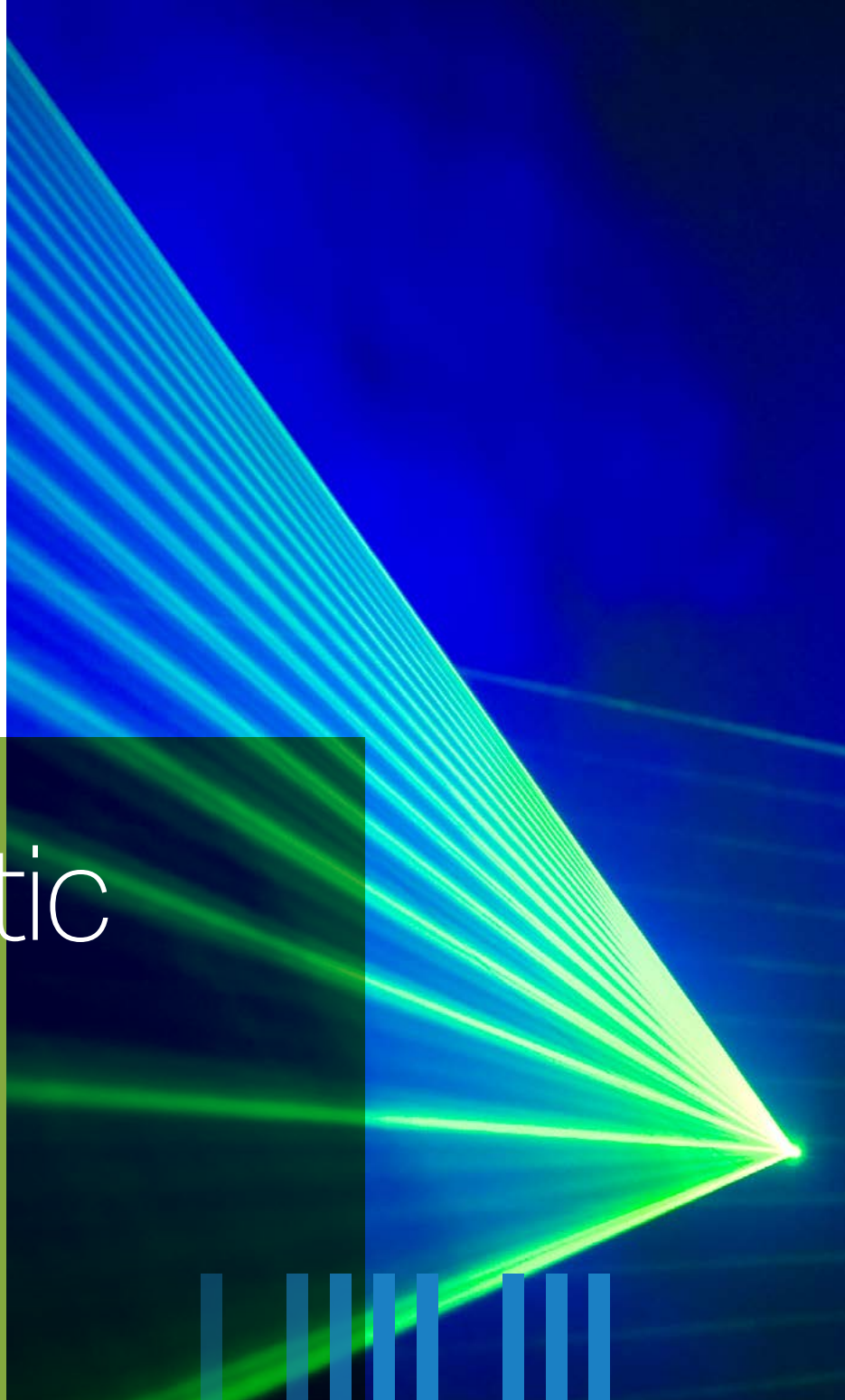




® Knowledge  
Beyond  
Measure.

# Fiber Optic Probes

For LDV/PDPA Systems



# Fiber Optic Probes for LDV/PDPA Systems

TSI® is the leading innovator for fiber optic technology used with Laser Doppler Velocimetry (LDV) and Phase Doppler Particle Analyzer (PDPA) systems, offering various types of fiber optic probes as transmitter, transceiver, and receiver systems. The single receiver three-detector probe was developed for the simultaneous particle size and velocity measurements with the PDPA system. TSI® continues to have the most efficient optical probes for velocity measurements in LDV, allowing the highest laser power throughput and the maximum power at the measuring volume. The Itasca laser module with the state-of-the-art fiber laser technology offers two equal power laser beams readily to be coupled with all transceiver or transmitter probe, to provide the LDV or PDPA system configuration.

## Transceiver Probes

Choosing the right probe for your application is very simple. From large to small, TSI® has the right type of probe for your application. Most LDV applications use the TR 60 series probe, since they are robust, versatile, economical and compatible with the XPD50-DPSS or XPD60 beam expanders. TR160 and TR260 are available in standard, as well as submersible stainless steel versions. The TR360 is a three-component probe, with the ability to measure all three velocity components with a single probe arrangement. The TR360 probe is particularly useful for water tunnel flows. Some special applications may require the use of the compact 25 mm diameter TR 20 series probe, or the miniature 15 mm diameter TR 10 series probe.

Probe	Benefits
TR 10 series	Compact, sealed, water-tight probe for "in-flow" applications and for use with the TSI® IC Engine Adaptor
TR 20 series	Sealed stainless probes for use in air or under water
TR 60 series	The most popular choice for LDV as well as PDPA systems. Wide selection of focusing lenses available. Large 61 mm collection aperture for better data rates. Heavy duty precision probe mount is included. Stainless steel versions are available for underwater applications.

Probe Series	TRx10			TRx20		TMx50			TRx60				TR360		
Maximum Outside Diameter (mm)	15.1			25		74			86				86		
Clear Aperture (mm)	10			20		50			61				61		
Fiber Cable Length (m)	8			8		8			8				8		
Length (mm)	158.8			180		310			440				584		
Std. Beam Diameter (mm)	0.47			1.06		1.77			2.65				2.82		
Std. Lens Focal Length (mm)	60			110		250			363				261		
Lens Series	TLN01-[Focal Length]			TLN02-[Focal Length]		TLN05-[Focal Length]			TLN06-[Focal Length]				TLN06-[Focal Length]		
Beam Expansion Options	—			—		0.5x or 2x using XPDN50-I 2.11x using XPD50-E			2.6x using XPD60				2.6x using XPD60		
Probe Without Beam Expander															
Lens Focal Length (mm)	60	80	120	110	144	500	750	1000	261	363	512	762	261		
Beam Spacing (mm)	7.5	7.5	7.5	15	15	20	20	20	50	50	50	50	25/50/25*		
Fringe Spacing (µm)	4.1	5.5	8.2	3.78	4.94	12.9	19.3	25.7	2.7	3.7	5.3	7.8	5.4/2.6/5.0*		
Meas. Volume Diameter (µm)	83	110	166	68	89	185	278	370	64	90	127	188	65/62/60*		
Using 2.11x Beam Expander for TMx50 probe or 2.6x Beam Expander for TRx60 and TR360 probes (partial list)															
	TRx10		TRx20		TMx50			TRx60			TR360				
Lens Focal Length (mm)	—		—		500	750	1000	480	760	2290	480		760		2290
Beam Spacing (mm)	—		—		40	40	40	130	130	130	65/130/65*		65/130/65*		65/130/65*
Fringe Spacing (µm)	—		—		6.1	9.1	12.2	1.9	3.0	9.1	3.8/1.8/3.5*		6.0/2.9/5.6*		9.1/4.4/8.4*
Meas. Volume Diameter (µm)	—		—		88	132	175	45.6	72.0	217.7	46/44/42*		73/69/67*		109/104/100*

\*Indicates values for 514.5 nm/488 nm/476 nm



## Transmitter Probes

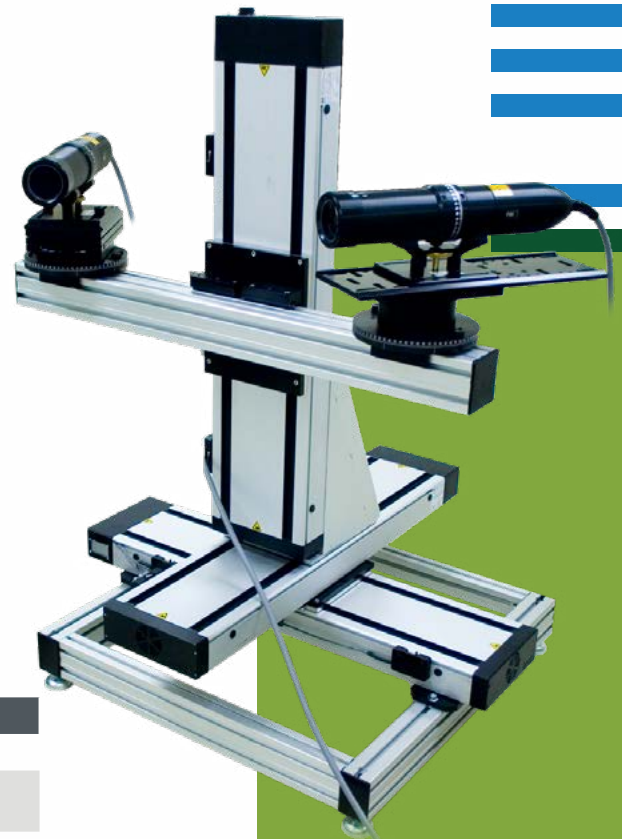
The transmitter probes are particularly designed for PDPA, to get droplet size measurements in sprays. The large fringe spacing and measuring volume are ideal for small droplet size range. The transmitter probe can also be equipped with a beam expander or contractor (XPD50-E or XPDN50-I), to expand the droplet size range.

## Receiver Probes

Receiver probes are an important part of the PDPA system. The receiver probe includes the optimized 3-Detector Fiber Bundle integrated as part of the probe design. Selecting the best probe is simple, because the RV 70 series receiver has all of the most-needed features built in. For specialized applications dealing with very small particles and dense sprays, the extended range and large aperture of the RV 100 series is recommended.

Probe	Applications
RV 70 series	General purpose receiver for most sizing applications
RV 100 series	Dense sprays, long stand-off, or small particle applications

Probe Series	RVx070					RVx100				
Maximum Outside Diameter (mm)	108					137				
Clear Aperture (mm)	72					106				
Fiber Cable Length (m)	10					10				
Length (mm)	475					615				
Optical Axis Height (mm)	108					108				
Standard Lens Focal Length (mm)	300					500				
Lens Series	TLN07-[Focal Length]					TLN10-[Focal Length]				
Standard Slit Width (μm)	150					150				
Phase Ratio (μm)	3.5:1					3.5:1				
Lens Focal Length (mm)	300	500	750	1000	1500	238	500	750	1000	1500
Nominal Minimum Diameter (μm)	0.5	0.7	1.1	1.4	2.1	0.5	0.5	0.7	1	1.5
Nominal Maximum Diameter (μm)	175	291	437	583	874	94	198	297	396	594



3D LDV System



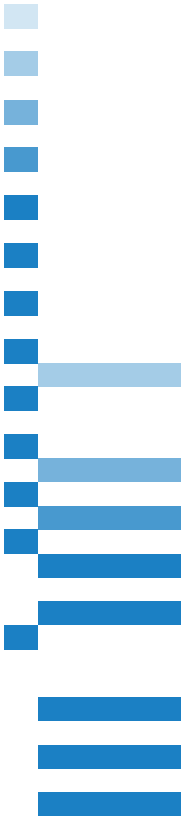
RVx100 Receiver Probe



RVx070 Receiver Probe



TRx60 Transceiver Probe



# Lasers to be Used with the Fiberoptic Probe

Fiberoptic probes for LDV and PDPA can be used with a variety of different laser light sources, including PowerSight DPSS lasers, Itasca fiber lasers, and Argon Ion lasers. Laser power of up to 1W for each wavelength are available for the PowerSight and Itasca laser modules. The PowerSight module combines the laser source with transceiver optics, resulting in a compact form factor ideal for LDV applications. The Itasca laser module is coupled with a fiber optic probe providing flexibility and excellent beam quality for LDV or PDPA applications, even in applications requiring long stand-off distances or harsh environments.

The table below shows the typical wavelength and power output for each type of laser.

Model	Description
Itasca-1	1D Itasca module with 532 nm 1W laser
Itasca-2	2D Itasca module with 532 and 520 nm 1W laser
Itasca-3	3D Itasca module with 546 nm 1W laser
PS-TM-1D-532	1D PowerSight with 532nm, 500mW laser (1st component system)
PS-TM-2D	2D PowerSight with 532 and 561 nm, 500mW lasers
PS-TM-1D-515	1D PowerSight with 515nm, 300mW laser (3rd component system)



A 2D LDV system shown consisting of a two-dimensional fiber optic probe, FSA5800, and two Itasca laser modules.

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<b>USA</b>	Tel: +1 800 874 2811	<b>India</b>	Tel: +91 80 67877200
<b>UK</b>	Tel: +44 149 4 459200	<b>China</b>	Tel: +86 10 8219 7688
<b>France</b>	Tel: +33 1 41 19 21 99	<b>Singapore</b>	Tel: +65 6595 6388
<b>Germany</b>	Tel: +49 241 523030		