

## Technical Specifications

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| <b>General Specifications</b>              |  |
| type of instrument                         | free-beam based external optics head coupled to low temperature objective and ultra-high transmission spectrometer                                     |
| sensor head specifics                      | unique low temperature compatible achromatic objectives with high numerical aperture, optimized for different wavelength ranges                        |
| <b>Confocal Unit</b>                       |  |
| configuration                              | compact and modular design, two or more optical channels; standard configuration: one excitation and one detection channel                             |
| key benefits                               | quick and reliable alignment of each channel, steering mirror for combined beams long-term stability   |
| quick-exchange of optical components       | beamsplitters, filter mounts for up to 4 filters/polarizers, (1" diameter); optional piezoelectric rotator with filter mount                           |
| pinhole configuration                      | two pinholes (fiber apertures), different illumination and collection wavelength possible  |
| pinhole size                               | dependent on fibers, typically 3 .. 9 $\mu\text{m}$ mode field diameter  |
| compatible LT-objective                    | LT-APO/VIS, LT-APO/VISIR, LT-APO/NIR (see accessory section for more information)  |
| inspection unit                            | sample imaging with large field of view: $\sim 54 \mu\text{m}$ (attoDRY)   |
| <b>Illumination</b>                        |  |
| excitation wavelength range                | 400 .. 1000 nm, default 532 nm (others on request)   |
| illumination port specification            | FC/ APC-connector for single mode fibers or free-beam configuration  |
| light source                               | dedicated Raman laser, single mode fiber coupled   |
| light power on the sample                  | typically 1 pW..10mW   |
| optical filter                             | laser line filter  |
| <b>Detection</b>                           |  |
| detection mode                             | 2D Raman images, time and single point Raman spectra   |
| spectrometer                               | ultra-high transmission spectrometer, $f=300 \text{ mm}$   |
| total optical transmission                 | greater 60% at 532 nm  |
| filters                                    | dichroic mirror & edge filter for signal detection as close as 90 cm <sup>-1</sup> to the laser line   |
| gratings                                   | typ. 600/mm and 1800/mm grating  |
| spectral resolution                        | 1 cm <sup>-1</sup> at 1800/mm grating  |
| CCD camera                                 | back-illuminated CCD, peltier-cooled to -60 °C at 20 °C room temperature, 1024x127 pixels, 90% quantum efficiency at 532 nm, 100 kHz readout converter |
| <b>Sample Positioning</b>                  |  |
| total travel range                         | 5 x 5 x 4.8 mm <sup>3</sup> (open loop)  |
| step size                                  | 0.05..3 $\mu\text{m}$ @ 300 K, 10..500 nm @ 4 K  |
| fine scan range                            | 50 x 50 $\mu\text{m}^2$ @ 300 K, 30 x 30 $\mu\text{m}^2$ @ 4 K (open loop)   |
| sample holder                              | ASH/QE/0 quick exchange sample holder and integrated heater with calibrated temperature sensor   |
| <b>Suitable Operating Conditions</b>       |  |
| temperature range                          | 1.5 K..300 K (dependent on cryostat); mK compatible setup available on request   |
| magnetic field range                       | 0..15 T+ (dependent on magnet)   |
| operating pressure                         | designed for He exchange gas (vacuum compatible version down to 1E-6 mbar on request)  |
| <b>Suitable Cooling Systems</b>            |  |
| titanium housing diameter                  | 48 mm  |
| bore size requirement                      | designed for a 2" (50.8 mm) cryostat/magnet bore   |
| compatible cryostats                       | attoDRY1000/1100/2100..  |
| <b>Compatibility with Electronics</b>      |  |
| scan controller and software               | FPGA-based RAMAN controller providing coarse positioning and scanning signals for x, y, and z.   |
| <b>Options and Upgrades</b>                |  |
| in-situ inspection optics                  | incl. with CFM I external optics head  |
| closed loop upgrade for coarse positioners | resistive encoder, range 5 mm, sensor resolution approx. 200 nm, repeatability 1-2 $\mu\text{m}$   |
| sample holder upgrade                      | ASH/QE/4CX quick-exchange sample holder (8 electrical contacts, integrated heater & T-sensor)  |
| Voigt geometry upgrade                     | optional scanner for Voigt & Faraday geometry  |

