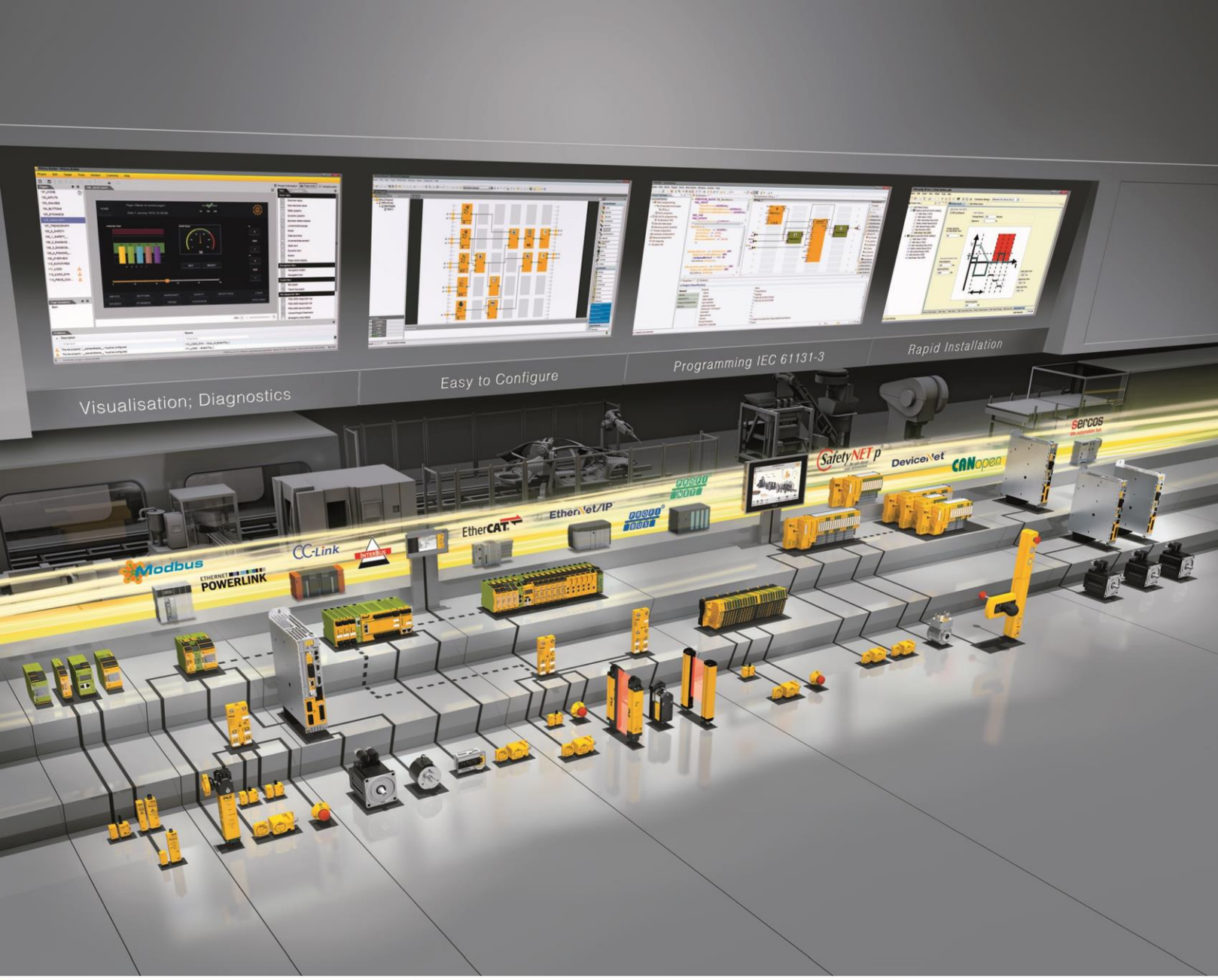


# PNOZmulti - Programming and Service

Intellectual Output “IO2”

PILZ
THE SPIRIT OF SAFETY

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

INDI 4.0

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**General Information:**

| | |
|---|---|
| Competence area / subject: | Machinery Safety, Programming, Fault analytics, project competence / information, |
| School type / occupational field / occupation: | Technical trainees, Students, from the industrial sector (Mechatronics, Electronics… |
| Curriculum / learning area reference: | Recommended qualification for all |
| Requirements | |
| Number of Participants | Maximum of 12 |
| Room | Chairs and tables for participants<br>Beamer |
| Knowledge (Trainer) | Basic knowledge machinery Safety<br>Expert knowledge PNOZmulti |
| Time range: | 10 Units [Unit ≙ 1 double lesson; 90 min] |
| Training System | 1 training system PNOZmulti per 2 participants |
| Software: | PNOZmulti Configurator (with Base-license)<br>PASVisu |

**Brief description and learning objectives of this lesson sequence:**
Programming and Service of the PNOZmulti

## 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 | Machinery Safety | Overview over the machinery safety,<br>Base knowledge about IOS 13849-1 | 3 |
| 2 | System range PNOZmulti | Overview and general information’s about the System range PNOZmulti | 4 |
| 3 | PNOZmulti Configurator | Introduction to the PNOZmulti Configurator | 5 |
| 4 | PNOZmulti configuration and software elements | Basics of programming the PNOZmulti | 6 |
| 5 | Diagnostic elements | Introduction and use of diagnostic elements | 7 |
| 6 | Communication | The communication modules and their use | 8 |
| 7 | PVIS and PASvisu | The communication modules and their use | 9 |
| 8 | Diagnostics and fault analysis | Error analysis with the help of the training system | 10 |
| 9 | Appendix A: Safe speed and analogue module | Appendix about Safe speed and analogue module | 11 |
| 10 | Appendix B: General issues | Appendix about General Issues | 12 |

## Lesson plan of 1st instruction unit – Machinery Safety

| | |
|---|---|
| Preparation | Familiarization with the presentation |

| Time min | Phases | Instruction steps | Patterns of activity | Media |
|---|---|---|---|---|
| 10 | Introduction | Welcome the Participants | Frontal teaching | -Presentation |
| 70 | Presentation | Deliver presentation | Frontal teaching<br>Discussion | -Presentation<br>-Training manual |
| 10 | Knowledge Check | Get Feedback | Multiple Choice | -Presentation<br>-Training manual |

**Explanation**
With the help of this chapter the participant gets an insight into the following points:
-Machinery Directive
-Standards / harmonized Standards
-Risk assessment in accordance with DIN EN ISO 13849-1

The goal in each case is a rough insight to understand the topics and to find simple solutions.

This chapter is held in the form of a frontal presentation.
The participants should be encouraged to ask questions immediately.
At the end of this unit there will be a small knowledge check in form of a multiple-choice-question.

## Lesson plan of 2nd instruction unit - System range PNOZmulti

| | |
|---|---|
| Preparation | Familiarization with the presentation<br>Load test program on training systems |

| Time min | Phases | Instruction steps | Patterns of activity | Media |
|---|---|---|---|---|
| 45 | Presentation | Deliver presentation | Frontal teaching<br>Discussion | -Presentation<br>-Training manual |
| 5 | Knowledge Check | Get Feedback | Multiple Choice | -Presentation<br>-Training manual |
| 15 | Hands-on exercise | Perform General Reset | Imitation<br>Try it out | -Training system |
| 20 | Presentation | Deliver presentation | Frontal teaching<br>Discussion | -Presentation<br>-Training manual |
| 5 | Knowledge Check | Get Feedback | Multiple Choice | -Presentation<br>-Training manual |

**Explanation**
This chapter will lead the participants to get an overview about the system family PNOZmulti.
The knowledge serves as a foundation for handling the PNOZmulti control system.

After this chapter the participant should be able to select the suitable base-unit for each project.
Also the handling for swapping and resetting is trained.

This chapter is held in the form of a frontal presentation.
The participants should be encouraged to ask questions immediately.
There are multiple small knowledge check in form of a multiple-choice-question during the Presentation.

## Lesson plan of 3rd instruction unit - PNOZmulti Configurator

| | |
|---|---|
| Preparation | Familiarization with the presentation<br>Load test program with suitable assignment list on training systems |

| Time min | Phases | Instruction steps | Patterns of activity | Media |
|---|---|---|---|---|
| 30 | Presentation and live View | Deliver presentation | Frontal teaching<br>Discussion | -Presentation<br>-Training manual |
| 15 | Hands-on exercise | Creating a Backup | Imitation<br>Try it out | -PNOZmulti-Configurator<br>-Training system<br>-Training manual |
| 15 | Presentation | Deliver presentation | Frontal teaching<br>Discussion | -Presentation<br>-Training manual |
| 30 | Programming exercise | Write a first program (Start-Stop) | Try-and-error | -PNOZmulti-Configurator<br>-Training system<br>-Training manual |

**Explanation**
This chapter will give the participants overview ant introduction about the PNOZmulti Configurator. The knowledge serves as a foundation for programming the PNOZmulti control system.

After this chapter the participant should be able to operate the PNOZmulti-Configurator

This chapter is held in the form of a frontal presentation.
The participants should be encouraged to ask questions immediately.
After the first Part of presentation there is a small practical exercise, where the handling for the creation of an backup is trained.
At the end the first own program should be written. The participants should solve the problem by their own via try-and-error. In case of ambiguity can be supported by the trainer

## Lesson plan of 4th instruction unit - PNOZmulti configuration and software elements

| | |
|---|---|
| Preparation | Familiarization with the presentation |

| Time min | Phases | Instruction steps | Patterns of activity | Media |
|---|---|---|---|---|
| 40 | Presentation | Deliver presentation | Frontal teaching<br>Discussion | -Presentation<br>-Training manual |
| 50 | Programming exercise | Extension of the first program<br>(Safety functions) | Try-and-error | -PNOZmulti-Configurator<br>-Training system<br>-Training manual |

**Explanation**

This chapter covers all the software elements for programming the PNOZmulti.
The focus is placed on the elements of the safety functions.

After the presentation, learned knowledge is to be implemented with the help of a more complex extension of the program.
The participants should solve the problem by their own via try-and-error. In case of ambiguity can be supported by the trainer.

## Lesson plan of 5th instruction unit - Diagnostic elements

| | |
|---|---|
| Preparation | Familiarization with the presentation |

| Time min | Phases | Instruction steps | Patterns of activity | Media |
|---|---|---|---|---|
| 45 | Presentation | Deliver presentation | Frontal teaching<br>Discussion | -Presentation<br>-Training manual |
| 45 | Programming exercise | Extension of the first program<br>(Diagnostic) | Try-and-error | -PNOZmulti-Configurator<br>-Training system<br>-Training manual |

**Explanation**

This chapter covers all the diagnostic elements for programming the PNOZmulti.

After the presentation, learned knowledge is to be implemented with the help of a more complex extension of the program.
The participants should solve the problem by their own via try-and-error. In case of ambiguity can be supported by the trainer.

## Lesson plan of 6th instruction unit - Communication

| | |
|---|---|
| Preparation | Familiarization with the presentation<br>6 prepared Faults, in addition to the training systems |

| Time min | Phases | Instruction steps | Patterns of activity | Media |
|---|---|---|---|---|
| 60 | Presentation | Deliver presentation | Frontal teaching<br>Discussion | -Presentation<br>-Training manual |
| 30 | Programming exercise | Extension of the second program<br>(e.g. Emergency-Stop via PDP) | Try-and-error | -PNOZmulti-Configurator<br>-Training system<br>-Training manual<br>-custom pre-pared exercise |

**Explanation**
This chapter covers all the Communication Modules for programming the PNOZmulti.
Lack of knowledge about bus systems may need to be explained

After the presentation, learned knowledge is to be implemented with the help of a more complex extension of the program.
The participants should solve the problem by their own via try-and-error. In case of ambiguity can be supported by the trainer.

## Lesson plan of 7th instruction unit - PVIS and PASvisu

| | |
|---|---|
| Preparation | Familiarization with the presentation<br>Prepared exercise, in addition to the training systems |

| Time min | Phases | Instruction steps | Patterns of activity | Media |
|---|---|---|---|---|
| 30 | Presentation | Deliver presentation | Frontal teaching<br>Discussion | -Presentation<br>-Training manual |
| 60 | Programming exercise | Extension of the last program<br>(e.g. Start-Stop via Visualization) | Try-and-error | -PNOZmulti-Configurator<br>-PVIS Configurator<br>-PASVisu<br>-Training system<br>-Training manual<br>-custom pre-pared exercise |
| | | | | |

**Explanation**
This chapter covers Visualization in combination to the PNOZmulti. The Visualization is programmed with PVIS and PASvisu.

After the presentation, learned knowledge is to be implemented with the help of a more complex extension of the program.
The participants should solve the problem by their own via try-and-error. In case of ambiguity can be supported by the trainer.

## Lesson plan of 8th instruction unit - Diagnostics and fault analysis

| | |
|---|---|
| Preparation | Familiarization with the presentation<br>6 prepared Faults, in addition to the training systems |

| Time min | Phases | Instruction steps | Patterns of activity | Media |
|---|---|---|---|---|
| 40 | Presentation | Deliver presentation | Frontal teaching<br>Discussion | -Presentation<br>-Training manual |
| 50 | Exercises | Fault Analysis<br>(searching 6 different Faults, on after another) | Try-and-error | -Presentation<br>-Training system<br>-Training manual<br>-custom pre-pared faults |

**Explanation**
In this chapter diagnostic and fault analysis is taught.

After an explanation with the presentation, 6 or more different Errors, should be implemented into the training system by the trainer.
The error should be found by the participants without the help of the trainer if possible.

## Lesson plan of 9th instruction unit - Appendix A: Safe speed and analogue module

| | |
|---|---|
| Preparation | Familiarization with the presentation |

| Time min | Phases | Instruction steps | Patterns of activity | Media |
|---|---|---|---|---|
| 30 | Presentation | Deliver presentation | Frontal teaching<br>Discussion | -Presentation<br>-Training manual |
| 60 | Programming exercise | Extension of the last program<br>(e.g. Motion Monitoring with enabling switch) | Try-and-error | -PNOZmulti-Configurator<br>-PVIS Configurator<br>-PASVisu<br>-Training system<br>-Training manual<br>-custom prepared exercise |

**Explanation**
This chapter covers Safe speed and safe analogue modules form the PNOZmulti.

After the presentation, learned knowledge is to be implemented with the help of a more complex extension of the program. Here the implementation of a speed monitoring is recommended.
The participants should solve the problem by their own via try-and-error. In case of ambiguity can be supported by the trainer.

## Lesson plan of 10th instruction unit - Appendix B: General issues

| | |
|---|---|
| Preparation | Familiarization with the presentation |

| Time min | Phases | Instruction steps | Patterns of activity | Media |
|---|---|---|---|---|
| 30 | Presentation | Deliver presentation | Frontal teaching<br>Discussion | -Presentation<br>-Training manual |
| 30 | Discussion | Discussion about the Course | Discussion | -Presentation |
| 30 | Ending | | Feedback | -Presentation |

**Explanation**

This chapter some General topics about the PNOZmulti.

Also, this chapter should be used to clarify open questions and solicit feedback from participants