# Laser Diffraction Sensor for in-, on- and at-line Particle Size Analysis

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## Technical Specifications

**Sensor**
- **Label**: MYTOS | MYTIS
- **Overall measuring range**: 0.25 - 3,500 µm<br> 0.5 - 3,500 µm
- **Measuring range modules**: 7<br> 2
- **Dispersing systems**: RODOS<br> GRADIS

**Measuring principle**
- **Laser diffraction**
  - Forward scattering in parallel beam
  - Classic optical FOURIER set up (DIN 13320)
  - Encapsulated measuring zone with shielded aerosol input (sheath flow)

**Light source**
- **Helium-neon laser**
  - Wavelength: λ = 632.8 nm (red)
  - Output power: P_out = 5 mW

**Measuring ranges and optics**
- **Discrete measuring ranges with highest precision and resolution.**
  - MYTOS: R2 (f = 50 mm) - 0.25 µm - 0.45 µm - 87.5 µm
  - MYTIS: R6 (f = 1,000 mm) - 0.50 µm - 9.00 µm - 1,750 µm

**Detector and data acquisition**
- **Multi-element detector**
  - 31 semi-circular segments (180°) for orientation-independent characterisation of even irregular shaped particles
  - 3 centre elements for precise autofocus prior to every measurement and for continuous monitoring of optical concentration during measurement
- **Acquisition rate**: 2,000 diffraction patterns per second
- **Measuring time**: 0.5 ms/measurement<br> 30 - 60 s/measurement
- **Data processing**: Desktop / Industrial PC, Laptop, Touch panel PC

**Dry Dispersing Systems**
- **RODOS**: Injection disperser for finest, even cohesive powders
- **GRADIS**: Gravity disperser for coarser, even fragile particulate systems

**System configurations**
- **MYTOS**
  - **in-line**: MYTOS & TWISTER 100 | 150 | 200 (pipe diameter: 80 - 200 mm, 5 measuring ranges: R2 ... R6M)
  - **on-line**: MYTOS R2 ... R6M | R6 ... R7 | GMP (for pipe diameters: 38 - 800 mm, 7 measuring ranges: R2 ... R7)
  - **at-line**: MYTOS & VIBRI | GMP (automatic feeding, stationary unit, 7 measuring ranges: R2 ... R7)
  - **MYTOS & VIBRI Module**: GMP (automatic feeding, mobile module, 5 measuring ranges: R2 ... R6M)

- **MYTIS**
  - **on-line or at-line**: MYTIS & VIBRI | GMP (manual or automatic feeding, stationary or mobile unit, 2 measuring ranges: R6 | R7)

**Operational conditions**
- **Product temperature**
  - **in-line**: -20°C to 80°C
  - **on-line**: -20°C to 150°C
  - **at-line**: -20°C to 40°C
- **Ambient temperature**: -20°C to 40°C
- **Process pressure**
  - **standard**: 0.8 to 1.1 bar absolute
  - **ATEX**: 0.8 to 1.1 bar absolute
- **Pressure bursts**: R2 ... R6M (< 1 s) up to 10 bar, R6 | R7 (< 1 s) up to 8 bar
- **Protection class**: IP64
- **Protection classes ATEX**
  - gas, for zone 1 II 1G
  - dust, for zone 20/21 II 1D
  - dust, for zone 20/22 II 1D
  - hybrid, for zone 1+20/1+21 II 2GD1/2GD
Sampling Systems for Process

Powder | Meal | Sand | Grit | Granules

Sample Feeding and Process Coupling

**TWISTER**
- Representative, dynamic sampler for installation in process pipes. Scanning the entire pipe cross section with adaptable sample size.
- Particle size range: 0.25 - 3,500 µm
- Pipe diameter: 50 - 800 mm
- Product temperature: -20°C to 150°C
- Ambient temperature: -35°C to 55°C
- Process pressure: 0.25 - 3,500 µm
- Pipe diameter: 65 - 250 mm
- Product temperature: -20°C to 150°C
- Ambient temperature: -35°C to 55°C
- Protection class: ATEX

**SCREWSAMPLER**
- Representative screw sampling in down pipe
- Particle size range: 0.25 - 1,750 µm
- Pipe diameter: > 200 mm
- Product temperature: -20°C to 80°C
- Ambient temperature: -20°C to 40°C
- Process pressure: 0.8 to 1.1 bar absolute

**L-Probes**
- Compact sampler with blow-back unit (static L-probe) or with pivoting option (pneumatic pivoting probe)
- Particle size range: 0.25 - 3,500 µm
- Pipe diameter: static probe 65 - 250 mm, pivoting probe 150 - 200 mm
- Product temperature: static probe -20°C to 150°C, pivoting probe -20°C to 100°C
- Ambient temperature: -35°C to 55°C
- Process pressure: standard 0.8 to 1.1 bar absolute, ATEX (< 1 s) up to 10 bar
- Protection class: ATEX

**MIXER**
- Static mixer for representative sampling behind a screw feeder or a feeding chute
- Particle size range: 0.25 - 1,750 µm
- Pipe diameter: 60 mm
- Mass flow rate: max. 400 kg/h
- Product temperature: -20°C to 80°C
- Ambient temperature: -20°C to 55°C
- Protection class: n.a.

**VIBRI**
- Vibratory feeder for precise dosing. For adaptation to proprietary sampler or for manual feeding
- Particle size range: < 0.1 - 10,000 µm
- Product temperature: 0°C to 55°C
- Ambient temperature: -10°C to 55°C
- Protection class: IP20

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8) Application-dependent industrial extraction unit required if sample is not to be reintroduced into process. Sample recovery may be employed by cyclonic separation. 9) Certified pressure shock resistance as an option. 11) The stated specifications are indicative and display the overall spectrum of possible configurations. Values of individual configurations may vary. 11) External control box for MYTOS required, dimensions depending on specification: H 625 ... 1,200 / L 460 ... 975 / W 238 ... 386 mm; 25 ... 60 kg.
Systems for in-, on- and at-line Particle Size Analysis

Dimensions | Weight | Supply

**Dimensions and Weights**

<table>
<thead>
<tr>
<th>Sensors</th>
<th>Dimensions H / L / W (mm)</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MYTOS &amp; TWISTER in-line</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DN100</td>
<td>1,224 / 563 (704)* / 350</td>
<td>100 (99)*</td>
</tr>
<tr>
<td>DN150</td>
<td>1,280 / 563 (704)* / 380</td>
<td>135 (134)*</td>
</tr>
<tr>
<td>DN200</td>
<td>1,527 / 563 (704)* / 380</td>
<td>150 (149)*</td>
</tr>
<tr>
<td>MYTOS R2 ... R6M on-line</td>
<td>717 / 563 (704)* / 300</td>
<td>30 (33)*</td>
</tr>
<tr>
<td>MYTOS R6 ... R7 on-line</td>
<td>880 / 860 / 348</td>
<td>45</td>
</tr>
<tr>
<td>MYTOS &amp; VIBRI at-line</td>
<td>* (...) ATEX models</td>
<td></td>
</tr>
<tr>
<td>R2 ... R6M</td>
<td>936 / 563 / 300</td>
<td>38</td>
</tr>
<tr>
<td>Compact</td>
<td>836 / 563 / 258</td>
<td>37</td>
</tr>
<tr>
<td>Module13</td>
<td>1,052 / 996 / 326</td>
<td>150</td>
</tr>
<tr>
<td>R6 ... R7</td>
<td>1,130 / 860 / 348</td>
<td>53</td>
</tr>
<tr>
<td>MYTIS &amp; VIBRI13 at-line</td>
<td>1,363 / 870 / 720</td>
<td>190</td>
</tr>
</tbody>
</table>

**Sampling systems and process coupling**

| TWISTER 50 | DN50 | 458 / 370 / 231 | 8 |
| TWISTER 100 | DN100 | 689 / 525 (605)* / 311 (285)* | 68 (64)* |
| TWISTER 150 | DN150 | 784 / 580 (660)* / 340 | 105 (101)* |
| TWISTER 200 | DN200 | 875 / 580 (660)* / 376 | 80 (76)* |
| TWISTER 250 | DN250 | 1,000 / 610 (670)* / 395 | 95 (91)* |
| TWISTER ... | DN400 ... 800 | H 1,421 ... 2,000 | 400 ... 600 |
| | | L 1,065 ... 1,400 |
| | | W 695 ... 1,150 | * (...) ATEX models |
| MIXER | 330 / 140 / 115 | 4 |
| SCREWSAMPLER | 250 / 600 / 80 | 3 |
| Pivoting probe | 167 / 135 / 650 | 16 |
| Static L-probe | 170 / 96 / 340 | 5 |

**Power**

| MYTOS | 90 ... 250 V @ 50-60 Hz | 60 W |
| MYTOS & VIBRI | 90 ... 250 V @ 50-60 Hz | 70 W |
| TWISTER 50 | 90 ... 250 V @ 50-60 Hz | 35 W |
| TWISTER 100 ... 250 | 115 / 230 V @ 50-60 Hz | 600 W |
| TWISTER 400 ... 660 | 230 V @ 50-60 Hz | 3,000 W |
| TWISTER 100 ... 660 ATEX | 230 V @ 50-60 Hz | 1,400 W |

**Compressed Air**

| MYTOS | 4 ... 6 bar | 570 ... 870 Nl/min |
| MYTIS & VIBRI | 4 ... 6 bar | 300 Nl/min |
| TWISTER 50 | 5 ... 6 bar | 25 Nl/min |
| TWISTER 100 ... 250 | 2 ... 6 bar | 25 Nl/min |

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12) With in-line solutions H determines installation height in process line. 13) Including control box and rack
14) External control box for TWISTER required, dimensions depending on specification: H 490 ... 1,200 / L 430 ... 975 / W 238 ... 386 mm; Weight 13 ... 75 kg.
Systems for Particle Size Analysis
Evaluation | Quality | Software | Peripherals

**Evaluation modes**
- FREE: Fraunhofer Enhanced Evaluation (Fraunhofer Diffraction, parameter free)
- MIEE: Mie Extended Evaluation (Mie Scattering, deploying the complex refractive index)

**Quality of measuring results**
- Repeatability (σ):< 0.3 %, typical, dry measurement
- Comparability (σ):< 1.5 %, mean relative standard deviation
- |Δx50|< 2.5 %, maximum relative deviation

**Quality assurance system**
- Certification: Standardised test procedure
- Reference material:
  - SiC-F1,200 (x50 = 4.5 µm)
  - SiC-P600 (x50 = 27 µm)
  - SiC-P80 (x50 = 260 µm)
  - SiC-P50 (x50 = 430 µm)
- Validation: Qualification of the measuring system within a validated process according to FDA regulations

**Software**
- PAQXOS: PC or remote control of application in terms of sensor, dispersing unit and sample feeding
- Control and evaluation software for particle size analysis:
  - Evaluation – Fraunhofer Enhanced Evaluation (FREE)
  - Mie Extended Evaluation (MIEE)
  - Mean values and standard deviations
  - Presentation of results based on user-defined reports and templates
  - Diagrams (distribution curves, trend graphs)
  - Tables
  - Characteristic values
  - Step-by-step wizard for quick & successful measurements
  - Intuitive SOP management
  - User-friendly, individual user interface

**Compliance**
- ISO 13320: The ISO standard requirements concerning "Particle size analysis - Laser diffraction methods" are met and in parts outperformed.
- FDA 21 CFR Part 11: The compliance to FDA rule standards concerning electronic records and electronic signatures is provided.

**Computer specifications**
- Operating system: Microsoft® Windows® 10 Professional (64 Bit)
- Hardware:
  - Up-to-date desktop PC, e.g., Intel® Core™ i5-6600, min. 3 GHz,
  - 8 GB RAM, 6 MB Cache, SSD 512 GB SATA,
  - Intel® HD Graphics 530, DVD±RW
- Display: 23” Full HD (1,920 x 1,080 px)
- Data transfer: Ethernet LAN connection (100 MBit/s), min. CAT5,
  - FOL-LAN using media converters
- Connectivity to distributed control system: Modbus® RTU, Modbus® TCP, Profibus®, OPC,
  - TCP/IP, FTP, analogue SPS signals

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15) optional 16) The given values are valid for measurements with reference material SiC P600 related to the x50-value. 17) Repeated dry measurement of riffled sample. 18) system-to-system reproducibility 19) Microsoft® Windows® 7 Professional (64 Bit) supported.
20) Sympatec reserves the right to supply equivalent or better specified personal computers.