MixTrain®

Sum and Difference Frequency Mixer for Tunable CW Lasers

mks | Spectra-Physics®

MixTrain is an advanced stand-alone device that enables sum or difference frequency mixing of single frequency CW laser beams in periodically polled crystals. High mixing efficiencies are achieved by precision temperature control to ensure optimal quasi-phase matching over the entire tuning range of the Matisse®. When combined with a high power fiber laser, sum frequency output exceeding 2 W is readily achieved.

The MixTrain is equipped with all optics needed for combining input lasers, mixing in periodically poled crystals, and separation of the desired sum (SFM) or difference (DFM) frequency mixing output from the residual input beams. The platform includes a lens to collimate the output, and an isolator to protect the fiber laser from damage due to back reflections.

Periodically poled mixing crystals are mounted in a removable configuration to allow for alternate fiber input wavelengths. The mixing crystals are housed in a temperature stabilized oven with motorized control, providing hands free tuning over >100 nm of the visible spectrum. When pumped with the Matisse C and the appropriate fiber laser the MixTrain provides hands-free, all solid state output from 422–670 nm for SFM – a attractive and versatile alternative to a CW dye laser. Flexible configuration of mixing and separating optics enables output from 1.1–4.2 µm for DFM, depending on fiber laser input.

The MixTrain Advantage

- Input wavelength range 690 to 1020 nm
- Choose output range from 422–670 nm for SFM and 1.1–4.2 µm for DFM
- Continuous scans of 20 GHz for SFM and 60 GHz for DFM
- Temperature stabilized crystal mount for maximum conversion efficiency and stability of output power
- All solid state solution providing tunable CW visible and near to mid-IR output

Applications

- High-resolution spectroscopy
- Molecular/atomic cooling and magneto-optic trapping
- Tunable visible/IR experiments
- Bose-Einstein condensates
- Atomic clocks
- Frequency combs

MixTrain Sum Frequency Mixing Specifications[1, 7]

Wavelength Range	422–518 nm	488–615 nm	515-670 nm
Output Power[2]	>1.0 W @ 450 nm	>2.0 W @ 520 nm	>1.0 W @ 555 nm
Automated Scan Range	>20 GHz	>20 GHz	>20 GHz
Fiber Laser Input Power/Wavelength[3]	5 W @ 1064 nm	10 W @ 1550 nm	5 W @ 1950 nm
Tunable Input Wavelength	700 nm–1020 nm	700 nm–1020 nm	700 nm–1020 nm
Efficiency[4]			
Tunable Input Power 2.0–6.0 W	>20%	>40%	>20%
Requirements			
Tunable Pump Laser[5]	TEM_{00}, M^2<1.1, single frequency laser, linewidth <5 MHz, linear polarized		
Fiber Pump Laser[6]	TEM_{00}, M^2<1.1, single frequency laser, linewidth <5 MHz, linear polarized		
Ambient Conditions	Constant temperature in the 20–25°C range		
Laboratory	Vibrational isolated optical table, dust-free air (flow box)		
Voltage	115/230 V, single phase, 50/60 Hz		
Physical Characteristics			
Size (L × W × H)	17.13" x 13.94" x 9.37–9.92" (435 mm x 354 mm x 238–252 mm)		

MixTrain Difference Frequency Mixing Specificationss[1, 7]

Wavelength Range	1120–2300 nm	1250–1450 nm 1650–2800 nm	2050-4200 nm
Output Power[2]	>100 mW @ 1500 nm	>200 mW @ 1700 nm	>10 mW @ 2500 nm
Automated Scan Range	>60 GHz	>60 GHz	>60 GHz
Fiber Laser Input Power/Wavelength[3]	5 W @ 532 nm	10 W @ 1550 nm	5 W @ 1064 nm
Tunable Wavelength Input	690–1020 nm	690–1000 nm	690–850 nm
Efficiency[4]			
Tunable Input Power 2.0–6.0 W	>2%	>4%	>0.2%
Requirements			
Tunable Pump Laser[5]	TEM_{00}, M^2<1.1, single frequency laser, linewidth <5 MHz, linear polarized		
Fiber Pump Laser[6]	TEM_{00}, M^2<1.1, single frequency laser, linewidth <5 MHz, linear polarized		
Ambient Conditions	Constant temperature in the 20–25°C range		
Laboratory	Vibrational isolated optical table, dust-free air (flow box)		
Voltage	115/230 V, single phase, 50/60 Hz		
Physical Characteristics			
Size (L × W × H)	17.13" x 13.94" x 9.37–9.92" (435 mm x 354 mm x 238–252 mm)		

1. Due to our continuous product improvement program, specifications are subject to change without notice.
2. Mixtrain output power is given at the 4.5 W peak output of the tunable laser and a fiber laser input of 10 W at the appropriate wavelength. Contact factory for performance specifications at desired output wavelength
3. Contact factory to inquire about non-standard fiber laser wavelengths.
4. Typical performance is only for Matisse Ti:Sapphire and dye pump lasers, calculated as a ratio of Mixtrain output power to Matisse input power.
5. Output linewidth of Mixtrain is determined by the broadest input linewidth. For specified linewidth of Matisse, refer to the appropriate Spectra-Physics datasheet.
6. Output linewidth of Mixtrain is determined by the broadest input linewidth. Refer to fiber laser manufacturer's datasheet for linewidth of fiber laser.
7. **The MixTrain is a Class IV – High Power Laser, whose beam is, by definition, a safety and fire hazard. Take precautions to prevent exposure to the direct and reflected beams. Diffuse as well as specular reflections can cause severe skin or eye damage.**
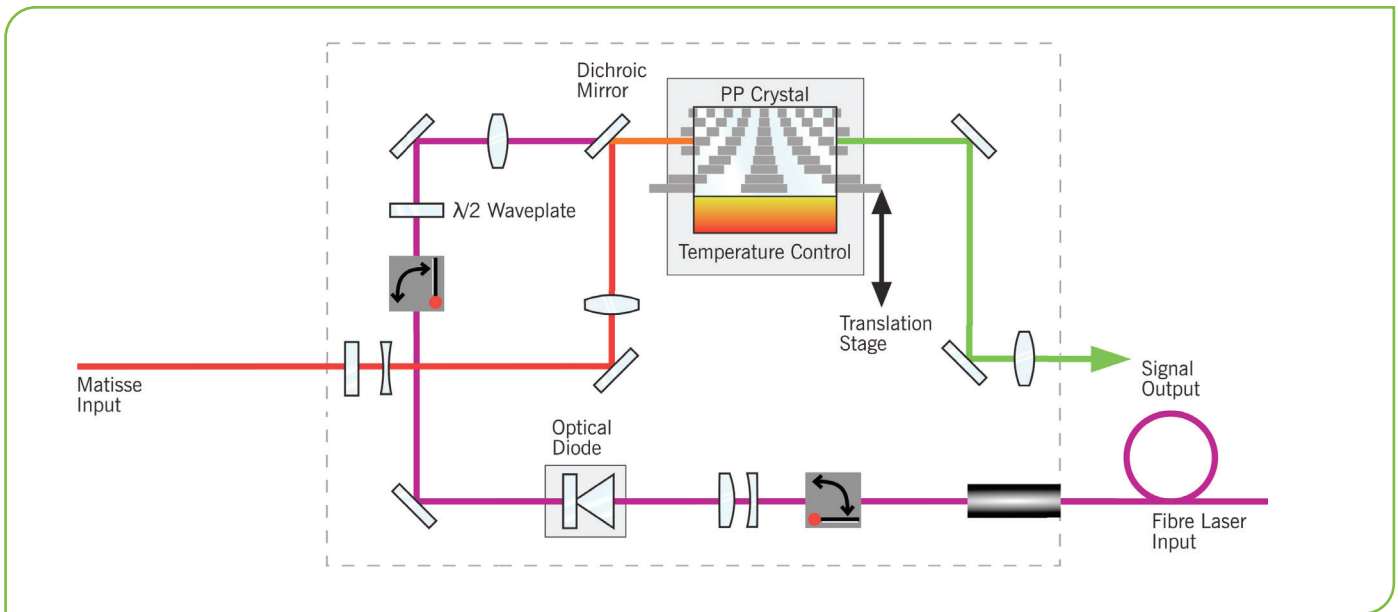
MixTrain SFM Tuning Curve[1,2]
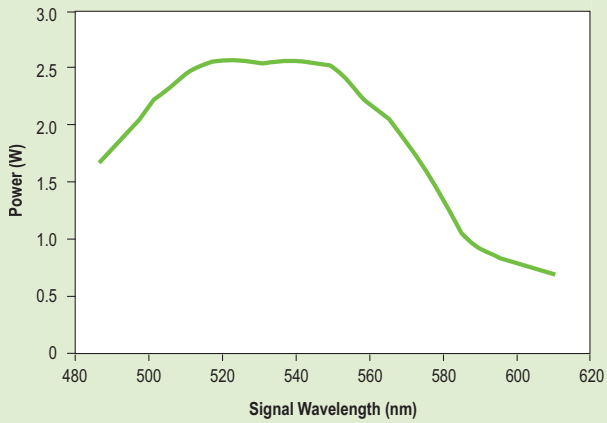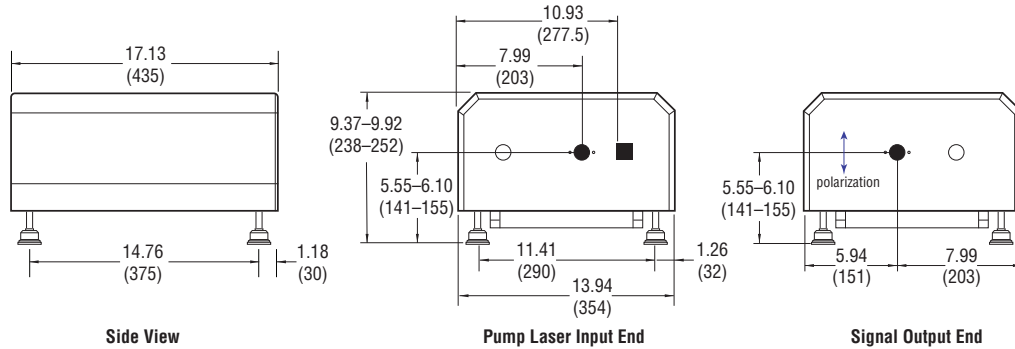

MixTrain DFM Tuning Curve[1,2]
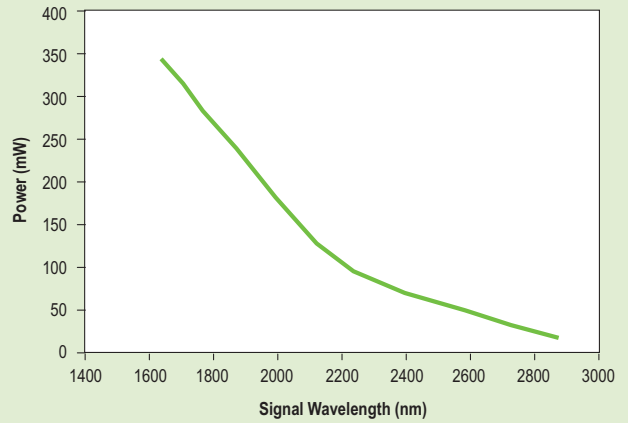
1. Typically measured performance; not a guaranteed or warranted specification.
2. Tuning curve generated using 4.5 W peak input from a Matisse 2 and 10 W input from a 1550 nm single frequency fiber laser.

MixTrain Optical Layout

MixTrain Dimensions

17.13
(435)

14.76
(375)

1.18
(30)

Side View

10.93
(277.5)

7.99
(203)

9.37–9.92
(238–252)

5.55–6.10
(141–155)

11.41
(290)

1.26
(32)

13.94
(354)

Pump Laser Input End

5.55–6.10
(141–155)

polarization

5.94
(151)

7.99
(203)

Signal Output End

Dimensions in inch (mm)

MixTrain 4/24
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Specifications are subject to change without notice.