



LFS-4000 LARGE DIAMETER FIBER SPLICER



Filament Fusion Splicer for Standard, Large Diameter and Specialty Optical Fibers





LFS-4000

A Stand Alone Optical Fiber Splicer

The LFS-4000 combines Vytran’s unique filament fusion technology, a high degree of user process control, and simple manufacturing operation, making it ideal for volume fiber assembly production. Equipped with an extensive applications library, the LFS-4000 also inherits the years of development and information that we have amassed using our GPX-3400 systems.

The LFS-4000 splices standard and specialty fibers up to 0.9 mm in diameter. It features the identical filament “furnace” assembly as the GPX-3400. This stable, high-temperature heat source allows maximum control of splice processing conditions. An embedded real time control system and powerful machine level macro programming language allow the user to develop unique event-driven routines for fast and flexible process development. All high-level system communication is done via a laptop graphical interface with two complementary screens – one for product development that allows all system functionalities, and another streamlined screen that allows only basic operator interface for volume production.

Key Applications

Splicing

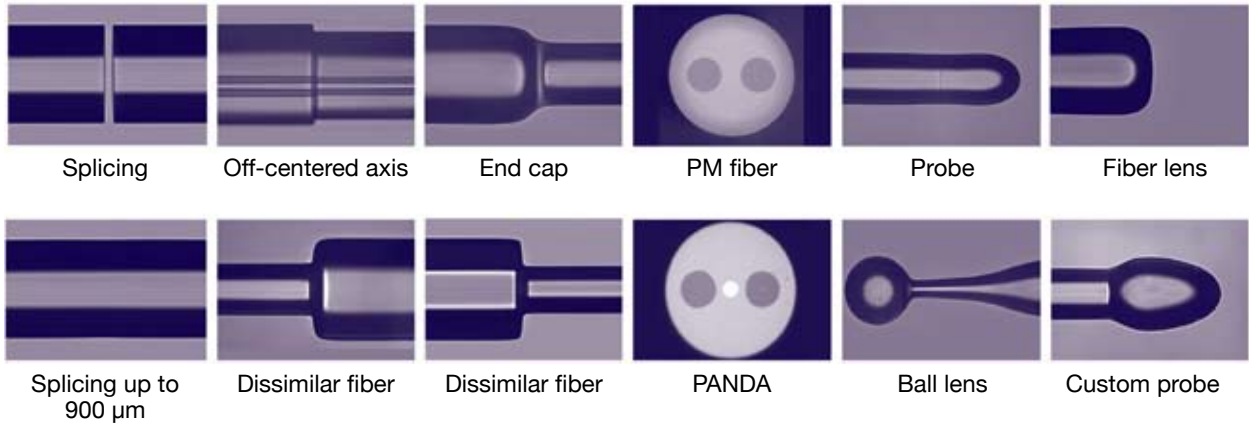
Splice standard and specialty fibers with diameters up to 0.9 mm. Standard - PM - Doped - PCF Dissimilar fibers - Off-center fibers LMA Fibers

Thermal Core Diffusion – Mode Field Adapters

Thermally diffuse the core dopants of a fiber, changing its waveguide characteristics. A controlled heat distribution profile along the fiber length enables adiabatic expansion of the mode field diameter.

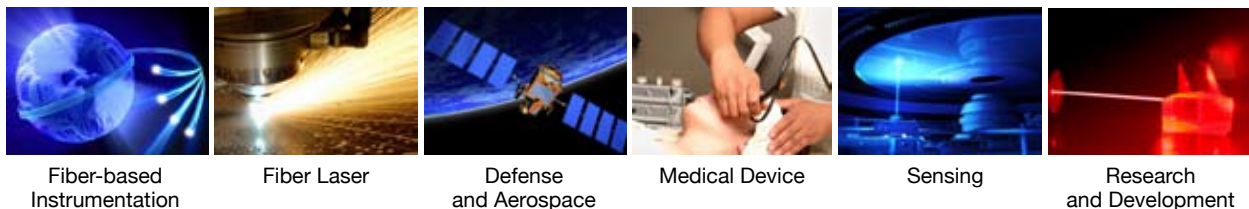
Fiber Termination

Terminate all fibers (end caps, beam delivery fibers, lenses, etc.)



Vytran provides application development services. For other applications, please contact us.

Key Markets





LFS-4000

Filament Fusion Technology for Precise and Consistent Splicing

Filament Fusion Provides Repeatable, High-Quality Splices

Vytran's filament fusion technology is a consistent and reliable method of making high-strength, low-loss splices. Under purge of an inert gas, a resistive heating element supplies the exact amount of thermal energy necessary for fiber fusion. The heating element's size, shape and power delivery can be changed to suit the application, easily scaling to very large diameter fibers.

The filament furnace assembly can also be moved along the length of the fiber, making many specialty processing applications possible, such as post-splice fire polishing for strength enhancement. These highly controlled conditions, in combination with constant power control circuitry, ensure repeatable performance splice after splice.



Fire Polishing Enhances Splice Strength

Vytran's patented fire polishing process significantly increases splice strength through a rapid post-fusion heat treatment of the splice region. When a fusion splice is made, silica evaporates off of the hot center region of the splice and condenses on either side of the joint where the fiber is cooler. The condensed silica deposits act as a surface flaw, lowering splice strength. Our fire polishing process removes or minimizes the deposits, thereby improving splice strength.

In addition, the fire polishing process provides core diffusion capabilities that can be used to adiabatically expand the mode field diameter of a fiber. Through this thermally expanded core (TEC) process, low-loss fusion splices can be achieved between markedly dissimilar fibers, such as those typically used in fiber laser applications.

Key Features	Benefits
Stable heat source	<ul style="list-style-type: none"> • Consistent fusion splicing • Consistent glass processing • Immune to ambient variation
Wide thermal dynamic range (a few 100°C to > 2500°C)	<ul style="list-style-type: none"> • Various fusion processes, splicing, couplers, end caps, etc. • Accommodates different fiber sizes (125 μm to > 900 μm in diameter) • Works for different types of fiber materials (silica glass, software glass, e.g. phosphate glass) that require different treatment temperatures
Wide and uniform concentric heat zone	<ul style="list-style-type: none"> • Stable and low loss fusion splicing
High fusion power	<ul style="list-style-type: none"> • Ideal for processing large fiber diameter
Mini fusion environment with Argon assist	<ul style="list-style-type: none"> • "Clean" fiber fusion with negligible surface contamination
Fire polish	<ul style="list-style-type: none"> • Low splice loss • High strength splicing • High performance mode field adapting
Different types of filament designs	<ul style="list-style-type: none"> • Provides robustness and flexibility for different applications
Ease of filament replacement	<ul style="list-style-type: none"> • Quick set-up for different applications and fast maintenance



LFS-4000

Complementary Product Suite for Development through Volume Production

Splice Loss Estimation

The LFS-4000 uses Vytran's True Core Imaging™ technology for precise fiber core alignment prior to splicing. Because this technology provides a clear view of the fiber's inner core, an accurate estimation of splice loss can be achieved based on an analysis of the completed splice. Vytran has developed a proprietary algorithm that accurately calculates loss for splicing a variety of similar or dissimilar single mode fiber types with a high correlation factor.

End-View Imaging

The LFS-4000 features a unique End-View Imaging system for looking directly at the ends of the fibers prior to splicing. This is

used in conjunction with high-resolution rotary positioners for automated alignment of polarization maintaining (PM) fibers through either image-based or active feedback control. End-View Imaging is also a powerful tool when working with fiber laser gain fibers, which may have non-circular claddings or micro-structured cores.

Dual Screen Software Interface

The PC-based laptop software features two complementary screens. The "development" screen allows users to access all of the unit's functionalities for full process optimization. The password-protected "production" screen allows only basic system operator interface for efficient volume manufacturing.



A Complete Product Suite

Vytran's LFS-4000, GPX-3400 glass processor, LDC-400 fiber cleaver, and PTR-200 fiber recoaters and proof testers make up a suite of complementary products. These tools facilitate early process development through volume manufacturing for applications such as splicing fiber assemblies and creating fused components and fiber terminations for fiber lasers, medical devices, sensing and aerospace, among others.

Our LFS-4000, GPX-3400 and LDC-400 products share a fiber holding block to ensure mechanical fiber integrity. LFS and GPX systems also feature extensive application libraries to help streamline processes from development to manufacturing.

Key Features / Benefits

Filament fusion technology

- High performance splices for fibers 125 μm to 900 μm
- Low-loss, high-strength splices
- Highly stable, consistent, and repeatable fusion process
- Uniform thermal treatment around the fiber
- Splice various specialty fibers, including PM fibers, non-circular cladding fibers or micro-structured fibers, and non-silica soft glass fibers

True Core Imaging™ (Real-time imaging)

- Accurate splice loss estimation for SM fibers
- Automatic high-accuracy fiber core alignment

Fire Polishing

Post-splice fire polishing enhances splice strength and reduces loss

Same fiber holding/transfer fixtures as GPX 3300/3400 Series and LDC-400 cleaver

Mechanical compatibility with GPX 3300/3400 glass processors

Other applications

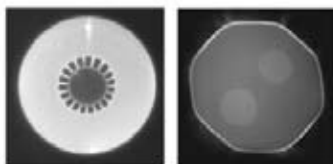
Fabrication of mode field adapters, couplers (MM and SM) and end caps (with LDC-400 cleaver)

Library of Applications

Comparable application library to established GPX products

End-View Imaging and high-resolution rotary positioners

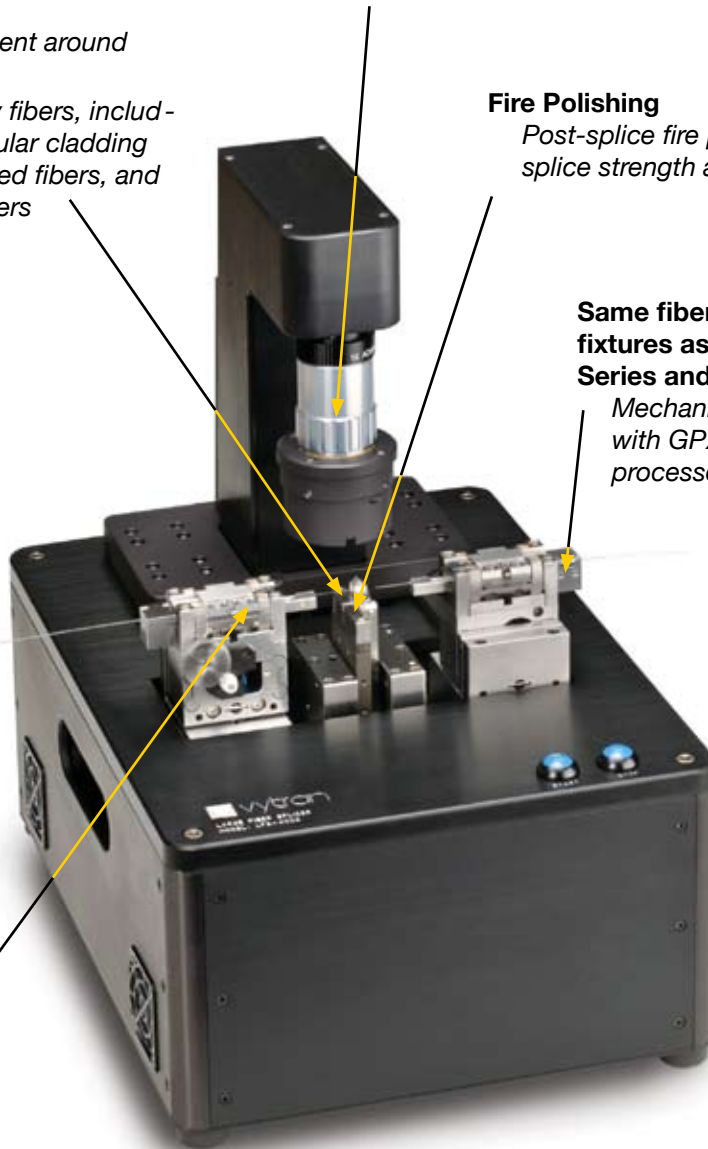
Automated splicing alignment for PM fibers, dissimilar fibers, off-centered fibers



End-View Imaging

Dual screen software interface (development screen; production screen)

- Leverage all system functionalities in development mode for full process optimization
- Simplified, locked-in production screen for automated volume manufacturing process





LFS-4000 Specifications

Size	9.0" (W) x 12.5" (D) x 13" (H) Including Camera Tower
Weight	29 lbs (13 kg)
Power	External power supply unit, universal input: 90-260 VAC, 47-63 Hz, single phase LFS-4000 input: 12V and 48VDC 10A PC input: 115 or 230 VAC, 47-63 Hz, single phase
Gas Supply	Argon, Zero grade at 10 PSIG
Fusion Method	Filament
Fiber Types	PM, non-PM, PCF, LMA, circular, non-circular, silica, soft glass
Max. Filament Temperature	~5600°F (3100°C)
Max. Fiber Cladding Diameter	0.9 mm
Furnace "Z" Movement	15.5 mm i.e. 12 (+) and 3.5 (-) From Home Position
Max. Fiber "Z" Movement	6 mm From Home Position of each FHB. (not cumulative range)
"Z" Movement Resolution	0.2 µm
Alignment Method	Fully Automated and Manual
X-Y Fiber Positioning Resolution	0.02 µm
Fiber Viewing	Side View Imaging (core) and End-View Imaging
Strength Enhancement	Fire Polish
Loss Estimation	Yes
Rotation Alignment	Fully Automated and Manual
Rotation Drive Resolution	0.02°
Rotation Travel	190°

Related Products:

LDC-400

A fully automated precision cleaver for standard, large diameter and specialty optical fibers.

GPX-3400

A multipurpose glass processing platform for creating splices, combiners, tapers, couplers and end caps with optical fibers from 125 microns to 1.5 mm in diameter.

PTR-200 Series

A family of manual to fully automated fiber recoaters and proof testers for high-volume optical fiber processing.