Section II: Digikröm™
Monochromators and Spectrographs

**MONOCHROMATORS**

**CM 110**
Compact 1/8 Meter Computer-Controlled

**CM 112**
Compact 1/8 Meter Computer-Controlled Double

*Standard Ruled Gratings for CM Series*
CM Series Options and Accessories

**DK240**
1/4 Meter Computer-Controlled

**DK242**
1/4 Meter Computer-Controlled Double

**DK480**
1/2 Meter Computer-Controlled

*Standard Ruled Gratings for DK Series*
DK Series Options and Accessories

**SPECTROGRAPHS**

**CMSP 110**
1/8 Meter Computer-Controlled

**CMSP 112**
1/8 Meter Computer-Controlled Double

**DKSP240**
1/4 Meter Computer-Controlled

**DKSP240-I**
1/4 Meter Computer-Controlled Imaging

**DKSP242**
1/4 Meter Computer-Controlled Double

**DKSP242-I**
1/4 Meter Computer-Controlled Imaging Double

**DKSP480**
1/2 Meter Computer-Controlled

**DKSP480-I**
1/2 Meter Computer-Controlled Imaging
Digikröm CM 110
Compact 1/8 Meter Computer-Controlled
Monochromator/Spectrograph

- Compact size - Only
  5¼"x3¼"x3¼"

- Connects to any computer via standard RS232 interface.

- Double grating turret allows for a broad spectral range coverage.

- May be factory configured as a monochromator or a spectrograph.

- Yields average efficiency TRIPLE that of a concave holographic grating monochromator/spectrograph.

- Scans in both directions and in nanometers, Ångstroms, microns, wave-numbers, or eV.

- Change slits on the fly.

- Monochromator may be factory configured for right angle or straight through beam path.

- Suitable for fluorescence, radiometry, process control, colorimetry, tunable filtering, Raman spectroscopy, among others.

The Leader: Price, Performance, Versatility

Single piece base construction, direct grating drive, and anit-backlash gearing ensure this unit is rugged and stable enough for demanding applications. Loaded with SP Optics and able to hold two high quality gratings, the CM 110 is ideal for spectrometry in the UV to IR spectrums. Each instrument is calibrated and certified prior to delivery and comes with easy-to-use software.
Specifications:

Design: Czerny-Turner, dual-grating turrets
Focal Length: 110mm
f/#: 3.9
Beam Path: Straight Through standard, Right Angle provided on request.
Wavelength Drive: Worm and wheel with microprocessor control and anti-backlash gearing. Bi-directional. Usable in positive or negative grating orders.
Wavelength Precision: 0.2nm
Wavelength Accuracy: ± 0.6nm over grating 30% range
Slew Speed: > 100nm/second
Stray Light: < 10^-5
Slits: Standard Set includes; 0.125mm, 0.15mm, 0.30mm, 0.6mm, 1.2mm and 2.4mm x 4.0mm. For other sizes, consult SP.
Max Resolution: < 1nm w/1200G/mm grating and standard slits

Gratings: One to two gratings (30 x 30mm) must be purchased. See Appendix A for options.
Software: Demonstration control program and LabView driver included.
Power: UL listed 110/220V power pack
Interface: RS232 standard (DK12AT)
Warranty: One year
Options:

- Hand-held control module with function keys and display for local control
- IEEE-488 interface
- Gold optics

See options and accessories

Ordering Information: Please indicate product number plus description when ordering.

CM110 Dual Grating Turret, 1/8 meter Monochromator
CMSP110 Dual Grating Turret, 1/8 meter Spectrograph
Digikröm CM 112
Compact 1/8 Meter Computer-Controlled Double Monochromator/Spectrograph

- Compact size - Only 5¼"x6¼"x3¼"
- Connects to any computer via RS232.
- Scans in both directions. Programmable in angstroms, nanometers, microns, wavenumbers, or eV.
- Dual double-grating turrets with automatic grating change allows for broad spectral range coverage.
- Subtractive dispersion mode minimizes image distortion and pulse spread, with sub-picosecond residual broadening versus nanosecond pulse broadening of regular monochromators.
- Additive mode gives increased dispersion and low stray light for Raman and fluorescence studies.
- May be configured as a monochromator or a spectrograph.
- Monochromator may be factory configured for right angle or straight through beam path.

The Digikröm CM 112: Much More than a Monochromator

The CM 112 is two single monochromators in series. The exit slit of the first monochromator is the entrance slit of the second. The two monochromators act as a double filter with the rejection of stray light being almost the square of the single monochromator value.

The CM 112 may be factory configured as an additive or subtractive dispersion double monochromator. As an additive instrument, the first grating spreads the spectrum over an angular range; the second grating then doubles this dispersion. The result is twice the resolution of a single 1/8 meter monochromator. As a subtractive instrument, the first monochromator selects a bandpass, the second monochromator then removes the temporal and angular aberrations introduced by the angular spectral dispersion in the first monochromator.

The CM 112 offers a solution to practical problems in monochromatic imaging. Selecting a monochromatic image with an ordinary monochromator fails because multiple wavelengths in the bandpass create multiple, overlapping images. In the CM 112, the second subtractive monochromator recombines these multiple images, creating a clear image.

Finally, the CM 112 is a unique solution to practical problems in the spectroscopy of pulsed sources. An ordinary monochromator has a spread in the internal optical path lengths that will introduce a 25 to 100 picosecond broadening in light pulses that are passed through the monochromator. In the subtractive dispersion CM 112, the second monochromator equalizes the optical path lengths so that broadening is reduced to a minimum.
**Specifications:**

**Design:** Double cascaded Czerny-Turner. Double-grating turrets standard in each section.

**Focal Length:** 110mm each section.

**f/#:** 3.9 overall

**Beam Path:** Right angle or straight through.

**Wavelength Drive:** Dual worm and wheel with electronic synchronization and computer control.

**Wavelength Precision:**

<table>
<thead>
<tr>
<th>Additive</th>
<th>Subtractive</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2nm</td>
<td>0.2nm</td>
</tr>
</tbody>
</table>

**Wavelength Accuracy:** ± 0.6nm ± 0.6nm

**Max Resolution:** < 0.5nm < 1nm

**Bandpass:** with standard slits 0.25nm 0.50nm

**Slew Speed:** > 100nm/second

**Stray Light:** < 10^-9

**Slits:** Standard Set includes: 0.125mm, 0.15mm, 0.30mm, 0.6mm, 1.2mm and 2.4mm x 4.0mm. For other sizes, consult SP.

**Gratings:** Two or four gratings (30 x 30mm) must be purchased. See Appendix A for options

**Software:** Demonstration control program and LabView driver included.

**Power:** UL listed 110/220V power pack

**Interface:** RS232 standard (DK12AT)

**Warranty:** One year

**Options:**
- Hand-held control module with function keys and display for local control
- IEEE-488 interface
- Gold optics

See options and accessories

**Ordering Information:** Please indicate product number plus description when ordering.

**CM112**
- Dual Grating Turret,
- 1/8 meter Double Monochromator
- Specify additive or subtractive mode.

**CMSP112**
- Dual Grating Turret,
- 1/8 meter Double Spectrograph
- Specify additive or subtractive mode.
## Standard Ruled Gratings

Size = 30 x 30 mm

<table>
<thead>
<tr>
<th>SP Part #</th>
<th>Ruling (g/mm)</th>
<th>Peak (nm)</th>
<th>Range (nm) @ &gt; 30% T</th>
<th>Peak %T</th>
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<tbody>
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<td>AG2400-00240-303</td>
<td>2400</td>
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<td>350 - 1300</td>
<td>80</td>
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<td>310 - 1100</td>
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<td>1500 - 6000</td>
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<td>500</td>
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<td>8000</td>
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<td>AG0045-01750-303</td>
<td>45</td>
<td>1750</td>
<td>1200-2500</td>
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</tbody>
</table>

See Appendix A for grating efficiency curves

NOTE: Ruled gratings blazed at different wavelengths and Holographic gratings are available on request - call for prices and availability. Response curves also available upon request.

**AG-303-KIT**

Backplate mounting kit, required for user installation of CM gratings.
**CM series Options and Accessories**

**DK1200**
Hand-held control module, 2 line x 20 character LCD display. Allows local operation of CM110/112 monochromators and CMSP110/112 spectrographs.

**CM GPIB**
IEEE-488/GPIB option for parallel interface operation of CM110/112 monochromators and AB300 Series automatic filter wheels.

**CM GPIB-220V** (220Vac input)
IEEE-488/GPIB option for parallel interface operation of CM110/112 monochromators and AB300 Series automatic filter wheels.

**CM SP-TO-CM**
Attachment to allow CMSP Spectrograph to operate as a monochrometor.

**AB200**
Single filter carrier that mounts directly between CM unit and accessories.

**IR110**
For use with CM110. Infrared (gold) coatings on CM110 mirrors. Enhances transmission by up to 40% between 600 and 1100 nm. *Not suitable for work below 600nm.*

**IR110SP**
Same as above, for use with CMSP110.

**IR112**
For use with CM112. Infrared (gold) coatings on CM112 mirrors. Enhances transmission by up to 80% between 600 and 1100 nm.

**IR112SP**
Same as above, for use with CMSP112.

**DK12AT**
RS232 Cable for AT style computer

**DK12PS**
RS232 Cable for PS2 style computer

**DK12MA**
RS232 Cable for MAC style computer

**Special Slit Sizes**
- DKFS010 Pair, 10µm slits
- DKFS020 Pair, 20µm slits
- DKFS025 Pair, 25µm slits
- DKFS050 Pair, 50µm slits
**Digikröm DK240**

1/4 Meter Computer-Controlled Monochromator/Spectrograph

- Connects to any computer via RS232 or IEEE-488.
- Motorized slits.
- Triple-grating turret allows high efficiency scanning across a broad spectral range.
- May be factory configured as a monochromator or spectrograph.
- Scans in both directions and with Constant Spectral Resolution (CSR).
- Integrates with SP filter wheel for automatic filter switching.
- Suitable for fluorescence and absorption studies, detector characterization, thin film measurements, etc.

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**The Workhorse: Direct Digital Drive/Constant Spectral Resolution**

The Digikrom DK240 is a complete computer integrated solution. Easy to use commands control the triple grating turret, motorized slits, and optional motorized filter wheel for quick and easy sorting. Instrument mode can be set for constant spectral resolution (CSR), where the slit width is automatically modified to compensate in the change in dispersion with wavelength to maintain constant spectral bandpass.

Rugged cast construction, A-thermal design, and SP direct grating drive make this unit the most repeatable and reliable in its class. Each instrument is calibrated and certified prior to delivery.

For DK240 models, for a full list of gratings see Appendix A

<table>
<thead>
<tr>
<th>Grating groove/mm</th>
<th>Wavelength (nm)</th>
<th>Dispersion nm/mm</th>
<th>Resolution* (nm)/slit 0.01mm</th>
<th>Resolution* (nm)/slit 0.125mm</th>
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<td>1200</td>
<td>200</td>
<td>3.5</td>
<td>0.1</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>800</td>
<td>3.3</td>
<td>0.1</td>
<td>0.4</td>
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<td></td>
<td>1500</td>
<td>1.9</td>
<td>&lt;0.1</td>
<td>0.2</td>
</tr>
<tr>
<td>600</td>
<td>200</td>
<td>6.9</td>
<td>0.2</td>
<td>0.9</td>
</tr>
<tr>
<td></td>
<td>1500</td>
<td>6.6</td>
<td>0.2</td>
<td>0.9</td>
</tr>
<tr>
<td></td>
<td>3000</td>
<td>3.8</td>
<td>0.1</td>
<td>0.5</td>
</tr>
<tr>
<td>150</td>
<td>200</td>
<td>27.5</td>
<td>0.8</td>
<td>4</td>
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<td>5000</td>
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</tr>
<tr>
<td></td>
<td>10000</td>
<td>21.2</td>
<td>0.6</td>
<td>3</td>
</tr>
</tbody>
</table>

* approximately equivalent to bandpass

rev 8/03
Specifications:

**Design:** Czerny-Turner.
Triple-grating turret standard.

**Focal Length:** 240mm

**f/#:** 3.9

**Wavelength Drive:** Worm and wheel with computer control. Bidirectional.

**Wavelength Precision and Reproducibility:** 0.01nm (with 1200 g/mm grating)

**Wavelength Accuracy:** ± 0.30nm standard (with 1200 g/mm grating)

**Scan Speed:** 1 to 1200nm/minute (with 1200 g/mm grating)

**Stray Light:** < 0.01% at 220nm (NaI)

**Slits:** Unilateral, computer controlled, curved entrance and straight exit standard.
  - Width - 10µm to 3000µm
  - Height - 2µm to 20µm

**Reciprocal Dispersion:** 3.2nm/mm (with 1200 g/mm grating)

**Max Resolution:** 0.06nm (with 1200 g/mm grating)

**Gratings:** One to three gratings (68 x 68mm standard, 68 x 84mm optional) must be purchased. See Appendix A for options.

**Software:** Demonstration control program and LabView driver included.

**Power:** 100 - 240V, 50/60Hz, 60W

**Interface:** RS232 standard (DK24AT)

**Weight:** 35 lbs.

**Warranty:** One year

**Options:**
- DKBS - Bi-lateral slits
- DKGPIB - IEEE-488 communication interface (internal)
- DK2400 - Hand-held controller for local control
- IR240 - Gold optics
- DKPURGE - Purge port

See options and accessories.

**Ordering Information:** Please indicate product number plus description when ordering.

- **DK240** 1/4 meter Monochromator
- **DKSP240** 1/4 meter Spectrograph w/flat field and fine focus adjustment
- **DKSP240I** Imaging 1/4 meter Spectrograph

Dimensions in inches.

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* rev 8/03
Digikröm DK242
1/4 Meter Computer-Controlled Double Monochromator/Spectrograph

- Internal controller connects to any computer via RS232 or IEEE-488. Hands-off control of three slit assemblies and two grating turrets.

- Scans in both directions and with Constant Spectral Resolution (CSR).

- Triple-grating turrets allows high efficiency scanning across a broad spectral range.

- Additive dispersion increases resolution and reduces stray light for Raman and fluorescence studies. Subtractive dispersion minimizes broadening of pulse sources.

- Integrates with SP filter wheel for automatic filter switching.

- May be factory configured as a monochromator or spectrograph.

The Pioneer: Better Resolution, Stray Light Control

The DK242 is two cascaded monochromators, with the exit slit of the first monochromator functioning as the entrance slit of the second. This instrument may be factory configured to operate as either an additive or subtractive dispersion double monochromator. In both modes, the two monochromators act as a double filter with the rejection of stray light being nearly the square of the single monochromator value. In the additive dispersion mode, the DK242 is the equivalent of a half-meter monochromator, but permits greater reduction of stray light. The first grating spreads the spectrum over an angular range; the second grating then doubles this dispersion. The result is twice the resolution of a single 1/4-meter monochromator. In subtractive dispersion mode the first monochromator selects a bandpass. The second monochromator then removes the temporal and angular aberrations introduced by the angular spectral dispersion in the first monochromator.

The DK242 offers a unique solution to practical problems in the spectroscopy of pulsed sources. For example, an ordinary monochromator will introduce up to 250 pico second broadening in light pulses that are passed through the monochromator. Operated in the subtractive dispersion mode, the DK242 reduces this broadening to almost zero because the second monochromator equalizes the optical path length of the first.

The DK242 is also a unique solution to the practical problems of Raman spectroscopy because the high stray light rejection of the two monochromators allows observation close to the laser line. CVI's unique CSR scanning technology also improves efficiency in the red and near IR while maintaining resolution. (In the CSR mode, the monochromator's change in dispersion with wavelength is compensated by a change in slit widths while bandpass remains constant. Intensity improvement up to 4x can occur).
Specifications:

**Design:** Double cascaded Czerny-Turner. Triple-grating turrets standard in each section. Double-grating turret optional.

**Focal Length:** 240mm each section

**f/#:** 3.9 overall

**Wavelength Drive:** Dual worm and wheel with electronic synchronization and computer control. Programmable in additive or subtractive dispersion.

**Scan Speed:** > 1 to 1200nm/minute (with 1200 g/mm grating)

**Stray Light:** < 10^-9

**Slits:** Unilateral, computer controlled, Width - 10µm to 3000µm

**Gratings:** Two to six gratings (68 x 68mm standard, 68 x 84mm optional) must be purchased. See Appendix A for options.

**Wavelength Precision:**
- **Additive:** 0.01nm
- **Subtractive:** 0.01nm

**Wavelength Accuracy:**
- **Additive:** ± 0.03nm
- **Subtractive:** ± 0.03nm

**Reciprocal Dispersion:** 1.60nm/mm (with 1200 g/mm grating)

**Max Resolution:**
- **Additive:** 0.04nm
- **Subtractive:** 0.06nm

**Pulse Broadening:**
- 200 ps max
- 10 fs max

**Interface:** RS232 standard.

**Warranty:** One year

**Options:**
- **DK24M S** - Increased precision (microstep) option now standard
- **DKBS** - Bi-lateral slits
- **DKGPIB** - IEEE-488 communication interface (internal)
- **DK2400** - Hand-held controller for local control
- **IR240** - Gold optics

See options and accessories

**Ordering Information:** Please indicate product number plus description when ordering.

<table>
<thead>
<tr>
<th>Product Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DK242</strong></td>
<td>Triple Grating Turret, Double 1/4 meter Monochromator</td>
</tr>
<tr>
<td><strong>DKSP242</strong></td>
<td>Triple Grating Turret, Double 1/4 meter Spectrograph</td>
</tr>
<tr>
<td><strong>DKSP242I</strong></td>
<td>Triple Grating Turret, Imaging Double 1/4 meter Spectrograph</td>
</tr>
</tbody>
</table>

**Software:** Demonstration control program and LabView driver included.

**Power:**
- 110 / 120V, 50/60Hz @ 1A standard.
- 220/230/240V, 50/60Hz @ 0.5A optional.

**Interface:** RS232 standard (DK24AT)
Digikröm DK480
1/2 Meter Computer-Controlled
Monochromator/Spectrograph

- Connects to any computer via RS232 or IEEE-488.
- Motorized slits.
- Triple-grating turret allows high efficiency scanning across a broad spectral range.
- May be factory configured as a monochromator or spectrograph.
- Scans in both directions and with Constant Spectral Resolution (CSR).
- Integrates with SP filter wheel for automatic filter switching.
- Suitable for fluorescence and absorption studies, detector characterization, thin film measurements, etc.

Wavelength Selection is No Longer Expensive

The Digikrom DK480 is a complete computer integrated solution. Easy to use commands control the triple grating turret, motorized slits, and optional motorized filter wheel for quick and easy sorting. Instrument mode can be set for constant spectral resolution (CSR), where the slit width is automatically modified to compensate in the change in dispersion with wavelength to maintain constant spectral bandpass.

Rugged cast construction, A-thermal design, and SP direct grating drive make this unit the most repeatable and reliable in its class. Each instrument is calibrated and certified prior to delivery.

For DK480 models, for a full list of gratings see Appendix A

<table>
<thead>
<tr>
<th>Grating groove/mm</th>
<th>Wavelength (nm)</th>
<th>Dispersion nm/mm</th>
<th>Resolution* (nm)/slit 0.01mm</th>
<th>Resolution* (nm)/slit 0.125mm</th>
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<tbody>
<tr>
<td>1200</td>
<td>200</td>
<td>3.5</td>
<td>0.05</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td>800</td>
<td>3.3</td>
<td>0.05</td>
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<td></td>
<td>1500</td>
<td>1.9</td>
<td>&lt;0.05</td>
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<tr>
<td>600</td>
<td>200</td>
<td>6.9</td>
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<td>10000</td>
<td>21.2</td>
<td>0.3</td>
<td>1</td>
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</table>

* approximately equivalent to bandpass
Specifications:

**Design:** Czerny-Turner
   Triple-grating turret standard

**Focal Length:** 480mm

**f/#:** 7.8

**Wavelength Drive:** Worm and wheel with computer control. Bidirectional.

**Wavelength Precision and Reproducibility:**
   0.01nm standard
   (with 1200 g/mm grating)

**Wavelength Accuracy:** ± 0.3nm standard
   (with 1200 g/mm grating)

**Scan Speed:**
   1 to 1200 nm/minute
   (with 1200 g/mm grating)

**Stray Light:** < 0.01% at 220nm (NaI)

**Slits:**
   Unilateral, computer controlled,
   curved entrance and straight exit standard.
   Width - 10µm to 3000µm
   Height - 2µm to 20µm

**Reciprocal Dispersion:** 1.60nm/mm
   (with 1200 g/mm grating)

**Max Resolution:** 0.03nm
   (with 1200 g/mm grating)

**Gratings:**
   One to three gratings
   (68 x 68mm standard,
   68 x 84mm optional)
   must be purchased.
   See Appendix A for options.

**Software:**
   Demonstration control program and LabView driver included.

**Power:**
   100 - 240V, 50/60Hz, 60W

**Interface:**
   RS232 standard (DK24AT)

**Weight:**
   45 lbs.

**Warranty:**
   One year

**Options:**
   - DKBS - Bi-lateral slits
   - DKGPIB - IEEE-488 communication interface (internal)
   - DK2400 - Hand-held controller for local control
   - IR480 - Gold optics
   - DK2PORT - Bifurcated fiber bundle for attaching 2 devices to 1 port.
   - AB300 - Automated 6 position filter wheel

See options and accessories

**Ordering Information:**
Please indicate product number plus description when ordering.

- **DK480** 1/2 meter Monochromator
- **DKSP480** 1/2 meter Spectrograph w/flat field and fine focus adjustment
- **DKSP480I** Imaging 1/2 meter Spectrograph
# Standard Ruled Gratings
for installation in Digikröm DK series
Monochromators/Spectrographs

## Standard Ruled Gratings
Size = 68 x 68 mm

<table>
<thead>
<tr>
<th>SP Part #</th>
<th>Ruling (g/mm)</th>
<th>Peak (nm)</th>
<th>Range (nm) @ &gt; 30% T</th>
<th>Peak %T</th>
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<tbody>
<tr>
<td>AG2400-00240-686</td>
<td>2400</td>
<td>240</td>
<td>180 - 680</td>
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</table>

See Appendix A for grating efficiency curves

**NOTE:** Ruled gratings blazed at different wavelengths and Holographic gratings are available on request - call for prices and availability. Wide gratings (68 x 84mm) are available at 40% above list price, add "W" at the end of the part number. Response curves also available on request.

**AG-686-KIT**
Backplate mounting kit, required for user installation of DK gratings.
DK Series Options and Accessories

**DK2400**
Hand-held monochromator controller for DK240/242/480. Allows local control of monochromator when computer is not available or in series with a computer.

**DK24AT**
RS232 Cable assembly for AT style computer. Standard with all Digikroms.

**DK24PS**
RS232 Cable assembly for PS/2 style computer.

**DK24MA**
RS232 Cable assembly for MAC style computer.

**DK24IC**
IEEE-488/GPIB universal cable assembly.

**DKBS**
Bi-lateral slit option for DK240/242/480. Both sides of slits are automatically controlled for maintaining image centering when wider slits are necessary (tolerance ± 10µm).

**DKGPIB**
Internal IEEE-488/GPIB communication interface option for DK240/242/480. Separate output connector from Monochromator.

**IR240**
For use with DK240. Infrared (gold) coatings on optics for DK240. Enhances transmission by up to 40% between 600-1100nm.
*Not suitable for work below 600nm.*

**IR240SP**
Same as above, for use with DKSP240.

**IR242**
For use with DK242. Infrared (gold) coatings on optics for DK242. Enhances transmission by up to 80% between 600-1100nm.

**IR242SP**
Same as above, for use with DKSP242.

**IR480**
For use with DK480. Infrared (gold) coatings on optics for DK480. Enhances transmission by up to 40% between 600-1100nm.

**IR480SP**
Same as above, for use with DKSP480.

**AB300-T**
Six position, 1" diameter automatic filter wheel assembly that bolts directly to DK entrance or exit slits. Receives power and commands directly through DK unit. See page 85 for more information.

**AB200**
Single filter carrier that mounts directly between DK unit and accessories.