TABLE OF CONTENTS

- About us ................................................................. page 1
- Quality policy. Prizes and awards................................. page 2
- Specialized courses in power hydraulics and pneumatics........................................... page 4
- Laboratories............................................................... page 12
- Power hydraulics stationary, mobile and hydrotronics......................................................... page 14
- Software........................................................................... page 22
- Industrial pneumatics..................................................... page 23
- Laboratory of Industrial Pneumatics dedicated for training sessions at client premises...... page 26
- Software. Teaching aids................................................ page 27
- Trainers and instructors................................................... page 28
- Welcome........................................................................ page 29
We specialize in providing training courses in the field of broadly defined engineering techniques. Our main training sections are:

- Mechanical engineering
- Visualization and control systems
- Industrial robots
- Material engineering
- Machinery safety
- SIEMENS PLM
- Production quality management

We organize workshops, conduct consultations, advise and support implementation, software and systems automation products, as well as running measurements and tests.

EMT-Systems has been operating in the field of engineering and technical training since 2006. We approach the subject of technical trainings for industrial personnel in an innovative way. We have sophisticated courses and new courses are created in response to the growing demand for training in certain fields of automation and modern technology.

They are often created to suit the specific requirements of the customer.

Our mission is to conduct high quality courses for industrial personnel to help them adapt to modern jobs using innovative technologies. We help to identify the real qualifications of the participants and plan the correct courses path for them. During the courses we check the knowledge growth of participants, which automatically allows us to illustrate the effectiveness of our work.

Because we are the only center that provides so many technical trainings courses as we do, we are the leader in technical qualifications development in Poland.

We have been on the training market since 2006.
Because we are constantly improving the quality of our training services, we have implemented the Product Certification System according to the following standards:

- PN-EN ISO 9001:2015
- ISO 29990:2010

The awarded certificates encourage us to the constantly improve and update our services.

We have been a member of the Polish Chamber of Training Companies since June 2013.
We are obliged to obey the regulations of the Code of Good Practice and use them in our everyday work. We have also signed the Training Service Standard document.
We are driven by the rules of professional ethics and business integrity.

We have received numerous awards and prizes:

- Laureate of the Training Company of the Year 2017 emblem received from Central Office of National Certificate.
- „European Medal 2017” obtained by dział szkoleń "Tworzywa sztuczne” from Business Centre Club.
- Award of the Caesar of Silesian Business 2016 awarded at the solemn Business Centre Club gala.
- „European Medal 2016” obtained by „CNC1: CNC Operator/Programmer” courses from Business Centre Club.
- The prestigious Highest Quality Gold Emblem 2016 a grand prix in the category Services in the most pro quality program in Poland, organized under the patronage of the Polish Agency for Enterprise Development, Polish Committee for Standardization and Polish Forum ISO 9000.
- Laureate of the Training Company of the Year 2016 emblem received from Central Office of National Certificate.
- Obtained certificate Enterprise of the Future 2015.
- Laureate of the Training Company of the Year 2014 emblem received from Central Office of National Certificate.
- The award of the Marshal of the Silesian Voivodeship during the conference „Innowacja. Cię rozwija” Innosilesia.
QUALITY POLICY, PRIZES AND AWARDS

- **Training laboratories**
  Participants can enjoy well-equipped training positions, which enable the practical exercises. We provide cutting-edge workstations built on the basis of actual components for industrial automation.

- **Experienced trainers**
  Trainers from the departments of maintenance and design firms with extensive technical knowledge to the design, implementation, and maintenance and repair of equipment and automation systems and high educational qualifications.

- **Training material and course documentation**
  Participants receive professional documentation in the form of textbooks, technical documentation, instructions and other publications. There is also the option of using materials and diagrams provided by the client.

- **Extra classes**
  Participants are entitled to participate in free extra classes on the chosen days, after the scheduled classes.

- **Training methodology**
  We focus on practical exercises and application of our tutors’ knowledge backed up by real-life examples. As a rule, 30% of time is devoted to theoretical training and 70% of time is designated to active forms of participation – workshops and exercises which allow the participants to gain practical skills on operating machines and systems.

- **Two different course types: open and closed**
  Such a solution provides the participants with the opportunity of choosing the best option. Open courses are aimed towards individual participants while closed courses are dedicated to firms.

- **Catering**
  For courses carried out in our training rooms we provide daily coffee breaks, hot and cold drinks, cookies and two course lunches.

- **Post-training and implementation support**
  We also provide support and help within the topics included in the courses in your everyday work.

For the participants of our courses we provide training laboratories allowing to work on industrial components of power hydraulics and pneumatics based on the most popular producers:

- Parker
- fluiconnecto
- PONAR Wadowice
- PONAR Silesia
- FESTO
- Rexroth Bosch Group
- RQS
- HYDAC
- Pneumax
Specialized courses in power hydraulics

Course symbol: H1

Course name: Power hydraulic components and systems - construction and operation

Course aims:
- Accurate identification, quick and effective troubleshooting;
- Increase of practical abilities in the field of renovation, current and periodic repairs;
- Deep understanding of the structure and principles of operation of power hydraulics elements;
- Unassisted construction, installation, commissioning and testing of simple hydraulic systems;
- Acquiring knowledge needed to recognize graphic symbols and reading hydraulic systems schemes;
- Learning to interpret hydraulic quantities, characteristics of valves and methods of measuring the flow rate, temperature and pressure;
- Learning about the rules of typical control of dislocation, velocity and pressure of the hydraulic systems.

Course summary:
- Hydrostatic drives
- A workshop in designing and checking operation of hydraulic systems; exercises at the assembly stations
- Displacement pumps
- Hydraulic cylinders
- Rotary positive displacement hydraulic motors
- Hydraulic valves
  - Directional valves
  - Pressure valves
- Flow control valves
- Hydraulic accumulators
- Hydraulic filters
- Connections of hydraulic devices
- Hydraulic tanks
- Auxiliary elements for hydraulic systems
- Graphical symbols of hydraulic elements and controls
- Reading and interpreting simple hydraulic diagrams
- Constructing and performance testing of power hydraulic systems
- Practical exercises at the assembly stations
- Application of Fluid-SIM H software in designing and simulating hydraulic control systems

Duration: 4 days

Course type: Open training
Hydraulic drives and control systems in machines and devices

Course aims:
Learning the conventional systems of control and regulation of the hydraulic actuators; developing the skills of experimental examination of hydraulic elements and systems; learning the structure and methods of setting adjustable units regulators; learning the design and operating principle of logic elements used in hydrostatic systems; learning the operation, maintenance and repair of hydraulic elements and devices.

Course summary:
- General design of hydraulic systems
- Systems supplied with pumps of constant productivity
- Hydrostatic systems
- Constructing and performance testing of power hydraulic systems
  - practical exercises at the assembly stations
- Hydraulic servo mechanism
- Cylinder motion synchronization
- The examination of the hydraulic elements and devices
- Logic elements in hydraulics
- Maintenance and repairs of the hydraulic elements and devices
- Practical exercises at the assembly stations

Duration: 3 days - 21 hours
Course type: Open training
### SPECIALIZED COURSES IN POWER HYDRAULICS

#### POWER HYDRAULICS

<table>
<thead>
<tr>
<th>Course symbol</th>
<th>Course name</th>
<th>Course aims</th>
<th>Course summary</th>
<th>Duration</th>
<th>Course type</th>
</tr>
</thead>
</table>
| H3            | Proportional hydraulics and electrohydraulics   | Familiarizing the design and operation principles in the electrically and proportionally controlled elements; developing the skills of designing, constructing, activating and testing simple electrohydraulically controlled systems; learning the techniques of proportional control and the control based on electrovalves; learning the ways of regulation of the proportional control elements. | • Design and operations of hydraulic elements with electric control  
• Design and operations of the electric control elements  
• Introduction to hydraulic proportional control technique  
• A workshop in designing and checking operation of electrohydraulic systems and proportional hydraulic systems; exercises at the assembly stations  
• Proportional directional control valves  
• Adjusting the characteristics of proportional valves  
• Control and regulation systems with proportional valves and servo valves  
• Selection of regulator settings in hydraulic servo drives  
• Practical exercises at the assembly stations | 3 days - 21 hours | Open training |

<table>
<thead>
<tr>
<th>Course symbol</th>
<th>Course name</th>
<th>Course aims</th>
<th>Course summary</th>
<th>Duration</th>
<th>Course type</th>
</tr>
</thead>
</table>
| H4            | Design of hydraulic drives and control systems  | Getting familiar with the algorithm of the design process of hydraulic systems; familiarize with the ways of setting parameters of hydrostatics systems; developing the skills of designing drives and controls of hydraulic machinery and devices; learn to select the components of stationary and mobile hydraulics based on defined design specification. | • Introduction  
• Formulas for practitioners  
• Constructing and performance testing of power hydraulic systems - practical exercises at the assembly stations  
• Examples  
• The algorithm of designing a hydraulic system  
• Designing of the hydraulic drives and controls  
• Practical exercises using dedicated LabStations | 3 days - 21 hours | Open training |
### Course H5: Diagnostics, maintenance and repairs of hydraulic devices and systems

**Course aims**: Knows the most important rules for safe use and maintenance of hydraulic devices; knows methods of finding and eliminating typical defects of hydrostatic system elements; is able to diagnose and evaluate technical condition of drive’s elements based on the analysis of the selected parameters of hydraulic system’s operation; knows methods of inspecting technical condition of hydraulically powered machines and devices; is able to identify irregularities and knows how to eliminate them in a fast and effective way; knows the principles of monitoring and analyzing the physical and chemical parameters of hydraulic fluids; is equipped with practical skills and technical awareness regarding renovation and current and periodic repairs.

**Course summary**:
- Diagnostics of technical condition of hydraulic system’s elements
- Practical exercises at the workstations – determination and evaluation of operation parameters of pumps and motors used in hydraulic systems
- Diagnosing hydraulic motors
- Diagnosing hydraulic valves
- Diagnostics and safe operation of hydraulic accumulators
- Methodology of detecting irregularities in systems with hydraulic drives
- Analysis of physical and chemical parameters of hydraulic fluids
- Maintenance of hydraulic fluid tanks
- Typical kinds of leakage in hydraulic installations and ways of eliminating them
- Preparing hydraulic systems for the first launch
- Operation and maintenance of the hydraulic elements and devices
- Typical symptoms of defects of hydrostatic system elements

**Duration**: 3 dni - 21 godz.

**Course type**: Szkolenie otwarte

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### Course H6: Servo-hydraulic drives: modeling, identification, control

**Course aims**: Modeling of the servo-hydraulic system on the basis of the physical properties of the components; knowledge on the basics of the theory of control, which is broadly used in servo-valve hydraulic systems; methods of tuning regulation loops in SvH systems; developing the skills of preparing and running the experiment of the servo-hydraulic system identification (experimental modeling).

**Course summary**:  
- Introduction to the servo-hydraulic drives  
- General characteristics of the electrohydraulic servomechanisms  
- Laws of physics in hydraulic systems  
- Modeling of a servo-hydraulic system on the basis of the physical properties of the components  
- Basics of the control theory  
- Regulation and adjusting of the system regulating the servo-valve system  
- Experimental modeling (identification)

**Duration**: 3 days

**Course type**: Closed training

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**Training rooms**
Our training rooms allow working on power hydraulic systems of the most popular manufacturers – PARKER Hannifin, BOSCH, Rexroth, Manuli Fluiconnecto, HYDAC and PONAR WADOWICE.

**H1, H2, H3, H4, H5, H6** More details on page 14
### MOBILE HYDRAULICS

<table>
<thead>
<tr>
<th>Course symbol</th>
<th>HM1</th>
<th>Course symbol</th>
<th>HM2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Course name</strong></td>
<td>Mobile hydraulics in machines and devices</td>
<td><strong>Course name</strong></td>
<td>Hydraulic drives and control systems in mobile hydraulics</td>
</tr>
<tr>
<td><strong>Course aims</strong></td>
<td>Design and operation principles of the hydraulic elements applied in mobile systems; design, assembly, implementation and testing simple hydraulic systems; interpreting graphical symbols and reading schematic diagrams of hydraulic systems; interpreting hydraulic quantities, valves characteristics and distinguishing methods of measuring flow temperature and pressure; displacement control principles, velocity and pressure control in hydraulic systems.</td>
<td><strong>Course aims</strong></td>
<td>Control and regulation of the velocity of actuators applied in mobile hydrostatic systems; operation principles of control systems type LS and LUDV; presentation of the typical pump controllers and regulators (DR, LR, HD, EP) and adjustable motors (EP, HZ, HA, DA) applied in mobile drive systems; design and operation principles of hydrostatic steering systems – Orbitrol; running experimental tests related to hydraulic elements and systems in mobile applications; operation, maintenance and repairs of the elements and devices in mobile applications.</td>
</tr>
</tbody>
</table>
| **Course summary** | • Basics of hydraulic drives in mobile systems  
• Positive displacement pumps  
• Hydraulic cylinders  
• Positive displacement rotary hydraulic motors (fast and low speed)  
• Hydraulic valves in mobile applications - flow control valves, pressure control valves, flow rate control valves, integrated control blocks in mobile applications, criteria for selection of hydraulic valves  
• Hydraulic accumulators  
• Working fluids applied in hydrostatic mobile systems  
• Conditioning elements for working fluids  
• Connections of hydraulic devices  
• Working fluid tanks in mobile applications  
• Hydraulic system auxiliaries  
• Graphical symbols of hydraulic elements and control systems  
• Reading and interpretation of simple schematic diagrams of hydraulic systems  
• Practical exercises on training positions – examination of exploitation properties of hydraulic elements in mobile applications  
• Using FluidSIM H software to present the functions of the hydraulic elements | **Course summary** | • General design of mobile hydraulic systems.  
• Hydrostatic systems.  
• Controllers and regulators of adjustable pumps and hydraulic motors in mobile applications – design and operation principle.  
• Drive systems dedicated to mobile hydraulic systems – design and operation principles.  
• Synchronization of the cylinder motion.  
• Receiver protection.  
• Control systems in mobile units.  
• Testing elements and hydraulic systems.  
• Basic information on operation, maintenance and repairs of hydraulic elements in mobile applications.  
• Reading and interpretation of schematic hydraulic diagrams.  
• Practical exercises on training positions – constructing and testing hydraulic systems.  
• Using Fluid-SIM H software to design and simulate hydraulic control systems. |
| **Duration** | 4 days - 28 hours | **Course type** | Open training |
### Mobile Hydraulics

<table>
<thead>
<tr>
<th>Course symbol</th>
<th>Course name</th>
<th>Course aims</th>
<th>Course summary</th>
</tr>
</thead>
</table>
| HM3           | Basics of IQAN control system | Fluent knowledge of the hardware layer characteristics of the IQAN Parker Hannifin system; unassisted basic operation of the IQAN. | • Basic characteristics of the hardware layer of the IQAN system – modular structure, “stand-alone” applications  
  • Selected hardware modules of the IQAN system  
  • Overview of the IQAN environment: IQANdesign, IQANsimulate, IQANanalyse, IQANrun  
  • Practical exercises at the workstations featuring IQAN system  
  • Developing the sample application for the IQAN central unit: allocating functions to binary and/or analog inputs of the central or extension unit, allocating functions to binary and/or analog outputs of the central or extension unit, introducing the logic functions facilitating the correlation between the input/output status (e.g. between the joystick lever angle and the control of the valve operating the cylinder), introducing the logic functions enabling taking account of feedback signals (e.g. signals from the pressure or position sensors),  
  • Preparing the virtual operator panel: control and corrective functions  
  • Practical exercises at the workbenches fitted with the IQAN system  
  • Unassisted student work |

#### Training rooms:
The station of mobile hydraulic drives and mobile control systems equipped in drive system with a pump with variable capacity, LOAD SENSING OPERATING SYSTEM (LS) and control system IQAN - Parker Hannifin.

### Hydrotronics

<table>
<thead>
<tr>
<th>Course symbol</th>
<th>Course name</th>
<th>Course aims</th>
<th>Course summary</th>
</tr>
</thead>
</table>
| HT1           | Hydrotronics – basic course | Poznание budowy i zasad działania elementów sterowanych elektrycznie; nabycie umiejętności projektowania, montażu oraz uruchamiania i badania prostych układów hydrotronicznych; zapoznanie się z technikami sterowania proporcjonalnego oraz sterowania serwozaworami; poznanie sposobów regulacji układów hydrotronicznych. | • Explanation of the terms „mechatronics”, „pneumotronics” and „hydrotronics”  
  • Fields covered by hydrotronics  
  • Conditions that need to be fulfilled so that a device or a system featuring hydraulic elements may be referred to as a hydrotronic solution  
  • Hydraulic elements predestined for hydrotronic applications: pumps, valves, actuators  
  • Typical sensors of hydraulic quantities and other physical quantities associated with hydraulic systems  
  • Practical exercises in building and checking the operation of hydraulic power systems at assembly workstations  
  • Controlling the pressure in hydraulic and hydrotronic systems  
  • Controlling the direction of movement of actuators in hydraulic and hydrotronic systems  
  • Controlling the velocity of actuators in hydraulic and hydrotronic systems  
  • Building the station for simulation and optimization of proportional valve settings  
  • Building the station for measuring energy recovery  
  • Building the station for testing the stability of hydrotronic systems  
  • Hydraulic axis controllers as a hydrotronic solution illustrated with an example of Compax3 F by Parker Hannifin  
  • Integrated hydrotronic environment illustrated with an example of IQAN by Parker Hannifin |

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<thead>
<tr>
<th>Course symbol</th>
<th>Course name</th>
<th>Course aims</th>
<th>Course summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>HT2</td>
<td>Hydrotronics – advanced course</td>
<td>Poznanie budowy i zasad działania układów hydrotronicznych znajdujących się w zasobach zamawiającego sklepu; zapoznanie się z technikami sterowania proporcjonalnego oraz sterowania serwozaworami; poznanie sposobów regulacji układów hydrotronicznych.</td>
<td>• Analysis of topics adjusted to the client’s needs.</td>
</tr>
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</table>

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<thead>
<tr>
<th>Duration</th>
<th>Course type</th>
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<tbody>
<tr>
<td>2 days - 14 hours</td>
<td>Closed training</td>
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<thead>
<tr>
<th>Duration</th>
<th>Course type</th>
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<tbody>
<tr>
<td>1 day</td>
<td>Closed training</td>
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</table>
# INDUSTRIAL PNEUMATICS

## Course Summary

<table>
<thead>
<tr>
<th>Course name</th>
<th>Course symbol</th>
<th>Duration</th>
<th>Course type</th>
<th>Course aims</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pneumatics - basic course</td>
<td>P1</td>
<td>3 days - 21 hours</td>
<td>Open training</td>
<td>Acquiring knowledge on the properties and preparation of compressed air; familiarizing the elements and functions of the pneumatic actuators and control systems applied in modern industry; developing the ability to read pneumatic schematic diagrams; gaining the skills of constructing pneumatic control systems with the use of training positions designed for configuring and testing pneumatic systems; gaining knowledge how to calculate and select proper pneumatic elements for given parameters; acquiring the ability to design pneumatic systems with the usage of the intuitive and algorithmic methods.</td>
</tr>
<tr>
<td>Industrial Electropneumatics</td>
<td>P2</td>
<td>3 days - 21 hours</td>
<td>Open training</td>
<td>Learning about the elements and operation of electropneumatic actuators and control systems used in the industry; acquiring the skills of reading schematic diagrams of electropneumatic control systems and skills of constructing pneumatic systems fitted with electropneumatic elements at the workstations enabling configuration and testing of the electropneumatic systems; gaining practical skills of constructing pneumatic systems fitted with electropneumatic elements and replacing pneumatic systems with electropneumatic units.</td>
</tr>
</tbody>
</table>
### Course aims

- Learning about the design and operation of the pneumatic and electropneumatic control systems; acquainting the participants with the methods of designing (synthesis) of such systems and with the simulation software used in the analysis of the pneumatic and electropneumatic control systems; applying the logic methods in designing control systems based on Boole's algebra.

- The basics of designing pneumatic systems.
- Selection of the basic elements of the system, taking into consideration the dynamics of pneumatic systems and pressure losses.
- Selection of the components and simulation of the pneumatic system using Computer-Aided Design tools (CAD).
- Intuitive method of synthesizing the pneumatic switch systems with examples of their practical application (advantages, disadvantages and functionality constraints).
- Elementary pneumatic actuator control systems constructed using intuitive methods and the detection of typical errors of such systems.
- Detection of typical errors occurring in control systems built according to intuitive method (logic connection errors, inappropriate selection of control and actuating elements, fungibility of control valves).
- Basic control systems with the application of pneumatic logic: NOT, OR, AND units.
- An algorithmic method of designing pneumatic switch systems, the notion of frequency unit (pneumatic cascade, step unit) and its construction on assembly boards.
- The analytic method of designing pneumatic and electropneumatic control systems on the basis of Boolean algebra and Karnaugh maps.
- Practical exercises - structure and testing the functioning of pneumatic and electropneumatic systems using assembly benches.

### Course summary

- Wiadomości wprowadzające z zakresu technik podciśnieniowych.
- Omówienie podstawowych grup zastosowań urządzeń technik podciśnieniowych (konfiguracja oraz wymagania).
- Konfiguracja układu podciśnieniowego (niezbędne elementy oraz parametry).
- Podstawowe odmiany przysawek podciśnieniowych (cechy oraz obszary zastosowań).
- Materiały konstrukcyjne stosowane do wytwarzania przysawek podciśnieniowych oraz zalecenia dotyczące czyszczenia i użytkowania.
- Podstawowe parametry układów chwytnych opartych o techniki podciśnieniowej.
- Podstawy projektowania układu przysawkowego.
- Chwytki specjalne (zalety oraz zastosowanie).
- Generatory próżni (cechy, budowa, zalety, zastosowanie).
- Technika zaworowa dedykowana do zastosowań podciśnieniowych.
- Elementy sterujące w technice podciśnieniowej.
- Filtry próżniowe (filtry przysawek, filtry wbudowane).
- Dodatkowe komponenty układu podciśnieniowego.
- Algorytm projektowania układu podciśnieniowego.
- Trendy, zgodne z koncepcją INDUSTRY 4.0 obowiązujące w technice podciśnieniowej.
- Ćwiczenia praktyczne.

### Duration

2 days - 14 hours

### Course type

Open training

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**INDUSTRIAL PNEUMATICS**

**Course symbol** P3

**Course name** Design and simulation of pneumatic and electropneumatic systems

**Course aims**
- Sposoby przygotowania sprężonego powietrza do potrzeb układów podciśnieniowych; identyfikacja podstawowych elementów wchodzących w skład systemów podciśnieniowych; projektowanie oraz modyfikacja podciśnieniowych układów manipulacyjnych do wymagań stawianych przez procesy przemysłowe; znajomość schematów układów podciśnieniowych; obowiązujące trendy w rozwoju technik podciśnieniowych.

**Course summary**
- Sposoby przygotowania sprężonego powietrza do potrzeb układów podciśnieniowych; identyfikacja podstawowych elementów wchodzących w skład systemów podciśnieniowych; projektowanie oraz modyfikacja podciśnieniowych układów manipulacyjnych do wymagań stawianych przez procesy przemysłowe; znajomość schematów układów podciśnieniowych; obowiązujące trendy w rozwoju technik podciśnieniowych.

**Course aims**
- Basic principles of vacuum technology

**Course summary**
- Basic principles of vacuum technology

**Duration**
- 2 days - 21 hours

**Course type**
- Closed training

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**Training rooms**

- P1
- P2
- P3
- P4

**The laboratory of pneumatics is equipped in tables contained components of: Parker, Festo, Rexroth, Pneumax/Rectus, and Fluid-SIM P software to learn the principles of design and simulation of pneumatic and electropneumatic control systems.**

**More details on page 23**
Laboratories

Training laboratories and unique equipment to practical workshops available as a part of training of POWER HYDRAULICS AND INDUSTRIAL PNEUMATICS. They have been developed from the ground up by the Engineering Training Center. They are based on elements of the largest suppliers of components.
Power hydraulics
stationary, mobile and hydrotronics
Courses codes: H1 - H6, HM1- HM3 and HT1 - 2

TRAINING POSITIONS FOR POWER HYDRAULICS COURSES

Training positions designed by The Engineering Training Center have been constructed with the PARKER Hannifin, BOSCH Rexroth, Manuli Fluiconnecto and PONAR components. Unique design of the positions allows performing exercises on all levels of progress in hydraulics:

- **Assembly and testing** of freely constructed hydraulic control systems whether conventional or electric,
- **Running experimental (operational) tests** of the typical hydraulic units like pumps, overflow valves, throttles or flow regulators,
- simple, effortless and quick **assembly of the designed hydraulic systems,**
- **Testing operation and functions** of the power supply, pressure units, flow direction control, flow intensity control and the actuators,
- acquisition of knowledge on the **design and construction of electrohydraulic systems** of electric and proportional relay control.
The workstations have a unique and Poland’s only design enabling exercises on different levels of advancement.

TRAINING POSITIONS FOR ELECTROHYDRAULICS AND PROPORTIONAL HYDRAULICS
The positions allows for:

■ assembly and testing the operation of freely configured conventionally or electrically controlled hydraulic systems,

■ acquiring skills in the field of design and installation of the electro-hydraulic systems of electric and proportional relay control,

■ parameterization of proportional systems.
THE WORKSTATIONS OF VISUALIZATION AND REGULATION OF HYDRAULICS SYSTEM OPERATION

The bench for practical exercises presents the classic operation of the hydraulic system. By using components made of PMMA, the channels, flows and the interior of each component used in the system while it is running.

The bench is controlled by the automation system with visualization on the operator panel. The system is used to present to the participants the operation of the hydraulic systems, their strengths, weaknesses and the most failure-prone spots with methods of quick troubleshooting. Components of the system:

- valve block,
- actuator,
- hydraulic accumulator,
- working medium tank,
- control panel with operator panel.
ADVANCED STATIONS OF MOBILE HYDRAULIC DRIVES

The station of mobile hydraulic drives and mobile control systems in proportional technology – IQAN control system – Parker Hannifin. The position is implemented by the block P70, adjusted to constant performance power pumps and equipped with a 5 section dividers, overflow valves and anti-cavitation on the individual sections and levers for manual control.
THE STATION OF MOBILE DRIVES WITH LOAD SENSING SYSTEM

The laboratory station is equipped in mobile applications block L90LS (counterpart of M4-12, M4-15 Bosch Rexroth), adapted to work with a pump with variable outputs, equipped with a Load Sensing system, 4 distribution sections, overflow valves and anti-cavitation, and also overflow valves on LS lines of individual sections. The block is responsible for controlling the pull-out of hydraulic cylinders (3 pieces) and hydraulic engine, loaded by means of throttle valves. The pump PV (Parker) with variable capacity with built-in pressure regulator, flow and overflow is connected to the distributor L90LS adapter.

On the basis of described elements students are able to design, simulate action, build and examine a typical mobile hydraulic systems.
UNIQUE TEACHING AIDS

During our courses, we also use unique teaching elements and components:

- tailor-made sections of all hydraulic system components,
- we disassemble the components in order to show the classic failure consequences.
The participants learn and perform a series of exercises using professional industrial tools and measuring equipment. At your disposal:

- **Parker Service Master Plus analyser** used to measure i.a.: flow, temperature and pressure of the working medium

- **HYDAC HMG 3010 and HMG 4000 analyzer** used to measure i.a.: flow, temperature and pressure of the working medium including a 5,7-inch touchpad

- **Parker iCount oil SamPler (iO5)** - a portable device for monitoring the condition of hydraulic fluid and oil

- **Parker Kittiwake** – monitoring system equipment and predictive maintenance systems for machinery in oil industry. During our trainings it is used for testing physicochemical properties of hydraulic fluid (such as kinematic viscosity, water content, acid value and base number), according to norms prescribed in the documentation and put into the console. Through the analysis of the results, operational suitability is identified

- **MHC** - a portable bearing checker instrument and acoustic monitoring device

- **Heated Viscometer** - testing viscosity of fuel oil is important for verifying the correct grade of fuel is delivered, for calculating combustion performance, plus adjusting of fuel handling and injection systems. It is used for monitoring changes in lubricating oil viscosity reporting in cSt @ 40°C and 50°C, preventing costly engine and machinery failures and also to verify correct fuel grade

- **FLIR Thermal Camera** - detects hazards using infrared technology

- many others
The teaching process is being supported by Fluid-SIM H. The software helps to learn the principles of the design and simulation of hydraulic and electrohydraulic control systems. The software enables analyzing the increase of the level and rate of the flow, pressure drops in the valves as well as designating the velocity and accelerations of the cylinder’s pistons.
Training rooms and laboratories are air-conditioned, large and spacious. Working positions for students are expertly equipped. Each participant has access to computers with simulation software and the latest product catalogs, sections of pneumatic components, and richly equipped laboratories used for practical exercises.
Our training rooms and laboratories allow working on actual industrial pneumatic components by leading manufacturers:

- Parker, ORIGA Parker, Festo, Rexroth, Pneumax/Rectus, PIAB, NORGREN, BIMBA Pneumatics, SMC (pneumatic and electropneumatic control systems and actuators).
- IFM, BALLUFF, Relpol, SIEMENS, Pneumax (industrial sensors, relay and control systems, valve terminals).
WORKSTATIONS OF INDUSTRIAL PNEUMATICS

- Actuating systems: single and double acting actuators, rodless linear actuators, grippers, multi-position shuttle tables with cushioning device, standardized multi-position actuators

- Directional 3/2, 5/2, 5/3 valves (actuated manually, mechanically, pneumatically and electrically)

- Check and throttle check valves, quick exhaust valves, throttle valves, reduction valves, safety valves

- Logic valves (AND/OR) in classic versions or to be mounted on DIN rails

- Proportional pressure regulators

- Vacuum technology elements (suction cups, pressure generators)

- Sensors (optical, induction, capacitive)

- Ultrasonic leak detector.
THE WORKSTATIONS DESIGNED TO STUDY THE SYNTHESIS OF PNEUMATIC AND ELECTROPNEUMATIC SYSTEMS

- monostable and bistable buttons (fitted with NO and NC contact sets),
- relays (enabling the synthesis of the intermediate valve control systems) fitted with NO and NC contact sets),
- multifunction timers with the following functions: on-delay, off-delay controlled by the contact, ON at a set time, one-time ON at a set time triggered by closing the control contact, symmetrical cyclic operation starting with a break or switch on, generation of a 0.5 second pulse after a set time, on at a set time triggered by opening the control contact, on and off-delay controlled by the contact, cyclic operation controlled by closing the control contact,
- visual and acoustic indicators of the operation status (signaling the presence of voltage),
- pneumatic counter,
- valves for panel mounting,
- passive hums for sensor inputs and pneumatic actuator reed relays.

Equipment available at the workstations facilitates building complex pneumatic and electropneumatic systems. The unique feature is the wide range of hardware versions (from universal pneumatics, through valve manifolds, to a variety of heavy-duty valves to be used in the toughest operating conditions).
Mobile workstations, designed and carefully prepared by specialists, facilitate a detailed presentation of issues related to pneumatic and electropneumatic systems.

We have two prepared mobile units based on the components provided by Pneumax. The workstations are equipped with elements of pneumatic actuators, controls and electropneumatic valves for trainings in Industrial Pneumatics on levels from P1 to P5 at the client’s location. The participants have the opportunity to freely combine actuators. The mobile laboratory enables the practical application of theoretical knowledge acquired during the course.
Software Teaching aids

During the course every participant has at one’s disposal individual workstations with **FluidSIM-P** software to study the **construction**, **simulation**, **analysis of parameters** of control systems and electro-pneumatic.
Trainers and instructors

Our trainers have extensive technical knowledge and broad experience supported by years of documented work in various implementation projects. In addition, they provide consulting services and they are experts for national journals. During the courses, their main focus is on passing knowledge of the real examples they have encountered in their professional work. Our trainers are open to all suggestions made by the participants. It is very common that during trainings the group discusses the issues beyond the scope of the standard program that cover specific aspects of the students work. Completed courses also lead to cooperation between EMT Systems Ltd. and representatives of industrial facilities in the following areas: projects, modernization and commissioning of the machine hydraulic systems and technological lines.
Our partners:

emt-systems.com

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