LSM 710 NLO and LSM 780 NLO Technical Data

Microscopes	
Stands	Upright: Axio Imager.Z2, Axio Imager.M2, Axio Examiner, Axio Observer.Z1 with rear port
Z drive	Smallest increments: Axio Imager.Z2: < 25 nm; Axio Imager.M2: < 25 nm; Axio Observer.Z1: < 25 nm; Axio Examiner: < 30 nm; fast Piezo objective or stage focus accessory; Definite Focus unit for inverted stand
XY stage (option)	Motorized XY-scanning stage, with Mark & Find function (xyz) and Tile Scan (mosaic scan); smallest increments 1 µm (Axio Observer), 0.2 µm (Axio Imager) or 0,25 µm (Axio Examiner)
Accessories	Digital microscope camera AxioCam; integration of incubation chambers

Scannning Module	
Models	Scanning module with 2, 3 or 34 spectral detection channels; high QE for LSM 780 (45 % for GaAsP typical), 3 × lower dark noise compared to conventional PMTs; up to 10 individual, adjustable digital gains; prepared for lasers from UV to IR
Scanners	Two independent, galvanometric scan mirrors with ultra-short line and frame flyback; highly linear scanning process
Scan resolution	4 × 1 to 6144 × 6144 pixels; also for multiple channels; continuously variable
Scanning speed	15 × 2 speed stages; up to 8 frames/sec with 512 × 512 pixels (max. 250 frames/sec 512 × 16); up to 4000 lines per second
Scan zoom	0.6 × to 40 ×; digital variable in steps of 0.1 (on Axio Examiner 0.67 × to 40 ×)
Scan rotation	Free rotation (360 degrees), in steps of 1 degree variable; free xy offset
Scan field	20 mm field diagonal (max.) in the intermediate plan, with full pupil illumination; 18 mm for Axio Examiner
Pinholes	Master-pinhole pre-adjusted in size and postion, individually variable for multi-tracking and short wavelengths (e.g. 405 nm)
Beam path	Exchangeable TwinGate main beam splitter with up to 100 combinations of excitation wavelengths and outstanding laser light suppression; optional laser notch filters for fluorescence imaging on mirror-like substrates (on request); outcoupling for external detection modules (e.g., FCS, B&H FLIM); low-loss spectral separation with Recycling Loop for the internal detection
Spectral detection	Standard: 2, 3 or 34 simultaneous confocal fluorescence channels with highly sensitive low dark noise PMTs; 32 x GaAsP for LSM 780 NLO; spectral detection range freely selectable (resolution down to 3 nm); additionally two incident light channels with APDs for imaging and single photon measurements; transmitted light channel with PMT; cascadable non-descanned detectors (NDD) with PMT or GaAsP NDD
Data depth	8-bit, 12-bit or 16-bit selectable; up to 37 channels simultaneously detectable

Laser Inserts	
Laser inserts (VIS, V)	(VIS, V, In *Tune*) pigtail-coupled lasers with polarization preserving single-mode fibers; stabilized VIS-AOTF for simultaneous intensity control; switching time < 5 µs, or direct modulation; up to 6 V/VIS-laser directly mountable in the scanning module; diode laser (405 nm, CW/pulsed) 30 mW; diode laser (440 nm, CW+pulsed) 25 mW; Ar-laser (458, 488, 514 nm) 25 mW or 35 mW; HeNe-laser (543 nm) 1 mW; DPSS-laser (561 nm) 20 mW; HeNe-laser (594 nm) 2 mW; HeNe-laser (633 nm) 5 mW (pre-fiber manufacturer specification)
External lasers (NLO, VIS, V)	Prepared laser ports for system extensions; direct coupling of pulsed NIR lasers of various manufacturers (including models with prechirp compensation); fast intensity control via AOM; NIR-optimized objectives and collimation; fiber coupling (single-mode polarization preserving) of external In *Tune* Laser, (488-640nm, <3nm width, pulsed) 1,5mW and prepared for UV laser (355nm, 60mW), manipulation lasers of high power in the VIS range 488–561 nm (e.g., LSM 7 DUO-systems)

Electronics Module	
Realtime electronics	Control of the microscope, the lasers, the scan module and other accessory components; control of the data acquisition and synchronization by real-time electronics; over-sampling read out logic for best sensitivity; data communication between real-time electronics and user PC via Gigabit-Ethernet interface with the possibility of online data analysis during image acquisition
User PC	Workstation PC with abundant main and hard disk memory space; ergonomic, high-resolving 16:10 TFT flat panel display; various accessories; operating system Windows Vista 32 or 64 bit; multi-user capable

ZEN Standard Software

System configuration	Workspace for comfortable configuration of all motorized functions of the scanning module, the lasers and the microscope; saving and restoring of application-specific configurations (ReUse)
System self-test	Calibration and testing tool for the automatic verification and optimal adjustment of the system
Acquisition modes, Smart Setup	Spot, line / spline, frame, z-stack, lambda stack, time series and all combinations (xyz λ t); online calculation and display of ratio images; averaging and summation (line / framewise, configurable); OSCiscan and step scan (for higher frame rates); smart acquisition setup by selection of dyes
Crop function	Convenient and simultaneous selection of scanning areas (zoom, offset, rotation)
RealROI scan, spline scan	Scanning of up to 99 arbitrarily shaped ROIs (Regions of Interest); pixel-precise switching of the laser; ROI definition in z (volume); scan along a freely defined line
ROI bleach	Localized bleaching of up to 99 bleach ROIs for applications such as FRAP (Fluorescence Recovery After Photobleaching) or uncaging; use of different speeds for bleaching and image acquisition; use of different laser lines for different ROIs
Multitracking	Fast change of excitation lines at sequential acquisition of multicolor fluorescence for reduction of signal crosstalk and for increased dynamics without global increase of laser exposure
Lambda scan	Parallel or sequential acquisition of image stacks with spectral information for each pixel
Linear unmixing	Generation of crosstalk-free multifluorescence images with simultaneous excitation; spectral unmixing – online or offline, automatically or interactively; advanced logic with reliability figure
Visualization	XY, orthogonal (xy, xz, yz); cut (3D section); 2.5D for time series of line scans; projections (maximum intensity); animations; depth coding (false colors); brightness; contrast and gamma settings; color selection tables and modification (LUT); drawing functions
Image analysis and operations	Colocalization and histogram analysis with individual parameters; profile measurements on any line; measurement of lengths, angles, surfaces, intensities etc; operations: addition, subtraction, multiplication, division, ratio, shift, filtering (low pass, median, high-pass, etc; also customizable)
Image archiving, exporting & importing	Functions for managing of images and respective recording parameters; multi-print function; over 20 file formats (TIF, BMP, JPG, PSD, PCX, GIF, AVI, Quicktime, etc) for export

Optional Software

LSM Image VisArt plus	Fast 3D and 4D reconstruction; animation (different modes: shadow projection, transparency projection, surface rendering); package 3D for LSM with measurement functions upon request
3D deconvolution	Image restoration on the basis of calculated point-spread function (modes: nearest neighbor, maximum likelihood, constraint iterative)
ROI-HDR	High dynamic range imaging mode with intelligent local improvement of signal dynamics, free choice of gain or laser power modulation
Physiology / Ion concentration	Extensive analysis software for time series images; graphical mean of ROI analysis; online and off-line calibration of ion concentrations
FRET plus	Recording of FRET (Fluorescence Resonance Energy Transfer) image data with subsequent evaluation; supports both the methods acceptor photobleaching and sensitized emission
FRAP	Analysis of the intensity kinetics of FRAP (Fluorescence Recovery After Photobleaching) experiments.
Visual macro editor	Creation and editing of macros based on representative symbols for programming of routine image acquisitions; package multiple time series with enhanced programming functions upon request
VBA macro editor	Recording and editing of routines for the automation of scanning and analysis functions
Topography package	Visualization of 3D surfaces (fast rendering modes) plus numerous measurement functions (roughness, surfaces, volumes)
StitchArt plus	Mosaic scan for large surfaces (multiple XZ profiles and XYZ stacks) in brightfield mode
RICS image correlation	Single molecule imaging and analysis for all LSM 710 and LSM 780 systems with PMT detectors (published by Gratton)

Certifications: