turning ideas into solutions

THIN FILM TECHNOLOGY

# MB COATING SOLUTIONS

## PHYSICAL VAPOR DEPOSITION



www.mbraun.com

## VACUUM DEPOSITION SYSTEMS

Vacuum deposition refers to a family of processes used to grow layers of material onto substrates under vacuum conditions. There may be multiple layers of different materials with thicknesses that can range from less than 1 nm to several microns. MBRAUN offers a number of products for thin film deposition applications. Our systems can either be glovebox integrated or offered as standalone units.

## PROCESS DEVELOPMENT

From a process point, a larger chamber with its additional vacuum ports allows for additional sources to be integrated into the chamber and for the overall source arrangement to be optimized which enhances the achievable coating uniformity and process quality. All commonly available sources for RF and DC sputtering, thermal resistance evaporation, organic material coatings and E-Beam processes have been integrated and are successfully used from MBRAUN's growing global customer base.

In addition, a process team has been established at MBRAUN to consult and support customers to choose the appropriate chamber size and to find the optimum source configuration for each specific coating process. The in-house application lab equipped with a MB ProVap 7G system and several state-of-the-art metrology tools offers the possibility to simulate and verify the process conditions even of challenging coating tasks.

Specifically for the MB ProVap series MBRAUN offers tailored solutions for demands which do not follow conventional requirements such as enhanced source control (multi-source co-evaporation), customized substrate masking, advanced heated/cooled substrate fixtures and many more.


**World-wide Quality Certifications**
**ISO 9001:2008 • NQA-1**


## MBRAUN DESIGNS COATING SYSTEMS FOR A VARIETY OF THIN FILM APPLICATIONS WITH A BROAD RANGE OF OPTIONS AND CUSTOMIZED SOLUTIONS. COATING SYSTEMS AT MBRAUN INCORPORATE ALL MAIN EVAPORATION TECHNOLOGIES INCLUDING

- Resistive Thermal Evaporation
- Temperature Controlled Evaporation (ex. Organic Material)
- Electron Beam Evaporation w/ Multiple Pocket Arrangements
- RF , DC or Pulsed DC Magnetron Sputtering
- Reactive RF Magnetron Sputtering w/ Reactive Gases

## FROM FRACTIONS OF A NANOMETER (MONO LAYER) TO SEVERAL MICROMETERS OF THICKNESS, MBRAUN HAS THE RIGHT SYSTEM FOR YOUR APPLICATION

- Thin Film Batteries
- OLED Technology / Organic Electronics
- Organic Photovoltaics Applications
- Semiconductor Applications

## QUALIFICATION AND CUSTOMER SUPPORT

- Fully functional demo system in our laboratory. MBRAUN offers the possibility to see and actively use our evaporation system before you make a purchasing decision.
- Factory acceptance testing before the system is shipped.
- MBRAUN offers complete testing of the system with materials specified by our customers.
- Surface profile with a Dektak®150 for the characterization and analysis of the coated substrates
- World-wide Support Network

MBRAUN COATING SYSTEMS

# MB EcoVap

The MB EcoVap coating tool is a high quality economic research solution when the available laboratory space is restricted. Even though compact in design all essential features for high quality functional coatings are incorporated in its standard configuration, making it the perfect entry model for many research groups who have decided to take the first steps in exploring vacuum coating technology. Choosing from a comprehensive set of optional upgrades the MB EcoVap system can be equipped to meet even more advanced requirements from experienced users.

Built according to MBRAUN's high quality standards the bell jar setup distinguishes itself from other compact solutions with an automatic, electro-pneumatic chamber lifting mechanism. The unique setup combines perfect accessibility of the sources with a space-saving design. In integral design of the MB EcoVap is the embedded shielding that help prevent the chamber walls to become coated during the vacuum process, thus allowing an efficient cleaning of the interior chamber.

Originally designed to be integrated into an MBRAUN glovebox, the MB EcoVap is available as a stand alone unit as well, so that applications which do not require inert conditions can be served.

All commonly available sources for RF and DC sputtering, thermal resistance evaporation, organic material coatings and E-Beam processes have been integrated and are successfully used from MBRAUN's growing global customer base.

## Features:

- Available in both glovebox integrated and stand alone versions
- For substrates up to 70 x 70 mm or 100 mm wafers
- Compact, space-saving design
- Automatic chamber lifting mechanism
- Shielded view port for visual process monitoring
- Recipe programmable PLC control
- Removable protective shielding
- Compatible with most standard deposition sources
- Ergonomic to operate, easy to clean
- All stainless steel construction
- UL listed and CE compliant


System configuration may vary

MBRAUN COATING SYSTEMS

# MB ProVap Series

The MB ProVap series is a versatile research and development tool for thin film deposition under vacuum conditions. The MB ProVap comes in a 3, 5, or 7 series configuration depending on the size chamber your research requires. The variety of chambers offer customers additional space for more sources and optional deposition tools such as in-situ, substrate heating and masking. The rectangular chamber design also offers additional pump configurations such as more powerful turbomolecular and cryopumps.

Instead of the automated chamber lifting mechanism of the MB EcoVap, this MB ProVap series offers a rear mounted hinged service door which hermetically seals against ambient conditions. For the glovebox integrated version this unique feature allows maintaining and cleaning the interior of the deposition tool without contaminating the inert conditions inside the connected glovebox.

The space saving sliding front door offers an ergonomically optimized access to all components located inside the MB ProVap. Procedures such as loading the sources, mounting the substrate and cleaning the system after the deposition are very easy and convenient. The standard features of the MB ProVap design separates this tool completely from other solutions which have not been originally configured for glovebox integration.

All commonly available sources for RF and DC sputtering, thermal resistance evaporation, organic material coatings and E-Beam processes have been integrated and are successfully used from MBRAUN's growing global customer base.

## Features:

- Available as glovebox integrated and stand alone
- For substrates up to 210 x 210 mm or up to 300 mm wafers*
- Compact, space-saving design
- Hinged rear service door
- Ergonomic sliding front door
- Shielded view port in front door for visual process monitoring
- Recipe programmable PLC control
- Removable protective shielding
- Compatible with most standard deposition sources
- Ergonomic to operate, easy to clean
- All stainless steel construction
- UL listed and CE compliant

*Substrate size will depend on the size of the chamber selected. Please see chamber specification for more information.

System configuration may vary

MBRAUN COATING SYSTEMS

# MB OptiVap

The MB OptiVap series is the current high-end solution in MBRAUN's deposition tool series. Designed for the requirements of specialized research up to pilot scale production, these tools find frequent use in industrial laboratories and state-of-the-art Universities throughout the world.

Offering the same quality standards, flexibility, reliability and the same precision as the MB ProVap and MB EcoVap series, the MB OptiVap has additional features and available options. Amongst many tailored solutions the predominant aspects of this system are automatic substrate handling under high-vacuum conditions, automatic mask storage and changing, self-alignment capabilities and a sophisticated process tracking & tracing software. The latter acts as a supervisory process control solution that allows embedding the tool into an array of other process tools in order to create a complete fully automated pilot line with comprehensive and substrate specific log files.

When standard deposition tools reach their limits choose the MB OptiVap. Please contact us if you have questions choosing the right thin film deposition system for your specification needs.

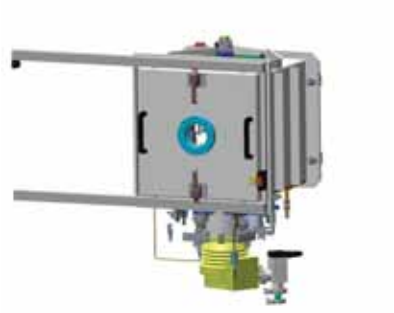
## Features:

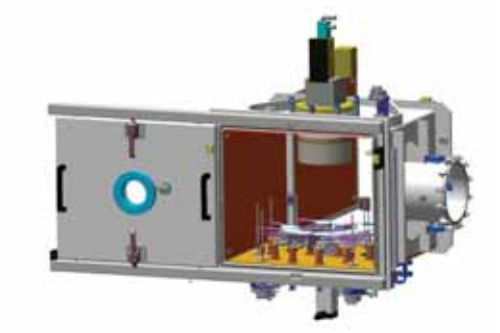
- Available as system embedded version, glovebox integrated and stand alone
- For substrates up to 300 x 300 mm or 300 mm wafers
- Open platform to meet unconventional coating needs
- Comprehensive set of automated components
- Hinged rear service door
- Ergonomic sliding front door
- Robot loading
- Data logging
- Tracking and tracing
- Shielded view ports for visual process monitoring
- Recipe programmable PLC control
- Removable protective shielding
- Compatible with all standard and customized deposition sources
- Ergonomic to operate, easy to clean
- All stainless steel construction
- UL listed and CE compliant

MBRAUN CHAMBER SPECIFICATION

| MBRAUN CHAMBER SPECIFICATION | | MB EcoVap |
|---|---|---|
| Performance | • Design | Cylindrical |
| | • Size footprint (mm) | Ø350 |
| | • Height (mm) | 400 |
| | • Volume | 38 |
| | • Material | Stainless Steel 1.4301 (US Type 304) |
| | • Maximum wafer size (mm) | 100 |
| | • Maximum substrate size (mm) | 70 x 70 |
| | • Vacuum feedthroughs | 14 |
| | • Vacuum pump connection | DN160 ISO-K |
| | • Vacuum level (@ 260l/s turbo molecular pump) | < 2 x $10^{-6}$ mbar |
| | • Vacuum level (@ 560l/s turbo molecular pump) | < 9 x $10^{-7}$ mbar |
| | • Vacuum measurement (Pirani/Penning) | ● |
| Equipment | • Protective shielding (stainless steel) | ● |
| | • Viewing window (DN100) | ● |
| | • Window protection shield | ● |
| | • Manual window protection shutter | - |
| | • Full glove box integration | ● |
| | • Stand alone configuration | ○ |
| Evaporation Sources | • Thermal resistance evaporation | ○ |
| | • Temp. controlled organic evaporation | ○ |
| | • Electron beam | ○ |
| | • RF, DC or DC pulsed magnetron sputtering (Optional with reactive gasses) | ○ |
| Accessories | • Substrate rotation | ○ |
| | • Substrate shutters | ○ |
| | • Source shutters | ○ |
| | • Substrate heating | ○ |
| | • Substrate heating and cooling | - |
| Vacuum Pump Configurations | • Quartz sensors | ○ |
| | • Turbomolecular pump >230l/s (Rough vacuum with rotary vane or dry scroll pump) | ○ |
| | • Turbomolecular pump >560l/s (Rough vacuum with rotary vane or dry scroll pump) | ○ |
| | • Turbomolecular pump >1050l/s (Rough vacuum with dry scroll pump) | - |
| | • Cryogenic pump >1200l/s (Rough vacuum with dry scroll pump) | - |
| | • Other pump configuration on special request | ○ |

[●] included [○] option available [-] option not available





| MB ProVap 3 | MB ProVap 5 | MB ProVap 7 |
|---|---|---|
| Square | Square | Square |
| 380 x 360 | 500 x 500 | 600 x 600 |
| 500 | 500 | 500 |
| 68 | 125 | 180 |
| Stainless Steel 1.4301 (US Type 304) | Stainless Steel 1.4301 (US Type 304) | Stainless Steel 1.4301 (US Type 304) |
| 185 | 250 | 300 |
| 130 x 130 | 175 x 175 | 210 x 210 |
| 14 | 24 | 31 |
| DN160 ISO-K<br>Optional up to DN250 ISO-K | DN160 ISO-K<br>Optional up to DN250 ISO-K | DN160 ISO-K<br>Optional up to DN250 ISO-K |
| < 2 x $10^{-6}$ mbar | < 2 x $10^{-6}$ mbar | - |
| < 9 x $10^{-7}$ mbar | < 9 x $10^{-7}$ mbar | < 9 x $10^{-7}$ mbar |
| • | • | • |
| • | • | • |
| • | • | • |
| - | - | - |
| • | • | • |
| • | • | • |
| ○ | ○ | ○ |
| ○ | ○ | ○ |
| ○ | ○ | ○ |
| ○ | ○ | ○ |
| ○ | ○ | ○ |
| ○ | ○ | ○ |
| ○ | ○ | ○ |
| ○ | ○ | ○ |
| ○ | ○ | ○ |
| ○ | ○ | ○ |
| ○ | ○ | ○ |
| ○ | ○ | - |
| ○ | ○ | ○ |
| - | ○ | ○ |
| - | ○ | ○ |
| ○ | ○ | ○ |

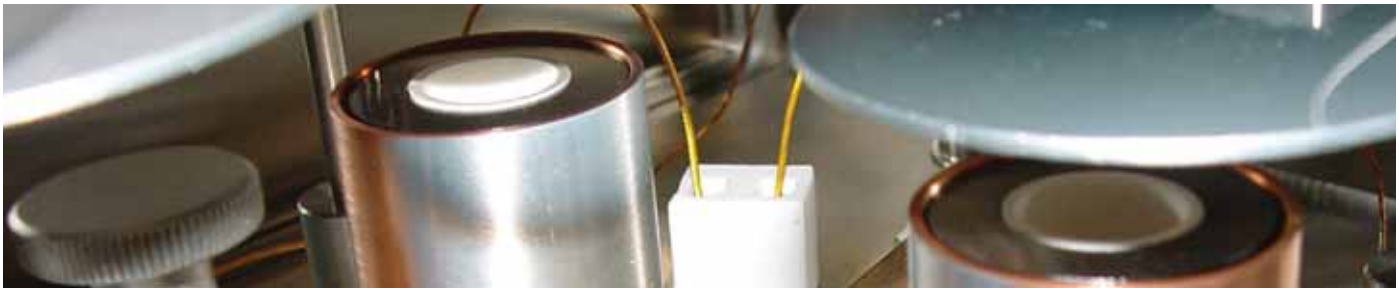
# MB SOURCES

Thin film deposition systems by MBRAUN include a variety of ways of depositing layers of material onto substrates. Our systems can be custom configured to include different coating techniques to meet the customer's exact specification. Customized sources can be integrated as well.

## MB Thermal Evaporator

| | |
|---|---|
| Set up | Single and double source |
| Maximum electrical power | 2000 VA |
| Maximum temperature | Up to 1800°C (depends on the used boat e.g. tungsten) |
| Typical heaters for thermal deposition | Crucible heater, filaments or boats made of tungsten, tantalum, molybdenum or other materials |
| Source shutter | Optional |

## MB Organic Source SC



| | |
|---|---|
| Set up | Single and double source |
| Crucible size | 2 cm³ (optional: 0.5 cm³, 1 cm³, 4 cm³ or 8 cm³) |
| Crucible form | Tapered (optional forms e.g. cylindrical, w/o aperture available) |
| Crucible material | Alumina (optional material is available) |
| Typical deposition rates | ($10^{-3}$)… 5 nm/sec |
| Heating system | Tungsten-coil with ceramic insulators |
| Temperature range | 50°C up to 600°C |
| Temperature stability | Down to 0.1 K (depending on PID controller) |
| Thermocouple | Type K |
| Source shutter | Included |

## MB EBEAM 6

| | |
|---|---|
| Maximum power | 6 kW (optional: 4 kW and 10 kW are available on special request) |
| HV range | 6-10 kV |
| Maximum filament current | 50 A |
| Primary beam deflection | 270° |
| x-/y-Magnet deflection | ± 3 A (100 Hz) |
| Beam spot size | Æ 3 mm (with minimum variation across pocket area) |
| Motor drive | 0.5 – 5 rpm; with optical positioning |
| Crucible diameter | 95 mm; 4-pocket configuration includes crucible 4 x 8 cm³<br>(optional: crucibles from 2 cm³ up to 100 cm³ available) |
| Controller | • x- / y-deflection with +/- 3 A @ 24 VAC;<br>• 0-100 Hz<br>• Sweep modes: sine wave, triangle, square, wave-form editor<br>• Gun Rotation Card, max. 12 pockets<br>• Filament Power Supply<br>• Storage capacity: 99 data sets; 20 material configurations<br>• Up to 64 data sets per process |
| Source shutter | Optional |

## MB-Sputter Sources DC/RF/HF

| | |
|---|---|
| Source size | For 2“, 3“ and 4“ targets |
| Power supply | DC/RF/HF sputtering 300W, 600W, or 1600W |
| Gas supply | Single or double gas inlet for reactive gas sputtering available;<br>Including mass flow controller |
| Options | Special sources on request! |

# MB CONTROLLERS

## MB EVAP Monitor 160

The MB EVAP Monitor 160 is used for high accurate rate and thickness measurement in thin film deposition processes. Features include:

- Two measurement channels standard, an additional four optional.
- Analog outputs for rate/thickness recording.
- High accuracy option: 0.03 Hz at 10 readings/sec.
- RS-232 standard, USB or Ethernet optional.
- Windows® software included.

## MB EVAP Controller 310

The MB EVAP Controller 310 allows highly accurate sequential or co-deposition control. Features include:

- Bright 1/4 VGA active matrix color LCD display.
- Standard RS-232 and USB (RS-232 and Ethernet optional).
- Easy setup and operation with a "Quick Setup" Menu.
- 6 context-sensitive push buttons, and convenient parameter setting knob.
- Windows® program for developing, testing, and downloading processes, and for logging instrument data to your PC for process analysis and quality control.
- Accurate process control, especially for low deposition rates, with ±0.03 Hz resolution at 10 readings/second.
- Storage capacity for up to 100 processes, 1,000 layers, 50 films.
- Monitoring of source material with a single sensor or with multiple sensors to provide accurate source distribution monitoring.

## MB EVAP PC Controller

Windows® based PC-Control for MBRAUN EVAP-System for precise Rate, film thickness, and co-evaporation control with user friendly visualization. Features include:

- Film thickness and evaporation rate control.
- Control of up to 8 sources.
- Co-evaporation control of up to 4 sources simultaneously.
- Interface to data acquisition and storage system in CSV-file or to external data base.
- Includes Windows-PC with monitor and keyboard.
- Interface to PLC controller.
- Inficon SQS-242 Software.
- Interface card Inficon SQM-242.

| Performance | MB EVAP Monitor 160 | MB EVAP Controller 310 | MB EVAP PC Controller |
|---|---|---|---|
| • Description | Multi film rate / thickness monitor for accurate measurement deposition rate and film thickness | Thin Film Deposition Controller for accurate control of deposition rate and film thickness | Windows® based PC-Control for MBRAUN EVAP-Systems for precise Rate-, film thickness- and co-evaporation control with user friendly visualization |
| • QCM sensor inputs | 2<br>Optional +4 | 4 | 4 |
| • Frequency range | 4 to 6 MHz | 4 to 6 MHz | 1 to 10 MHz |
| • Frequency resolution | +/- 0.12 Hz<br>@ 4 readings/second | +/- 0.03 Hz @ 0.10 sec measurement period | 0.05 Hz |
| • Frequency stability | +/- 2 ppm total over 0 to 50°C | +/- 2 ppm total over 0 to 50°C | +/- 2 ppm total over 0 to 50°C |
| • Measurement/Update rate | 0.10 to 2 sec<br>(in .05 sec increments) | 1 to 10 Hz | 0.1 bis 2 sec |
| • Rate display resolution | 0.1 Angstrom/sec | 0.01 Angstrom/sec | 0.05 Angstrom/sec* |
| • Thickness display resolution | 0.001 k Angstrom | 0.001 k Angstrom | 0.02 Angstrom* |
| • Storage | 99 films | 100 processes<br>1000 layers 50 films | Unlimited<br>(CSV-file or<br>to external data base) |
| • Co-deposition functionality | - | Up to 4 sources simultaneously | 2 sources simultaneously optional up to 4 |
| • Interfaces | RS-232 | RS-232 and USB standard | PC-interface |
| • Windows® software | included | included | Including SQC-242 PC-Software and Runtime Software WinCC Flexible |

***Rate and thickness resolution values given for period=0.5 sec and density =2.73 gm/cm³ (aluminum)**

*turning ideas into solutions*

MB OptiVap S stand alone vacuum deposition system

MB EcoVap S stand alone vacuum deposition system

MB ProVap S stand alone vacuum deposition system

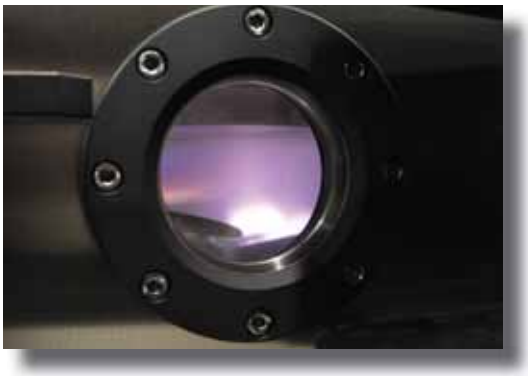
System configuration may vary

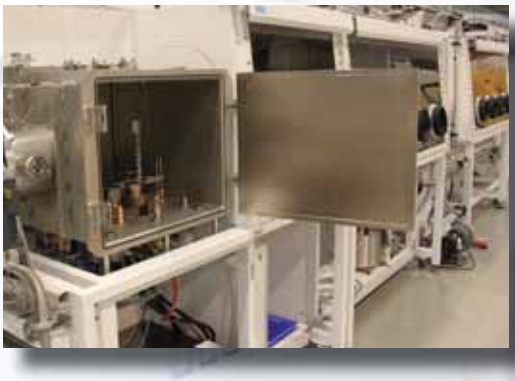
Glovebox integrated MB ProVap

Glovebox integrated MB EcoVap with spin coater glovebox connected by T-Chamber

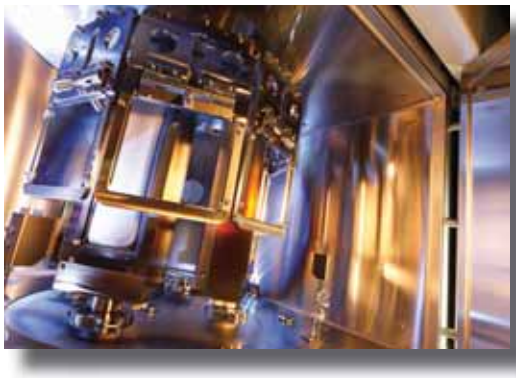
System configuration may vary

*turning ideas into solutions*



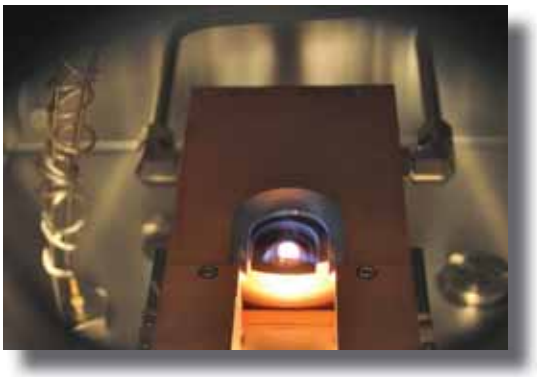


System configuration may vary



System configuration may vary

*turning ideas into solutions*

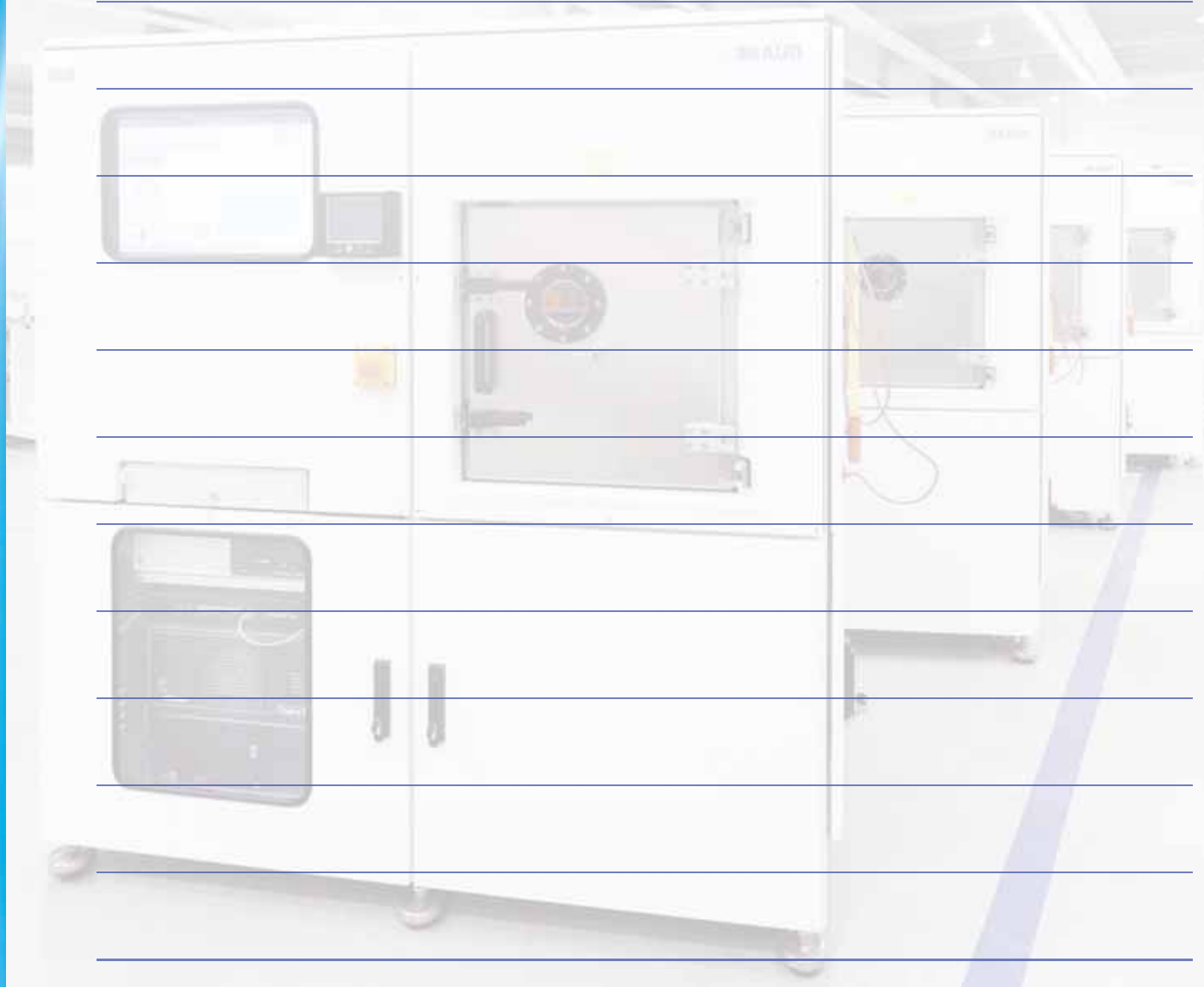



System configuration may vary

System configuration may vary

# COMPLETE THIN FILM
## DEPOSITION SOLUTIONS

Notes:



## Germany

**M. Braun Inertgas-Systeme GmbH (Headquarters)**
Dieselstr. 31 • 85748 Garching • Germany
Phone: +49 89 32669-0 • Fax: +49 89 32669-105
www.mbraun.de • info@mbraun.de

## USA

**M. Braun Incorporated**
14 Marin Way • Stratham, NH • 03885
Phone: +1 603-773-9333 • Fax: +1 603-773-0008
www.mbraunusa.com • info@mbraunusa.com

## USA West Coast

**M. Braun West Coast Office**
Suite 206 • 2570 North First Street • San Jose, CA • 95131
Phone: +1 408-273-4594 • Fax: +1 408-273-4694
www.mbraunusa.com • info@mbraunusa.com

## UK & Ireland

**M. Braun UK & Ireland**
Mansfield Business Center • Ashfield Avenue • Mansfield
Nottinghampshire • NG18 2AE • United Kingdom
Phone: +44 1623 404329 • Fax: +44 1623 404277
www.mbraun.co.uk • info@mbraun.de

## China

**M. Braun Inertgas Systeme Co. Ltd. (Shanghai)**
Ground floor of Building #1 • No. 145 Jintang Road • Tangzhen, Pudong,
Shanghai, 201201 • P.R. China
Phone: +86 21 5032 02 57 • Fax: +86 21 5032 02 29
www.mbraunchina.com • info@mbraunchina.com