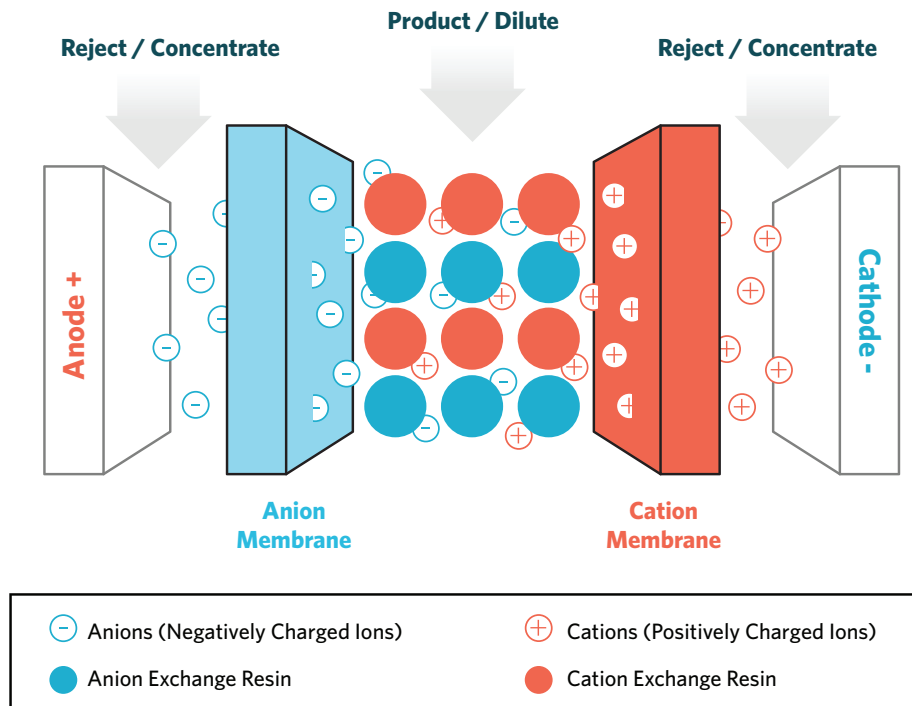


IONPURE® CONTINUOUS  
ELECTRODEIONIZATION  
(CEDI) MODULES

**CEDI MODULES FOR A WIDE  
RANGE OF HIGH-PURITY  
APPLICATIONS**



# WHAT IS CONTINUOUS ELECTRODEIONIZATION (CEDI)?



CEDI is a chemical-free, self-regenerating technology used to provide a consistent flow of high-quality deionized water.

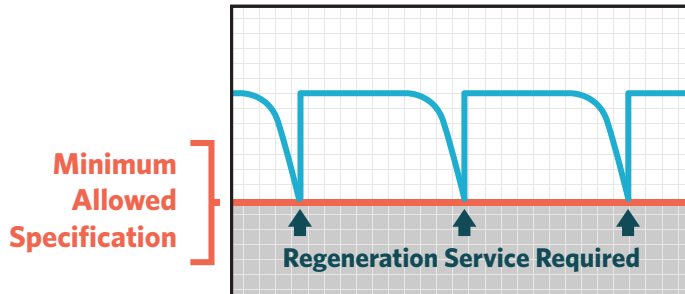
With the growing costs of chemicals for regeneration and waste neutralization, and heightened safety concerns with handling hazardous chemicals, many industrial customers began seeking an alternative to cost-prohibitive, on-site regenerable ion exchange for creating ultrapure water. Evoqua's IONPURE® module offers that solution. The first to commercialize CEDI in 1987, we have provided thousands of modules that deliver ultrapure water at capacities ranging from 0.013 m<sup>3</sup>/h (0.06 gpm) to 22.7 m<sup>3</sup>/h (100 gpm).

In short, CEDI is a water treatment process that uses a combination of ion-exchange resins, ion-exchange membranes, and direct current to continuously deionize water without the need for chemicals. The avoidance of chemicals helps to reduce the systems' operating and maintenance costs and, therefore, improve your bottom line.



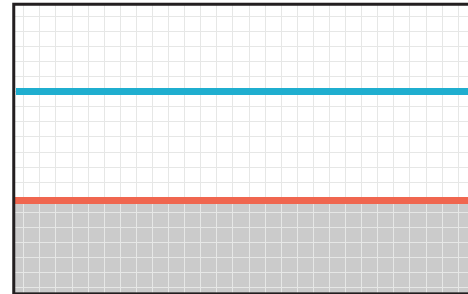
# CEDI OR MIXED-BED DEIONIZATION (MBDI)

## Mixed-bed Deionization: Batch Process



As ion-exchange resins exhaust, contaminants begin to break through, eventually requiring downtime for resin regeneration or replacement.

## Continuous Electrodeionization: CEDI



IONPURE® CEDI modules deliver a consistent flow of high-purity product water, without the need for downtime or exchange service.

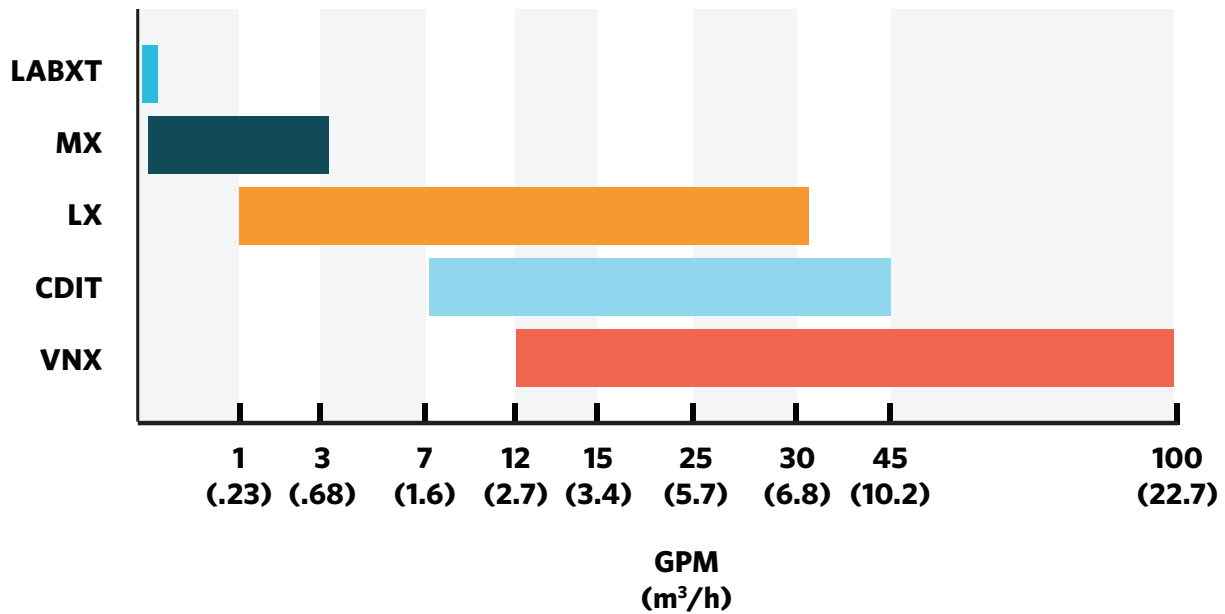
Since its commercialization, the use of CEDI technology has grown in popularity. Some of the major advantages of CEDI over traditional mixed-bed deionization systems include:

- No acid or caustic bulk storage, pumping, waste neutralization, or disposal issues
- Lower operating costs due to lower manpower requirements, as well as lack of chemical regeneration
- Smaller footprint
- Safer, more consistent operation

While both ion exchange and EDI use ion-exchange resins, the removal mechanisms are quite different. Conventional ion exchange utilizes chemically regenerated ion-exchange resins, which function in a capture (exhaustion cycle) and discharge (regeneration cycle) mode. This results in a breakthrough of ions at the end of the service cycle and a rinse out of regenerant at the beginning of the next service cycle. Capacity and selectivity are the most important resin properties in the mode of operation.

CEDI uses a reaction/transport mechanism to remove ions through resin under influence of a DC field. This requires a continuous path of like-charge resin beads. The transport is largely across the surface of the resin beads. Transport through resin bead (particle diffusion) can be limiting.

## IONPURE® CEDI Module Flow Range



## IONPURE® PRODUCT OVERVIEW

We have a full line of products varying in size to meet your requirements. Our product lines include:

**VNX** - high-flow applications; flow rates of 5.7 m<sup>3</sup>/h (25 gpm) to 22.7 m<sup>3</sup>/h (100 gpm)

**LX** - medium-flow applications; flow rates of 0.23 m<sup>3</sup>/h (1 gpm) to 7.7 m<sup>3</sup>/h (33.8 gpm)

**LabXT & MX** - low-flow and laboratory-flow applications; flow rates of .003 m<sup>3</sup>/h (0.013 gpm) to 0.75 m<sup>3</sup>/h (3.3 gpm)

Whether you want to eliminate chemical handling and regenerant waste or just need a system to help purify water for your supercritical boiler, rest assured that one of our CEDI modules will meet your needs. In addition, we're continuously developing new products or improving our existing modules to better serve our customers' needs. We also have an entire team of technical support experts available to troubleshoot any problems you may run into.

### DISTRIBUTION

IONPURE CEDI modules and power products are distributed through a large base of highly trained and knowledgeable Original Equipment Manufacturers (OEMs), who know the ins and outs of our technologies. Our OEMs bid on projects and provide in-depth project specifications detailing the predicted performance of IONPURE CEDI modules for the application.

### ADVANTAGES

**Product** - The most robust CEDI device with the simplest operation and maintenance

- The best product for your application

**Experience** - 35+ years of innovation, IONPURE CEDI modules have been adopted worldwide in many Power, Microelectronics, Pharmaceutical and other high-purity applications.

**Support** - A global network of trained and knowledgeable OEMs and regional support personnel

- The support you need when you need help



## MARKET OVERVIEW

### POWER GENERATION:

Power plants worldwide are switching out their conventional MBDI for IONPURE® CEDI modules to feed boilers for steam generation. Designed similarly to reverse osmosis (RO) systems, they're used in conjunction with RO as a polishing step for boiler feed water and cooling tower applications. For boilers, the modules provide deionized water to create the steam that turns the turbines. The following modules are used for power generation:

- VNX-EP, VNX-Max/Mini, and VNX-CDIT
- LX-X and LX-Z

### MICROELECTRONICS:

Manufacture of semiconductor devices needs the highest purity water of nearly every industry, requiring extremely low levels of contaminants such as sodium, silica, and boron. The microelectronics industry demands low-maintenance technology that will operate efficiently with minimal downtime. Safety is also an industry concern, which is why more and more companies desire a system that will reduce its chemical usage. IONPURE VNX Ultra, E and EX modules are designed to deliver a continuous supply of ultra pure water without the use of chemicals or downtime due to service exchange.

### PHARMACEUTICAL:

Many major multinational pharmaceutical companies use CEDI technology. The majority of the top 10 companies own and operate multiple hot water sanitizable LX-HI units. The IONPURE LX CEDI modules are the only ones on the market that allow instantaneous hot water sanitization without temperature ramping, continuous operation at up to 60° C (140° F) and 2 bar/30 psi feed pressure during sanitization. There's no need to re-torque these modules after installation/startup. IONPURE LX-X and LX-EU CEDI modules are also available for pharmaceutical applications where hot water sanitization is not required.

### LOW-FLOW APPLICATIONS

Our low-flow modules are used in laboratories, hospitals and universities for a wide range of applications, including:

- Central water system for lab
- Tabletop high-purity water systems for laboratory use
- Feed to equipment such as autoclaves and clinical analyzers

### BULK DEIONIZATION/GENERAL INDUSTRIAL:

IONPURE CEDI modules are used in a variety of general industrial applications to provide high-quality demineralized water.

## LX & VNX PRODUCT SPECIFICATIONS

### FEED WATER SPECIFICATIONS

Feed Water Conductivity Equivalent (FCE)	< 40 $\mu\text{S}/\text{cm}$
Operation Temperature	41 - 113°F (5 - 45°C)
Inlet pressure	< 100 PSI (6.9 bar)

### TYPICAL PRODUCT PERFORMANCE

Product Resistivity at Nominal Flow Rate	15-18 $\text{M}\Omega\text{-cm}$
Recovery	90-95%
Silica ( $\text{SiO}_2$ ) removal	90-95%

## SPECIALTY PRODUCT SPECIFICATIONS

### LX-HI

#### FEED WATER SPECIFICATIONS

Feed Water Conductivity Equivalent (FCE)	< 40 $\mu\text{S}/\text{cm}$
Operation Temperature	41 - 140°F (5 - 60°C)
Sanitization Temperature at 30 psi (2.0 bar)	185F (85°C) $\pm$ 5°C

#### TYPICAL PRODUCT PERFORMANCE

Product Conductivity at Nominal Flow Rate	< 0.1 $\mu\text{S}/\text{cm}$
Recovery	90-95%
Silica ( $\text{SiO}_2$ ) removal	90-99%

### VNX-ULTRA

#### FEED WATER SPECIFICATIONS

Feed Water Conductivity Equivalent (FCE)	< 10 $\mu\text{S}/\text{cm}$
Operation Temperature	68 - 113°F (20 - 45°C)
Inlet pressure	30 - 100 psi (2.1 - 6.9 bar)

#### TYPICAL PRODUCT PERFORMANCE

Product Resistivity (DI feed)	$\geq$ 18.0 $\text{M}\Omega\text{-cm}$
Product Resistivity (2-pass RO Feed)	$\geq$ 17.5 $\text{M}\Omega\text{-cm}$
Sodium (Na) and Chloride (Cl) Removal	$\geq$ 99.9%
Silica ( $\text{SiO}_2$ ) and Boron removal	$\geq$ 99.8%

### VNX-HH

#### FEED WATER SPECIFICATIONS

Feed Water Conductivity Equivalent (FCE)	< 40 $\mu\text{S}/\text{cm}$
Operation Temperature	41 - 113°F (4 - 45°C)
Total Hardness (as $\text{CaCO}_3$ )	up to 2 ppm

#### TYPICAL PRODUCT PERFORMANCE

Product Resistivity at Nominal Flow Rate	> 16 $\text{M}\Omega\text{-cm}$
Recovery depending on hardness	80-90%

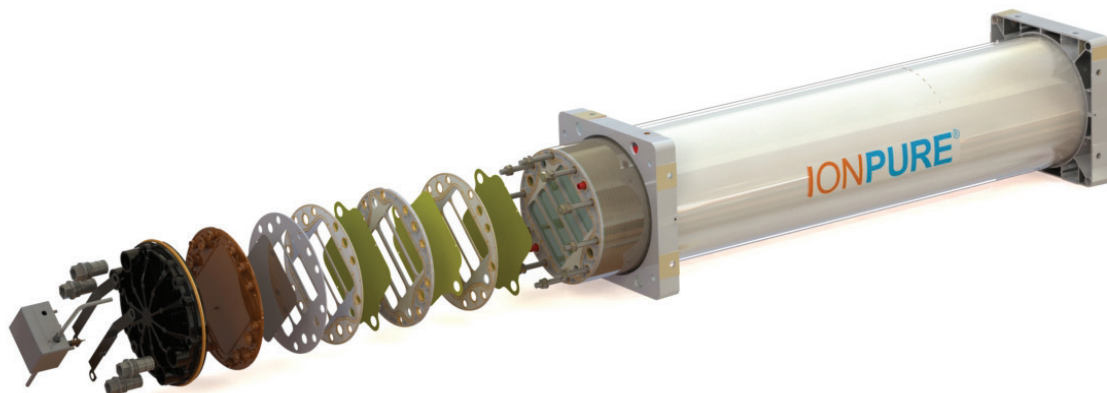
### VNX-CDIT

#### FEED WATER SPECIFICATIONS

Feed Water Conductivity Equivalent (FCE)	< 100 $\mu\text{S}/\text{cm}$
Operation Temperature	41 - 113°F (4 - 45°C)
Total Hardness ( $\text{CaCO}_3$ )	Up to 4 ppm
Silica ( $\text{SiO}_2$ )	Up to 2 ppm

#### TYPICAL PRODUCT PERFORMANCE

Product Conductivity at Nominal Flow Rate	< 0.1 $\mu\text{S}/\text{cm}$
Recovery	90-95%



# CEDI POWER PRODUCTS

## PROVIDING TOTAL SOLUTIONS FOR ORIGINAL EQUIPMENT MANUFACTURERS (OEMS)

### IONPURE DC3 Power Supply

For your convenience, we're proud to provide a complete CEDI solution - including the power supply required to power your system. IONPURE DC3 Power Supply, which provides constant control of current, voltage and/or power to our CEDI modules. To put it simply, the DC3 Power Supply is designed to optimize performance, which ultimately allows for a more cost-effective and simplified solution for electrical system design. Some of the benefits of the DC3 include, but are not limited to:



- Allows direct connection from power line, so no separate isolation transformer is required
- Features a high-efficiency, 3-phase switch mode design to reduce power consumption vs. traditional SCR power products
- Features on-board diagnostics and alarms
- Features LED power and status indicators
- MODBUS® TCP ethernet connection

### Digital Communication Rectifiers Available

In addition to the DC3 Power Supply, Evoqua offers Digital Communication Rectifiers (DCRs). Like the DC3, these products also allow for constant control of power of CEDI modules. The DCR is compact, reliable, single-phase DC power controller designed with a high-performance microprocessor. It also features on-board digital communication to ensure easy integration with existing PLC/HMI with the use of MODBUS or 4-20mA signals. A separate external isolation transformer is required for the DCR.



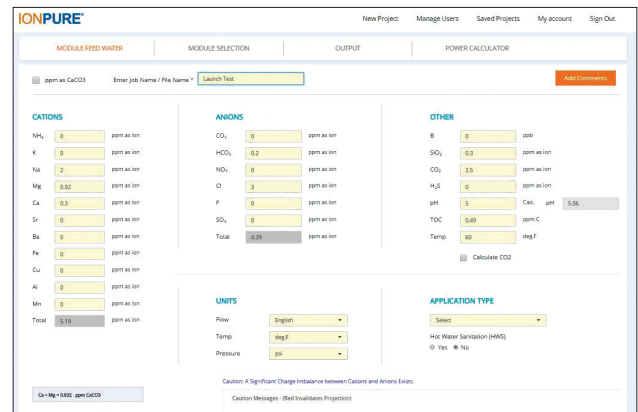
### Touch Panel Display

An optional 4.3" touchscreen HMI is available for use with the DCR-M or DC3.

## IP-PRO ONLINE

### ACCURATELY PREDICT MODULE PERFORMANCE WITH AN ONLINE TOOL

In addition to manufacturing and providing the products needed to power CEDI modules, Evoqua has developed a tool—IP-Pro Online—to help you predict the performance of our modules. Simply enter the information, including anions, cations, flow rate, application type, etc., and our online projection software will determine which module(s) will best suit your needs. To use the tool, you must first register for an account. Existing users must login prior to use.



TRANSFORMING  
**WATER**  
— ENRICHING —  
**LIFE**



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