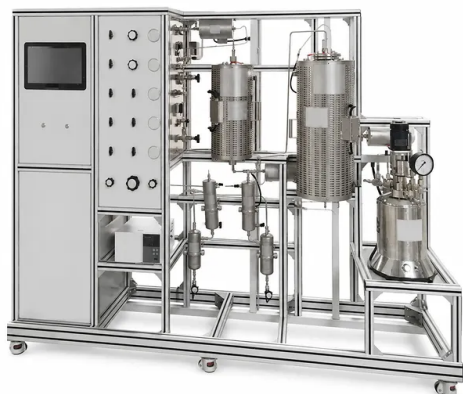


# Multi-Reactor Educational Pilot Plant For Reaction Engineering Unit Operations

Item Number: LPK-DGNFY



## Introduction

Integrated bench-scale educational pilot plant for chemical engineering teaching featuring fixed bed fluidized bed and stirred tank reactors with web-based digital twin controls and safety interlocks for hands-on unit operations and reaction engineering comparative studies in one compact system.

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| System Component / Module           | Technical Specifications & Capabilities                                                                                                                                                          | Educational & Experimental Objectives                                                                                                                                                                                                           |
|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Fixed Bed Reactor (FBR)</b>      | <ul style="list-style-type: none"> <li>Tubular design with customizable dimensions</li> <li>Programmable electric heating jacket</li> <li>Internal axial thermowell</li> </ul>                   | <ul style="list-style-type: none"> <li>Determination of catalyst activity and selectivity</li> <li>Evaluation of temperature profiles in packed beds</li> <li>Calculation of space-time and space velocity</li> </ul>                           |
| <b>Fluidized Bed Reactor (FLBR)</b> | <ul style="list-style-type: none"> <li>Vertical column with gas distributor plate</li> <li>Visible fluidization zone</li> <li>Independent preheating</li> </ul>                                  | <ul style="list-style-type: none"> <li>Observation of fluidization regimes and bed expansion</li> <li>Determination of minimum fluidization velocity (<math>u_{mf}</math>)</li> <li>Heat and mass transfer in gas-solid fluidization</li> </ul> |
| <b>Stirred Tank Reactor (STR)</b>   | <ul style="list-style-type: none"> <li>Autoclave design with variable speed agitator</li> <li>Pressure gauge and liquid/gas sampling ports</li> <li>Electric heating and cooling coil</li> </ul> | <ul style="list-style-type: none"> <li>Study of residence time distribution (RTD)</li> <li>Kinetics of liquid-phase and multiphase reactions</li> <li>Heat transfer coefficients in agitated vessels</li> </ul>                                 |
| <b>Feed &amp; Preheating System</b> | <ul style="list-style-type: none"> <li>Multi-channel gas mass flow controllers</li> <li>Dual-stage vapor/gas preheaters</li> <li>Corrosion-resistant 3-way routing valves</li> </ul>             | <ul style="list-style-type: none"> <li>Gas mixing thermodynamics</li> <li>Vaporization and preheating calculations</li> <li>Piping and instrumentation diagram (P&amp;ID) familiarity</li> </ul>                                                |
| <b>Control &amp; Software Suite</b> | <ul style="list-style-type: none"> <li>Centralized touchscreen PLC/HMI panel</li> <li>WebGL-enabled remote-access interface</li> <li>Automated instructor assessment tool</li> </ul>             | <ul style="list-style-type: none"> <li>Real-time data logging and trend analysis</li> <li>Process automation and PID tuning concepts</li> <li>Digital-twin pre-lab preparation and testing</li> </ul>                                           |