

## LEWA EcoPrime® Twin LPLC

Multi-functional, twin column continuous chromatography in a simple, robust design.

### Leading the continuous processing evolution

The LEWA EcoPrime Twin LPLC is an easy-to-use, GMP-ready, multi-column chromatography system offering analytical performance for continuous chromatography from process development to large-scale biopharmaceutical production. The EcoPrime Twin platform spans a wide range of flow and column sizes and has several options to incorporate multiple functionality on a single unit. The EcoPrime Twin is built on ChromaCon's Contichrom patented approach to twin-column purification. Because of the two-column configuration, the EcoPrime Twin is a simple design that facilitates continuous chromatography implementation, reduces risk of costly downtime, and minimizes operating expenses. It is well suited for capture steps using Protein A or IEX separations for monoclonal antibody, recombinant or plasma protein purification processes.



Fig. 1: LEWA EcoPrime Twin LPLC 100

### One system, multi-function

This advanced system can be configured to operate in multiple modes: batch, integrated (consecutive) batch and continuous chromatography with enhanced buffer in-line dilution (BID). The design accommodates parallel or in-series column configurations for integrated batch using an on-board BID for in-line adjustment of pH, thus eliminating any hold up step.

### EcoPrime Twin LPLC delivers

- Faster processing by up to 2x
- Improved Protein A utilization by up to 40%
- Simple design to facilitate GMP validation
- Exclusive digital fluid management
- Ability to perform batch, integrated and continuous processes
- On-board buffer in-line dilution option
- Scale-up/-down from Contichrom® CUBE bench-top instrument
- Space-saving, compact footprint

### Increased productivity, quick payback

The flexible functionality of EcoPrime Twin, its precision performance and simple design, enables users to experience increased productivity and buy one unit that does the work of several systems, which translates into an increased ROI compared to other chromatography systems. The multi-functionality of the system increases asset value allowing the use of the same skid for batch, integrated batch and continuous operations.

### Advanced Simplicity

The two-column EcoPrime Twin achieves the same productivity improvements as systems with more columns but with significantly less complexity. This accelerates validation, significantly simplifies maintenance, and minimizes costly downtime and operating expenses. In addition, the simple design streamlines implementation in the process development lab or in production because the system is easy to understand and use.

## Unique dynamic range

LEWA EcoPrime Twin systems have an extraordinary flow range allowing the user to employ a very wide choice of column diameters on the same system (Table 1). The large dynamic range makes one system span the breadth of process development, pilot and even production on a single skid.

Table 1. EcoPrime Twin LPLC dynamic range

		Flow	Column ID	Process Range	Feed	Product
		L/min	cm	L/min	L/day	kg/day
Twin 100	Min	0.004	2.5	0.033	47.12	0.212
	Max	0.6	10	0.524	754.0	3.4
Twin 250	Min	0.02	5	0.131	185.5	0.85
	Max	2.4	20	2.094	3016	13.6
Twin 500	Min	0.06	8	0.295	424	1.91
	Max	9	45	10.603	15268	68.7

The above data are projections based on 5 g/L titer and a column linear velocity of 400 cm/h with a 24-hour operation time.

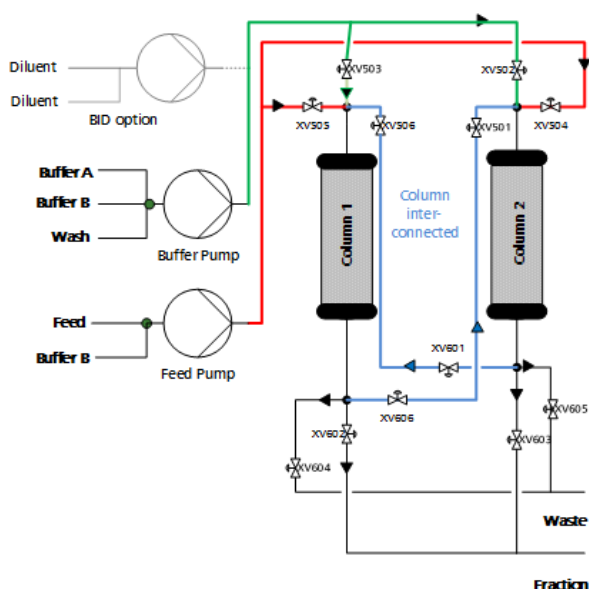


Fig. 2: EcoPrime Twin flow schematic

## System design and performance

The system is designed to accommodate multiple modes in a single skid; batch, integrated batch, continuous chromatography, and buffer in-line dilution capability (Figure 2). Columns can be configured either in-parallel or in-series. With integrated batch operation, two different modes of chromatography can be run consecutively, for example, ion exchange (IEX) on Column 1 and then hydrophobic interaction chromatography (HIC) on Column 2 with or without buffer adjustment and no hold-up step.

The system's design and performance was verified using EcoPrime Twin in several experiments using lysosome surrogate feed stock as well as a standard series of tests with buffer and WFI both with and without 5 cm columns (10 cm bed height). Tosoh IEX resin was used in the chromatography test runs. An example result from the experiments is presented in Figure 3. Target reproducibility, stability over 48 hours continuous run time, yield and purity were achieved in all experiments. The chromatographic separation was shown to meet the acceptance criteria. Further, the results show predictable scale-up performance from similar tests on the Contichrom CUBE instrument running the CaptureSMB protocol.

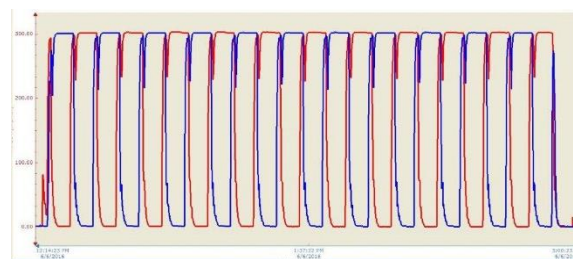


Fig.3: Performance over extended runs demonstrates high reproducibility and robust design. (Shown conductivity over time.)

## Digital control, advanced fluidic design

Designed to meet the demanding requirements of next generation process development, EcoPrime Twin LPLC consists of LEWA digitally-controlled, hygienic ecodos pumps that provide industry-leading flow precision and accuracy. The triplex pump configuration ensures pulse-free flow. An optimized system flow path and specially designed multi-port valves deliver extremely low hold-up volume for exceptional chromatographic performance and to facilitate clean-in-place.

## Scale up, scale down

A simple tool for scaling-up or down is ChromaCon's Contichrom CUBE instrument (Figure 4) that can be used to develop new processes or troubleshoot existing ones. The CUBE is a modular, bench-top instrument for performing batch, integrated batch, and continuous chromatography at a smaller scale (flow 0.1 – 36 mL/min or 0.1 – 100 mL/min, up to 50 bar; HPLC versions up to 100 bar). Proven ChromIQ software provides enhanced functionality and visualization for continuous, cyclic processes. ChromaCon and LEWA teams have worked hand-in-hand in the development of EcoPrime Twin software continuity with the ChromIQ software.

## Robust design for reliable operations

EcoPrime Twin systems incorporate comprehensive safety features, such as a two-level alarm monitor: one level to give a warning message and the other to give a critical alarm to enable immediate suspension of the chromatography process. Industrially designed for manufacturing environments with a manual Emergency Stop and Master Reset buttons, the system embodies LEWA's uncompromising commitment to safety.

## Typical applications where the system is used

EcoPrime Twin is used in process development and pilot labs for continuous, batch, and integrated batch process development and small production runs. EcoPrime Twin, with its wide dynamic range, is ideally suited for multi-product environments. The small footprint enables installation in space-constrained facilities.

### Application examples

- Monoclonal antibody, mAb fragment, and antibody drug conjugate purification
- Virus and recombinant protein purification
- mAb isoform profile tuning
- Fc fusion protein purification
- Plasma fractionation and purification of plasma proteins
- Purification of PEGylated proteins



Fig. 4: Scale up / scale down is seamless with Contichrom CUBE (shown left)

## Quality and regulatory considerations

As with all LEWA bioprocess equipment, the EcoPrime Twin LPLC system is designed to meet high quality expectations. The design and construction of the equipment meets the following standards, assuring a safe, ergonomic system capable of producing the product within the guidelines of the FDA:

- System designed for GMP operation and validation
- Audit trail to support 21 CFR part 11 compliance and performer/verifier traceability for GMP operations and compliance
- USP Class VI materials and seals
- Compliance to ASME-BPE
- LEWA hygienic metering pumps are EHEDG certified (European Hygienic Engineering & Design Group)
- CE conformity

## Software

An information-rich, graphical interface displays system and process information as well as historical trends (Historian) putting relevant information in one place enabling informed decision-making (Figure 5). The main process screen can also be used to manually operate the system to facilitate qualification and troubleshooting.

The EcoPrime Twin LPLC system uses PLC software to control the chromatography process, to acquire data and to provide historical trending. The software provides user configurable control of all chromatographic parameters. The user adaptable software enables 21 CFR Part 11 compliance and is built on Rockwell FactoryTalk® View SE. The system provides recipe management (Figure 6) with access control to prevent modification of a recipe by unauthorized users, as well as providing an audit trail for recipe modification. Batch reports are easily generated.



Fig 6. EcoPrime Twin LPLC Recipe configuration screen

The software generates system documentation such as an Alarm Table and I/O and Interlock lists to facilitate qualification. There is built-in audit and event tracking to support validation.

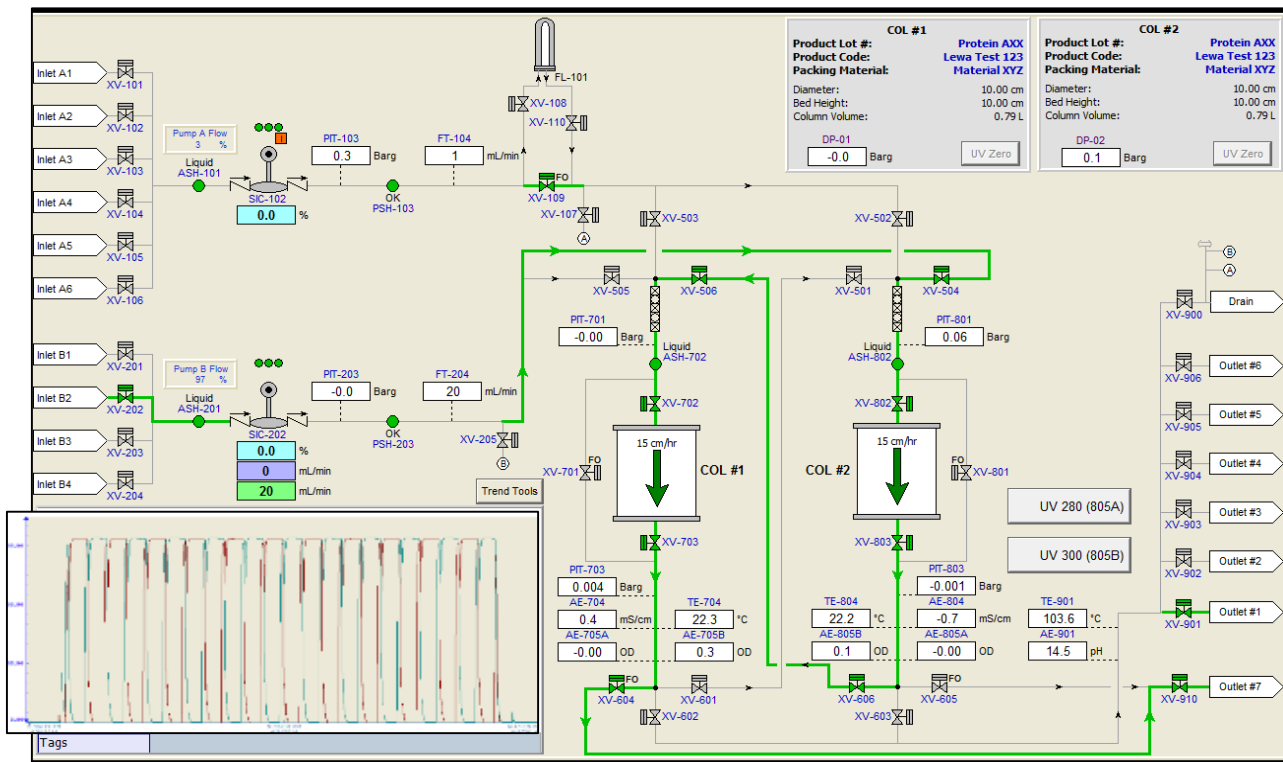


Fig 5. HMI Process flow chart and main navigation screen for monitoring and controlling the system.

## System models and information

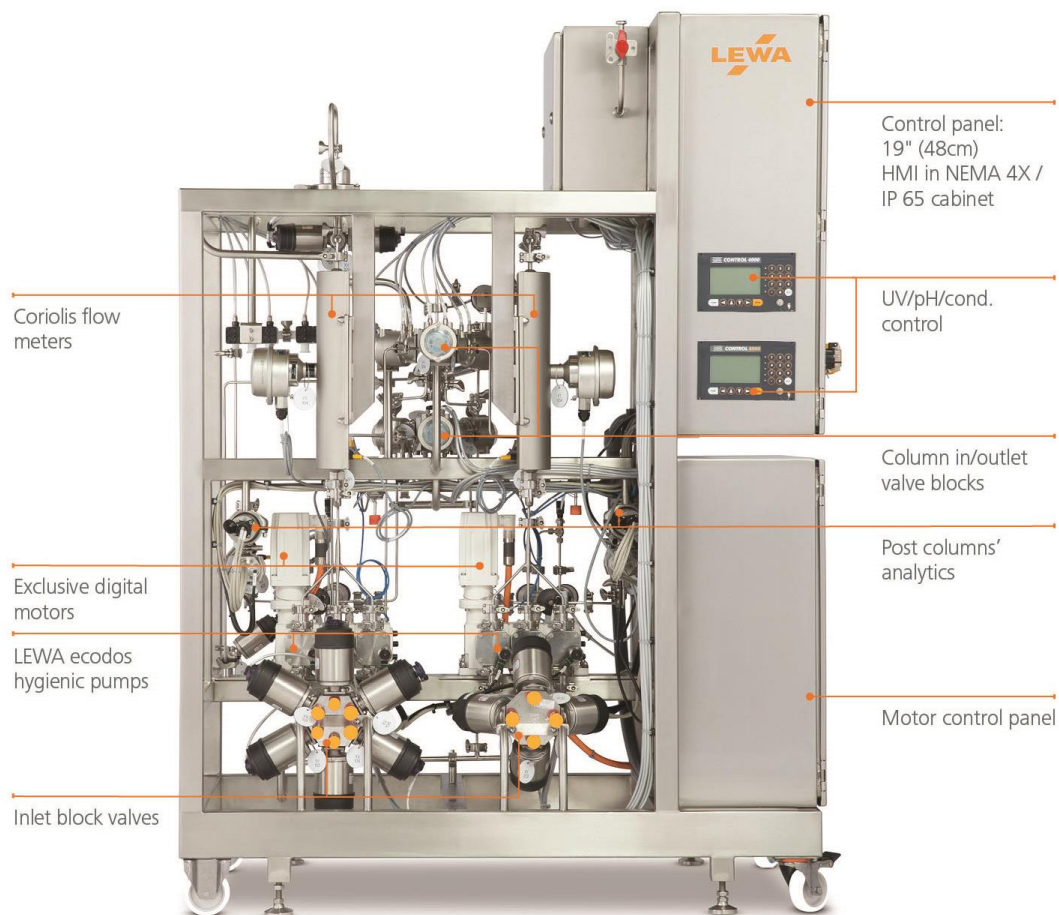
Model	System Capability
Twin	Base Twin – Twin Capture only (not batch capable)
Twin Plus	Base Twin plus batch capability; user can perform step and linear gradients
Twin Plus & BID	Base Twin with BID. Includes Capture, Batch and BID functionality
Twin Plus Consecutive	Base Twin, Batch, BID and capability for integrated Batch

## Operating Pressure and Temperature

Maximum operating pressure	7.5 bar
Ambient temperature range	4 – 25 °C
Process temperature range	4 – 40 °C

## System Specifications

System	Flow rate range
EcoPrime Twin 100	0.004 – 0.6 LPM
EcoPrime Twin 250	0.02 – 2.4 LPM
EcoPrime Twin 500	0.06 – 9.0 LPM
UV absorbance	280 nm and 313 nm
pH range	0 – 13
Conductivity range	0 – 200 mS/cm
Skid size (LxWxH)	
EcoPrime Twin 100	57 x 34 x 79 in. (145 x 87 x 200 cm)
EcoPrime Twin 250	72 x 35 x 79 in. (183 x 89 x 200 cm)
EcoPrime Twin 500	91 x 44 x 79 in. (231 x 112 x 200 cm)
Skid weight	
EcoPrime Twin 100	950 lb (430 kg)
EcoPrime Twin 250	1350 lb (612 kg)
EcoPrime Twin 500	1750 lb (800 kg)
Enclosure protection class	UL Type 4x/IP 65
Materials of construction	316L stainless steel



## Ordering information

To order the EcoPrime Twin LPLC system, please contact your regional sales representative.

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