



***Innovation in Training***



**- Available in 8 different languages**





**LearnWARE®**  
**P&L's guarantee**  
**of effective learning**

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# Knowledge underpins work satisfaction, efficiency, productivity and quality.

A well-trained and motivated staff is an asset to any company. In manufacturing, people who possess sound knowledge of the machines and processes they run work more efficiently are happier and feel more secure in what they do.

This leads to greater life satisfaction. Motivation depends on the quality of life and since employees are a company's greatest resource it pays to protect and enhance this. Training is a key factor, especially in technology-driven industries where keeping up-to-date can be vital to success.

P&L has great experience of training production staff, engineers and designers in industry. We offer flexible training packages based on courses run by teachers, private study, distance studying and on-the-job training, and as a result we have been commissioned to carry out a large number of training projects.

For more than 10 years we have been training people in industry and we have accumulated an impressive arsenal of methods and tools for effectively training industrial staff. Our holistic approach is based on the needs of individuals. All training focuses on learning through experience ... learning whilst working.

We firmly believe that customers should "own" the learning process and not just "buy" training packages. Thus, customers themselves ensure that a course is structured correctly and run in the most effective way, guaranteeing that the knowledge acquired will be of real use at work.

## Our vision of success

We looked long and hard to find something that describes the things we stand for in the training and personal development of customer's staff. In P&L we often use this quotation from Emerson to motivate ourselves and find enjoyment in our daily work:

To laugh long and often; to win the respect of intelligent people and the affection of children; to earn the esteem of honest critics and endure the deceit of friends, to enjoy beauty, to find the best in others; to leave behind a world that is a little better thanks to a healthy child or improved social conditions; to know that at least one living creature can breathe more easily because you have lived.

That is the meaning of success!

Peter Bengtsson



# LearnWARE® Interactive learning

## - The Concept

Advanced simulation engine combined with easily accessible multimedia provides realistic learning

Students can easily work on their own and at their own pace which increases effectiveness.

The demands made on everybody in society are increasing. As a result many feel insecure. There is, therefore, a great demand for the efficient and customised transfer of knowledge. Furthermore, training tools should always be available and be totally adapted to the environment in which they are to be used.

P&L's LearnWARE® packages provide the opportunity to acquire knowledge of automation and technology in the best possible way, both at work and at home. The programs have been developed based on our daily experience of working with training in industry and are updated in keeping with the rapid pace of technological progress. The programs are used widely in Swedish and European industry to support the continual need for learning.



## Create a secure feeling by giving a comprehensive picture

- You acquire knowledge on your own and at your own pace. Advanced simulation and stimulating animation makes learning easier for all. The program also includes a search system where the student can find the information he needs. The programs are developed by industrial experts and their contents are based on P&L's experience from the industrial and training sectors. They are totally based on real situations and the knowledge presented is entirely based on modern methods and practices.
- As many of the student's senses are engaged as possible by using advanced simulations and animations. Sight, hearing and touch are all involved simultaneously. The fact that all the equipment – PLCs, controllers, control valves and pneumatic cylinders – behave in a realistic way makes learning even more inspiring, correct and effective.
- The Learning Program is interactive which means, just as with the dialogue between student and teacher, there is a continual dialogue between the student and the computer. The programs are adapted according to the requirements and ideas of each individual student. In this way every training minute between the student and the Learning Program is personalised.



# Supporting the learning culture

## Measurable results

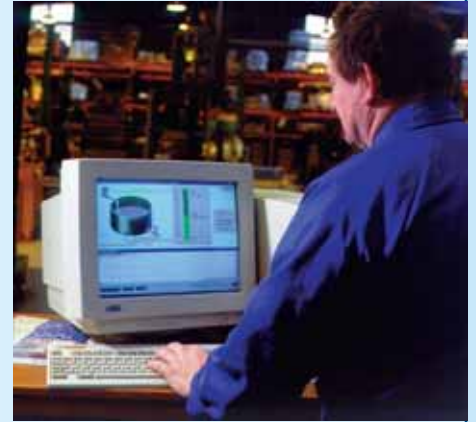
The instructor is helped with planning, implementation and evaluation of the training.

## Unique techniques to support recurring learning

The "Learning Culture", with recurring daily learning, is the aim of most companies today. A combination of Learning Programs, professional teachers and books creates a modern learning situation that is innovative. The learning effect is best when different media are used, thus engaging different senses.

## We all learn in different ways

Students learn at their own rate and according to their own abilities. They can omit sections they know already or return to ones they need to repeat or revise. The Learning Programs can also be used as reference works through a well-constructed 'help' function. The programs activate many of the senses and thereby provide deep, lasting knowledge. LearnWARE® provides variety in learning that increases concentration and receptiveness, plus student become familiar with using a computer.



Learn something new every day!

## Private study at home

Studying on your own can also take place at home as the programs are completely portable. As the Learning Programs are self-instructional, the student can increase his knowledge on his own. They are also made to be adapted to each customer's needs. For example, a customer's machines can be simulated to increase further the level of adaptation to the actual situation in which the knowledge is to be used.



## What does LearnWARE® give?

- Complete course plan for the student.
- 25 -30 hours of training
- Realistic animation of abstract concepts.
- Real-time simulations to ensure learning is effective.
- Interactive exercises to solve problems based on actual situations in real-time.
- Knowledge assured through built-in questions and practical exercises.

# Industrial Automation

Automation has developed at an incredible rate during the past few years. Daily, systems become more complex, and incorporate ever greater functionality. This has radically changed working conditions for people in industry. Employee knowledge is extremely important today now that they have increased responsibility and the demands of production are increased. Maintenance work in a plant is divided up between a larger number of people which is why they all need to be well trained.

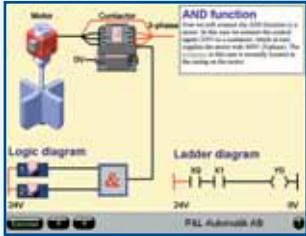


## Private study in Industrial Automation

Anders Marklund, Ericsson Mobile Communication, has used P&L's LearnWARE® Automation package to train over 2 000 operators at Ericsson Mobile Communication. He says: "We have achieved a high level of learning using this training method. The training is also highly flexible as operators can be brought to the training room at short notice. There they can, helped by the instructors, work at their own pace with automation. A side effect is that they will be more used to using computers. A valuable feature of the Learning Program is that it remembers where each student left off. Furthermore, the results for each student can be seen."

"The possibility of evaluating each student's results afterwards is also highly appreciated."

"The aim of the training is that each operator will, through increased knowledge, be able to take a greater part in factory maintenance. They shall actively participate in remedying faults and contribute to increasing productivity."



# Industrial Automation

## – basic course

### Target group

For beginners in industrial automation and PLC programming who want to know more about how the various parts of an automated process work together.

The course provides a thorough, basic understanding of the problems in industrial automation.

### Previous knowledge

None required.

### Course length

25 to 30 hours.

### Course content

- Contains a completely new form of learning for automation and above all in the understanding of how a PLC functions.
- Provides a complete overview of industrial automation by applying it to daily control situations. These situations are familiar to everyone and therefore highly suitable for control exercises that give a good understanding of the whole field.
- Starts with the simple programming of a PLC system and ends up by automating a sorting machine.
- Programming in ladder, function blocks, instruction list, and sequential function charts.
- A wide range of control objects to experiment with.
- Also describes in detail the control components, such as how a magnetic valve controls a cylinder and the functions of an inductive sensor.
- The customer's plant could be simulated, as an additional exercise.
- Simulation of Siemens S7, Mitsubishi or standard IEC 1131.



# Industrial Automation

## – continuation course

### Target group

For those who have some experience of simple PLC control and want to know more about advanced PLC instructions. Analogue handling, calculations and structured programming with ladder, function blocks, instruction list or sequential function charts.

### Previous knowledge

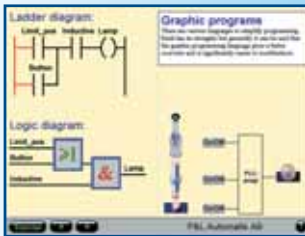
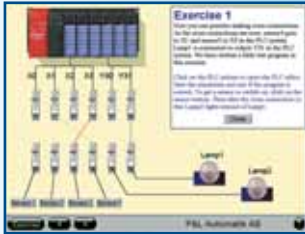
LearnWARE® Industrial Automation basic course or equivalent.

### Course length

25 to 30 hours.

### Course content

- A complete vehicle factory with stores, production and testing areas is simulated.
- Connecting the PLC to other equipment.
- Review of the safety aspects of automation (emergency stops etc.)
- Structuring of larger programs.
- Programming in ladder, function blocks, instruction list, and sequential function charts.
- Further instructions for processing data and calculations
- Analogue signals and the PLC instructions required for them.
- Simulation of Siemens S7, Mitsubishi or standard IEC 1131.
- Development of a complete PLC- program for control of the factory vehicle.





# Industrial Automation

## – continuation course

### Exercise 1

You can now practice with cross connections. With the present connections in the PLC system, sensor4 goes to X1 and sensor3 to X3. Lamp 1 is connected to output Y3 in the PLC system. We have written a little test program in this exercise. Click on the PLC picture to open the PLC editor. Start the simulation and test that the program works. To get a sensor to switch on, click on the sensor button. Then change the cross connections so that lamp2 lights instead of lamp 1.



### Task

You are going to write a program that lights the lamp when the Limit Position and Button are actuated. The lamp should also light if the Inductive sensor alone is actuated.

### I/O list

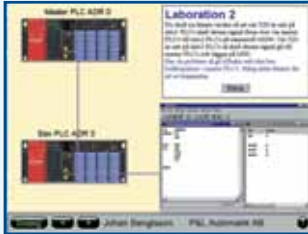
Inductive, X1 Limit Position, X2 Button, Y10 Lamp

Write names in the 'name window' and then use these when programming (instead of X0....) Then close the window and test run.

### MOV(P)

MOV moves the value in the source and places it in the destination register. In our example, the PLC system collects the constant value 50 (K50) and puts it in D10. Close this window. Then click on the X10 button and test run MOV(P).





# Industrial Automation

## – advanced course

### Target group

For those who know about PLC programming and want to know more about communicating with PLCs and make advanced calculations such as P control.

The course provides knowledge of PLC programming and fieldbuses as well as covering the configuring and programming of operator terminals.

### Previous knowledge

LearnWARE® Industrial Automation continuation course or equivalent.

### Course length

25 to 30 hours.

### Course content

- A complete vehicle factory with stores, production and testing areas. How are the various parts controlled by the different PLCs that are joined together in a network?
- Advanced PLC calculations.
- Further instructions and structures for programs in a network.
- Programming in ladder, function blocks, instruction list, and sequential function charts.
- Configuring a network.
- Programs for master and slaves in PROFIBUS DP.
- Configuring and programming an operator terminal.
- Simulation of Siemens S7, Mitsubishi or standard IEC 1131.

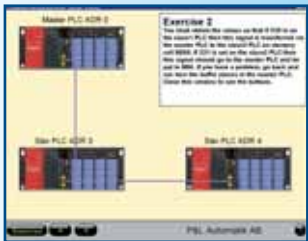


# Industrial Automation

## – advanced course

### Store

Chassis and bodies are brought from the stores and are then transported on a conveyor belt. At the end of each belt is a sensor that gives a signal to the PLC system when anything breaks the light beam. The object of the crane is to place the chassis on the assembly belt and bodies on the paint belt. Click on the store and you will see an enlarged picture.



### Exercise 2

Connect the modules so that the addresses agree with the buttons X10 and X40 as well as lamp Y0. Click on the PLC button to open the PLC editor. Write a program which makes the lamp light when both the buttons are pressed. Click on CLOSE to see the whole picture.

### Exercise 2

You shall obtain the values so that if X20 is on the slave1 PLC then this signal is transferred via the master PLC to the slave2 PLC on memory cell M200. If X21 is set on the slave2 PLC then this signal should go to the master PLC and be put in M50. If you have a problem, go back and see how the buffer places in the master PLC. Close this window to see the buttons.

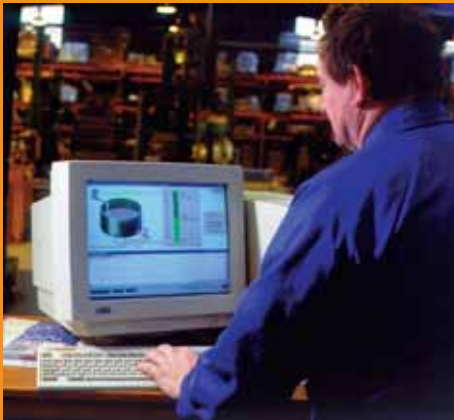
# Process Control

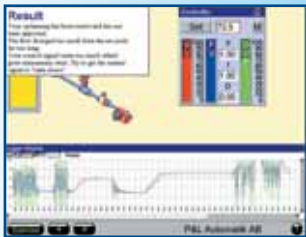
Process Control is of major and increasing importance in an industrial society. The advent of the computer has changed the working life of those who work in process industries. Employees today have far greater responsibility to cope with the higher rate of production. The complexity of industry has increased which is why knowledge of both basic and advanced process control technology is required. Plant maintenance is very important in avoiding downtime.



## Self-tuition in Process Control

Air Liquide Gas in Malmö, Sweden, carried out internal training in Process control technology. The company used P&L's LearnWARE® Process Control basic course for this. The training was almost entirely done through private study as the majority of the participants were engineers who were out travelling for the most part. 23 people took part. This is a good example of a flexible form of training that LearnWARE® provides. Fifteen minutes a day is far better than attending a short course. Furthermore, each individual can choose when to study. This provides greater motivation to study.





# Process Control

## – basic course

### Target group

For beginners in process control technology who want to know more about how processes and control systems work.

The course provides a thorough, basic understanding of Process Automation technology ideas and an insight into the various parts that affect the result of control.

### Previous knowledge

None required.

### Course length

25 to 30 hours.

### Course content

- Contains a considerable amount of new teaching for process control and above all the PID controller.
- Gives an overview of process control by, among other things, applying it to a car. This is a problem everybody is familiar with and therefore highly suitable for control exercises that provide a good understanding of the whole field.
- You have a wide range of control objects to experiment with.
- Also describes in detail control components such as the things to take into consideration when locating a sensor.
- The PID controller is described in a simple way by using simple animations and realistic simulations.
- The program evaluates the optimisation you have carried out. Furthermore, you are given good advice on how to improve your optimisation knowledge.



# Process Control

## – continuation course

### Target group

For those who have some experience of process control technology and want to know more.

The course provides knowledge about things like larger control systems and interaction between processes. You also learn a more advanced way of optimising a control system.

### Previous knowledge

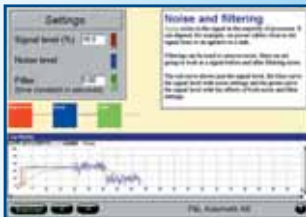
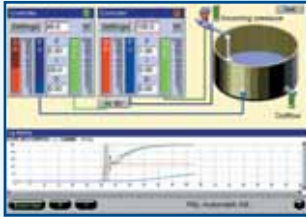
LearnWARE® Process Control basic course or equivalent.

### Course length

25 to 30 hours.

### Course content

- Why more advanced process control?
- Locating a sensor and valve as well as adjusting and calibrating them.
- Review of noise, filtering, non-linearity and linearising, split range.
- PID (controller), sampling time, etc.
- Cascade control, gain scheduling, feed forward, interaction between processes and ratio control.
- Various types of control systems; batch, position and speed control.
- Trouble shooting in a control system. Valves with friction or hysteresis. Sensor problems and their implications.
- How to optimise with an advanced and effective method (the Lambda method.)





# Process Control

## – continuation course

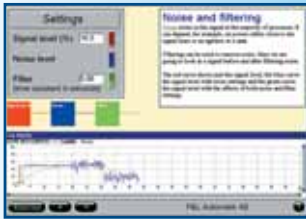
### Concentration control



Location  
Outflow  
Concentration in  
Logger display

### Noise and filtering

There is noise in the signals from most processes. This can be caused by power cables near to the signal cables or an agitator in a tank. Filtering will remove noise. Here we will look at the changes in a signal before and after noise is filtered out. The red curve just shows the signal level with noise, the green curve the same signal after filtering.

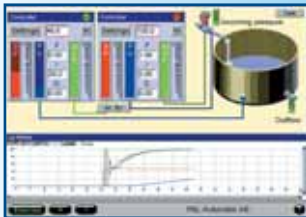


### Settings

Signal level  
Noise level  
Filter (time constant)

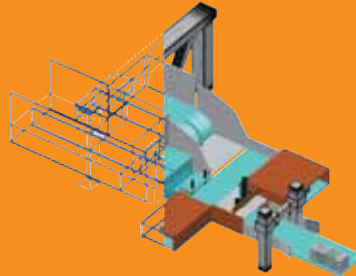
### Optimisation

This is a cascade connection of a level and a flow. The objective is to optimise both the controllers. First check that the level is at 50%. This corresponds to an output signal from the level controller of around 45%, which is the same as the set point in the flow controller.



# Asset Management and Troubleshooting

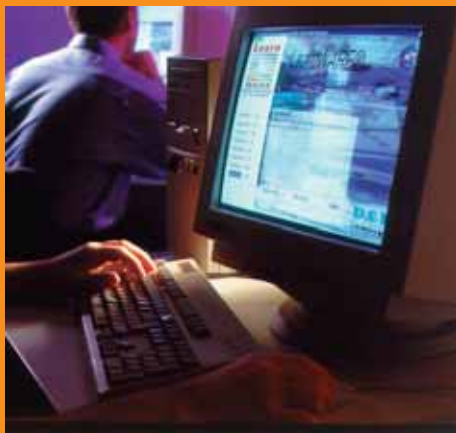
The conditions for those who are working in industry are changing as industry develops. Machines and robots now do the heavy and monotonous work previously carried out by production staff. For the most part today the work of production staff involves monitoring machines and robots, as well as being the first line of maintenance. To cope with the maintenance element, personnel should possess basic knowledge of control technology.

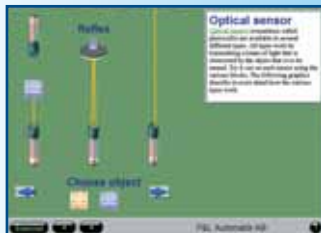


## Self-tuition in automation

One of our customers is SCA Hygiene Products in Lilla Edet outside Gothenburg. The mill uses P&L's LearnWARE® Automation as a tool for training its operators. The program is used both on the short courses run by P&L at the mill but is above all used as a self-tuition tool between courses. To increase the effectiveness of the learning, P&L has developed a simulated model of production at Lilla Edet. The operators practice their newly acquired trouble shooting, programming and component skills on this model. The students can experiment and test without risking expensive damage to equipment.

The training can also take place on employees' computers at home, giving a freedom to study that is unique.





# Automation

## – for plant personnel in process industries

### Target group

For staff in a process industry who want to know more about how processes and control systems work.

The main aim is to take the mystery out of automation and give an overview that increases confidence with the possibility of increasing production efficiency as well as reducing downtime. Furthermore, the student will be able to see the whole system from the component level to interpreting process curves and thus be able to take the correct measurements.

### Previous knowledge

None required.

### Course length

20 to 25 hours.

### Course content

- The package gives an overview of process control and control technology by applying it to daily control problems. The problems are familiar to everybody and therefore highly suitable as exercises that give a good understanding of the whole field.
- The principle of automating a machine.
- Various types of sensors and what can happen when sensors go wrong.
- How does a PLC work and what does a program look like?
- What is control technology and what is it used for?
- The principles of controlling a process.
- Review of control components, for example what to take into consideration when locating a sensor.
- How does a controller work and how to set it?
- What do electricians/instrument engineers do when trouble shooting in a process and control system?
- What is an operator display and how is an operator system constructed?
- Methodical troubleshooting by practical exercises on a simulated machine / process.
- The basis for better cooperation with maintenance staff (writing trouble shooting reports, discussing, participating in the work etc.)



# Automation

## – for plant personnel in process industries Control circuit



To control a process a complete controller circuit is required. This always consists of :

- A sensor that measures the process value.
- A controller that runs the control function.
- A control device to control the flow.

Sensors include level, temperature, pressure and flow sensors; control devices are items like control valves, fans and radiators.



## Optical sensors

There are various types of optical sensors. All optical sensors emit a light beam that is broken by the object to be detected. Test the different blocks on each sensor. How the different types of sensors work is described in more detail in the following pictures.





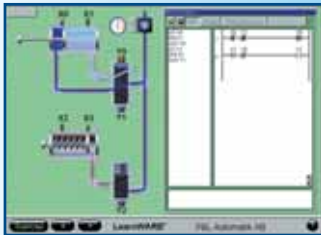
# Automation

## – for plant personnel in manufacturing industry

### Target group

For staff in a manufacturing industry who want to know more about how machinery is controlled.

The main aim is to take the mystery out of automation and give an overview that increases confidence and the possibility of increasing production efficiency as well as reducing downtime. Furthermore, the operator should be able to see the whole from the component level to status display in function blocks or ladders and therefore able to take the correct measures and supply the correct information to the maintenance staff.



### Previous knowledge

None required.

### Course length

20 to 25 hours.

### Course content

- The packet gives an overview of industrial automation by applying it to daily control problems. The problems are familiar to everybody and therefore highly suitable as exercises that give a good understanding of the whole field.
- The principle of automating a machine.
- Various types of sensors and what can happen when sensors go wrong
- How does a PLC work and what does its program look like?
- What do electricians do when trouble shooting a PLC system?
- How does an industrial robot work and how is it programmed?
- What is an operator display?
- Methodical trouble shooting in automated machines.
- The basis for better cooperation with maintenance staff (writing error reports, discussing, participating in the work etc.)



# Automation

## – for plant personnel in manufacturing industry

### Introduction

Industrial manufacture involves processing and putting together materials and components. Some industries carry out the whole process from raw materials to finished products. Others only do some of the work, i.e. they make parts for other industries which then assemble them to finished products. Those that make parts for other industries are often called subcontractors.



### Trouble shooting (fault 1 of 5)

A fault has occurred. See what happens and then find out what is wrong. Then remedy the fault, either yourself or by calling for an electrician or a mechanic.

Hand

Electrician

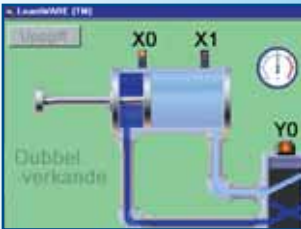
Mechanic

Clean

Adjust

Lift the reel

No electrical fault with the sensor





# Automation

## – robot and assembly

### Target group

For plant personnel in manufacturing industry. The main aim is to increase the understanding about production lines and robot systems. Robot and PLC programming are included, but focus is on fault diagnosis in industrial automation. The course participant will increase competence in how to find fault and what to do about it. He/she is encouraged to find a own method in their work.

### Previous knowledge

LearnWARE® Automation – for plant personnel in manufacturing industry.

### Course length

30 – 35 hours.

### Course content

- Understanding about the connection between machine and control system.
- Where are the components for automation located and how do the work?
- Line production and cell production?
- How does PLC's and robots work and how is the programming done.
- Vision system.
- Safety aspects for robots and automation equipment.
- Fault diagnosis in production plants.

# Communication and Fieldbus

**Serial communications from RS 232 to fieldbus Communication between computers is very widely used today in offices and on factory floors to increase company efficiency and product quality. One reason for the increasing demands made on communication is that the various pieces of equipment contain functions that need to be shared. To do this requires a well-designed communication network. In the factory this is referred to generically as "fieldbus".**

Communication between different computers and units on the factory floor is a necessity in many industries today. To create a communication network as simple and flexible as possible, a couple of standardised fieldbus communication technologies - for example PROFIBUS or Foundation Fieldbus - has been devised. One of the many advantages with this is that the products of all the leading suppliers of automation equipment employ PROFIBUS or Foundation Fieldbus as a standard. This means that companies are not restricted to one supplier but can choose from the wide range of products available today.



PROFIBUS Competence Center at P&L



## Private study in communication

Leif Eriksson, a system engineer at Stora Skoghall outside Karlstad, Sweden, uses P&L's LearnWARE® Communication. He has participated in the major projects that took place at Skoghall, the majority including machinery controlled via fieldbus. The Learning Program was acquired to increase knowledge about communication and fieldbus.

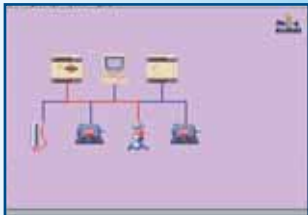
"There are so many new terms and methods in the field of communication we didn't understand so we bought the program from P&L to learn in a simple and effective way about this subject. The training has been through private study during slack periods and even lunch breaks. The program has given us all a chance to understand the technology and has worked excellently!"

"We now use the Learning Program everyday as a reference work. When we have questions or problems we start the program and create a simulation," says Leif.



[www.pol.se](http://www.pol.se)





# Communication

## Target group

For those who work with control equipment in industry and are going to start communicating between systems. Or for those who already use these techniques and wants to know more about Industrial Communication.

## Previous knowledge

None required.

## Course length

20 to 25 hours.

## Course content

- Provides a complete understanding of the basic principles of industrial communication and digital transmission.
- What is handshaking in the communication context?
- How can high security be achieved in transmissions?
- How sensitive is communication to interference?
- What are topology and what types are there?
- Various methods of access such as token bus, token ring and CSMA/CD.
- Networks and fieldbuses.
- The principle of the OSI model. Advanced animation and simulation make understanding the OSI model possible.



# PROFIBUS

## Target group

For those who are thinking about or have already installed PROFIBUS.

The course provides good basic understanding of PROFIBUS-DP, -FMS and -PA. You learn by, for example, configuring and trouble shooting in a PROFIBUS network.

## Previous knowledge

None is required but we recommend that you have gone through the LearnWARE® Communication course.

## Course length

15 to 20 hours.

## Course content

- Why use fieldbuses? When should I use a fieldbus?
- Technical concepts for fieldbuses and the PROFIBUS solution.
- PROFIBUS's various types of media for transfer.
- A comprehensive description of PROFIBUS-DP.
- A brief description of when and how a PROFIBUS-PA should be used.
- Complete coverage of PROFIBUS-FMS.
- Configuring PROFIBUS-DP, -FMS and -PA networks.
- Trouble shooting in a PROFIBUS network. Both faults in the cables and the hardware as well as configuration faults are covered.



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