The Evactron® De-Contaminator: Fast, Safe, and Reliable Remote Plasma

The Evactron® De-Contaminator System removes residual hydrocarbon contamination, allowing users of Electron and Ion Beam instruments such as SEMs, TEMs, and FIBs to easily maintain optimal imaging environments. These problematic hydrocarbons can interact with the beam to precipitate onto the surfaces of the sample being examined and lead to the “Black Squares,” seen in the image on the top left. Brief operation of the Evactron system removes the contamination from the vacuum system and results in superior images, such as the one on the bottom left.

The sources of these unwanted contaminants are many and include the vacuum system components, residual manufacturing materials, or even the samples themselves. Today’s more demanding examinations at higher magnification and lower accelerating voltages amplify contamination problems. Improvement in the cleanliness of the vacuum is more important than ever.

The Evactron system’s in-situ cleaning is much more efficient than “cryo-trapping” with a Liquid Nitrogen Cold Finger. In as little as 10 minutes, the Evactron De-Contaminator actually removes the hydrocarbon molecules, rather than just sequestering them.

With over 1,100 Evactron systems in use today, XEI Scientific is providing a low power (<20 W) solution proven to be safe for EDS Detector Windows, WDS spectrometers, EBSD detectors, and current stage lubricant materials. This is the safest and most effective method to remove hydrocarbon contamination in your SEM, TEM, FIB, or other vacuum system.
How The Evactron® De-Contaminator Works

Evactron systems have been interfaced with nearly every manufacture and model of electron microscopes. They can be easily installed by the user with adaptors available, using common flanges for many ports as seen in the picture to the left. As Evactron in-situ plasma cleaning occurs in the 0.05 –0.6 Torr (7-80 Pa) range, a cleaning cycle may be easily combined with a chamber venting or sample exchange operation.

The Evactron De-Contaminator works by using a technique called Downstream Plasma Cleaning, illustrated in the figure to the right. The Plasma Radical Source (PRS) is shown on the left side of the chamber and uses a patented hollow cathode to create RF plasma, which remains contained in the PRS module. Reactive gas-phase radicals created in the PRS then migrate through the instrument chamber and chemically react with the unwanted hydrocarbon molecules, breaking them down into CO, CO₂, and H₂O, which are easily removed by the system vacuum components. Sensitive system parts are not directly exposed to the energetic plasma or ions. The best location for the PRS module is on a chamber port opposed to the vacuum source.
Evactron® De-Contaminator Complete Models

All Models have the following features:

- Separate controller and Plasma Radical Source (PRS) with cable bundle (12.5’, 3.8m), power cord, and instructions
- Evactron Models 25, 40 and 45 include CD with PC user interface and C command library
- All controllers have the following:
  * Power On, RF On, Plasma On, and Fault indicators
  * RF power and pressure adjustments
  * Vacuum level and RF cable interlocks
- All controllers except for Model 40 have digital power and vacuum meters
- Room air, oxygen containing gas, or hydrogen gas can be used
- Replaceable filter on inlet
- KF40 interface flange on PRS
- Worldwide power input (100-240 VAC, 50-60 Hz, <2.0 A)
- 5 year limited warranty
- CE, NRTL, SEMI S2, and RoHS compliance

Evactron Tabletop Models

All tabletop Evactron models are supplied with 12.5’ (3.8 m) cable bundles

<table>
<thead>
<tr>
<th>Evactron® Models</th>
<th>Part Numbers</th>
<th>Features</th>
<th>Suggested Applications</th>
</tr>
</thead>
</table>
| **Evactron 25**  | 233425-01 w/ PRS-v 12.5’ (3.8 m) cable bundle | • Pre-programmed automatic cleaning, no manual adjustments needed  
  • Serial port allows PC communication with controller  
  • GUI interface provided | General purpose, multi-user labs – minimum training needed |
| **Evactron C**   | 233312-01 w/ PRS-c and 12.5’ (3.8 m) cable bundle | • Gas bleed needle valve for manual flow and pressure adjustment  
  • Power settings manually adjusted by user | Service engineers, dedicated user labs, R&D |
Evactron® De-Contaminator Complete Models

Evactron Rack-mounted (2U Enclosure) Models
All rack-mounted Evactron models are supplied with 22’ (6.7 m) cable bundles

<table>
<thead>
<tr>
<th>Evactron® Models</th>
<th>Part Numbers</th>
<th>Features</th>
<th>Suggested Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evactron 45</td>
<td>233388-02 w/ PRS-p</td>
<td>• Pre-programmed automatic cleaning, no manual adjustments needed</td>
<td>Integrated system operated from host computer or front panel</td>
</tr>
<tr>
<td></td>
<td>233388-04 w/ PRS-v</td>
<td>• Serial port allows PC communication with controller • GUI interface provided</td>
<td></td>
</tr>
<tr>
<td>Evactron 40</td>
<td>233400-01 w/ PRS-p</td>
<td>• Same as Evactron 45, except there are no front panel controls</td>
<td>Integrated system operated from host computer only</td>
</tr>
<tr>
<td></td>
<td>233400-02 w/ PRS-v</td>
<td>• GUI interface provided</td>
<td></td>
</tr>
</tbody>
</table>

Plasma Radical Source (PRS) Models
Additional PRS units can be purchased for multiple instruments

<table>
<thead>
<tr>
<th>PRS Models</th>
<th>PRS-p</th>
<th>PRS-v</th>
<th>PRS-c</th>
<th>PRS-u</th>
</tr>
</thead>
<tbody>
<tr>
<td>Descriptions</td>
<td>unshrouded, horizontal configuration</td>
<td>shrouded, vertical configuration</td>
<td>for use with Evactron C controller only</td>
<td>for use in high vacuum systems with Evactron 25, 40 or 45 controller</td>
</tr>
<tr>
<td>Part Numbers</td>
<td>233607-01</td>
<td>233613-00</td>
<td>233262-03</td>
<td>233950-00</td>
</tr>
</tbody>
</table>
**Evactron® SoftClean™ Chamber**

The Evactron SoftClean System allows users to “pre-clean” specimens and holders, eliminating sources of contamination before their introduction into the microscope chamber. This system consists of an Evactron De-Contamination System, a SoftClean Chamber and suitable vacuum pump and uses the same downstream plasma ashing process as that found in more than 1,000 other instruments around the world. Further, the SoftClean chamber may be used as a standalone sample cleaner or serve as a storage system for cleaned samples. Unlike high power and more expensive traditional plasma cleaning systems that sputter with energetic ion species and can potentially damage specimens with heat and ion bombardment, the delicate downstream process chemically ashes hydrocarbon contamination and removes it from the chamber.

- Chamber dimensions 8.5” (216 mm) diameter x 5.5” (140 mm) height
- 4 KF 40 + 1 KF 16 vacuum mounting flanges with manual shut-off valve for vacuum port
- Adaptor flanges for TEM sample holders available
- 1 venting port + Plated Al lid with 5.5” OD glass view port and RF shield
- Shipping — 12 lb. (6 kg.)
- 5 year warranty

**Evactron SoftClean Chamber Options**

<table>
<thead>
<tr>
<th>Descriptions</th>
<th>Part Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evactron SoftClean System</td>
<td>233427-00</td>
</tr>
<tr>
<td>[SoftClean Sample Cleaning Chamber, Evactron 25 De-Contaminator including controller, 12.5’ (3.8 m) cable bundle, and PRS-v. Does not include Vacuum Pump or TEM Adapter]</td>
<td></td>
</tr>
<tr>
<td>SoftClean Sample Cleaning Chamber</td>
<td>233900-00</td>
</tr>
<tr>
<td>SoftClean Adjustable Platform</td>
<td>233910-00</td>
</tr>
<tr>
<td>SoftClean TEM Adapter for JEOL Sample Rod</td>
<td>233916-00</td>
</tr>
<tr>
<td>SoftClean TEM Adapter for FEI Sample Rod</td>
<td>233917-00</td>
</tr>
<tr>
<td>SoftClean TEM Adapter for Zeiss Sample Rod</td>
<td>233923-00</td>
</tr>
<tr>
<td>SoftClean TEM Adapter for Hitachi Sample Rod</td>
<td>233927-00</td>
</tr>
<tr>
<td>Evactron PRS-v (shrouded, vertical configuration)</td>
<td>233613-01</td>
</tr>
<tr>
<td>Dry Scroll Pump Kit, 115V AC Power Outlet</td>
<td>234000-00</td>
</tr>
<tr>
<td>Dry Scroll Pump Kit, 230V AC Power Outlet</td>
<td>234001-00</td>
</tr>
<tr>
<td>[Pump Kits include 7.5 ft (2.6 m) hose and KF16 centering ring and clamp]</td>
<td></td>
</tr>
</tbody>
</table>
Evactron® CombiClean™ System

RF Downstream Plasma Cleaner combines onboard vacuum cleaning chamber and external PRS (Plasma Radical Source) control in one unified system. Using XEI Scientific Inc.’s proven downstream plasma process, the Evactron® CombiClean™ System is designed to provide users of Electron or Ion Microscopes (SEMs, TEMs, or FIBs) the ability to easily clean both specimens and parts destined to be placed into the microscope, as well as the internal surfaces of the microscope vacuum environments.

Providing a complete laboratory anti-contamination resource, it combines Evactron in-situ microscope cleaning with a desktop sample cleaning chamber that allows parts, specimens, and specimen holders to be gently plasma cleaned by a second Plasma Radical Source (PRS).

Evactron® CombiClean™ System - Part Number 235800-00

Specifications

Overall Dimensions:  H, W, D – 8.25” x 25.7” x 10.6”, (210 mm x 652 mm x 270 mm)
RF Power: 0-25 Watts at 13.56 MHz
Status LEDs: Power, RF On, Plasma ON, Faults, Local and Remote
Front Panel Display for operating conditions and status
Encoder Knob and Enable/Disable button for Front Panel Control
Plasma Radical Source Selection Switch
Computer control with RS 232 I/O, DB9 Connector, Null Model Cable, 56k Baud
GUI with Event Log
C Communication Library for software integration
Internal Plasma Radical Source (PRS) with RF Match
Two horizontal ports for TEM stage holder cleaning (specific microscope adapters are optional)
Top loading lid for placing SEM samples and parts onto adjustable internal platform for cleaning
MKS MicroPirani Transducer for vacuum pressure measurement and vacuum interlock
Optional remote computer interlock
Electrically adjusted metering valve for flow/pressure adjustment
RF power interlock prevents starting when out of vacuum pressure range
Fault display and readout
Nitrogen purge feature
100-240VAC 50/60 Hz input
Ni Plated Aluminum lid with 5.5” diameter glass viewing port and RF screen
Adaptor flanges for all major manufacturers of TEM sample holders available
22.5’ cable for use between unit and external PRS
Shipping- 35 lbs. (16 kgs.)
Five year limited warranty
Evactron® TEM Wand

Evactron® Cleaning Wand is inserted into TEM Stage

Transmission Electron Microscopes can also suffer loss of image quality due to contamination in the critical sample/beam interaction area. In the past, cleaning this portion of the microscope required time-consuming and expensive service and it was difficult to deliver an in situ solution due to long cleaning times and hardware modifications. Now, the TEM Wand allows the user to remove hydrocarbon contamination quickly and without additional hardware. Mounting the patented RF electrode on the end of a sample insertion rod, creates reactive oxygen radicals where they are most effective. The user first vents the chamber and then inserts the TEM Wand, similar to a specimen exchange. Now cleaning in the TEM can occur right where it is most needed, in the critical sample examination region. After cleaning, the user removes the TEM Wand and allows the column to pump down and the system is cleaned and ready to take high quality images.

- Includes Evactron 25 Controller, Cable Bundle and Power Cord
- Worldwide power input (100-240 VAC, 50-60 Hz, <2.0 A)
- Insulated Pelican Carrying and Storage Case also included
- 5 year limited warranty and free factory service

TEM Wand and Evactron 25 Controller for JEOL TEM
Part Number: 233425-03

TEM Wand and Evactron 25 Controller for Hitachi Part Number: 233425-04

If you have interest in this product, please contact XEI Scientific, Inc. directly at information@evactron.com or 1.650.369.0133

Evactron® Options for Models C, 25, 40

<table>
<thead>
<tr>
<th>Descriptions</th>
<th>Part Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable Bundle 22' (6.7m)</td>
<td>233230-41</td>
</tr>
<tr>
<td>Black Pelican #1610 Travel Case</td>
<td>1610-0001-00</td>
</tr>
<tr>
<td>Inlet Air Filter - 0.003μm Mesh</td>
<td>2150-0064-00</td>
</tr>
<tr>
<td>Inlet Air Filter - 0.500μm Mesh</td>
<td>2150-0043-00</td>
</tr>
<tr>
<td>USB to RS 232 Adaptor (Dongle) Edgeport /1</td>
<td>4000-0004-00</td>
</tr>
<tr>
<td>(Models 25, 40, and 45 only)</td>
<td></td>
</tr>
<tr>
<td>Venting Capability Pkg. Interlock override</td>
<td>1200-0007-00</td>
</tr>
<tr>
<td>(Models 25, 40, and 45 only)</td>
<td></td>
</tr>
</tbody>
</table>
## Evactron® Adaptor Flanges – SEM Port to KF40

### Abbreviation Key
- **OD** = Outside Flange diameter
- **ORID** = O-Ring Inside Diameter
- **#H** = number of mounting holes + mounting hole symmetry

### Notes
- All dimensions are in millimeters
- O-ring not included with Adaptor Flange

### Part Numbers | Adaptor Flange Descriptions
--- | ---
2150-0018-00 | CF 2.75” to KF40 adaptor flange

#### FEI
- 230090-01 | FEI GIS, Asymmetrical Octagon, 4H asymmetric
- 230141-01 | FEI OD-100, ORID-75, 6H symmetric
- 230153-01 | FEI OD 85, ORID 60, 3H symmetric
- 230154-01 | FEI OD-100, ORID-70, 3H symmetric
- 230235-01 | FEI Tecnai Plug
- 230335-01 | FEI Flange for DB235, OD 88, ORID 60, 3H symmetric
- 230350-01 | FEI Large, OD 120, ORID 93, 6H symmetric
- 230351-01 | FEI Strata Y Port, 1 Piece, OD 59, ORID 38, 4H symmetric
- 230359-01 | FEI OD 90, ORID 70 3H symmetric

#### HITACHI
- 230004-01 | Hitachi S5500 Plug, 4H symmetric
- 230006-01 | Hitachi small port, OD 57, ORID 34.6, HP4 symmetric
- 230320-01 | Hitachi S5000 Plug, 4H symmetric
- 230333-01 | Hitachi S5200 Plug, 4H symmetric
- 230568-01 | Hitachi OD 69, ORID 47.5, 4H symmetric

#### ISI
- 230588-01 | ISI Rectangular 330 X180 4H asymmetric

#### JEOL
- 230001-01 | JEOL 6700F, OD 64 ORID 40, 4H symmetric
- 230002-01 | JEOL 99 OD, 75 ORID, 4H symmetric
- 230003-01 | JEOL JSM 6700F WDS, 206 x 87, 4H asymmetric
- 230005-01 | JEOL 6460 LV, OD 73, ORID 50, 4H symmetric
- 230010-01 | JEOL 4500 FIB, OD 73, ORID 50, 4H symmetric
- 230011-01 | JEOL 7600 EDS, 74 x 90, oval o-ring groove, 4H asymmetric
- 230013-01 | JEOL 7000 EDS, OD 88, ORID 45, 4H asymmetric, longer KF40 fitting
- 230030-01 | JEOL OD 160, ORID 110, 4 H symmetric
- 230322-01 | JEOL 6320 Arched 98 H x 75W, 4H asymmetric
- 230323-01 | JEOL 5900, OD 94, ORID 65 4H symmetric
- 230324-01 | JEOL 6360, OD 99, ORID 75 4H symmetric
- 230664-01 | JEOL OM port OD-95, ORID-76, 3H symmetric
- 230672-01 | JEOL OD 160, ORID 110, 4 H symmetric
- 230893-01 | JEOL JSM-35, WDS port, 4H asymmetric + 1 pin
- 230894-01 | JEOL JSM 7600F right BEI port, 160 x 80, 4H asymmetric
## Abbreviation Key

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OD</td>
<td>Outside Flange diameter</td>
</tr>
<tr>
<td>ORID</td>
<td>O-Ring Inside Diameter</td>
</tr>
<tr>
<td>#H</td>
<td>number of mounting holes + mounting hole symmetry</td>
</tr>
</tbody>
</table>

## Notes

- All dimensions are in millimeters
- O-ring not included with Adaptor Flange

## Part Numbers

<table>
<thead>
<tr>
<th>Part Numbers</th>
<th>Adaptor Flange Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>230008-01</td>
<td>Zeiss small port, OD 55, ORID 30, 4H symmetric</td>
</tr>
<tr>
<td>230009-01</td>
<td>Zeiss BSE, OD 100, ORID 72, 4H symmetric</td>
</tr>
<tr>
<td>230012-01</td>
<td>LEICA 360, Square 64 x 64, 4H asymmetric</td>
</tr>
<tr>
<td>230014-01</td>
<td>Zeiss Auriga, OD 73, ORID 53, 4H symmetric</td>
</tr>
<tr>
<td>230019-01</td>
<td>Zeiss OD 78, ORID 53, 4H symmetric</td>
</tr>
<tr>
<td>230034-01</td>
<td>Zeiss Left 96mm, 72 ORID 4H asymmetric</td>
</tr>
<tr>
<td>230356-01</td>
<td>Zeiss LF 100, ORID 60, 6H symmetric</td>
</tr>
<tr>
<td>230357-01</td>
<td>Zeiss OD 89, ORID 60, 4H asymmetric</td>
</tr>
<tr>
<td>230358-01</td>
<td>Zeiss EDS, 97 x 81, 4H symmetric</td>
</tr>
<tr>
<td>230364-01</td>
<td>Zeiss Square 85 x 85 ORID 70, 4H symmetric</td>
</tr>
<tr>
<td>230366-01</td>
<td>Zeiss WDS 190x150</td>
</tr>
</tbody>
</table>

## RoHS

- 2002/95/EC