Motion & Control Training
Hydraulic Training Equipment
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.

The company’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. 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 and Control Training Department offers a full range of training equipment and curriculum to support the teaching of hydraulic 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 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 modular hydraulic training system is a flexible training platform. The system can be customized to meet the user’s needs and budget. The modular frame consists of either a single panel for a one-sided training station, or two panels to form a back-to-back double-sided training station. Individual panels are also available to be placed on a horizontal work surface. The modular frame is mounted on casters, enabling the unit to be easily relocated or stored for shared facility usage.

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 hydraulic applications.
PSKSP0 – Standard Platform

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 unique training opportunity for students to learn about industry standards and proper maintenance.
- 1 horsepower
- 115 volt electric motor
- Pressure gauge
- Filter
- Motor starter
- Tank gauge
- Bypass valve
- Swivel locking casters

PSK20607 – Hose Assemblies

A total of 13 hose assemblies are included, offering a mix of 60 inch and 30 inch lengths for connecting the power unit and hydraulic learning modules. Each end is connected to a flush face coupler for easy connections and provides a leak free training environment.
BHLM01 – Basic Hydraulic Learning Module

The 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. The lab manual (Bulletin 0216-B8) describes the step-by-step procedures for all fourteen experiments and references the learnings of the industrial hydraulic technology student textbook.

### BHLM01 – Basic Hydraulic Learning Module

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<tr>
<th>Part Number</th>
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<tbody>
<tr>
<td>PSK20600</td>
<td>2</td>
<td>Manifold</td>
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<tr>
<td>PSK20601</td>
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<td>Closed Center Lever Operated Valve</td>
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<td>PSK20604</td>
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<td>6&quot; Double-Acting Cylinder</td>
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<td>PSK20606</td>
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<td>Needle Valve</td>
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<td>Flow Control Valve with Bypass Check</td>
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<td>PSK20614</td>
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<td>PSK20615</td>
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<td>0-1000 psi Gauges</td>
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<td>Bulletin 0232-B1</td>
<td>1</td>
<td>Student Textbook</td>
</tr>
<tr>
<td>Bulletin 0232-B3</td>
<td>1</td>
<td>Digital Images CD</td>
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<tr>
<td>Bulletin 0216-B8</td>
<td>1</td>
<td>Lab Manual</td>
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Lab Manual – Bulletin 0216-B8

Basic Hydraulic Learning Module – Lab Manual Learning Exercises:
• Maximum Relief Pressure
• Flow Rate of Pump
• Standard Closed Center Circuit
• Setting Flow Rate Through a Flow Control Valve
• Cylinder Leak Test
• Regeneration
• Measuring Flow Out of a Cylinder
• Meter-In
• Meter-Out
• Meter-Out With Pressure Compensated Control Valve
• Bleed-Off Flow Control, Retract
• Bleed-Off Flow Control, Bidirectional
• Pressure Reducing Valve Adjustment
• Pressure Reducing Circuit

ISBN 978-1-55769-065-8

This CD, which does not require special software to run, contains all the graphics from student textbook (Bulletin 0232-B1), chapter quiz solutions, videos and animations.

Industrial Hydraulic Technology Instructor Guide – Bulletin 0232-B2
ISBN-978-1-55769-053-1

The instructor guide follows the format of the student textbook (Bulletin 0232-B1). The instructor guide includes the answers to the chapter quizzes, margin notes for the instructor and the answer key to the final exam (Bulletin 0232-B5).

Industrial Hydraulic Technology Final Exam – Bulletin 0232-B5 (order separately)
The final exam package includes ten copies the industrial hydraulic technology final exam. The 50 question exam is developed from the content in the student textbook (Bulletin 0232-B1). The answer key to this exam is included in the instructor guide (Bulletin 0232-B2).

Student Textbook – Bulletin 0232-B1

Industrial Hydraulic Technology – 2nd Edition
ISBN 1-55769-025-1

The industrial hydraulic technology student textbook is designed to introduce hydraulics as it relates to industrial machinery. The 330 page text is organized into fifteen chapters which include:
• The Physical World of a Machine
• Hydraulic Transmission of Force and Energy
• Petroleum Base Hydraulic Fluid
• Fire Resistant Hydraulic Fluid
• Operation at the Suction Side of the Pump
• Hydraulic Actuators
• Control of Hydraulic Energy
• Check Valves, Accumulators and Cylinders
• Flow Control Valves
• Directional Control Valves
• Pressure Control Valves
• Pilot Operated Pressure Control Valves
• Hydraulic Pumps
• Hydraulic Motors
• Reservoirs, Coolers and Filters

Each chapter includes an exercise reviewing the lesson’s main points.

Technologia Oleohidraulica Industrial – Bulletin 0232-B9
ISBN 1-55769-035-9

Spanish language version of the industrial hydraulic technology student textbook.

Course Materials
Colleges, universities and corporations throughout the world use Parker textbooks in motion and control courses. To learn more, contact us at mctrain@parker.com or call 216-896-2495.
The BHEM02 basic hydraulic expansion module must be used with the BHLM01 basic hydraulic module. The lab manual (Bulletin 0216-B8), describes the details for an additional 16 experiments. All of the components in this module are mounted on individual fixtures that snap onto a modular panel. The 12" stroke cylinder is equipped with all of the electronics to be used with the electrohydraulic valves and digital amplifiers provided with the electrohydraulics module (purchased separately).
Lab Manual – Bulletin 0216-B8

Basic Hydraulic Expansion Module Learning Exercises:
• Standard Open Center Circuit
• Closed Center Pressure Buildup
• Regeneration Without Full Flow Through Directional Valve
• Synchronize on Extend Only
• Synchronize Both Ways Without Flow Control
• Hydraulic Motor Meter-In Flow Circuit
• Hydraulic Motor Meter-Out Flow Circuit
• Flow Divider
• Counterbalance
• Counterbalancing a Hydraulic Motor
• Sequence Valve Adjustment
• Sequencing Cylinders
• Sequencing Cylinder and Motor
• Sequencing and Pressure Reducing
• Crossover Relief
• Tri Pressure System
• Directional Control Without Directional Control Valve (Introductory Lab for Cartridge Valve Systems)

Curriculum
Additional learning exercises simulate thousands of real world applications.

The BHEM02 basic hydraulic expansion module utilizes the same textbook, instructor guide, presentation and final exam as the BHLM01 basic hydraulic module.
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.

<table>
<thead>
<tr>
<th>Part Number</th>
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<th>Description</th>
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<tr>
<td>SKHD1FP</td>
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<td>Servo/Proportional Valve</td>
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<tr>
<td>SKPID</td>
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<td>Signal Conditioning Card</td>
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<tr>
<td>SKPS2401</td>
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<td>Power Supply 24 Volt - 4 Amps</td>
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<td>SKPDS</td>
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<td>Potentiometer</td>
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<tr>
<td>SKEHC</td>
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<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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SKHD1FP Servo/Proportional Valve

High response control valves with VCD® technology. In contrast to standard proportional solenoid drives, this technology actuates the spool by using a moveable coil. The spool is rigidly connected to the coil, which moves over a permanent magnetic cylinder free of friction. When the coil is energized, the spool is moved to the desired position. The spool position is fed back into the control electronics via a high resolution feedback system. When the power supply is powered down the spool is driven by a spring to a defined position.

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
Electrohydraulic Training Module 01
Lab Manual – Bulletin 0217.1

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
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.

**EHMC01 – Electrohydraulic Expansion Module**

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<tr>
<td>SKRS232</td>
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<td>Cable</td>
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</table>

**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.
Parker’s IQAN System

The state-of-the-art IQAN system by Parker is a unique, totally electronic approach that replaces mechanical and electromechanical systems for controlling and monitoring hydraulics in mobile machines.

IQTM01 – IQAN Training Module

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<tr>
<td>IQAN-LM</td>
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<td>Joystick</td>
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<tr>
<td>IQAN-XA2</td>
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<td>Expansion Module</td>
</tr>
<tr>
<td>IQAN-PS</td>
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<td>Power Supply</td>
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</tbody>
</table>

IQAN-LM Joystick

The IQAN-LM is a joystick suitable for learning to set up continuous duty machine operations required in mobile applications.

IQAN-XA2 Expansion Module

The IQAN-XA2 expansion module allows students to communicate with a master controller over a CAN bus.

IQAN-PS Power Supply
Modular Platform Accessories

PSKPL24X16 – Modular Panel
Portable frame for integrating training modules. Work surface measures 24” X 16” and can lay on a flat surface or be carried into the classroom for demonstration purposes.

PSKPL32X24 – Modular Panel
Portable frame for integrating training modules. Work surface measures 32” X 24” and can lay on a flat surface or be carried into the classroom to enhance the learning experience.

PSKPL48X28 – Modular Panel
Aluminum panel can be mounted onto PSKMF for a double-sided stand or can be mounted on a flat surface as the primary training surface for attaching learning modules.

PSK*** – Modular Plates
Individual plates can be ordered for users to incorporate their own technology to the modular frame. Hydraulic, pneumatic or electronic components mounted on these plates will easily snap onto any of the modular panels.

PSK9T66 – Storage Cart
The storage cart rolls beneath the modular frame for easy storage or can be used to transport training modules into the classroom to support a visual learning experience.
The HTU00 integrated hydraulic training system is a fully integrated hydraulic training unit that includes all the necessary components for learning basic hydraulic technology. The lab manual instructs the users to implementing over 30 exercises.

**Portable Hydraulic Trainer**

The portable hydraulic trainer is designed to be a tool for learning hydraulic technology principles and circuitry. It has been engineered for ruggedness, portability and ease of operation. The unit is completely self contained and operates on standard 115V AC single-phase outlet electrical power. All necessary connections are made with hoses and leak-free quick disconnects. Simply plug in the components needed to arrange a circuit.

**Student Textbook – Bulletin 0232-B1**

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The industrial hydraulic technology student textbook is designed to introduce hydraulics as it relates to industrial machinery. The 330 page text is organized into fifteen chapters. Each chapter includes an exercise reviewing the lesson’s main points.

**Lab Manual – Bulletin 0249**

The 35 exercises in the industrial hydraulic technology lab manual address cavitation, aeration, regeneration, synchronization, meter-in and meter-out circuits, cylinder deceleration, counterbalancing, sequencing and more.

**Industrial Hydraulic Technology Digital Images CD-ROM – Bulletin 0232-B3/CD**

ISBN 978-1-55769-065-8

This CD, which does not require special software to run, contains all the graphics from student textbook (Bulletin 0232-B1), chapter quiz solutions, videos and animations.