Motion Control Training
Training Equipment and Services
Parker Hannifin is the World’s leading diversified manufacturer of motion and control technologies and systems, providing precision engineered solutions for a wide variety of commercial, mobile, industrial, and aerospace markets. Parker’s products are vital to virtually everything that moves or requires control, including the manufacture and processing of raw materials, durable goods, infrastructure development, and all forms of transport.

Systems from a Global Leader

Customers rely on Parker for engineering excellence, World-class manufacturing, and outstanding customer service to provide comprehensive application solutions. Parker’s technical training for Hydraulic, Pneumatic, and Electromechanical technology is the best in the World.

Custom Learning Modules

Parker’s Motion Control Institute offers a full range of training equipment and curriculum to support the teaching of Hydraulic, Pneumatic, and Electromechanical motion control technologies. Utilized by Colleges, Universities, Technical Schools and industry around the World, Parker’s training systems, textbooks, lab manuals, instructor’s guides, and teaching aids have been educating technology students for over 40 years.

Training products are available individually, or grouped with other components and curriculum to create custom learning modules. Hundreds of Colleges and Universities use Parker learning modules to educate the next generation of motion and control professionals.
Flexible Learning with Parker Solutions

• Parker’s Motion and Control Institute offers a full range of training equipment and curriculum to support the teaching of hydraulic and pneumatic motion control technologies. Utilized by Colleges, Universities, Technical Schools and industry around the world, Parker’s training systems, textbooks, lab manuals, instructor’s guides, and teaching aids have been educating technology students for over 40 years.

• Parker’s modular training system is a flexible training platform. The system can be customized to meet the user’s needs and budget.

• The components on Parker’s training equipment are industrial grade and are used in industry today. Students benefit from learning with the components actually used in demanding real-world applications.

• Training products are available individually, or grouped with other components and curriculum to create custom learning modules. Hundreds of Colleges and Universities use Parker learning modules to educate the next generation of motion and control professionals.
PSKSP0 – Standard Platform

PSKPO – Standard Platform

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Quantity</th>
<th>Description</th>
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<tbody>
<tr>
<td>PSKMF</td>
<td>1</td>
<td>Modular Frame</td>
</tr>
<tr>
<td>PSK-PL48X28</td>
<td>1</td>
<td>Modular Panel</td>
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<tr>
<td>PSKPU1</td>
<td>1</td>
<td>Power Unit</td>
</tr>
<tr>
<td>Duraclean</td>
<td>3</td>
<td>Filter &amp; Hydraulic Oil – 5 gal bucket</td>
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PSKMF – Modular Frame
The lightweight aluminum frame is ideal for a versatile training environment. Components from any learning module easily snap onto the panel in any configuration. An additional panel (PSK-PL48X28) can be mounted to the back for a double-sided learning platform.

Circuits can be created with ease and brought into the classroom to reinforce learning objectives.
- 68" high x 54" wide x 31" deep
- 4" swivel locking casters
- Hose rack

PSKPU1 – Power Unit
The industrial power unit is used in many hydraulic applications and connects directly to any of the hydraulic components or through a manifold (PSK20600). It offers a huge training opportunity for students to learn about industry standards and proper maintenance. Also includes 15 gallons of Duraclean™ Hydraulic Oil.

Power Unit
- 1 horsepower
- 115 volt electric motor
- Pressure gauge
- Filter
- Motor starter
- Tank gauge
- Bypass valve
- Swivel locking casters

Duraclean™
- Formulated for high performance hydraulic power units and equipment
- Formulated to help extend the life of hoses and seals
- Superior thermal stability for uncompromised performance at high temperatures
- Parker gold dye for easy identification
BHLM01 & BHEM02 – Basic Hydraulic Learning Modules

The BHLM01 Basic Hydraulic Learning Module includes fourteen experiments to provide hands-on learning. All of the components in this module are mounted on individual fixtures that snap onto the modular panels.

BHLM01 – Basic Hydraulic Learning Module

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Quantity</th>
<th>Description</th>
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<tbody>
<tr>
<td>PSK20600</td>
<td>2</td>
<td>Manifold</td>
</tr>
<tr>
<td>PSK20600A</td>
<td>1</td>
<td>Manifold with SensNODE</td>
</tr>
<tr>
<td>PSK20601</td>
<td>1</td>
<td>Closed Center Lever Operated Valve</td>
</tr>
<tr>
<td>PSK20604</td>
<td>1</td>
<td>6” Double-Acting Cylinder</td>
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<tr>
<td>PSK20606</td>
<td>4</td>
<td>Tees</td>
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<tr>
<td>PSK20607</td>
<td>13</td>
<td>Hose Assemblies</td>
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<tr>
<td>PSK20608</td>
<td>1</td>
<td>Needle Valve</td>
</tr>
<tr>
<td>PSK20609</td>
<td>1</td>
<td>Flow Control Valve with Bypass Check</td>
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<tr>
<td>PSK20610</td>
<td>1</td>
<td>Check Valve</td>
</tr>
<tr>
<td>PSK20611</td>
<td>1</td>
<td>Pressure Compensated Flow Control Valve</td>
</tr>
<tr>
<td>PSK20612</td>
<td>1</td>
<td>Flow Meter</td>
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<tr>
<td>PSK20614</td>
<td>1</td>
<td>Pressure Reducing Valve</td>
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<tr>
<td>PSK20615</td>
<td>2</td>
<td>0-1000 psi Gauges</td>
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<tr>
<td>Bulletin 0232-B1</td>
<td>1</td>
<td>Student Textbook</td>
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<tr>
<td>Bulletin 0232-B3</td>
<td>1</td>
<td>Digital Images CD</td>
</tr>
<tr>
<td>Bulletin 0216-B8-R1</td>
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<td>Lab Manual</td>
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The BHEM02 Basic Hydraulic Expansion Module combines with the BHLM01 Basic Hydraulic Module to allow for an additional seventeen experiments.

BHEM02 – Basic Hydraulic Expansion Module

<table>
<thead>
<tr>
<th>Part Number</th>
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<tbody>
<tr>
<td>PSK20602</td>
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<td>3-position, 4-way, Open Center Lever Operated</td>
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<tr>
<td>PSK20603</td>
<td>1</td>
<td>12” Double-acting Cylinder</td>
</tr>
<tr>
<td>PSK20609</td>
<td>1</td>
<td>Flow Control Valve with Bypass Check</td>
</tr>
<tr>
<td>PSK20610</td>
<td>1</td>
<td>Check Valve</td>
</tr>
<tr>
<td>PSK20613</td>
<td>1</td>
<td>Sequencing Valve</td>
</tr>
<tr>
<td>PSK20618</td>
<td>1</td>
<td>Bidirectional Gerotor Motor</td>
</tr>
<tr>
<td>Bulletin 0216-B8-R1</td>
<td>1</td>
<td>Lab Manual</td>
</tr>
</tbody>
</table>
Curriculum

Additional learning exercises simulate thousands of real world applications.

The BHEM02 basic hydraulic expansion module utilizes the same textbook, instructor guide, as the BHLM01 basic hydraulic module.
MHLM01 – Mobile Hydraulic Module

Our new Mobile Hydraulic Module features a mobile, two spool proportional valve. It is configured to highlight metering in both the open and closed center mode.

The valve has the capacity for simultaneous metering of two actuators. It also can be configured to show the power beyond function plus much more.

The valve itself is a current production model used in real world applications.

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Quantity</th>
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<tbody>
<tr>
<td>MOB50600</td>
<td>1</td>
<td>Mobile Valve Assembly-Lever Operated</td>
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<tr>
<td>Bulletin 0274-B1</td>
<td>1</td>
<td>Mobile Hydraulic Technology Textbook</td>
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<tr>
<td>Bulletin 0274-B8.1</td>
<td>1</td>
<td>Mobile Hydraulic Technology Lab Manual</td>
</tr>
</tbody>
</table>
Mobile Hydraulic Technology Lab Manual – Bulletin 0274-B8.1

Learning Exercises:
• Simple Circuit – Open Center
• Simple Circuit – Closed Center
• Operating a Cylinder with a Float Section
• Multiple Circuit – Splitting with an Open Center Valve
• Multiple Circuit – Splitting with a Closed Center Valve
• Measuring Flow out of a Cylinder
• Regeneration
• Pressure Reducing Valve Adjustment
• Pressure Reducing Circuit
• Sequence Valve Adjustment
• Sequencing Cylinders
• Sequencing a Cylinder and Motor
• Meter – In
• Meter – Out
• Synchronize Cylinders with Flow Controls
• Synchronize Cylinders Both Ways without Flow Controls
• Closed Center Pressure Build-up
• Cylinder Leak Test Power Beyond Circuit

Mobile Hydraulic Technology Textbook – Bulletin 0274-B1

Mobile Hydraulic Technology is one of our most recent additions to the line of Parker technical textbooks. Over 400 pages, this text covers technical topics including steering systems, directional control valves, hydraulic cylinders, fluids, and applications. This text is a must as a fundamental introduction to mobile hydraulics. Chapters include:
• Introduction to Mobile Hydraulics
• Basic Hydraulic Principles
• Mobile Hydraulic Pumps
• Hydraulic Motors and Hydraulic Drives
• Hydraulic Cylinders
• Pressure Control Valves
• Flow Control Valves
• Directional Control Valves
• Remote Controls in Mobile Hydraulic Systems
• Fluids
• Hydraulic Filters
• Fluid Conductors
• Steering Hydraulic Systems & Accumulators
• Reservoirs and Coolers
• Unit Conversions
• Applications
• Hydraulic Fluid Filter Selection
Learn the skill of Open and Closed loop control exactly as you would in the real world. Automatic control of hydraulic systems has evolved into an increasingly superior alternative for many industrial applications. Advances in hydraulic hardware and electronics have combined to make the design and installation of these systems more intuitive, reliable, cost effective, repeatable and user friendly.

Controlling the position of a cylinder is one of the more demanding hydraulic motion control techniques. The electrohydraulic module is intended to develop a solid background in controlling the position of a cylinder, along with references to controlling velocity, pressure, force and combinations thereof.

**SKHD1FB Servo/Proportional Valve and Cylinder**
This Electrohydraulic Axis is the heart of hydraulic control in many applications. The proportional directional valve is available with digital onboard electronics. The valve parameters can be saved, changed and duplicated in combination with the digital power amplifier. The cylinder feedback is a magnetostrictive probe common in high end applications.
- Digital onboard electronics.
- ProPxD software available on the internet.
- Set Ramps, Limits and Dead-band with your computer.
- Command options for D1FB +/- 10V.
- Plot spool command and linearization.
- Manual override.

**SKPID Signal Conditioning Card**
The digital servo amplifier unit combines all necessary functions for the optimal operation of closed loop controls. The most important features are:
- Extended PID controls.
- Speed control with position feedback.
- Differential input stage with different signal options.
- Output stage with different output options.
- Four-quadrant ramp function.
- Status indicator.
- Digital circuit design.
- Connection by disconnectable terminals.
- Compatible to the relevant European EMC standards.

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<table>
<thead>
<tr>
<th>Part Number</th>
<th>Quantity</th>
<th>Description</th>
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<tbody>
<tr>
<td>SKHD1FB</td>
<td>1</td>
<td>Servo/Proportional Valve and cylinder</td>
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<td>SKPID</td>
<td>1</td>
<td>Signal Conditioning Card</td>
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<tr>
<td>SKPS2401</td>
<td>1</td>
<td>Power Supply 24 Volt - 4 Amps</td>
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<td>SKPDS</td>
<td>1</td>
<td>Potentiometer</td>
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<tr>
<td>SKEHC</td>
<td>1</td>
<td>7-pin Valve Cable</td>
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<tr>
<td>SK0866</td>
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<td>Cylinder Cable</td>
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<tr>
<td></td>
<td>1</td>
<td>Parametrizing Cable</td>
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<tr>
<td>Bulletin 0211-B1</td>
<td>1</td>
<td>Electrohydraulic System Engineering Textbook</td>
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<tr>
<td>Bulletin 0217.1</td>
<td>1</td>
<td>Electrohydraulic System Engineering Lab Manual</td>
</tr>
</tbody>
</table>
Electrohydraulic Training Module ENTM07
Lab Manual – Bulletin 0217-B8-R1

Learning Exercises:
- Electrohydraulic Valve
- LVDT (linear variable differential transformer)
- PC Board Input/Output Connections
- “On Board” Driver Card Current and Bias Options
- “On Board” Driver Card Electronic Limits
- “On Board” Driver Card Deadband Compensators
- Open Loop Operation with Cylinder
- Proportional Valve Characteristics
- Open Loop Operation with a Motor
- Closed Loop Operation with a Cylinder

Electrohydraulic System Engineering
Textbook – Bulletin 0211-B1

The Electrohydraulic System Engineering Textbook focuses on the challenges faced by individuals involved with electrohydraulic systems. These challenges include bridging the theory of open and closed loop hydraulic systems to real applications for improved system performance.

These concepts are highlighted by the chapter descriptions.

Chapter 1
- Electrohydraulic Valves (Servo and Proportional Valves)

Chapter 2
- Defining Force Requirements
- Open Loop Considerations

Chapter 3
- Motion Profiles
- Establishing Target Position, Velocity and Acceleration

Chapter 4
- Sizing Hydraulic System Parameters
- Meeting Force and Velocity Requirements

Chapter 5
- Hydraulic System Dynamics
- Meeting Closed Loop Requirements
- Position and Following Error Tolerances

Chapter 6
- Optimizing System Performance
- Tuning Parameters and Their Effects
The BPLM01 Basic Pneumatic Learning Module includes fifteen experiments to provide hands-on learning. All of the components in this module are mounted on individual fixtures that snap into the modular panels.

The lab manual (Bulletin 0213-B8) describes the step-by-step procedures for all of the experiments and references the learnings of the Pneumatic Technology for Industry student textbook.

<table>
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<th>Part Number</th>
<th>Quantity</th>
<th>Description</th>
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<tr>
<td>BPT30600</td>
<td>2</td>
<td>Single Rod Cylinder</td>
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<tr>
<td>BPT30601</td>
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<td>Double Rod Cylinder</td>
</tr>
<tr>
<td>BPT30602</td>
<td>1</td>
<td>5/2 Manual Hand Valve</td>
</tr>
<tr>
<td>BPT30603</td>
<td>3</td>
<td>3/2 Manual Hand Valve</td>
</tr>
<tr>
<td>BPT30604</td>
<td>3</td>
<td>Quick Exhaust/Shuttle Valve</td>
</tr>
<tr>
<td>BPT30605</td>
<td>2</td>
<td>3/2 Single Air Pilot Valve</td>
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<tr>
<td>BPT30606</td>
<td>5</td>
<td>5/2 Double Air Pilot Valve</td>
</tr>
<tr>
<td>BPT30607</td>
<td>1</td>
<td>Filter-Regulator with Gauge</td>
</tr>
<tr>
<td>BPT30608</td>
<td>2</td>
<td>Regulator with Gauge</td>
</tr>
<tr>
<td>BPT30609</td>
<td>5</td>
<td>In line Flow Controls; ¼&quot; Tube</td>
</tr>
<tr>
<td>BPT30610</td>
<td>1</td>
<td>¼&quot; Tube Check Valve</td>
</tr>
<tr>
<td>BPT30611</td>
<td>1</td>
<td>Six Port Junction</td>
</tr>
<tr>
<td>BPT30612</td>
<td>3</td>
<td>Quad Junction</td>
</tr>
<tr>
<td>BPT30613</td>
<td>5</td>
<td>Tee</td>
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<tr>
<td>BPT30614</td>
<td>13</td>
<td>Plug</td>
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<td>Bulletin 0212-B1</td>
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</tr>
<tr>
<td>Bulletin 0213-B8</td>
<td>1</td>
<td>Lab Manual</td>
</tr>
</tbody>
</table>
Learning Exercises:
• Operating a cylinder with two 3-way, 2-position valves
• Use of a 5-way, 4-position valve to actuate a double acting cylinder
• Use of a spring applied, air pressure released rodlock to restrict cylinder motion
• Controlling a large valve using a smaller valve, using pneumatic control
• Use of a quick exhaust valve to open an actuator very quickly
• Pneumatic circuit that will cycle automatically
• Automatic circuit with two stop signals – momentary and retained
• Control system that converts a momentary pressure signal into a sustained pressure signal
• Automatic reciprocating circuit that does not use the limit valves
• Pneumatic sequencing circuit
• Two pressure pneumatic circuit
• Energy conservation circuit
• Using limit valves to cause cylinder’s motion to precede another
• Two speed circuit
• 3 position circuit using a duplex cylinder

The Pneumatic Technology for Industry student textbook is designed to introduce pneumatics as it relates to industrial machinery. The 217 page text is organized into 10 different chapters which include:
• Compressed air Safety
• Introduction to compressed air
• Symbols
• Actuators
• Control valves
• Pneumatic circuits
• Air preparations
• Solenoids and electronic control
• Pneumatic Logic
• Compressed air production and distribution
Digital motion controllers transform the way hydraulic systems function in today’s demanding applications. Profiles are entered into the motion controllers with the expectation that the electrohydraulic system will closely follow the profile. This module is designed to explore all the variables that affect the performance of these systems.

**SKC3F01**

The Compax3F was especially designed to meet the requirements of electrohydraulic systems for the control of position and force of hydraulic axes.

Motion control with motion profiles was created with Standard IEC 61131-3. The motion control functions specified in PLC open are also provided by Parker as a library with the device and control software.

**SKRS232-Cable**

This cable is required to communicate with the SKC3F01 Controller.
What Courses Are Offered?

• Motion Control Institute Instructor Led courses are conducted globally by qualified subject matter experts providing both theory and hands-on exercises to help develop skills used throughout the industry.

• Technology courses currently offered in North America include Industrial Hydraulic, Mobile Hydraulic, and Pneumatic. Hydraulic Product Schools are also offered at a number of Parker locations in the United States and Canada.

• Fluid Power Society Certification courses are currently offered, and arrangements can be made for field schools to be conducted on site.

> Industrial Hydraulic

**Industrial Hydraulic Technology (IHT)**
Covers basic components of an industrial hydraulic system. Class sessions are reinforced with lab exercises.

**Introduction to Electrohydraulics (EHD)**
Students are introduced to electrohydraulic proportional control. The course concentrates on how electronics are used to control hydraulic components. A typical circuit board is analyzed and explained. 25% lab work 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% lab connecting, operating, and tuning a closed loop electrohydraulic system.

**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 Maintenance Technology (HMT)**
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, troubleshooting, and graphic symbology reading.

**Fluid Power Society – Hydraulic Specialist Review Class & Exam (FPS HS)**
This review and test encompasses 28 hours of review for the Hydraulic Specialist Certification, followed by a 3 hour written test. The review consists of going through the material/knowledge required for the Certification (including any necessary math), as well as taking sample written tests. The course is taught by an IFPS Accredited Instructor.

> Mobile Hydraulic

**Mobile Hydraulic Technology (MHT)**
Designed to introduce students to fundamentals of mobile hydraulic components and how to maintain and diagnose components within a system. Students will apply these fundamentals through the use of actual circuit assembly.

**Advanced Mobile Hydraulics (AMH)**
This component and control level course will incorporate component symbols learned in MHT into complete schematics. Remote control of pressure valves using pilot valves, bleed off orifices, and proportional controls will be discussed. Simultaneous control of multiple actuators while maintaining pressure and flow requirements will be reviewed. Operation and setup of load sense pumps will be demonstrated. Slip-in and cartridge valve design and operation will be presented. Proportional directional control valve function will be introduced. Closed loop hydrostatic systems, power steering, and power beyond functions will also be covered.

> Industrial Pneumatic

**Pneumatic Technology for Industry (PTI)**
3 day course – Designed to introduce students to pneumatics as it relates to industrial machinery. Students will learn how and why pneumatic components work, and how to maintain pneumatic systems.

**Fluid Power Society – Pneumatic Specialist Review Class & Exam (FPS PS)**
This review and test encompasses 28 hours of review for the Pneumatic Specialist Certification, followed by a 3 hour written test. The review consists of going through the material/knowledge required for the Certification (including any necessary math), as well as taking sample written tests. The course is taught by an IFPS Accredited Instructor.