



Visualisation; Diagnostics

Easy to Configure

Programming IEC 61131-3

Rapid Installation

Workshop Machinery Safety

Intellectual Output "IO2"

PILZ
THE SPIRIT OF SAFETY



Co-funded by the
Erasmus+ Programme
of the European Union

IND4.0

Project No. 2019-1-DE02-KA202-006099

General Information:

Competence area / subject:	Machinery Safety, Research and present professional competence, project competence / information,
School type / occupational field / occupation:	Technical trainees, Students, from the industrial sector (Mechatronics, Electronics...)
Curriculum / learning area reference:	Required in some training regulations, Recommended qualification for all
Requirements	
Number of Participants	Maximum of 20
Room	Chairs and tables for participants Presentation material for 3 groups Beamer
Knowledge (Trainer)	Basic knowledge machinery Safety
Time range:	5 Units [Unit \cong 1 double lesson; 90 min]
Training System	5 x PES- Sensor-Board js en 5x PES- Logic board pnozs 5x PES actuator board ec 5x Cable set suitable for the education systems 5x Power Supply
Software:	None

Brief description and learning objectives of this lesson sequence:

Learn basic knowledge about machinery safety and apply it practically

Introduction and overview of the lesson plan

The lesson plan represents the central theme on which the lesson is oriented and the content structured. A grid with standard points is used (cf. Table 2) for the lesson plan in the education of trainers; these points however can be extended in several other respects.

Time	Phases	Instruction steps	Social forms and patterns of activity	Media

The "phases" are the particular headers of the instruction steps and are, as standard, described by the methodical basic sequence of entry, working on and solidifying (of results). In the entry phase, it concerns the acceptance of the task by the trainees in creating a common orientation basis. In the working phase, the trainees, with a high level of independent work, are to become acquainted with the correlations and the trainer and trainees are to come to an agreement on the result of the instruction work.

As social forms, methods and patterns of activity used in this instruction series are already described in Chapter 4 in this context, this column will be simply overwritten with "Patterns of activity" in the following. Necessary, formal items such as "Welcome" will be completely dispensed with here.

Overview

This instruction series comprises five instruction units, each of 90 minutes, with the following intentions:

	Contents	Intention	Page
1	Introductory questions, presentation	Motivation and introduction to standards, directives and machinery safety.	3
2	1 st to 3 rd tasks: Experiment and answering questions	Deepening acquired knowledge.	4
3	Preparing the presentation and presenting the group results	Mutual informing on group results. Exercising presentation ability.	5
4	4 th task: Solving the problem "Installing an E-STOP pushbutton on the machine" 5 th task: Solving the problem "Change in the hazard"	Practical application of acquired knowledge. Use technical documents.	6
5	5 th task: Continued 6 th task: Validation 7 th task, if necessary: Bonus task, depending on the time available.	Practical application of acquired knowledge. Use technical documents. Checking and evaluating results.	7

Lesson plan of 1st instruction unit

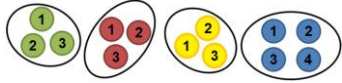
Preparation of lesson	- Preparation of presentation
-----------------------	-------------------------------


Time min	Phases	Instruction steps	Patterns of activity	Media
5	Motivation: Machinery safety	Show video on machinery safety	Frontal teaching	Video
85	Introduction	Deliver presentation	Frontal teaching	Presentation

Explanation

To promote the motivation of the trainees, the context of justification of machinery safety as a topic must be explained. This includes the question of wherein the subject is justified, what the subject includes, which areas of the subject are relevant to a qualified electrical engineer and where this subject can be applied in his everyday work. As a starter, the CE mark should be used on electrical devices, such as smartphones. It only remains to clarify the questions of which areas affect the qualified electrical engineer and which reason is to be given for applying the standard EN ISO 13849. That is to be covered by the introductory presentation. The presentation shall ensure that the trainees all have the same common level of knowledge.

Lesson plan of 2nd instruction unit

Preparation of lesson	<ul style="list-style-type: none"> - Class divided into teams of three = core groups  <ul style="list-style-type: none"> - A "Pilz Education System" per core group - 45 laboratory lines per core group
-----------------------	--

Time min	Phases	Instruction steps	Patterns of activity	Media
20	Introduction: Directives and standards	Read problem description together. Solve 1 st task together. Explain flow chart.	Plenum	Problem description 1 st task Flow chart
25	Development: Justifying standards	Read 2 nd task together and carry out in the core groups. Joint discussion of the results and having thoughts about solutions.	Experiment in teams of three. Discussions of solutions in plenum.	A "Pilz Education System" per team 2 nd task
45	Working on the contents of EN ISO 13849	Divide the core groups into three expert groups. Carry out the 3 rd task in the expert groups.  Give individual help in the groups	Group work: Group puzzle phase 1	<u>3rd task</u> 1 st group: Task sheet 1 2 nd group: Task sheet 2 3 rd group: Task sheet 3

Explanation

To now deepen the expert knowledge acquired and link directly to an everyday situation, the technical experiment, the flow chart for risk assessment and risk reduction are now to be applied. Then follows the individual working on the standards in group puzzle phase 1, in which the groups solve their particular task sheet.


Lesson plan of 3rd instruction unit

Time min	Phases	Instruction steps	Patterns of activity	Media
30	Preparation of the presentation on the group results	Each group prepares a presentation of its group results in order to explain its contents to the other groups.	Group work in expert groups	Results of the 3 rd task Posters
60	Presentation of the group results	Group presentations (20 minutes per group) on the contents developed. Joint discussion of the results.	Group presentations by the expert groups	Posters

Explanation

In a classic group puzzle, the experts present their results following the expert meeting in their core groups. Here however, each expert group should preferably present its result in front of the class so that the trainer can make corrections and give additional information and it is ensured that all have the same level of knowledge. This method also promotes the presentation ability of the trainees.

Lesson plan of 4th instruction unit

Time min	Phases	Instruction steps	Patterns of activity	Media
60	Deepening: Planning and implementation of a single safety function	<p>Return of the experts to their original core groups.</p>  <p>Inform about the products and circuit diagrams of the safety technology. Perform 4th task: Problem "Installing E-STOP pushbutton". Give individual help in the core groups.</p>	Group work in the core groups	"Pilz Education System" 4 th task
30	Deepening: Planning an extended safety function	5 th task: Planning the problem "Change in the hazard"	Group work in the core groups	5 th task

Explanation

The 4th task should now be implemented in the core groups where the problem "Install E-STOP pushbutton" is to be solved with the aid of the acquired theoretical expert knowledge. To ensure learning success and therefore also learning motivation, the first problem is not too demanding and contains many already defined items. The trainees are guided step-by-step in the terminology of safety technology and see the basic structure of the system function. A maximum of 60 minutes should be taken for the simple problem in the 4th task. This leaves more time for tackling the more complex problems. The extended problem represents, in addition to an extra safety device, further demands on the problem solution, whereby even more acquired expert knowledge is applied.

Lesson plan of 5th instruction unit

Time min	Phases	Instruction steps	Patterns of activity	Media
50	Solidifying: Implementation of the extended safety function	5 th task: Installing and wiring up in accordance with planning the problem "Change in the hazard" in the "Pilz Education System" Give individual help in the groups.	Group work in the core groups	"Pilz Education System" 5 th task
20	Solidifying: Monitoring and evaluating the planning and implementation	Performing the validation of the safety function of the 5 th task and Evaluation and solution comparison with the whole class	Group work in the core groups and then Plenum	"Pilz Education System" 6 th task and Group solutions
20	Repetition: Task for repeating and consolidating.	Perform 7 th task. Secure a further danger zone.	Group work when time still available or as homework	"Pilz Education System" 7 th task

Explanation

The planning from the 5th task is now to be implemented in that the further safety device is installed and the "Pilz Education System" is wired up. As the demands in this problem are greater than in the previous ones, individual help in the various groups is essential.

Finally, validation must still be carried out in accordance with the standard for review, check and evaluation of the problem solution – which takes place in the 6th task. Then the instruction series must be concluded. All steps taken in the plenum are to be reflected and evaluated in order to bring the knowledge of all trainees to a common level and satisfy the requirements of practice-oriented instruction.

To solidify and deepen the subject, the 7th task should still be performed in which a further danger zone is to be used. This can be done as homework or during instruction, if time permits.



The published work above is licensed under a [Creative Commons Attribution-ShareAlike 4.0 International License](https://creativecommons.org/licenses/by-sa/4.0/).

"The European Commission support for the production of this publication does not constitute an endorsement of the contents which reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein."