



FLEXCELL[®] INTERNATIONAL CORPORATION

Biotechnology Products for Cellular Biomechanics

FX-4000[™] Flexercell[®] Tension Plus[™] Specifications and Sole Source Statement

The purpose of the following information is to provide you with data describing our FX-4000[™] Flexcell[®] Tension Plus[™] System and Tissue Train[™] System. These systems are composed of scientific instrumentation designed to provide a mechanically active environment for the purpose of cell culture and tissue engineering research. This specialized equipment incorporates proprietary technology and is protected by both United States and International patents. Flexcell International Corporation is the sole source for this equipment.

FX-4000[™] Flexcell[®] Tension Plus[™] & Tissue Train[®] System Specifications

FX-4000T[™] System Features

- Uses vacuum to deform a flexible-bottom culture plate yielding up to 30% substrate elongation
- Minimum strain resolution capability is 0.1% elongation
- Applies a defined, controlled, static, or cyclic deformation to growing cells *in vitro*
- Housed valving mechanism automatically regulates and maintains pressure to provide the specified strain regimen
- Capable of driving up to 4 independent FlexLink[®] remote strain and/or compression controllers
- Capable of delivering frequency ranges from 0.1→5Hz
- Capable of delivering single cycle strain rates as high as 6.9s⁻¹, and infinitely small creep strains, using a series of incrementally changing static waves
- Capable of delivering multi-cyclic strain rates ranging from 0.2→10s⁻¹ using the ½ sine, sine, triangle or square cyclic waveforms
- Works Only with BioFlex[®], Tissue Train[™], UniFlex[™] and Flex I[®] series culture plates
- Able to program multiple frequency, amplitude, and wave changes in one regimen
- Waveforms available: Static wave, sinusoidal wave, heart wave (electronic and pressure), triangular wave, square wave, and custom waveform templates
- Provides equibiaxial strain or unconstrained distension to the BioFlex[®] culture plate membrane
- Optional Tissue Train[™] System and UniFlex[™] can be used in conjunction with Arctangle[™] Loading Stations[™] to achieve uniaxial strain
- Optional StageFlexer[®] device allows strain application to cells while viewing in real time under an upright microscope
- Optional FlexStop[™] provides a way to prevent pressure-induced flexing of any number of BioFlex[®] wells

Culturing Cells in a Mechanically Active Environment

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FX-4000™ Components and Specifications

- FX-4000™ FlexCentral® system CPU
- PS/2 Keyboard
- PS/2 Mouse
- Flat Panel monitor
- FX-4000™ Software, FlexSoft® V5.0, Microsoft Vista
- FlexLink® controller
- Accessory Pack - nuts, ferrules
- Flexercell® vacuum pressure baseplate, gaskets, and acrylic window for BioFlex® culture plates
- BioFlex® 25mm diameter Loading Stations™ and Lubricant
- Water trap
- System Drying filter
- Vacuum inlet and outlet tubing
- Flexercell® FX-4000™ Tension Plus™ Operator's Manual, other ancillary manuals for computer and monitor
- Surge protected power outlet strip

Tissue Train™ Accessory Kit (Optional)

(Note: If purchased as a system, Tissue Train™ Accessory Kit is substituted for the Flexercell® vacuum pressure baseplate, gaskets, and acrylic window for BioFlex® culture plates and BioFlex® Loading Stations™)

- Flexercell® vacuum pressure baseplate, gaskets, and acrylic window for Tissue Train™ culture plates
- Arctangle™ Loading Stations™ and Lubricant
- Trough Loader™ Loading Stations™

FX-4000™ CPU Specifications

- case
- Pentium® 4 2.4 GHz CPU or higher
- 1.44 MB
- 40 GB/7200 rpm hard drive or higher
- 52X CDROM or higher
- 256 MB of DDR RAM
- Video (64 Meg), sound, and LAN built into the motherboard

FX-4000™ FlexLink® Component Specifications

- Custom design vacuum controller board
 - Microprocessor sampling rate for display data transducer: 200 Hz
 - Microprocessor sampling rate for feedback/error (valve adjustment) transducer: 1 KHz
- 2 proportional-solenoid valves
- 1 RS-232 serial interface connection for CPU communication
- 1 RS-232 serial interface connection for daisy-chaining multiple FlexLinks®

FX-4000™ Physical Specifications

FX-4000™ Controller:	Size, W x H x D:	8" x 17.5" x 17" (20.3 cm x 44.5 cm x 43.2 cm)
	Power Requirements:	115/230V – 6/3A – 60/50 Hz
	Weight (unit only):	20 lbs (9.1 kg)
Tension FlexLink®:	Size, W x H x D:	7" x 7.25" x 17" (17.8 cm x 18.5 cm x 43.2 cm)
	Power Requirements:	115/230V – 6/3A – 60/50 Hz
	Weight (unit only):	24 lbs (11 kg)
Monitor (17" LCD Flat Panel):	Size, W x H x D:	
	Power Requirements:	115V - 60 Hz Auto switch to 230 V
	Weight (unit only):	13.22 lbs (6 kg)

FX-4000T™ FlexLink® Calibration Specifications

Unconstrained Static Performance (low side transducers):

Maximum allowable waveform variance from static line: $\pm 0.25\%$ elongation
Maximum %elongation error (actual vs. programmed): $\pm 0.6\%$ elongation
Maximum allowable transducer inaccuracy: ± 1.0 kPa

Unconstrained Dynamic Performance (low side transducers):

Maximum %elongation error (actual vs. programmed): $\pm 0.75\%$ elongation,
(except below 5% elongation: $+0.5 / -1.98\%$ elongation), at the following frequencies:
<10% elongation @ 1.0 Hz; $10\% \leq x \leq 20\%$ elongation, 0.5Hz;
 $20\% < x \leq 30\%$ elongation, 0.3 Hz
Maximum allowable transducer inaccuracy: ± 1.0 kPa

BioFlex 25mm Loading Station Static Performance (high side transducers):

Maximum allowable waveform variance from static line: $\pm 0.25\%$ elongation
Maximum %elongation error (actual vs. programmed): $\pm 0.5\%$ elongation
Maximum allowable transducer inaccuracy: ± 2.0 kPa

BioFlex 25mm Loading Station Dynamic Performance (high side transducers):

Maximum %elongation error (actual vs. programmed): $\pm 0.75\%$ elongation, at
the following frequencies: $\leq 12\%$ elongation, 1.0 Hz; $12\% < x \leq 17.5\%$ elongation, 0.5Hz
Maximum allowable transducer inaccuracy: ± 2.0 kPa

Loading Stations™ Specifications

25mm Diameter Loading Stations™ (equibiaxial strain):

Minimum achievable %elongation with the FX-4000T™: 0.70%
Maximum achievable %elongation with the FX-4000T™: 20.0%

28mm Diameter Loading Stations™ (equibiaxial strain):

Minimum achievable %elongation with the FX-4000T™: 0.90%
Maximum achievable %elongation with the FX-4000T™: 15.3%

31mm Diameter Loading Stations™ (equibiaxial strain):

Minimum achievable %elongation with the FX-4000T™: 0.65%
Maximum achievable %elongation with the FX-4000T™: 5.2%

Tissue Train™ w/Arctangle™ Loading Stations (uniaxial strain):

Minimum achievable %elongation with the FX-4000T™: 1.5%
Maximum achievable %elongation with the FX-4000T™: 19.0%

UniFlex™ w/Arctangle™ Loading Stations (uniaxial strain):

Minimum achievable %elongation with the FX-4000T™: 1.5%
Maximum achievable %elongation with the FX-4000T™: 12.0%

FX-4000T™ Vacuum Requirements

To achieve the maximum system capability, the minimum vacuum source requirements are:

- Maximum Vacuum: 1.5×10^{-3} torr
- Free Airflow Rate: 5.7 cfm (161 L/min)