lab Conveyor PLC	<b>CP-L-EuroSkills-iDrill.zap16</b>
2.11	iDrilling module PLC	<b>CP-AM-iDrill_OPC-UA.projectarchive</b>

### iDrilling Module Initial Position

- The cylinder of the drilling unit (Z axis) is at upper end position
- The cylinder of the sliding unit (X axis) is at the left end position

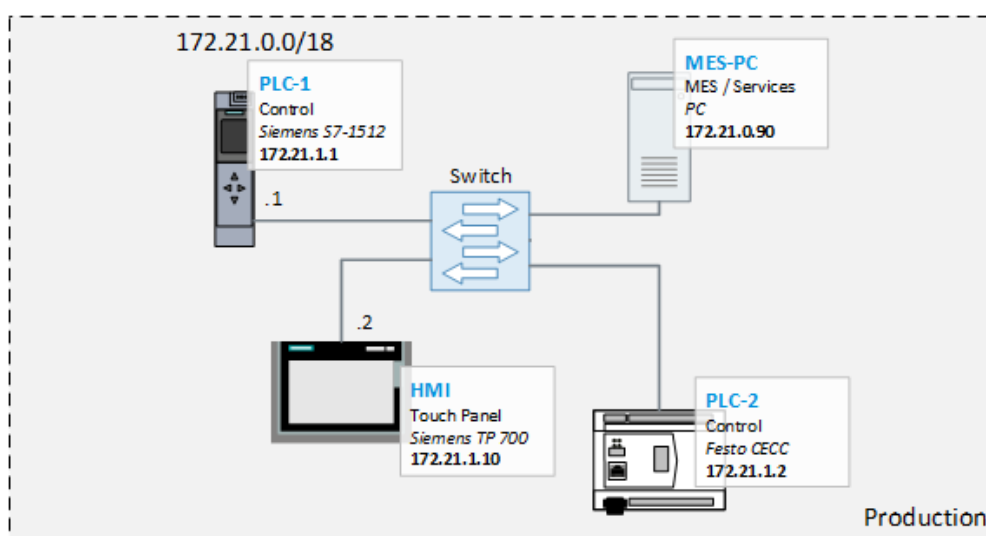
### iDrilling Module Process Description

1. If a carrier with a workpiece is transported up to the stopper when the application is activated, the carrier is stopped, and an automatic sequence is started
2. The workpiece is interrogated, there must be a front cover on the carrier, there must be no back cover on the front cover, the position of the front cover must be correct on the carrier
3. The drilling machines are switched on. Depending on the drilling program, the X axis moves to /stays on the left.
4. The drilling unit moves downwards and drills two holes into the part
5. The drilling unit moves up again
6. The X axis moves to the right position, depending on the drill program.
7. The drilling unit moves downwards and drills the holes 3 and 4 into the part
8. The drilling unit moves up again and the drilling machines are switched off
9. Depending on the drill program, the X axis returns to its initial position
10. The program is finished, the stopper switches downwards and the carrier leaves the station.

## Network Configuration

The IP address of the MES Server Computer is **172.21.0.90/18**.

The remaining part of the system is available in the 192.168.0.0/24 subnet. The required network setting is the following:





## MES4 configuration



A resource must be configured with the capability of drilling on the left and right side of the workpiece.

Specification of the Resources:

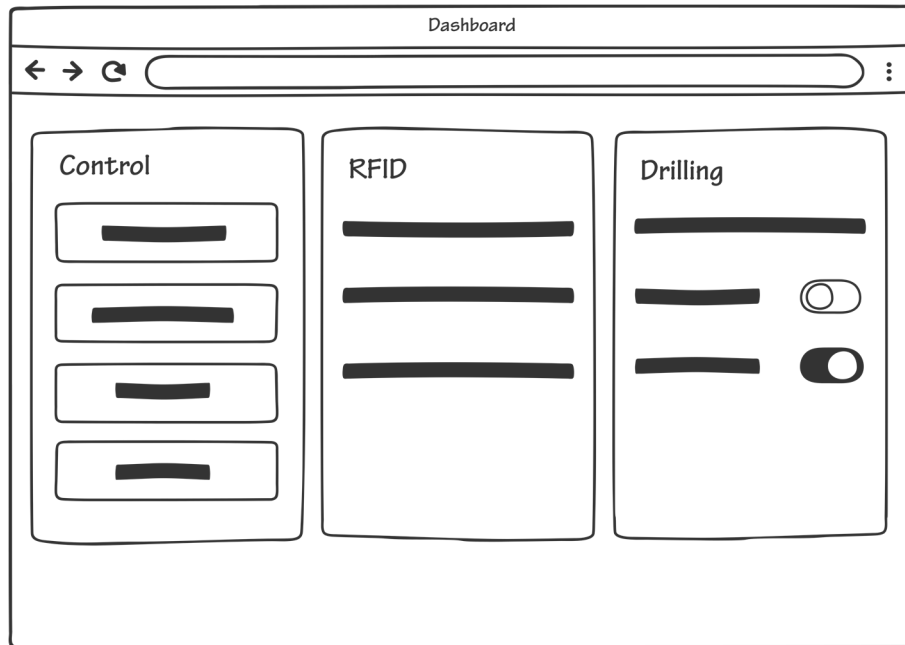
No.	Item description	Value / Type
3.10	Resource ID	1
3.11	Name	CP-AM-iDrill
3.12	IP address	172.21.1.1
3.13	PLC Type	Siemens
3.14	Buffer	-
3.15	Operation 1	120 – drilling right
3.16	Operation 2	121 – drilling left

The workplan must contain two steps with the operation Drilling Left and Drilling Right.

Specification of the workplan:

No.	Item description	Value / Type
3.21	Workplan number for the drilling operation	200
3.22	Name of workplan	Drilling left and right
3.23	Part number	200
3.24	Name of part	Drilling left and right
3.25	Workplan type	Production
3.26	Part number type	Production part
	<b>Step 1</b>	
3.30	Resource ID of station	1
3.31	Operation number	121
3.32	Drilling operation type	Drilling left
	<b>Step 2</b>	
3.40	Resource ID of station	1
3.41	Operation number	120
3.42	Drilling operation type	Drilling right

## Dashboard Function



One block of the dashboard must contain the 4 main control buttons of the CP-Lab, with the same functionality as on the Home / Operation window of the original CP-Lab HMI, from top to down as:

- Reset                    must move the CP-Lab Drilling module to initial position
- Automatic            must activate the automatic mode of the CP-Lab Drilling module
- Manual                must activate the manual mode of the CP-Lab Drilling module
- Cycle End            must end the automatic or manual mode in the end of a running cycle

The text on the buttons must be identical with the text on the CP-Lab HMI and all letters must be capital.

The second block of the dashboard must contain the following data of the RFID of the last Carrier:

- Carrier ID            unique identification number of the Carrier
- Order number        order number written on the RFID
- Order position       order position written on the RFID

The third block of the dashboard must show the order counter of the drilling module as “Order counter” and it must be able to disable the spinning of both drilling motors separately for both direction while they are at upper position.

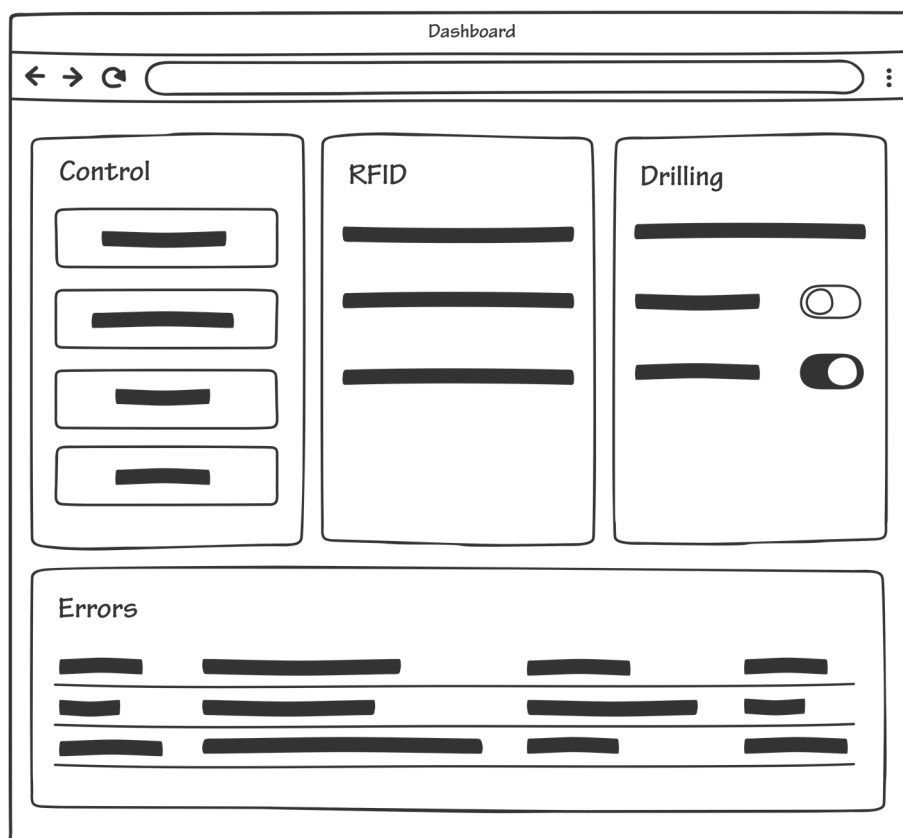
The OPC-UA server endpoints\*:

- S7-1512SP            opc.tcp://172.21.1.1:4840
- CECC-LK              opc.tcp://172.21.1.2:4840

\*The list of most important OPC-UA variables is available in the OPC-UA documents, in the “Documents” folder.

## Error and Warning Messages

The error and warning messages what are available on the webserver of the CP-Lab Conveyor controller must be shown on the bottom of the dashboard.



# Instructions to the Competitor

The task and related documents will be provided on a USB stick. In the end of the task the created documentation must be provided in this USB stick back to the jury.

During the competition use of personal computers are allowed, however the final solution must be implemented on the provided MES Server PC. It is allowed to connect monitor(s), a keyboard, and mouse to the PC or to access it via Remote Desktop Connection (see *MES Server PC Documentation*, in the folder “Documents”).

During the marking, only solutions running on the competition system are evaluated, unless requested differently.

## Equipment, machinery, installations, and materials required

There is not any equipment or material is required that is not listed in the Infrastructure List.

ITEM	QUANTITY	MATERIAL	DESCRIPTION	NOTES

# Marking Scheme

TASK	SUBTASK	BY JUDGEMENT	BY MEASUREMENT	TOTAL
A	Assembly and Adjustment	0	6	6
	Software Update	0	1	1
	MES4 Configuration	0	4	4
	Dashboard Function	1	18	19
	Error and Warning Messages	1	2	3
	Documentation	1	0	1
TOTAL		3	31	34