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Ordering Code # :SFT - 2004 - 10A - UK

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FILTRATION TECHNOLOGY

Laser Particle Counter LasPaC 1

Local solutions for individual customers worldwide

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Stauff Filtration Technology

Stauff Filtration Technology offers a complete range of filtration products and services that will provide the system designer or user with the highest level of contamination control demanded by today's most sophisticated applications. Products include pressure filters, return line filters, elements, spin on filters suction strainers and filler breathers for various hydraulic, lubrication and fuel oils.

Stauff has the technical expertise to provide superior filter element designs for the Stauff original filter housings and also for the interchange element market. Stauff manufactures more than 10,000 different elements. Many of these are designed to fit into filter housings produced by other companies while maintaining or surpassing the original performance.

The "Stauff Contamination Control Program" includes the diagnostic services including fluid sampling and laser particle counting products needed to monitor the system contamination level.

Stauff, through its global network of wholly owned companies and technically qualified distributors, is ideally placed to assist its customers in the total contamination process providing a well balanced filtration solution.

Laser Particle Counter — Page

Laser Particle Counter - LasPaC 1

The ***new*** **STAUFF Laser Particle Counter I** is a microprocessor-controlled 8-channel particle counter designed for monitoring the degree of contamination of mineral based hydraulic fluids. In contrast to other commercially available particle counters, the **LasPaC I** is characterized by a few special features.
The readings from the **LasPaC I** will immediately indicate the condition of the hydraulic system, the data will be documented, and you will be able to intervene at an early stage in order to prevent wear and damage to the components in the hydraulic system. This does not only minimize repair costs, but also reduces overall equipment downtime.

1. Mobile ➢ Light weight and handy
With its comparatively low weight of 8.5 kg *(18.7 lbs)* – only 18 kg *(40 lbs)* with its rugged aluminum case – the device is well suited for use in the field, even in areas that are difficult to access.

2. Quick results ➢ ease of operation
Operator input is conducted via touch-screen and function keys. The control features of the particle counter have been designed so that measurements can be done quickly and easily. User defined measuring programs can be entered and stored with password protection.

3. Flexible ➢ multi-range calibration (optional) to ISO 11 171 and ISO 4402 (for NAS 1638)
The LasPaC offers several optional calibrations (see Ordering Code):
“N” for New calibration ISO 11171, Cleanliness Levels according to ISO 4406 (1999) and SAE AS4059 Rev. D (2001) “O” for Old calibration ISO 4402, Cleanliness levels according to ISO 4406 (1991) and NAS 1638 (1964) “B” for New and Old Calibration. In this case, the LasPaC is set to the latest calibration per ISO 11 171 by default. However, if users wish, they can switch to the older ISO 4402 calibration for comparision. The device also evaluates readings based upon NAS 1638 classes.

4. For any type of application ➢ various pressure stages
The LasPaC I features two integrated pressure ranges for 0 to 6 bar *(0 to 87 PSI)* low pressure and 5 to 420 bar *(73 to 6000 PSI)* high pressure. This allows oil samples to be taken from pressureless systems or reservoirs without any other equipment. Many other products available today require special add-ons or pressure cartridges which need to be recharged. The STAUFF TEST hose which are provided with the device, allow easy connection to common test couplings (M16 x 2).

5. Global use ➢ variable voltage supply
The integrated power supply unit provides a voltage range of 110 V ... 240 V.

6. Independent use ➢ storage-type battery

The integrated rechargeable battery makes it possible to perform on-the-spot measurements, even in cases where a direct connection to an external power supply is not possible. The measured data are stored and can be transferred to a computer later on if necessary.

7. "In black and white"➢ built-in printer

The integrated printer supports printouts in the field, thus providing immediate documentation.

8. Making the connection ➢ downloading via a serial interface

The measured data can be downloaded onto any PC or notebook via the device's serial interface, supported by a convenient downloading software. Further processing and storage of the data is done in Microsoft Excel® with the use of specially designed macros. The prepared forms provide for easy transfer of the data. The integrated diagrams represent the data graphically for more clarity. Likewise the data can be assembled to a trend analysis. With Microsoft Excel®, it is possible to edit the data as required, e.g. with the customer's logo.

9. Always up-to-date ➢ an integrated clock

An integrated and rechargeable battery-operated clock provides the exact date and time which are shown on every printout. In addition, every download of measured data is marked with date and time. The precise time of measurement is thus documented on all printouts and for all the data stored.

10. Adaptable ➢ software updates

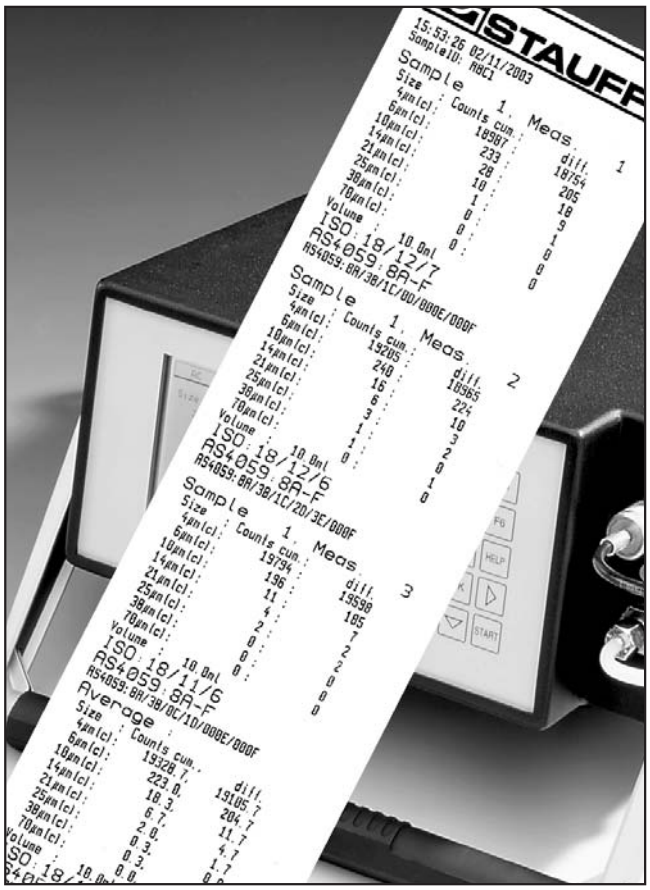
The serial interface ensures flexibility for future developments in terms of calibration, evaluation and output. Moreover, software updates can be installed on the particle counter, without any problems.

11. 100% Coverage

The fluid passes a vitreous measuring cell and is rayed by a laser beam. This laser beam is evaluated at the backside of the cell. Dimensions and the number of particles are calculated from electronic impulses transformed by the shadows. With many other particle counters only a part of the measuring cell is lighted by the laser beam, the particles are only partially registered and the result is projected. In contrast the cell of the LasPaC is completely examined and all particles are registered. Inaccuracies as a result of the projections are avoided.

12. Robust ➢ Ceramic Piston Pump

The integrated piston pump works in both directions: it outputs the fluid in "low pressure" mode and controls the flow in "high pressure" mode. Due to the ceramic pump components this pump is very resistant and nearly indestructible against abrasive, solid contaminants and various fluids.



STAUFF®

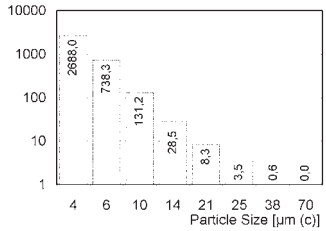
LasPaC I Report

according to ISO 11171

Sample ID / No.	: ABC-1	
Service Hour	: 23.581 h	
Oil Temperature	: 41°C	
Notes	: Control	
Test Date	: **18. Nov 2002 13:40**	
Report Date	: 20. Nov 2002	
Profile Name	: Std. High Press.	
Meas. Volume	: 10 ml	
Analysis Volume	: 1 ml	
ISO 4406	: 19 / 17 / 12	(Calibr. ISO 11 171: 1999)
AS 4059	: 9 A-F (9A/8B/6C/7D/6E/6F)	(Calibr. ISO 11 171: 1999)
ISO 4406	: 19 / 17 / 13	(Calibr. ISO 4402: 1991)
NAS 1638	: 9 (9/8/8/7/8)	(Calibr. ISO 4402: 1991)

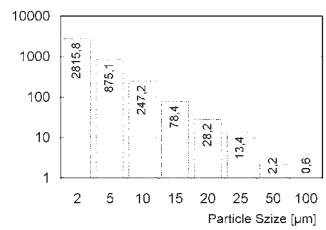
Analysis ISO 11 171

Particle Size	Particle / ml
> 4.0 µm (c)	2688,0
> 6.0 µm (c)	738,3
> 10.0 µm (c)	131,2
> 14.0 µm (c)	28,5
> 21.0 µm (c)	8,3
> 25.0 µm (c)	3,5
> 38.0 µm (c)	0,6
> 70.0 µm (c)	0,0



Analysis ISO 4402

Particle Size	Particle / ml
> 2.0 µm	2815,8
> 5.0 µm	875,1
> 10.0 µm	247,2
> 15.0 µm	78,4
> 20.0 µm	28,2
> 25.0 µm	13,4
> 50.0 µm	2,2
> 100.0 µm	0,6



13. Technical Data

Microprocessor-controlled 8-channel particle counter for contamination monitoring of mineral based hydraulic fluids. The particle counter is equipped with a laser sensor. The orifice of the sensor has a cross-section of 500 x 500 µm. The maximum concentration is 24,000 p/ml at a flow rate of 25 ml/min (ISO 4406 Code 23). The sensor can be calibrated in accordance with the following standards:

Calibration according to ISO 11 171 (1999):
4 ... 70 µm(c) relating to ISO 4406 (1999) and SAE AS4059 Rev. D (2001)

Calibration according to ISO 4402 (1991):
2 ... 100 µm relating to ISO 4406 (1987) and NAS 1638 (1964)

Channels	1	2	3	4	5	6	7	8
ISO 11171 in µm (c)	4	6	10	14	21	25	38	70
ISO 4402 in µm	2	5	10	15	20	25	50	100

Fluid compatibility
Mineral oils and phosphate esters
(other fluids on request, e.g. Skydrol)

Pressure and viscosity
High pressure 5 bar ... 420 bar *(73 ... 6000 PSI)*
Viscosity up to 300 mm²/s
Low pressure 0 ... 6 bar *(0 ... 87 PSI)*
Viscosity up to 160 mm²/s
(Through the integrated pump)

Power supply
Voltage range: 110 V ... 240 V AC
10 V ... 36 V DC
Rechargeable battery operation: 2,5 h
(battery charger is integrated in the counter)

Working conditions
Fluid temperature: 0 ... 90°C *(32 ... 194°F)*
Ambient temperature: 0 ... 40°C *(32 ... 104°F)*
Humidity 20% ... 85%, non-condensing
95% by storage

Data output:
Cumulative particle counts, as well as cleanliness classes to ISO 4406 / SAE AS4059 Rev. D (2001) and ISO 4406 / NAS 1638 depending on calibration (see ordering code).

Integrated printer

Integrated memory: 500 standard measurements (made of 3 single measurements)

Download software
Downloading and storage of the data in ASCII format, as well as the evaluation and the further processing in Microsoft Excel® 2000.

Dimensions (w x h x d)
Particle counter 310 x 310 x 145 mm
(12.2 x 12.2 x 5.7 in)
Case with wheels 410 x 720 x 200 mm
(14.3 x 18.5 x 7.1 in)

Weight
Particle counter 8.5 kg *(18.7 lbs)*
Particle counter with case and accessories
18 kg *(40 lbs)*

14. LasPaC I Kit includes:

1 x LasPaC I particle counter
1 x Aluminum trolley (case with wheels)
1 x Power supply connection cable
1 x Serial connection cable for connection to PC or notebook
1 x Software Download and Report
2 x STAUFF TEST hose (l = 1,5 m) for input/output
1 x Suction hose transparent (l = 1,5 m)
1 x Adapter low pressure hose to test coupling
1 x Control pen with plastic pin for the touchscreen
5 x Spare paper roll for built-in printer (order code SPR LasPaC)
1 x Operating instructions, in German and in English

15. Ordering code

LasPaC I - N - A

LasPaC I
Standard type

N	New Calibration ISO 11 171
O	Old Calibration ISO 4402
B	Both - New and Old Calibration

Electrical connection cable	
(none)	Standard "Schuko" connection plug (German standard)
A	North American connection plug

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FILTRATION TECHNOLOGY

Laser Particle Monitor - LPM 1

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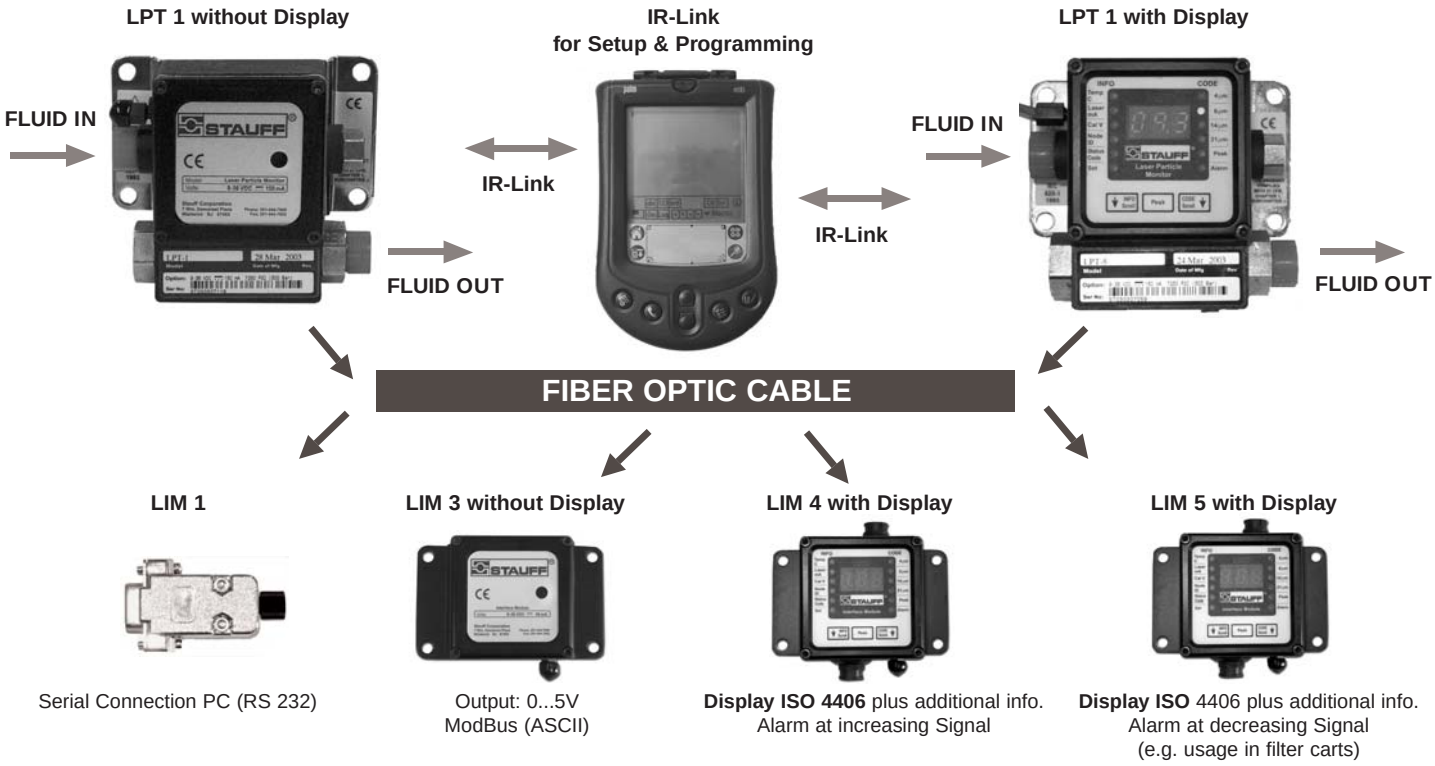
Laser Particle Monitor LPM 1 — Page

Laser Particle Monitor LPM 1

Description

The STAUFF Laser Particle Monitor System LPM 1 is a laser based 4-channel inline particle monitor designed for the continuous monitoring of particle contamination. The LPM 1 provides cumulative particle concentration information at >4 $\mu m_{(c)}$, >6 $\mu m_{(c)}$ and >14 $\mu m_{(c)}$ sizes applicable to the ISO 4406, ISO 11943 und ISO 11171 requirements for optical particle counters. A > 21 $\mu m_{(c)}$ channel is also provided for larger particle concentration information. Machine operators are alerted to changes in particle contamination levels in a machine's fluid by the indications provided from the LPM 1. The contamination level will be shown on the display or can be transmitted via the RS-232 serial port into a personal computer. With the ModBus-serial port the data can be transferred into a computer network or to an external display. It is also necessary to configurate the LPT particle sensor via an IR-port on a Palm or Pocket Computer. The LPM 1 system consists of a Laser Particle Transducer LPT and a Laser Interface Module LIM (see functional diagram).

Functional diagram

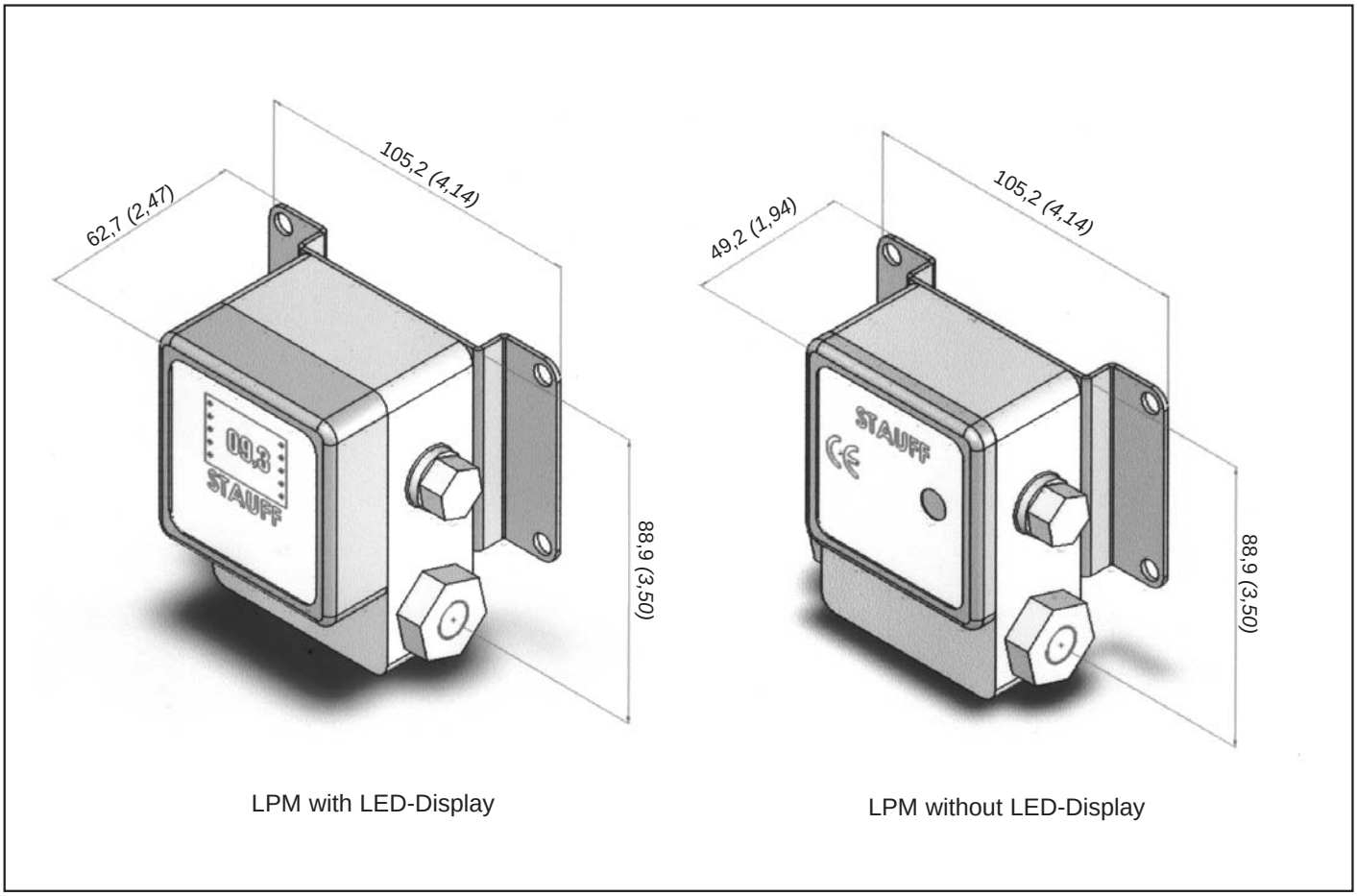


Laser Particle Monitor LPM 1

Technical Specification

Channel Sizes	4, 6, 14 and 21 $\mu m_{(c)}$ (ISO MTD/ISO 11171)
Light Source	Laser Diode
Verification	Optional certification available
Sampling	Online continuous monitoring
Reproducibility	± 0.5 ISO code (ISO 4406)
Display	Optional local display presents ISO codes and alarms
Power suplpy	9 to 36 volts DC
Output	RS-232, RS-485, 0 to 5 volts, Modbus, alarm contacts, local display
Reports	Particles/ml, ISO 4406 codes 4, 6, 14 and additional 21 $\mu m_{(c)}$ (ISO MTD/ISO 11171)
Connections	SAE – 4 (7/16-20 UNF)
Flow Rate	50 to 500 ml/min through the viewing area. All units offer integrated flow rate monitoring with alarms.
Fluid compatibility	Mineral based hydraulic and lubrication oils. Phosphate Esters optional
Viscosity	2 cSt (*32 SUS*) minimum
Operating Pressure	1.4 to 500 bar *(20 to 7250 PSI)*
Operation Temperature	-20 to 60 °C *(-4 to 140°F)* ambient, -20 to 85 °C *(-4 to 185°F)* fluid
IP	Rating 67
Accessories Included	DDE Software, 6m *(20 ft.)* fiber optic cable, operators manual

Dimensions



LPM with LED-Display

LPM without LED-Display

All dimensions in mm *(inch)*

Laser Particle Monitor LPM 1

Description

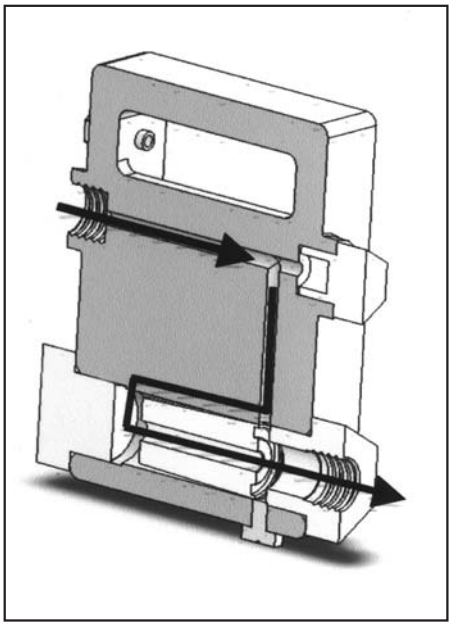
The LPM 1 system consists of two parts: a LPT Particle Transducer and a LIM Interface module.

Laser Particle Transducer LPT

The LPT Particle transducer contains the sensing device and electronics for detecting the level of contamination.

The laser based sensor uses light blocking technology for particle detection whereby particles passing through an optical flow cell block an amount of laser light proportional to the particle size.

The resultant particle concentration data from the LPT are sent to the LIM interface module via a fiber optic cable. The configuration of the LPT has to be done through the IrDA port of any PDA with IRA capabilities.



Flow Pattern

The LPT Particle transducers have a flow inhibitor downstream of the sensor that restricts and controls fluid flow from variable pressure sources.

The pressure is reduced to near atmospheric for return to the hydraulic reservoir. The inlet pressure ranges from 1.4 to 500 bar *(20 to 7250 PSI)* in three models are listed below.

The LPT's are available with or without a LED display. The three digit display shows the selected ISO code value or other function parameters.

Available types of LPT

LPT-1	28 to 500 bar *(400 to 7250 PSI)*, without LED-display
LPT-4	28 to 500 bar *(400 to 7250 PSI)*, with LED-display
LPT-7	3.4 to 83 bar *(50 to 1200 PSI)*, without LED-display
LPT-8	3.4 to 83 bar *(50 to 1200 PSI)*, with LED-display
LPT-9	1.4 to 13.8 bar *(20 to 200 PSI)*, without LED-display
LPT-0	1.4 to 13.8 bar *(20 to 200 PSI)*, with LED-display

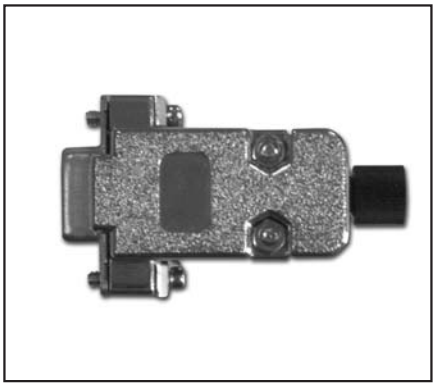
Interface Module LIM

The LIM interface module converts the raw count data from the LPT for display or use in acquisition, logging or control systems. A terminal emulation program can be used to read the ASCII data string. The LIM interface modules are available in four types to meet a wide variety of applications. The LPT is connected to the LIM via a fiber optic cable with a length up to 50 meters *(175 ft.)*.

LIM-1

The LIM-1 interface module has a DCE configuration (9-pin female) for attachment directly to a computer's RS-232 serial port. Power for the LIM-1 is supplied by the computer serial port.

The LIM-1 receives the raw serial data from the LPT transducer via a fiber optic cable and transmits them directly to the computer.



LIM-3

The LIM-3 receives raw serial data input from the LPT transducer via a fiber optic cable. This data string is analyzed and converted into 0 to +5 VDC analog output voltages proportional to the ISO codes and also into ModBus ASCII device protocol for interface to a PLC or computer via RS-485 and RS-232 serial port.

Special adapters also allow the integration into an ethernet-computer network.

All signal outputs, as well as the input supply voltage (9 to 36 VDC), are connected to the LIM-3 through a DB-15 connector.

LIM-4 and LIM-5

The LIM-4 and LIM-5 receive the raw serial data input from the LPT transducer via a fiber optic cable. Results are displayed on the front panel 3-digit LED display.

The ISO 4406 code number displayed is categorized in four size channels (>4, >6, >14 and >21 $\mu m_{(c)}$). The ISO number represents the number of particles counts per ml fluid. The user also can select internal information about the transducer (Temperature C, laser mA, Cal V, Node ID status code).

Alarm levels can be programmed for any of the four particle size channels. When set, an alarm indicator will flash if the alarm level is reached. For the LIM-4 the alarm is activated if the measured ISO numbers exceed the set alarm level and for the LIM-5 the alarm is activated if the ISO number falls below the set level.

Alarms on the LIM-4 and LIM-5 may be deactivated by pressing any button. Supply voltage is external and can be from a 9 to 36 VDC source.

Software (optional)

The standard software allows the download and the visualization of the measured particle distribution. On request a special software is available that allows the customer to control, monitor and analyse more than one LPM which are connected in a network. To achieve the required individual configuration please contact your local STAUFF partner.

Ordering Code

LPM 1 - T1 - M4

LPM 1
Laser Particle Monitor series LPM 1

Transducer Type LPM 1			
Code	**P/N**	**Operating Pressure**	**Display option**
0	-	no sensor	-
T1	LPT-1	28 to 500 bar *(400 to 7250 PSI)*	Without LED
T4	LPT-4	28 to 500 bar *(400 to 7250 PSI)*	With LED
T7	LPT-7	3.4 to 83 bar *(50 to 1200 PSI)*	Without LED
T8	LPT-8	3.4 to 83 bar *(50 to 1200 PSI)*	With LED
T9	LPT-9	1.4 to 13.8 bar *(20 to 200 PSI)*	Without LED
T0	LPT-0	1.4 to 13.8 bar *(20 to 200 PSI)*	With LED

Interface Module Type LIM		
Code	**Type**	**Output**
0	-	without interface module
M1	LIM-1	PC-connection RS-232 serial port
M3	LIM-3	8-channel (0-5 VDC) output, Modbus PC-connection RS-485 serial port
M4	LIM-4	LED-Display with alarm contacts (for exceeding the set alarm level)
M5	LIM-5	LED-Display with alarm contacts (for falling below the set alarm level)

Each LPM 1-Kit includes:

1 x LPT Laser Particle Transducer
- -includes 3 m *(10 ft.)* flying lead power cable (9 to 36 VDC required, not supplied)

1 x LIM Interface module
- -LIM-1, includes 6 m *(20 ft.)* interconnecting fiber optic cable
- -LIM-3, includes 6 m *(20 ft.)* interconnecting fiber optic cable and two 3 m *(10 ft.)* power cable with 3 pin connector.
- -LIM-4, includes 6 m *(20 ft.)* interconnecting fiber optic cable and one breakout cable with 15 pin connector
- -LIM-5, includes 6 m *(20 ft.)* interconnecting fiber optic cable and one breakout cable with 15 pin connector

1 x Quick Start Guide

1 x Operators Manual

1 x Software
- - Includes DDE server
- - Hex and terminal logger for RS-232
- - PDA Shareware