Global Motion & Control
Training
2012 North American Course Schedule
Motion & Control Training Profile

The Motion & Control Training Department at Parker Hannifin was established in the early 1970’s and is recognized today as the industry leader in the development and presentation of training materials and programs. The Department’s charter states that the primary focus of activity shall include all phases of technical training for hydraulic and pneumatic industries. The charter also states that this would be non-commercial and involve state-of-the-art methodology.

The Motion & Control Training website (www.parker.com/training) contains all our current publications -- textbooks, instructors guides and reference textbooks. Our most popular textbook, Industrial Hydraulic Technology, introduces the student to the "how and why" of hydraulics, from components to systems. Follow-up texts include Hydraulic Maintenance Technology and Hydraulic Pumps and Controls.

Our classes can be offered at your site. For more information please contact the Motion & Control Training Department
E-mail: mctrain@parker.com or call: 216-896-2577
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<td>10</td>
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##液压培训

- Mobile Hydraulic Technology (MHT)
- Industrial Hydraulic Technology
- Hydraulic Maintenance Technology (HMT)
- Hydraulic Component Sizing (HCS)
- Introduction to Electrohydraulics (EHD)
- Hydraulic Pumps and Controls (HPC)
- Electrohydraulic Feedback Systems (EFS)

##自动化培训

- Pneumatic Technology for Industry (PTI)
- Electromechanical Fundamentals (EMF)
- Open Motion Control (OMC)
- PLC Open (PLC)
- Pneumatic Circuitry (PnC)
- Pneumatic Component Selection (PCS)
**IHT**

**Industrial Hydraulic Technology (IHT)** - A 3½-day course which covers basic components of an industrial hydraulic system. Class sessions are reinforced with lab exercises.

<table>
<thead>
<tr>
<th>Participants</th>
<th>Maintenance, sales, engineering or non-engineering personnel and anyone who desires to increase their basic knowledge of hydraulic components and systems.</th>
</tr>
</thead>
</table>
| Objectives   | • Learn where and why hydraulics are used in industrial machinery  
• Understand how and why hydraulic systems and components work  
• Read and draw hydraulic schematics  
• Transfer information from a hydraulic schematic to an actual application |
| Content      | • Hydraulic transmission of force and energy  
• Hydraulic Fluids, Actuators & Pumps  
• Control of Hydraulic Energy  
• Flow Control Valves  
• Filtration  
• Hydraulic circuitry  
• System operation at suction side of pump  
• Hands-on experience building hydraulic circuits on system simulators |
| Duration     | 3½ days  Tue-Thursday 8:30am - 4:30pm  
Friday - 8:30am - 12:00pm  
Canada start time is 9:00 |
| Fee          | $1100 |
| Materials    | *Industrial Hydraulic Technology* textbook, lab manual and drafting template |
| Prerequisite | None |
| Class Size   | Limited to 18 students |
| Dates/Location | February 7-10  
May 1-4  
June 5-8  
November 6-9  
Milton  
Rochester Hills  
Calgary  
Elyria |
Hydraulic Maintenance Technology (HMT) - A 3½-day course which covers basic theory and methods for maintaining and troubleshooting hydraulic components and circuits. The student will receive actual hands-on experience with such things as pump setup procedures, circuit assembly and troubleshooting and graphic symbology reading.

<table>
<thead>
<tr>
<th><strong>Participants</strong></th>
<th>Maintenance personnel and anyone responsible for establishing and maintaining fluid power systems.</th>
</tr>
</thead>
</table>
| **Objectives**   | • Review operation and functional relationship of industrial hydraulic components  
                     • Help students to understand hydraulic troubleshooting concepts  
                     • Help students to read and understand hydraulic graphic symbols as found in typical hydraulic system schematics |
| **Content**      | • Graphic symbols of hydraulic components utilizing the International Standards Organization (ISO) System  
                     • Troubleshooting common hydraulic components such as pumps, cylinders, valves, rotary actuators, hydraulic motors, etc.  
                     • Noise and its related causes  
                     • Maintenance of fluid power systems |
| **Duration**     | 3½ days  Tues - Thurs 8:30am - 4:30pm  
                     Friday - 8:30am - 12:00pm  
                     Canada start time is 9:00 |
| **Fee**          | $1100 |
| **Materials**    | *Hydraulic Maintenance Technology* text, lab manual and drafting template |
| **Prerequisite** | IHT or MHT |
| **Class Size**   | Maximum 12 students |
| **Dates/Location** | January 10-13  Rochester Hills  
                     April 17-20  Calgary  
                     September 11-14  Elyria  
                     October 23-26  Milton |
**HCS, HPC**

**Hydraulic Component Sizing (HCS)** - An in-depth study of hydraulic components, their performance and how available performance data should be interpreted to evaluate circuits for effectiveness, cost savings and energy conservation. In addition, students will learn to recognize and overcome problem areas related to individual component characteristics which can affect the total operation of a system.

**Hydraulic Pumps & Controls (HPC)** - A 3½-day course whereby participants learn how to properly use performance and engineering data of variable displacement pumps. Students will also apply a logical circuit design procedure to any hydraulic application, and will achieve an efficient hydraulic design through many pumps and controls that are available.

<table>
<thead>
<tr>
<th></th>
<th><strong>HCS</strong></th>
<th><strong>HPC</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Participants</strong></td>
<td>This course is designed to assist anyone who designs, builds, or sells hydraulic systems. Participants should be familiar with basic hydraulic symbols and principles.</td>
<td>Maintenance personnel, engineers and anyone who desires to increase knowledge and understanding of pressure compensated variable volume pumps and the various controls available with them</td>
</tr>
</tbody>
</table>
| **Objectives**       | • Teach a practical approach to component sizing, beginning with the actuator and ending with power unit requirements  
                       • Emphasize the proper selection of components and how this affects other components in the system | • Fundamentals of pump controls  
                       • How pressure compensated variable volume pumps operate as well as how the controls function  
                       • Proper use of performance and engineering data of components |
| **Content**          | • Logical approach to component selection  
                       • Rod, bore, stop tube and cushion sizes  
                       • Explanation and use of velocity profiles to meet cycle time requirements  
                       • Sizing of hydraulic accumulators  
                       • Sizing and selection of hydraulic pumps  
                       • Electric motor requirements  
                       • Heat exchange requirements | • Apply a logical circuit design procedure to any hydraulic application  
                       • Basic control theory  
                       • Pressure compensation  
                       • Load sensing  
                       • Horsepower limiting  
                       • Electrohydraulics |
| **Duration**         | 3½ days Tuesday - Thursday 8:30am - 4:30pm; Friday 8:30am to 12:00pm                      | 3½ days Tuesday - Thursday 8:30am - 4:30pm; Friday 8:30am to 12:00pm                      |
| **Fee**              | $1100                                                                                     | $1100                                                                                     |
| **Materials**        | *Design Engineers Handbook* and class handouts                                           | *Hydraulic Pumps & Controls* textbook and lab manual                                       |
| **Prerequisite**     | Industrial Hydraulic Technology or Mobile Hydraulic Technology                           | Hydraulic Component Sizing or Mobile Hydraulic Technology                                 |
| **Class Size**       | Limited to 20 students                                                                     | Limited to 18 students                                                                    |
| **Dates/Location**   | February 21-24 Elyria                                                                     | September 25-28 Marysville                                                               |
Mobile Hydraulic Technology (MHT) - A course designed to introduce participants to the fundamentals of mobile hydraulic components and how to maintain and diagnose components within a system. Participants will also apply these fundamentals through the use of actual circuit assembly.

<table>
<thead>
<tr>
<th>Participants</th>
<th>Anyone who works with mobile equipment and wants to broaden understanding of hydraulics and its use in the mobile industry. Participants include maintenance, sales, assembly, test and new engineering personnel.</th>
</tr>
</thead>
</table>
| Objectives   | • Learn where hydraulics are used on mobile equipment  
• Understand how hydraulic systems and components work on mobile equipment  
• Learn how to read and interpret hydraulic schematics and transfer that information to the actual application  
• Understand some of the unique problems and solutions that are inherent with mobile equipment |
| Content      | • Basic hydraulic principles  
• Mobile hydraulic pumps and actuators  
• Hydrostatic drives  
• Mobile hydraulic control valves  
• Hydraulic pumps accumulators and steering systems  
• Hydraulic fluids  
• Mobile applications |
| Duration     | 3½ days Tuesday-Thursday 8:30am - 4:30pm; Friday 8:30am to 12:00pm  
Canada start time is 9:00 |
| Fee          | $1100 |
| Materials    | Mobile Hydraulic Technology textbook |
| Prerequisite | None |
| Class Size   | Maximum 12 students |
|              | March 6 -9  
|              | May 15-18  
|              | July 10-13  
|              | December 4-7  
|              | Elyria  
|              | Milton  
|              | Calgary  
|              | Rochester Hills |
**EHD, EFS**

**Introduction To Electrohydraulics (EHD)** - A 3½-day course whereby students are introduced to the rapidly developing field of electrohydraulic proportional control. The course concentrates on how electronics are used to control hydraulic components. A typical circuit board is analyzed and explained. Twenty-five percent of the time is spent in the lab working with electrohydraulic proportional valves.

**Electrohydraulic Feedback Systems (EFS)** concentrates on how to design a predictable, stable, electrohydraulic positioning system to meet speed, force, duty cycle, and accuracy requirements. Approximately 25% of the class time students spend in our lab connecting, operating, and tuning a closed loop electrohydraulic system.

<table>
<thead>
<tr>
<th></th>
<th>EHD</th>
<th>EFS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Participants</strong></td>
<td>Anyone requiring an increased understanding of the rapidly emerging field of electrohydraulic proportional control valves and the electronics used to operate these valves</td>
<td>Sales and application engineers at both the distributor and manufacturer levels who need to apply motion control to industrial machinery</td>
</tr>
</tbody>
</table>
| **Objectives**  | • Fundamental electronic theory applicable to electrohydraulic proportional valves  
• Understand how electrohydraulic proportional valves operate  
• Examine, in detail, a typical printed circuit board used with a typical electrohydraulic proportional valve  
• Get hands-on experience connecting and using a proportional valve | • To expose the student to practical experiences with feedback systems  
• Control system position and speed  
• Understand closed loop control, and should be able to set up basic position and speed servomechanisms  
• Provide methods for sizing a servo or proportional valve for a given application and deciding which type to use |
| **Content**     | • Basic D.C. electronics  
• Interpreting circuit board schematics  
• How proportional valves work  
• Interpreting valve specifications  
• Recognizing electrical components  
• Calculating the performance envelope of a system | • Valve sizing, bandwidth and feedback  
• Speed and positioning loops  
• Valve characteristics and testing  
• Frequency response, stability/oscillation  
• Servo loop gain and errors  
• Interpretation of catalog data  
• Valve control of cylinder motion |
| **Duration**    | 3½ days Tuesday - Thurs. 8:30am - 4:30pm and Friday 8:30 am - 12:00 pm | 3½ days Tuesday - Thurs. 8:30am - 4:30pm and Friday 8:30 am - 12:00 pm |
| **Fee**         | $1300                                                                | $1300                                                                |
| **Materials**   | Text and *Lexicon III*                                              | *Hydraulic Systems Engineering* textbook                             |
| **Prerequisite**| Industrial Hydraulic Technology or Mobile Hydraulic Technology      | Introduction to Electrohydraulics (EHD)                             |
| **Class Size**  | Limited to 12 students                                              | Limited to 12 students                                              |
| **Dates/Location** | June 19-22 Elyria                                                   | July 17-20 Elyria                                                   |
**OMC, PLC**

OMC is a programming course using IEC61131-3 standard code for programming motion control. IEC61131-3 is an international standard programming standard used in PLC and Motion Control programming.

This course is offered using either CoDeSys or ACR View for programming. This course is approximately 50% lecture and 50% hands-on.

The PLC course covers all five programming languages that are defined in the IEC61131-3 standard.

Attendees will use two different programming environments and PLC systems on the course. This is an applications-oriented training using real examples drawn from industry. This course is approximately 50% lecture and 50% hands-on activities using a variety of controllers and simulations. Tasks include traditional PLC control and motion control.

<table>
<thead>
<tr>
<th><strong>Participants</strong></th>
<th>Engineers, Motion Control Professionals and programmers working in automation.</th>
<th>Engineers, sales personnel and maintenance staff that need to apply and program PLCs.</th>
</tr>
</thead>
</table>
| **Objectives**   | • Learn a practical approach to programming motion control  
                   • Learn to create an easily maintained and reliable PLC program  
                   • Learn the Basics of the IEC61131-3 languages |
                   | • Learn a practical approach to programming PLCs in an organized and structured manner.  
                   • Learn to create an easily maintained and reliable PLC program.  
                   • Learn the basics of the five IEC61131-3 programming languages.  
                   • Learn to use and combine the five languages to create high quality PLC programs. |
| **Content**      | • IEC61131-3 Basics  
                   • The “scan” and its affect on motion programming  
                   • The LD & FB languages  
                   • CFC Programming  
                   • ST programming |
| **Duration**     | 3 days Tues-Thurs  8:30am - 4:30pm | 4.5 days Mon-Thurs  8:30am - 4:30pm; Friday - 8:30am - 12:00pm |
| **Fee**          | $975 | $1300 |
| **Materials**    | Class and lab materials are provided. | Class and lab materials are provided. |
| **Prerequisite** | None - but some programming experience would be beneficial | None - but some programming experience would be beneficial |
| **Class Size**   | Limited to 10 students | Limited to 10 students |
| **Dates/Location** | February 28-March 1  
                   May 8 - 10  
                   November 13-15  
                   Rohnert Park  
                   Irwin  
                   Rochester Hills | January 23-27  
                   March 12 - 16  
                   September 17-21  
                   Rochester Hills  
                   Irwin  
                   Rohnert Park |
## PTI, PnC

**Pneumatic Technology for Industry (PTI)** - A three-day course designed to introduce participants to pneumatics as it relates to industrial machinery. In addition, students will learn how and why pneumatic components work and how to maintain pneumatic systems.

**Pneumatic Circuitry (PnC)** - Introduces pneumatic symbology and circuit design techniques. The participant will have the opportunity to design and construct some practical pneumatic circuits.

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<th><strong>PTI</strong></th>
<th><strong>PnC</strong></th>
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<tr>
<td><strong>Participants</strong></td>
<td>Maintenance personnel, engineers and anyone who desires to increase basic knowledge of pneumatic components and systems</td>
<td>Individuals who have a thorough understanding of how pneumatic components operate and relate to each other within a system</td>
</tr>
</tbody>
</table>
| **Objectives**   | • Introduce participants to pneumatics as it relates to industrial machinery  
                    • Help the participants to understand how and why pneumatic components work  
                    • Help the participant to understand the importance of maintaining a pneumatic system for optimum work and efficiency | • Are given an in-depth look at graphic symbols based on the ISO 1219 standard  
                    • Receive help in reading and understanding system schematics of typical pneumatic circuits  
                    • Will be able to use system schematics for effective troubleshooting |
| **Content**      | • Pneumatic actuators, directional valves, flow valves, quick exhaust valves, FRL's  
                    • Air production and preparation  
                    • Air distribution systems  
                    • Hands-on work with pneumatic trainers | • Air preparation circuits  
                    • Pressure and speed control circuits  
                    • Sequencing and air logic control circuits  
                    • Electropneumatic control circuits  
                    • Vacuum circuits |
| **Duration**     | 3 days  
                    Tuesday - Thursday 8:30am - 4:30pm  
                    **Canada start time is 9:00** | 3 days  
                    Tuesday - Thursday 8:30am - 4:30pm  
                    **Canada start time is 9:00** |
| **Fee**          | $725 | $725 |
| **Material**     | *Pneumatic Technology for Industry* textbook | *Pneumatic Circuitry* textbook |
| **Prerequisite** | None | Pneumatic Technology for Industry |
| **Class Size**   | Limited to 18 students | Limited to 18 students |
| **Dates/Location** | January 10-12  
                        March 27-29  
                        April 24-26  
                        October 9-11  
                        Wadsworth  
                        Atlanta  
                        Milton  
                        Rochester Hills | June 12-14  
                        November 6-8  
                        Milton  
                        Rochester Hills |
### Pneumatic Component Selection (PCS)
- This course will allow participants to properly select pneumatic components and circuits for optimum performance, cost and energy savings. This class discusses how component design and circuit design affect purchase cost, performance, and, most importantly, the total cost of ownership.

### Electromechanical Fundamentals (EMF)
- This 3-day course introduces electromechanical motion control. Students will learn about the various components in an electromechanical motion control system and how the components fit into the system. Some basic component sizing and selection criteria are discussed.

<table>
<thead>
<tr>
<th>PCS</th>
<th>EMF</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Participants</strong></td>
<td>Anyone who designs, builds or sells pneumatic systems. Participants should be familiar with basic pneumatic symbols and principles.</td>
</tr>
</tbody>
</table>
| **Objectives** | • Teach a practical approach to component sizing and selection beginning with the end-effector and ending with calculating total system demand  
• Emphasize proper selection of components and how this can affect cost of the system over the life of the system. | • To expose students to electromechanical motion  
• To understand the mechanical and electronic components used in motion control  
• To understand different motor technologies  
• To understand the differences between open and closed loop control |
| **Content** | • Logical approach to component selection  
• Gripper selection  
• Selection of vacuum cups & generators  
• Selection of cylinders  
• Sizing of air valves  
• Sizing of filters | • Motors  
• Drives & controllers  
• Stepper systems  
• Servo systems  
• Linear motors & motor sizing  
• Component selection |
| **Duration** | 3 days  
Tuesday - Thursday 8:30am - 4:30pm | 3 days  
Tuesday - Thursday 8:30am - 4:30pm **Canada start time is 9:00** |
| **Fee** | $725 | $975 |
| **Material** | *Pneumatic Component Selection* textbook, Lab Manual | *Motor Drive Technology* textbook, Lab Manual |
| **Prerequisite** | Pneumatic Technology for Industry | None |
| **Class Size** | Limited to 20 students | Limited to 20 students |
| **Dates/Location** | March 6-8 Rochester Hills | February 7-9 Charlotte  
April 17-19 Rochester Hills  
September 25-27 Milton  
October 23-25 Irwin  
December 11-13 Rohnert Park |
Registration Form

Please Note: Cancellations received less than ten (10) working days in advance of the class date, or student no-shows, will be charged with 100% cancellation fee per student.

For U.S. class locations, fax registration form to password protected fax @ 216/514-6738

To register for Toronto or Calgary classes fax registration form to:
Attn: Preet Jones @ fax 905/876-0788
Motion & Control Canada, phone 905/693-4749

Name: (Enter as you would like it to appear on your certificate)

Phone: __________________________ Cell: __________________________
Company: ___________________________________________
Address: __________________________________________ E-Mail: __________________________
City: __________________________ State: ______ Zip: ___________

Special Need _______________________________________

Method of Payment:

☐ Check Enclosed (payable to Parker Hannifin Corp.) ☐ Purchase Order No. ______________________ (Parker Distributors only)
Mail to: Parker Hannifin Corporation
M & C Training Dept. W3MC01
6035 Parkland Blvd
Cleveland, OH 44124-4141

☐ Credit Card - Visa, MasterCard or American Express
Card Number __________________________ Exp. Date _________ CVV code _________

I would like to attend:

<table>
<thead>
<tr>
<th>Date(s)</th>
<th>Registration Fee*</th>
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<tbody>
<tr>
<td>IHT</td>
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<td>EFS</td>
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<td>HS</td>
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<td>PS</td>
<td>$500</td>
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</tbody>
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* Registration Fees subject to change without notice. All tuition fees in U.S. dollars.
**Fluid Power Society Review & Test**

**Certified Hydraulic Specialist (HS)**  
Review Class: Monday through Thursday, 8:00am - 5:00pm  
HS Certification Test Date: Friday, January 13, 2012, from 8:00am - 12:00pm  
Test Site (for the FPS application): Parker Hannifin Corporation HQ, Cleveland, Ohio  
**Deadline to register: December 3, 2011**

**Certified Pneumatic Specialist (PS)**  
Review Class: Monday through Thursday, 8:00am - 5:00pm  
PS Certification Test Date: Friday, March 16 from 8:00am - 12:00pm  
Test Site (for the FPS application): Parker Hannifin Corporation HQ, Cleveland, Ohio  
**Deadline to register: February 14, 2012**

<table>
<thead>
<tr>
<th><strong>Content</strong></th>
<th>Ernie Parker will facilitate the review portion of the certification leading up to the test on Friday. Ernie is a Fluid Power Engineering Technology Instructor at Hennepin Technical College in Minnesota. In 2009, he received the Educator of the Year Award for Excellence in Teaching from the Minnesota State Colleges and Universities Board of Trustees. He is an active member of the Fluid Power Certification Board, Society of Automotive Engineers and the American Society of Mechanical Engineers. Ernie’s knowledge and experience have helped many to achieve FPS certifications in both Pneumatics and Hydraulics.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Duration</strong></td>
<td>4.5 days Mon-Thurs 8:00am - 5:00pm; Friday - 8:00am - 12:00pm</td>
</tr>
<tr>
<td><strong>Fee</strong></td>
<td>$500  Participants are also responsible for all travel and accommodation expenses in addition to Fluid Power Society test fees.</td>
</tr>
<tr>
<td><strong>Materials</strong></td>
<td>Class and lab materials are provided.</td>
</tr>
<tr>
<td><strong>Class Size</strong></td>
<td>Limited to 20 students</td>
</tr>
<tr>
<td><strong>Dates/Location</strong></td>
<td></td>
</tr>
</tbody>
</table>
January 9-13 (HS)  
March 12-16 (PS)  
Cleveland Corporate Office |  
Cleveland Corporate Office |
Motion & Control Training Department Personnel

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Hydraulic Maintenance Technology
Hydraulic Pumps & Controls
Mobile Hydraulic Technology

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Pneumatic Technology for Industry
Pneumatic Circuitry
Electromechanical Fundamentals
Pneumatic Component Selection
Open Motion Control
PLC

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Training Website Administrator
Customer Service

Carol Kuhner
Ass’t. Training Coordinator
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Class Registration & Logistics
Accounts Receivable
Training Locations

Atlanta Training Center
1300 Six Flags Road
Lithia Springs, GA 30122

Electromechanical Automation
5500 Business Park Drive
Rohnert Park, CA 94928

Elyria Training Center
520 Ternes Ave.
Elyria, OH 44036

Hose Products Division
30240 Lakeland Blvd.
Wickliffe, OH 44092

Hydraulic Pump Division
14249 Industrial Parkway
Marysville, OH 43040

Pneumatic Division
135 Quadral Drive
Wadsworth, OH 44281

SSD Drives
9225 Forsyth Park Drive
Charlotte, NC 28273

Rochester Hills Training Center
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Rochester Hills, MI 48309

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