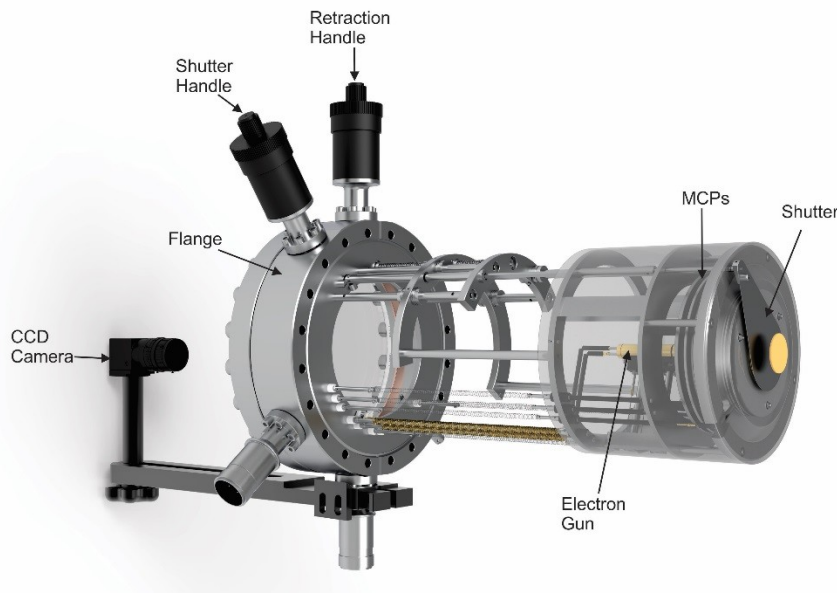


# LEED 800 MCP Configuration Guide and Specifications



## LEED configuration

| Base configuration  |            |  |
|---------------------|------------|--|
| Model               | Order Code |  |
| BDL800IR-MCP1-3GR   |            | Back-Display LEED spectrometer with 3 grid high resolution (0.2%) retarding field analyzer based on gold plated tungsten hemispherical grids, integral miniature electron gun with 10 mm O.D lenses made of gold plated copper alloy, optical quality glass-luminescent display, one 80 mm LongLife™ microchannel plate (MCP), Mu-metal magnetic shielding with front shield (80% magnetic shielding) mounted on double sided CF150 (CF8" O.D.) flange with vacuum insert diameter 142 mm. Filament: tungsten hairpin. Viewport and mounting kit included. Wide beam current range: from pA to uA. Flange to sample distance: to be specified. |
| LMX                 | AO00016    | Integral linear retraction based on 4 linear ball bearings up to 100 mm  |
| LPS075-D            | AO00023    | Digital power supply (0-750 V) with USB interface and PC control software for Windows 10. True primary beam current and total emission measurements. Automatic start-up and shut down, 10 memory settings including standby and outgassing mode with timer, constant beam current mode controlled by filament current or Wehnelt voltage. All cables included.   |
| MCPS1               |            | Electronics for one microchannel plate with digital displays of voltages and MCP load current measurements and protection.   |
| Options             |            |  |
| ISH-8-MCP           |            | Integral shutter for BDL800IR-MCP  |
| LaB <sub>6</sub>    |            | LaB <sub>6</sub> single crystal filament instead of a tungsten wire filament   |
| MCP2                |            | Two 80 mm LongLife™ microchannel plates (MCP) in chevron configuration instead of one MCP  |
| MCPS2               |            | Electronics for two microchannel plates with digital displays of voltages and MCP load current measurements and protection.  |
| Electronics Upgrade |            |  |
| LPS300-D-UP         |            | Upgrade from LPS075-D to LPS300-D  |
| LOA10-AES           | AO00025    | Model LOA10-AES, Digital AES controller with lock-in amplifier, AES high voltage   |

|  |  |  |
|--|--|--|
|  |  | ramp board 0-2.0 kV with precision sinewave oscillator (0.5-20 Vpk-pk) and AES software. Serial RS232 or USB communication to PC. High Auger signal sensitivity based on integrated band-pass filter and pre-amplifier (0.05% of monolayer for Ag peak 351-356 eV). All cables included. |
|--|--|--|

## LEED and AES configuration

| Base configuration       |            |  |
|--------------------------|------------|--|
| Model                    | Order Code |  |
| Model BDL800IR-MCP1- 4GR |            | Back-Display LEED spectrometer with 4 grid high resolution (0.2%) retarding field analyzer based on gold plated tungsten hemispherical grids with 77 deg. capture angle, integral miniature electron gun with 10 mm O.D lenses made of gold plated copper alloy, optical quality glass-luminescent display, one 80 mm LongLife™ microchannel plate (MCP), Mu-metal magnetic shielding with front shield ( 80% magnetic shielding) mounted on double sided CF150 ( CF8" O.D.) flange with vacuum insert diameter 142 mm. Filament: tungsten hairpin. Wide beam current range: from pA to uA. Viewport and mounting kit included. Flange to sample distance: to be specified |
| LMX                      |            | Integral linear retraction based on 4 linear ball bearings up to 100 mm  |
| LPS300-D                 |            | Digital LEED-Auger power supply (0-3.2 kV) with USB interface and PC control software for Windows 7. True primary beam current and total emission measurements. Automatic start-up and shut down, 10 memory settings including outgassing with timer, automatic switch from LEED to AES, constant beam current mode. All cables included.  |
| MCPS1                    |            | Electronics for one microchannel plate with digital displays of voltages and MCP load current measurements and protection.   |
| Options                  |            |  |
| ISH-8-MCP                |            | Integral shutter for BDL800IR-MCP  |
| LaB <sub>6</sub>         |            | LaB <sub>6</sub> single crystal filament instead of a tungsten wire filament   |
| LOA10-AES                |            | Model LOA10-AES, Digital AES controller with lock-in amplifier, AES high voltage ramp board 0-2.0 kV with precision sinewave oscillator (0.5-20 Vpk-pk) and AES software. Serial RS232 or USB communication to PC. High Auger signal sensitivity based on integrated band-pass filter and pre-amplifier (0.05% of monolayer for Ag peak 351-356 eV). All cables included.  |
| MCP2                     |            | Two 80 mm LongLife™ microchannel plates (MCP) in chevron configuration instead of one MCP  |
| MCPS2                    |            | Electronics for two microchannel plates with digital displays of voltages and MCP load current measurements and protection.  |

## LEED Software

| Software Options |            |   |
|------------------|------------|---|
| Model            | Order Code |   |
| LIM12            |            | <p>Full version LEED pattern measurements, analysis software &amp; hardware for Windows 10 including:</p> <ul style="list-style-type: none"> <li>-12-bit colour or black and white high-performance video CCD camera with sensitivity control</li> <li>- 1/3" CCD sensor size, 1.3 MP (1288x964) - sized images, 3.75 um pixel size, CS-mount lenses</li> <li>- Linear Full Well: 9000e-, Dynamic Range: 59 dB</li> <li>- PCIe express USB3.1 card (option if computer doesn't have USB3.1)</li> <li>- Flange mounting kit with ambient light cover and cables</li> </ul> <p>Software features:</p> <ul style="list-style-type: none"> <li>- Automatic LEED pattern acquisition</li> <li>- Automatic I-V analysis with spot tracking</li> <li>- Automatic I-T analysis</li> </ul> |

|        |  |   |
|--------|--|---|
|        |  | - Automatic spot profile analysis   |
| LIM12B |  | Basic LEED pattern measurements and analysis software and hardware for Windows 10 including:<br>-12-bit colour high performance video CCD camera with sensitivity control and USB3 interface<br>-1/3" CCD sensor size, image size: 1.3 MP (1288x964), 3.75 um pixel size, CS-mount lenses<br>-Linear Full Well: 9000e-, Dynamic Range: 59 dB<br>-PCIe express USB3.1 card (option if computer doesn't have USB3.1)<br>-Automatic LEED pattern acquisition<br>-Flange Mounting kit with ambient light cover and cables   |
| LIM14  |  | Advanced LEED pattern measurements, analysis software & hardware for Windows 10 including:<br>-14-bit colour or black and white high-performance scientific grade CCD camera with sensitivity control and USB 3 interface: 2/3" CCD sensor size and 1.4-megapixel resolution (1384x1032), 6.45 um pixel size, C-mount lenses<br>- Linear Full Well: 22,000e-, extremely low noise, Dynamic Range: 68 dB<br>- PCIe express USB3.1card (option if computer doesn't have USB3.1)<br>- Flange mounting kit with ambient light cover and cables.<br>Software features:<br>- Automatic LEED pattern acquisition<br>- Automatic I-V analysis with spot tracking<br>- Automatic I-T analysis<br>- Automatic spot profile analysis |

## Detailed Specifications

| <b>BDL800IR-MCP optics</b>   |  |
|------------------------------|--|
| Glass display                | Fused silica glass coated with indium-tin oxide conductive layer and P31 phosphor (ZnS:Ag:Cu-green, 525 nm wavelength) |
| Angle of acceptance          | 101° from sample at a distance of 75 mm  |
| Retarding Field Analyzer     | Concentric assembly of hemispherical grids   |
| Working distance from sample | 20 mm  |
| Grid material                | Gold coated tungsten wire mesh (100 mesh, 81% transparency)  |
| Energy resolution            | 0.2% -0.5% at low modulation voltage   |
| Monitoring                   | 8" standard viewport   |
| Linear motion                | Up to 100 mm retraction from sample; linear ball bearing and acme thread with all spring electrical connections        |
| Integral shutter             | Manual shutter driven by a rotary feedthrough  |
| Magnetic shielding           | Mu metal cylinder with front cover for maximum attenuation   |
| Assembly                     | Extreme high vacuum compatibility with stainless steel, high alumina and Au-plated copper alloy materials              |
| Mounting                     | 8" (CF150) double sided conflat flange with sample distance 145 mm - 400 mm  |
| Bakeability                  | Under vacuum, 250°C maximum  |

| <b>Integral miniature electron gun</b> |   |
|--|---|
| Beam energy                            | LEED: 0-750 eV<br>AES: 0-3000 eV  |
| Beam current                           | LEED: 2 µA at 100 eV and 0.5 mm beam size<br>AES: up to 100 µA at 3 keV                           |
| Beam size                              | From 1 mm to 250 µm-adjusted by wehnelt potential, limited by exchangeable aperture down to 50 µm |
| Electron source                        | Tungsten 2% thoriated filament (standard) or single crystal LaB <sub>6</sub> filament (optional)  |
| Energy spread                          | 0.45 eV (thoriated-tungsten filament)   |
| Overall size                           | 10 mm lens diameter and 80 mm length  |

| <b>Microchannel Plates</b> |  |
|----------------------------|--|
| Working area               | 75 mm  |
| L/D ratio                  | 40:1   |
| Channel diameter           | 25 microns                                   |
| Center to center spacing   | 32 microns                                   |
| Plate thickness            | 1.0 mm                                       |
| Bias angle                 | 8°   |
| Electron gain              | 10 <sup>4</sup> to 10 <sup>5</sup> per plate |

| <b>LPS075-D and LPS300-D Electronics</b> |   |
|--|---|
| Beam Voltage                             | LPS075-D: negative 0-750 V<br>LPS300-D: negative 0-3000 V   |
| Filament current                         | 0-3.2 A Tungsten/ 0-2.1 A LaB <sub>6</sub>  |
| Wehnelt voltage                          | 0-37 V with respect to the filament   |
| Focus voltage                            | LEED: positive 70-180% of the beam voltage<br>AES: negative 0-3000 V  |
| Retarding (grid) voltage                 | Negative 50-110% of the beam voltage  |
| Screen voltage                           | Positive 0-5000 V   |
| Emission current                         | 1-200 μA  |
| Beam current                             | 0.01-200 μA   |
| Monitoring                               | All voltages and currents   |
| Display                                  | Vacuum fluorescent, displaying all voltages, currents and program functions   |
| On-board automation                      | 5 pre-programmed and fully programmable operating programs for outgassing, stand-by, filament forming, beam voltage scanning, constant beam current and diagnostics |
| Manual control                           | Of all voltages via rotary dials and selection switches   |
| PC control                               | PC software for full control of all functions via USB   |
| Protection                               | Over-voltage, over-current, and short circuit   |
| Dimensions                               | 3U 19" rack mount (5.25"/133 mm), depth of 17.5" (440 mm), weight 12 kg   |

| <b>High Voltage Ramp Generator Model LOA10-AES (Lock-In)</b> |                                       |  |
|--|---------------------------------------|--|
| Sweep Generator  | Sweep Voltage                         | 0-2000 V   |
|  | Sweep Rate                            | AES software controlled (16-bit DAC)   |
|  | Sweep Voltage Offset (start)          | AES software controlled (16-bit DAC)   |
|  | Sweep Voltage Offset (end)            | AES software controlled (16-bit DAC)   |
|  | Ramp Voltage Monitor                  | AES software controlled (16-bit DAC)   |
| Internal Oscillator and Modulator                            | Frequency                             | Fixed at 1.457 kHz, trimmer adjusted ±5%   |
|  | Amplitude (peak-to-peak)              | Regulated from 0.5 to 20 V (16-bit DAC)  |
|  | Distortion                            | Harmonic 0.1%<br>Noise 50 μV RMS   |
| PSD  | Type                                  | Switching multiplier   |
|  | Input Impedance                       | AC coupled, 100 nF into 1 MΩ   |
|  | Input                                 | True differential  |
|  | AC Gain                               | 10, 100, 1000, 10000 (and 1, 2, 4, 8) software selectable                          |
|  | Interstage Coupling                   | Simple high pass typically with -3 dB per 72 Hz                                    |
|  | Post Detection Low Pass Filter        | Equal component Sallen-Key, 2nd order with a time constant of 0.1, 0.5, 1, and 3 s |
|  | Signal Channel Equivalent Input Noise | Typically, less than 20 nV/Hz at 1 kHz   |
| PLL  | Input Impedance                       | AC coupled, 10 nF into 1 MΩ  |
|  | Frequency Range                       | 0.2-7.5 kHz with a typical phase jitter < 0.2%                                     |
|  | Locks Onto                            | The fundamental or 2nd harmonic  |
| ADC  | Chip                                  | TI ADS7807   |
|  | Resolution                            | 16 bits  |
|  | Accuracy                              | ±1.5 LSB max INL   |
|  | Conversion Time                       | 25 μs  |
| DAC  | Chip                                  | TI DAC715  |
|  | Resolution                            | 16 bits  |

|                    |   |           |
|--------------------|---|-----------|
|                    | Settling Time   | 3 $\mu$ s |
|                    | Channels  | 1         |
| Computer Interface | USB   |           |
| Software           | AES data acquisition and analysis software for Windows 7/10             |           |
| Dimensions         | 2U 19" rack mount (3.5" / 89 mm), depth of 13.5" (343 mm), weight 6 kg. |           |

| <b>Low Noise Input Coupler Model AUS30</b> |  |          |
|--|--|----------|
| Input Impedance                            | 10 M $\Omega$ (internal bandpass filter) |          |
| Amplifier                                  | FET input, 500 gain                      |          |
| Dimensions                                 | 180 mm $\times$ 105 mm $\times$ 65 mm    |          |
| Low Noise Bandpass Filter                  | Central Frequency                        | 2.95 kHz |
|  | 3 dB Band Width                          | 200 Hz   |
|  | 20 dB Band Width                         | 7.83 kHz |