Confocal Scanner Unit

CSU-W1

Wide and Clear

Confocal scanner unit CSU has evolved!

Advantages of the Evolution

Wide and Clear

Confocal Scanner Unit, CSU series, have been improved from the original CSU10 to the most recent CSU-X1, which are widely recognized as the de facto standard tool for live cell imaging, due to fast scanning and low photo-bleaching capability.

CSU-W1 is our answer to the researchers’ request for “Wider FOV” and “Clearer Images”.

Wide

Widest FOV confocal! Provides 4 times wider FOV than the conventional model.

Clear

Newly designed disk unit offers much improved image quality.

Due to significantly reduced pinhole crosstalk, CSU-W1 enables clear observation much deeper into thick samples.

Points of the Evolution

Original and Flexible

Original

Newly designed disk unit to achieve wider FOV and much improved image quality

Large diameter disks

The large diameter disks offer 4 times wider FOV to compare with our conventional model. This wide FOV matches with most advanced wide-field cameras.

Newly designed pinhole (Nipkow) disk

Wider inter-pinhole distance for the CSU-W1 offers considerably reduced pinhole crosstalk and thus provides clearer images.

Flexible

Flexible selectably functions to meet versatile applications

New bright field path (Default)

New mechanism to move the disks out of the light path allows much easier projection of confocal and non-confocal images such as phase contrast.

High confocality pinhole (Optional Component)

In addition to our conventional 50µm pinhole size, 25µm pinhole size with higher confocality is available.

You can select either one or both pinhole size, with easy-to-use motorized disk exchange mechanism.

Simultaneous dual color imaging mechanisms (T2 and T3 Models)

CSU-W1 offers single camera split-view model, in addition to the dual camera model which are much improved from those for the CSU-X1. Thanks to the wide FOV, even the split-view offers 2 times wider image area than with older model. By using various dichroic mirrors, it is possible to select various dye-combinations for dual-color imaging** with both the two camera model and split-view model.

**Appropriate excitation lasers are necessary to utilize each dichroic mirror.
Image gallery -Wide-

Wide FOV without compromising the resolution offers most effective long-term observation of various biological events in a large tissue or many cells.

Early stage mouse embryo

Zebra fish embryo

By courtesy of Kazuo Yamagata, Ph.D., Center for Genetic Analysis of Biological Responses, The Research Institute for Microbial Diseases, Osaka University (Present post: Department of Genetic Engineering, Faculty of Biology-Oriented Science and Technology, Kanazawa University)

By courtesy of Makoto Suzuki, Ph.D. and Naoto Ueno, Ph.D., Division of Morphogenesis, National Institute of Basic Biology
Image gallery

- Clear -

Most suitable for clear and thorough imaging of thick specimen, even tissues or small animal body, for a long time. Selection of the optimal pinhole disk provides high level of confocality at both high and low magnification to give most detailed 3D reconstructions of live specimen.

Brain slice of mouse fetus

Left: 3D reconstructed slice (partial)
Right: 3D reconstructed image of whole slice
Fluorescent probe: GFP (Excitation: 488nm)
RFP (Excitation: 561nm)
Pinhole: 35µm
Objective lens: 60x water LWD
Z-sections/stack: 29.5µm (0.5µm/600sec)

Excerpts (10 minutes’ interval)
From Time lapse(MP)
Fluorescent probes: GFP (Excitation: 488nm)
RFP (Excitation: 561nm)
Pinhole: 35µm
Objective lens: 60x water LWD
Z-sections/stack: 13µm (0.3µm/100sec)
Total time: 2 hours (Interval: 1min)

By courtesy of Atsumi Shitamuku, Ph.D., Laboratory for Cell Asymmetry, Center for Developmental Biology, RIKEN

Ocular cup organ regenerated from mouse ES cells

Left: 3D image
Upper right: MP
Lower right: Y2 plane
Fluorescent probe: Cy3 (Excitation: 640nm)
Pinhole: 25µm
Objective lens: 20x dry
Z-sections/stack: 100µm (2µm/51sec)

By courtesy of Mototsugu Inoue, Ph.D., and Yukio Hasegawa, Ph.D., Sasaki Lab, Organogenesis Neurogenesis group, Center for Developmental Biology, RIKEN

(Present post: Laboratory for in vitro Histogenesis, Center for Developmental Biology, RIKEN)

ES cell colony

Left: 3D image
Right: MP
Fluorescent probe:
GFP (Excitation: 488nm)
RFP (Excitation: 561nm)
Pinhole: 50µm
Objective lens: 60x oil
Z-sections/stack: 50µm (1µm/51sec)

By courtesy of Nozomu Takata, Ph.D., Sasaki Lab, Organogenesis Neurogenesis group, Center for Developmental Biology, RIKEN

(Present post: Laboratory for in vitro Histogenesis, Center for Developmental Biology, RIKEN)
CSU-W1 offers selection from a total of three basic configurations, two pinhole sizes, options for near infrared observation and an external light path which is useful for versatile applications such as photo bleaching, while bright field light path is now a standard feature. All switching mechanisms in the CSU-W1 are fully motorized and thus ready for automated experiments.

**Basic Configurations**

CSU-W1 provides a total of three basic configurations for multi-color imaging: 1) Sequential imaging with one camera and a filter wheel, 2) Simultaneous two-color imaging with two cameras, and 3) Split-view two color imaging with one camera shared by 2 optical paths. All features are upgradeable after installation.

<table>
<thead>
<tr>
<th>Filter</th>
<th>Option</th>
<th>1 Camera model</th>
<th>2 Camera model</th>
<th>Split-view model</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIR port</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>External light path</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>Variable aperture</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>Camera port lens</td>
<td>Selectable from 0.83x, 1x</td>
<td>Selectable from 0.83x, 1x (1st camera)</td>
<td>Selectable from 0.83x, 1x (2nd camera)</td>
<td></td>
</tr>
<tr>
<td>Additional lens to Lens switcher</td>
<td>Selectable from 0.83x, 1x, 2x</td>
<td>Selectable from 0.83x, 1x, 2x</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*1 1 Camera model, 2 Camera model

**Option**

- **Near Infrared (NIR) Port**
  NIR port provides up to 785nm excitation capability to allow less-invasive deep imaging. The NIR laser is introduced via a dedicated optical fiber in the same way as visible lasers. It is possible to combine NIR and visible lasers within the CSU-W1 unit to allow simultaneous excitation.

- **External light path**
  External light path provides the direct path bypassing the disks to microscope. Versatile applications such as photo activation are available by introducing an external light scanner through this port.

- **Lens switcher**
  Newly designed motorized lens switcher between 2 relay lenses is useful for fitting CSU-W1 image size with various camera types, and also for easy magnification change without exchanging objective lenses.

- **Variable aperture**
  Variable aperture to change laser illumination area, and thus the imaging area by the CSU-W1, is useful to minimize laser damages in the specimen.

Spectral curve example of filter combination
**System configuration**

**2 Camera model, 1 Camera model**

- **Camera port**
  - Selectable from 0.3x or 1x
- **Lens mount**
  - Selectable from 0.3x, 1x or 2x
- **Filter wheel**
  - Max 10 EM filters, Easily exchangeable
- **2nd Filter wheel**
  - Selectable from 0.3x or 1x
- **Image splitting dichroic mirror**
  - Selectable from 25 particle disk, 50 particle disk or double disk
- **Variable aperture**
  - Selectable from 0.3x or 1x
- **Dichroic mirror block**
  - Max 3 dichroic mirrors, Easily exchangeable
- **Microscope adapter**
- **Near Infrared (NIR) Port**
  - [Option]
- **External light path**
  - [Option]
- **Light source**
  - Fiber
- **Power unit**

**Split-view model**

- **Camera port**
  - Selectable from 0.3x or 1x
- **Image splitting dichroic mirror**
  - Max 5 filters, Easily exchangeable
- **Filter wheel**
  - Selectable from 25 particle disk, 50 particle disk or double disk
- **Disk unit**
- **Light source**
- **Fiber**
- **Microscope adapter**
- **Near Infrared (NIR) Port**
  - [Option]
- **External light path**
  - [Option]
- **Dichroic mirror block**
  - Max 3 dichroic mirrors, Easily exchangeable

**Microscope setup**

- Zeiss Axio Observer
- Nikon ECLIPSE T2
- Olympus IX83
- Leica DM8

**External Dimensions**

- **1 Camera model (T1)**
- **2 Camera model (T2)**
- **Split-view model (T3)**

Unit: mm

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*1 2 Camera model  *2 2 Camera model and Split-view model
*3 1 Camera model and 2 Camera model
## General Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>1 camera model (T1)</th>
<th>2 camera model (T2)</th>
<th>Split-view model (T3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confocal scanning method</td>
<td>Microlens-enhanced Nipkow disk scanning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spinning speed</td>
<td>1,500rpm ~ 4,000rpm (75fps ~ 200fps)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>External synchronization</td>
<td>Scan-speed synchronization through pulse signals input/output: TTL level 300Hz up to 800Hz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disk unit</td>
<td>Selectable up to 2 disks from pinhole size 50μm and 25μm: Motorized switching</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bright field</td>
<td>Motorized switching between confocal and brightfield</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effective FOV</td>
<td>17 × 16mm [Option] Variable aperture</td>
<td>17 × 16mm adjustable in longer side</td>
<td></td>
</tr>
<tr>
<td>Excitation wavelength</td>
<td>405nm ~ 785nm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laser introduction</td>
<td>Yokogawa’s standard fiber⁴, Beam shaping optics VIS port (405 ~ 647nm) [Option] NIR port (685 ~ 785nm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excitation shutter</td>
<td>Built-in shutter, Opening and shutting time: 30msec or less, Opening and shutting cycle: 10Hz or less</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observation wavelength</td>
<td>420nm ~ 850nm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dichroic mirror switching</td>
<td>Motorized switching 3-position (Dichroic mirror block can be exchanged)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emission filter wheel</td>
<td>10-position filter wheel</td>
<td>6-position filter wheel</td>
<td></td>
</tr>
<tr>
<td>Filter size</td>
<td>φ 25mm</td>
<td>φ 25mm</td>
<td></td>
</tr>
<tr>
<td>Switching speed</td>
<td>100msec max. (Standard mode)</td>
<td>40msec max. (High speed mode)</td>
<td>100msec max.</td>
</tr>
<tr>
<td>Camera port</td>
<td>C mount, selectable from 0.83x or 1x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lens switcher</td>
<td>[Option] Motorized switching, 2-position selectable from 0.83x, 1x or 2x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>External light path</td>
<td>[Option] Port for external scanner</td>
<td></td>
<td></td>
</tr>
<tr>
<td>External control</td>
<td>RS-232C (CSU-X1 command upper compatible)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating environment</td>
<td>15 ~ 35°C, 20 ~ 75% No condensation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power</td>
<td>Input: 100 ~ 240 VAC ±10%, 50 / 60Hz, Power consumption: 250VA max</td>
<td></td>
<td></td>
</tr>
<tr>
<td>External dimensions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main unit</td>
<td>480(W) × 327(L) × 252(H) mm</td>
<td>480(W) × 476(L) × 252(H) mm</td>
<td>425(W) × 374(L) × 252(H) mm</td>
</tr>
<tr>
<td>Power unit</td>
<td>213(W) × 438(L) × 132(H) mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>Main unit 17kg</td>
<td>20.5kg</td>
<td>18kg</td>
</tr>
<tr>
<td></td>
<td>Power unit 5kg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Microscope connection</td>
<td>Yokogawa original specific adapter for Olympus IX series, Nikon ECLIPSE Ti series, Zeiss Axio Observer and Leica DM68.⁴²</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*¹ Each CSU-W1 head is optimized with its fiber at factory. Please inquire about fiber exchange if necessary.
*² Some microscopes/options could limit the FOV of CSU-W1 or connection with CSU-W1, please inquire.

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**Safety Precautions**

- Read the user’s manual carefully in order to use the instrument correctly and safely.
- If used in combination with a laser light source, this product falls under the category of class 3B laser products. Do not look directly into the beam and avoid touching it or any other direct exposure to it.

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