Leica HCS LSI

High Content Screening Automation

Technical Documentation

Living up to Life

Leica

MICROSYSTEMS

Leica HCS LSI – High Content Screening Automation

**Explore the new dimensions of imaging!**
High content is provided by true confocal high resolution point scanner technology for pre-screen and secondary screens. Fast analysis is performed by digital camera imaging. Maximum flexibility is generated by the adaptive zoom technology, combining the innovative optical zoom with confocal zoom for universal applications. Large working distance macro objectives as well as micro objectives offer perfect system adaptation to your experiments.

The High Content Screening Automation software enables efficient screening and easy automation. Computer Aided Microscopy allows external system control and turns your Leica imaging system into an intelligent microscope.
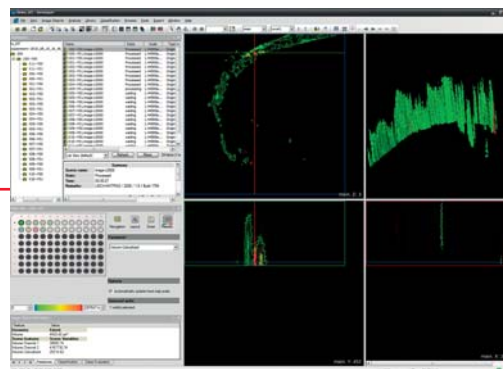
For image analysis, the OME.TIF format provides highest compatibility with existing solutions. The Leica Edition of Definiens Developer XD even enables 4D image analysis.

Leica HCS LSI
Application Solution

Acquisition: Leica HCS LSI Imaging System
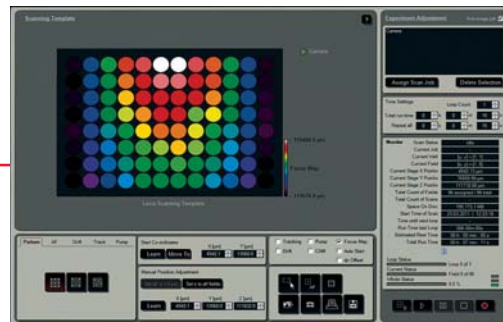
Automation: Leica LAS AF Matrix M3

Analysis: Leica Edition Definiens Developer XD

Specifications

True spectral confocal point scanning system			
Scanner	Method		True confocal point scanner
	Confocal channels		1
	Scanner		Galvo, [x, y]
	Sequential scan		yes
	Channels		1- 8, sequential multiplexing
Laser	Laser type		solid state
	Laser		max 4
	Laser excitation wavelength	[nm]	405, 488, 561, 635
	Excitation attenuation		AOTF, direct modulation
	Excitation attenuation control		automated
	Range	[%]	0-100
Spectral detection	Spectral detection		yes
	Band selection		continuously variable
	Bandwidth	[nm]	430 – 750
	Spectral resolution	[nm]	5 nm
	Detector		1, direct coupling
	Detector type		ultra high dynamic PMT
Transmitted light	Transmitted light detector		yes
	Detector type		ultra high dynamic PMT
Resolution	Range (min – max)	[pixel^2]	128 – 2048
	Scan formats	[pixel]	128, 256, 512, 1024, 2048
	Image bit depth	[bit]	8 or 12, switchable
Beam splitter	Type		high performance dichroics
	Beam splitter 1, wavelength	[nm]	405, 488, 561, 635
	Beam splitter 2, wavelength	[nm]	405, 588, 561
	Beam splitter 3, ND	[%]	30/70
	Beam splitter exchange		automated
Pinhole	Pinhole type		motorized, variable
	Range (min - max)	[µm]	35 – 600
	Pinhole adjustment	[%]	0 – 100
	Control		automated via GUI
Scan modes			
	2D	Line, time, area	xt, xy, xz
	3D	Volume	xyz; xzy
		Area, time	xyt; xzt
		Area, lambda	xyλ; xzλ
	4D	Volume, time	xyzt; xzyt
		Area, lambda, time	xyλt; xzλt
		Volume, lambda	xyλz
		Area, lambda, time	xyλt
	5D	Volume, lambda, time	xyzλt
Speed	Speed mode		uni-, bi-directional
	Line speed range	[Hz]	400, 600, 800, bi: 1200, 1600
	max @ 128^2 bi-directional	[f/s]	7.0
	standard @ 512^2	[f/s]	2.0
	min @ 2048^2	[f/s]	0.36
FOV	Field of view (diagonal)	[mm]	16
Power supply	Power supply integration		yes
	Type		auto select
	Voltage range	[V]	100–240 AC
Digital camera imaging	Digital camera		DFC365 FX
	Number of dichroics		4 + empty, manual turret

Workstation			
External computer	Processor		Intel® Xeon® Quad Core
	Memory	[GB]	12
	HD-Size	[GB]	2000
	Operating system		Windows 7®
Interfaces	USB		8
	FireWire		4 (1 x 1394a, 3 x 1394b)
	Ethernet		1
	DVI, HDMI		1/1
Monitor	Graphics resolution	[Pixel]	2 x (2560 x 1600)
	Monitor size		2 x 19"/30" (48 cm/76 cm)

Micro & macroscope stand			
Characteristics	Type	upright	LSI6000, base
	Application		Micro and Macro
	Focusing drive		motorized
	Head Travel Range	[nm]	150
Illumination	Transmitted light, intensity control		automated and manual
	Fluorescence illumination		EL6000
	Contrasting		Rottermann tilted illumination
Workspace	Height, Depth, Width	[mm]	180, 420, 555
	Wing door access, open	[°]	180
Laser safety	Laser safety acrylic glass box		yes
	Laser safe tube		yes
Micro manipulation	Manipulator type		Eppendorf, motorized
	Mounting		inside, variable
Environmental control	Sample light protection		yes
	Temperature		yes
	CO_2		yes
	Humidity		yes
	Gas cover for galvo stage		yes

Z-drives	Type	Drive	Travel range [µm]	Z-resolution [µm]
	SuperZ stage	Galvanometer stage	500	0.01
	Fine focus	Stepper motor	10,000	5.0
	Motor focus	Stepper motor	150,000	1.0

Leica HCS LSI – Optics

Adaptive Zoom Technology			
	Zoom types		2
Confocal zoom	Type		Confocal scanner integration
	Magnification range		1x – 58x
	Zoom increment		0.1
	Zoom control		motorized, continuously variable
	NA		0.3 – 1.30, objective independent
Optical zoom	Type		Z6 APO A	Z16 APO A
	Magnification range	variable	0.57 – 3.6x	0.57 – 9.6x
	Zoom increment		0.01	0.01
	NA, w objective 5x	variable	0.10 – 0.50	0.09 – 0.50
	Zoom control		motorized, continuously variable
	Focus control		motorized fine focus optics
	Optical z-positioning		motorized
	Diaphragm		motorized

Objectives	Magnification	NA, objective	Working distance [mm]
Macro objectives	1x	0.117	97.0
	2x	0.234	39.0
	5x	0.5	19.0
Micro objectives[5]	10x	0.3	0.30
	20x	0.6	0.16
	40x	0.8	0.16
	63x	1.3	0.15

Optical parameters

Macro objectives with optical zoom

	Parameter	Field of view [mm]							Optical magnification [x]					
	Zoom type	Z16 APO A			Z6 APO A				Z16 APO A			Z6 APO A		
	Objective	1x	2x	5x	1x	2x	5x		1x	2x	5x	1x	2x	5x
Optical zoom settings	0.6	22.0	11.0	4.4	22.0	11.0	4.4	0.6	0.7	1.4	3.5	0.7	1.4	3.5
	0.8	15.7	7.8	3.1	15.7	7.8	3.1	0.8	1.0	2.0	5.0	1.0	2.0	5.0
	1.0	12.5	6.3	2.5	12.5	6.3	2.5	1.0	1.2	2.5	6.2	1.2	2.5	6.2
	1.3	10.0	5.0	2.0	10.0	5.0	2.0	1.3	1.6	3.1	7.8	1.6	3.1	7.8
	1.6	7.8	3.9	1.6	7.8	3.9	1.6	1.6	2.0	4.0	9.9	2.0	4.0	9.9
	2.0	6.3	3.1	1.3	6.3	3.1	1.3	2.0	2.5	5.0	12.4	2.5	5.0	12.4
	2.5	5.0	2.5	1.0	5.0	2.5	1.0	2.5	3.1	6.2	15.5	3.1	6.2	15.5
	3.2	3.9	2.0	0.8	3.9	2.0	0.8	3.2	4.0	7.9	19.8	4.0	7.9	19.8
	3.6	3.5	1.7	0.7	3.5	1.7	0.7	3.6	4.5	8.9	22.3	4.5	8.9	22.3
	4.6	2.7	1.4	0.5				4.6	5.7	11.4	28.5			
	5.0	2.5	1.3	0.5				5.0	6.2	12.4	31.0			
	6.3	2.0	1.0	0.4				6.3	7.8	15.6	39.1			
	8.0	1.6	0.8	0.3				8.0	9.9	19.8	49.6			
	9.2	1.4	0.7	0.3				9.2	11.4	22.9	57.2			

Note: The dark green fields mark the recommended range for 3D imaging at confocal zoom 1. For Z16 APO A, NA increases up to 6.3x optical zoom.

Magnification range, optical zoom	max. 0.6x – 9.2x

Macro objectives with optical and confocal zoom

Combination of optical and confocal zoom	yes
Magnification range of optical and confocal zoom, total	max. 0.6x – 533.6x

Micro objectives[5] with confocal zoom

Magnification range of confocal zoom, total	1x – 58x

Parameter	Field of view [mm]						Optical magnification [x]					
Adapter 1x	15 6904 623						15 6904 623					
Objective	10x	20x	40x	63x			10x	20x	40x	63x		
Confocal zoom 1	1.60	0.80	0.40	0.25			10x	20x	40x	63x		

Leica HCS A – High Content Screening Automation

Leica HCS A platform information

	System support[1]		TCS LSI, HCS LSI
	LAS AF version		2.5.0 or higher
Image acquisition	Imaging technologies		True confocal point scanner
			Digital imaging
	Supported cameras		DFC365 FX
Multicolor	Confocal	No. of colors	8
	Camera	No. of colors	1
Transmitted light	Confocal		yes, optional
	Camera		yes, optional
Motorized stage	Scanning stage	15 6905 202	Included in HCS LSI only
	xy-travel range[2]		127 x 83 mm
Export formats	Image types[3]		TIF, OME.TIF, LIF
	Image data format		OS platform independent
Network	Protocol		TCP/IP
	Administration		Local system admin
Remote system control	Control via network		Yes, with CAM
	Control interface		Computer Aided Microscopy, CAM
System requirements	Platform		TCS LSI, HCS LSI
	Operating system		Windows XP®, SP3, Windows 7®
	Recommended		
	Processor speed	[MHz]	3
	Memory	[GB]	4
	Hard disk	[GB]	500
	Network		yes
Limitations		Hardware excluded	TCS SP5 X, TCS SP5 MP, TCS STED, DMI6000 CFS
			TCS SMD FCS, FLIM, FLCS, WLL
		Software excluded	FRAP, FRET, Electrophysiology

Leica HCS A software				
Imaging automation	Licenses			Included in the HCS LSI product
	LAS AF MATRIX Mosaic Advanced	156602501		yes
	LAS AF MATRIX Mosaic+Multiwell Advanced	156602502		yes
	LAS AF MATRIX Mosaic Full Version	156602504		yes
	LAS AF MATRIX Multiwell Full Version	156602505		yes
	LAS AF MATRIX Full Version w/o CAM	156602511		yes
Remote system control	LAS AF MATRIX Developer Entry	156602512		upgrade option, not included
	LAS AF MATRIX Developer Full w. CAM	156602514		upgrade option, not included
Accessory tools	LAS AF MATRIX Single Object Tracking	156602507		upgrade option, not included
	LAS AF MATRIX Z-Drift Compensator	156602509		upgrade option, not included

Leica HCS LSI – System Performance

Leica HCS LSI system performance					
	Acquistion speed measurement		Avg. time per well incl. xy-travel, 96-well plate		
True confocal screen	HCS LSI w. confocal system				
Parameter	No. of channels incl. TLD	No. of colors	No. of z-sections	Format	Confocal [min/well]
Primary screen	2	1	1	256 x 256	0.04
	2	1	1	512 x 512	0.04
	2	1	1	1024 x 1024	0.06
Secondary screen	2	1	1	2048 x 2048	0.06
	2	1	10	512 x 512	0.36
	2	1	30	512 x 512	0.37
	2	1	100	512 x 512	0.89

Digital camera screen	HCS LSI w. DFC360 FX, binning: none, image depth: 12 bit				
	No. of channels, no TLD	No. of colors	No. of z-sections	Format	Camera [min/well]
	1	1	1	1392 x 1040	0.06
	1	1	10	1392 x 1040	0.09
	1	1	30	1392 x 1040	0.13
	1	1	100	1392 x 1040	0.31

Leica HCS LSI – Compatible Image Analysis and Control

Image analysis & remote control software options		
Compatible software (examples)		Not included in the packages
	Programming languages	C++, C#, VB, Lab VIEW™, MATLAB™
	Image manipulation	Adobe Photoshop®
	Image analysis software[4]	ImageJ with LOCI plug-ins for OME import
		MetaMorph®, MM AF® TIFF import

Leica Edition of Definiens		Not included in the packages
	Image analysis software	Leica Edition of Definiens Developer XD
	Import	OME.TIF, LIF, Metadata
	Programming & Plug-ins	yes
	Report out	yes

Annotations:

1 Supports technology within the range of the product specification.

2 For all sample carrieres, a test is recommended.

3 Open Microscopy Environment (OME) is a multi-site collaborative effort among academic laboratories and a number of commercial entities that produces open tools to support data management for biological light microscopy. Designed to interact with existing commercial software, OME source code is available under GNU public copyleft licenses. OME is developed as a joint project between research-active laboratories at the Dundee, NIA Baltimore and Harvard Medical School and LOCI.

4 C++ is a programming language standardized by ISO. C# is a programming language developed by Microsoft, Inc. Lab VIEW™ is a registered trademark of NI National Instruments Inc. MATLAB™ is a registered trademark of The MathWorks™, Inc. Adobe Photoshop® is a registered trademark of Adobe Systems® Incorporated. ImageJ is a public domain Java image processing program inspired by National Institutes of Health, NIH. Windows® XP is a registered trademark of the Microsoft® Corporation. Definiens® is a registered trademark of Definiens AG. Meta-Morph® is a registered trademark of MDS Analytical Technologies.

5 The software supports switching between two macro objectives. For micro objectives, an adapter is required. For micro objectives, only the confocal zoom is applicable.
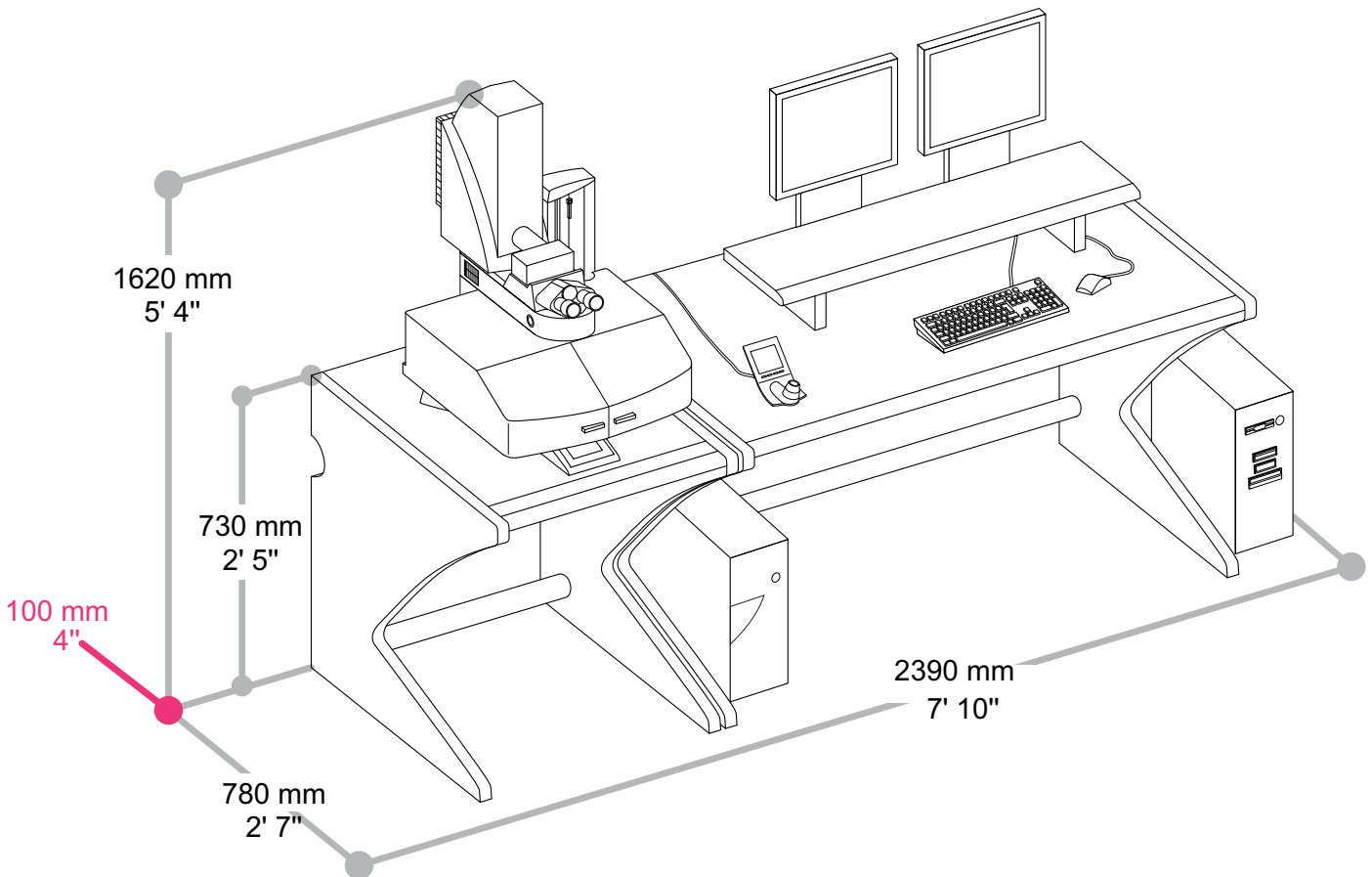
Room Requirements

Power supply			
	Power supply integration		yes
	Type		auto select
	Voltage range	[V]	100 – 240 AC
	Power consumption	[VA]	800
	Independent circuits	[no.]	1
	Frequency	[Hz]	50/60
	Fuse: standard	[A]	10

	Note: The optimal optical performance can only be achieved on stable room floors.		
	Concrete floors are required. Others, i.g. wooden floors, are not suitable.		

Environment			
	Humidity	[%]	10 – 80
	Operating temperature	[°C]	18 – 30
	Guaranteed stability	[°C]	23 +/- 2

Load capacity and weight			
	Confocal unit, max.	[kg]	75
	Microscope, max.	[kg]	45
	System	[kg]	90
	Static floor load	[kg/m²]	200

1620 mm
5' 4"

730 mm
2' 5"

100 mm
4"

780 mm
2' 7"

2390 mm
7' 10"

Visible radiation:

LASER RADIATION
VISIBLE AND INVISIBLE - CLASS 3B
AVOID DIRECT EXPOSURE TO BEAM
< 500mW   350-700nm
IEC 60825-1: 2007

Leica HCS LSI Systems

Confocal Scanning Units

Solid State Laser:
- ☀ R: SS 18 mW 632 nm
- ☀ Y: SS 20 mW 561 nm
- ☀ B: SS 10 mW 488 nm
- ☀ V: SS 25 mW 405 nm

Scanhead

PC

Supply Unit

R Y B V

Solid State Laser   AOTF

(14)
(15)

Confocal Macroscopes

(9)
(16)
(8)
(1)
(2)
(6)
(5)
(3)
(4)

Base CSQ VIS
Lasersafe, Fluo-axis, 5x Fluo BF Base
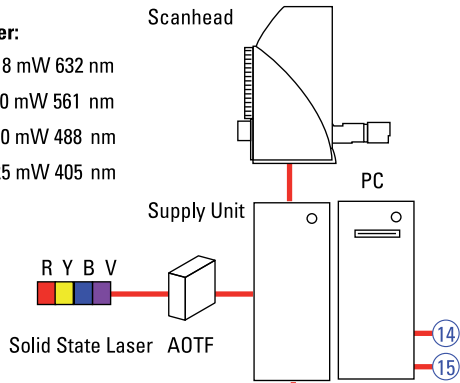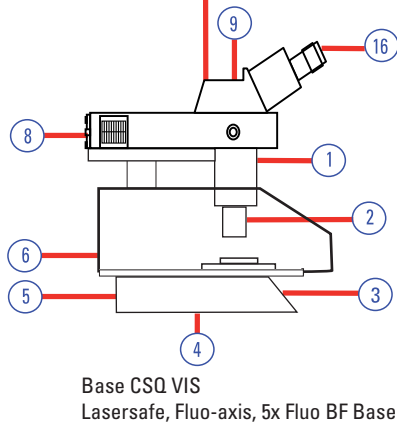
Macroscope Accessories:

Input/Output Equipment

Touch Control Panel

Control Panel Opti

(15)

Keyboard,
Mouse
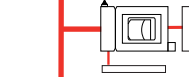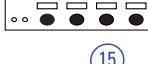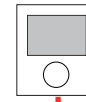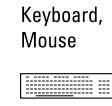
Precise mot. Scanning
Stage Kit incl. CTR6500
Drive Control, Smart Move

SuperZ Galvo
Focus Stage

(8)

Insert for SuperZ,
basic, system
included

EL6000, system in
External Fluo-light
HXP120 Burner, Li
Guide, Adapter 1"

(3a)
(3b)

Optional
Stage Inserts

Optional
Plate Inserts

Fast Z-Positioning Control

Fluorescence -Ill

Additional Leica HCS LSI options

Upgrades:

15 6901 703 Leica TCS LSI Confocal Unit RYB upgr.
15 6901 721 Leica TCS LSI Confocal Unit RYBV upgr.
15 6901 232 Leica TCS LSI Macroscope Z16 APO A*
15 6901 232 Leica TCS LSI Macroscope Z6 APO A*
15 6901 232 Leica TCS LSI Macroscope Basic**

Hardware-Options:

(15)
15 6905 711
Control Panel for TCS LSI

15 6905 703
30" High Brilliance Monitor

15 69 05 712
External Workstation

(16)
15 69 04 700
Inversion Ocular TCS LSI

Transmitted Light Detector Kit:

(5)
15 6905 100
Transmitted Light Detector for TCS LSI
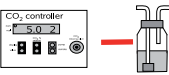
### SuperZ Galvo Stage Inserts:

(3a) (3b)
15 6604 410
Stage Insert for SuperZ,
rotatable

(3b)
15 5935 411
Stage Insert for SuperZ,
universal

(3b)
15 6604 412
Stage Insert for SuperZ,
basic (system included)

(3b) **Plate Inserts:**

15 6604 420 Plate Insert -Microtiter Plate
(system included)
15 6604 421 Plate Insert -Willco Dish 35 mm
15 6604 422 Plate Insert -Willco Dish 50 mm
15 6604 423 Plate Insert -MatTek Dish 35 mm
15 6604 424 Plate Insert -Petri dishes 36 mm
15 6604 425 Plate Insert -Petri dishes 39 mm

Climate Control:

15 6905 602
Universal Gas Cover for SuperZ w. In/Outlet

(3b) (3c)

15 6905 600
TCS LSI CO_2-Control Set 110V/230V

(3c)

Including:
SuperZ CO_2-Cover

CO_2 controller

CO_2-Controller,
Humidifier

15 6905 400 Leica LSI Climate Kit

(6)

heating unit

Including Tubing,
Sensor
Heating Control Unit

Including
Temp Control Unit

Note: * Automated imaging only with one fluorescence channel. Multichannel acquisition only with confocal upgrades.   ** No automated image acquisition included.

Leica HCS LSI Systems

15 6901 303 Leica HCS LSI m. Basis CSQ RYB
15 6901 321 Leica HCS LSI m. Basis CSQ RYBV

Macro Confocal
Zoom Optics:

① **15 6904 602**
Zoom 6x APO Motorized Kit   ②

15 6904 603
Zoom 16x APO Motorized Kit

Macro Objectives for Zoom Optics

② **15 6904 610**
PLAN APO 1x Objective

15 6904 611
PLAN APO 2x Objective

15 6904 612
PLAN APO 5x Objective

Micro Confocal

Micro Objectives Adapter

① **15 6904 623**   ②
Objective Adapter for 3-Plate Stages
and Scanning Stages (system included)

Micro Objectives

② **15 6904 630**
ACS APO CS 10x/0.30 Dry

15 6904 634
ACS APO CS 20x/0.60 Im

15 6904 631
ACS APO CS 40x/1.15 Oil

15 6904 632
ACS APO CS 63x/1.30 Oil

included.
Source,
uid Light

mination

Digital Camera Kit:

⑨ **15 6905 309**
Leica DFC365 FX Fluo
Camera Kit, C-Mount
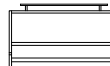Adapter, Software, Cable

Software LAS AF - Screening TCS LSI
HCS A High Content Screening Automation

⑭ **Leica HCS A**
see LAS AF Matrix M3 Products

Software LAS AF - Imaging TCS LSI

⑭ **15 6902 202**
LAS AF LSI Life Data Mode

15 6902 203
LAS AF LSI Co-Localization

15 6902 204
LAS AF LSI Deconvolution

15 6902 205
LAS AF LSI 3D Visualization

15 6902 208
LAS AF LSI Dye Finder

15 6902 211
LAS AF SPE Camera Advanced

15 6902 215
LAS AF LSI FRAP

Tables:

④ **15 6906 100**
Microscope Table LSI, passive

15 6906 102
Microscope Table LSI, active

④a **15 6906 101**
Computer Table

Leica HCS LSI Product Overview

Product Overview			
Platforms	System support		HCS, LSI, TCS LSI
Image acquisition	Technology		True spectral confocal
			Digital camera option
	Available laser lines, solid state		405, 488, 532, 561, 635
	Pre-scan and secondary scan		yes
Motorized stage	Scanning stage	15 6905 202	yes
	Multiwell xy-travel range	127 x 83 mm	yes
Environmental control	Climate chamber		
Imaging automation	LAS AF MATRIX Mosaic Advance	15 6602 501	yes
	LAS AF MATRIX Mosaic + Multiwell Advanced	15 6602 502	yes
	LAS AF MATRIX Mosaic Full Version	15 6602 504	yes
	LAS AF MATRIX Multiwell Full Version	15 6602 505	yes
	LAS AF MATRIX Full Version w/o CAM	15 6602 511	yes
Workstation	Power PC with Intel Core Duo-Processor		yes
	Operating system	Windows 7®	yes
	Monitor TFT 19" (48 cm)	2	yes
	Keyboard, Mouse	1	yes

1. Confocal scanhead
2. Optical zoom, motorized
3. Motor focus drive
4. Laser safety chamber
5. Wing doors
6. SuperZ Galvo stage
7. xy-stage control device
8. Macroscope touch control
9. Confocal control panel
10. Leica EL6000 fluorescence illumination
11. Keyboard, mouse
12. Monitor
13. Digital camera
14. Confocal laser supply unit
15. Workstation
16. Antivibration table, passive
17. Computer table
18. Workspace
19. Motorized xy-stage
20. Heat pipe adapter
21. Transmitted light detector
22. Micro- and macroscope stand
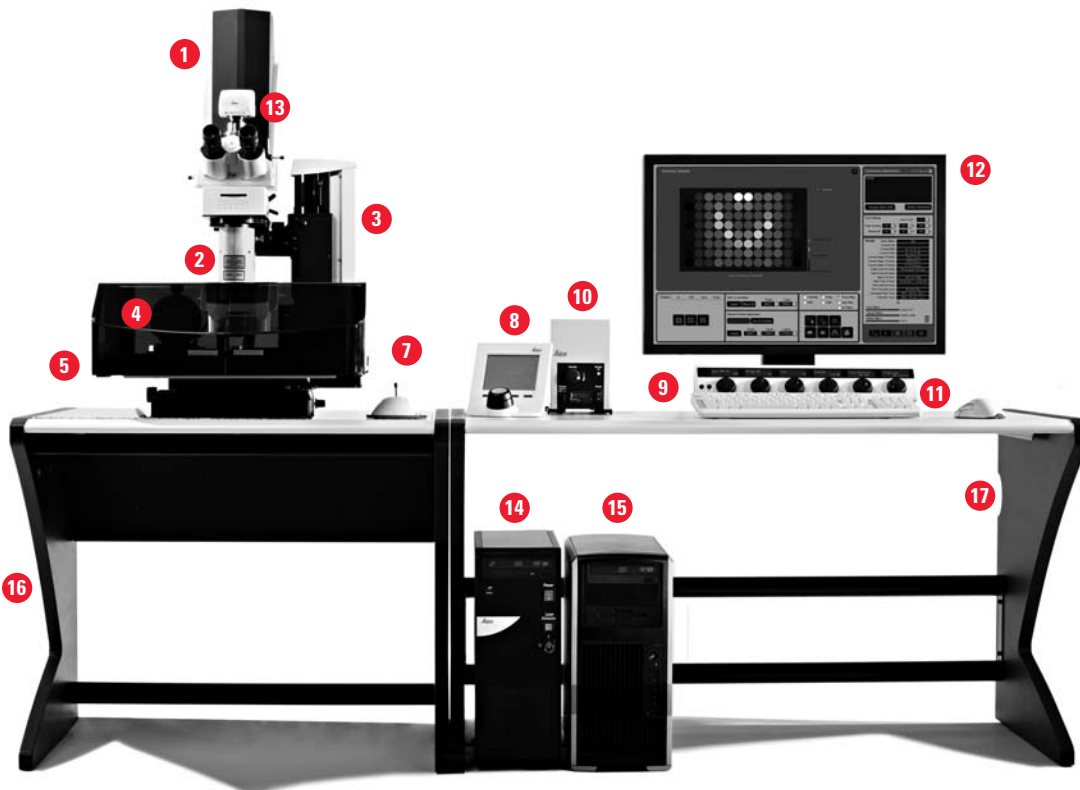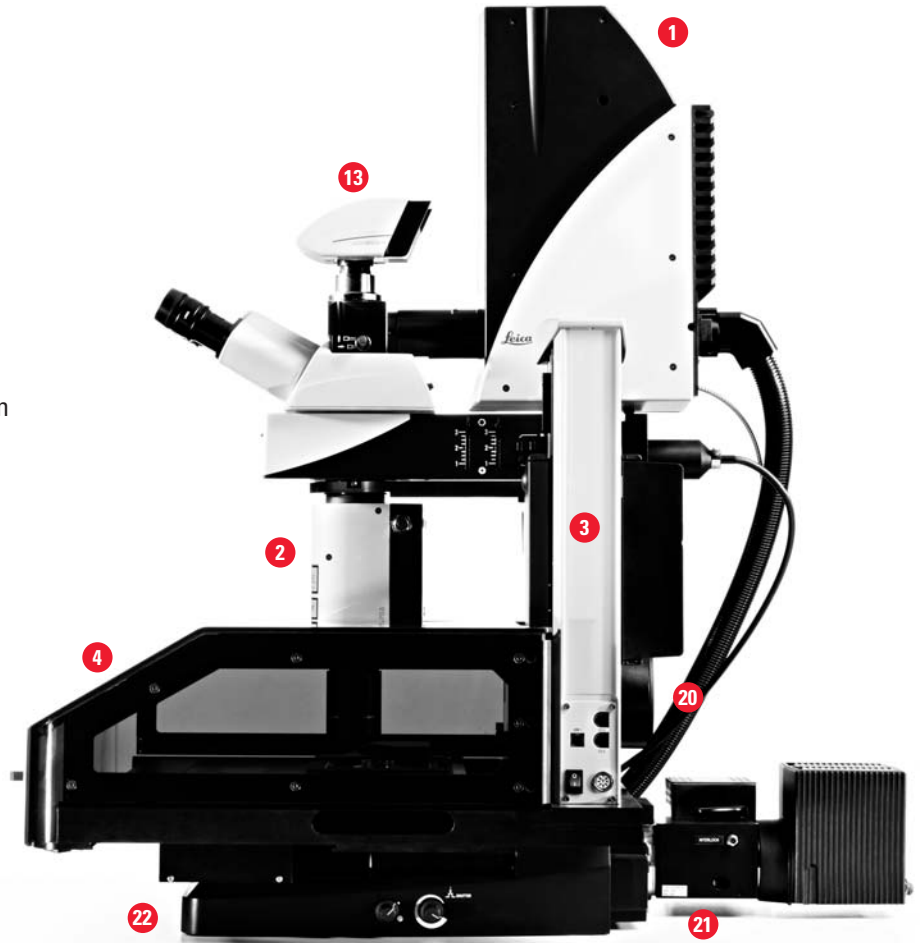
Please note that as result of the continuous development of our products the data and final appearance can vary from the information provided in this document.

"With the user, for the user"
Leica Microsystems

Leica Microsystems operates globally in four divisions, where we rank with the market leaders.

Life Science Division

The Leica Microsystems Life Science Division supports the imaging needs of the scientific community with advanced innovation and technical expertise for the visualization, measurement, and analysis of microstructures. Our strong focus on understanding scientific applications puts Leica Microsystems' customers at the leading edge of science.

Industry Division

The Leica Microsystems Industry Division's focus is to support customers' pursuit of the highest quality end result. Leica Microsystems provide the best and most innovative imaging systems to see, measure, and analyze the micro-structures in routine and research industrial applications, materials science, quality control, forensic science investigation, and educational applications.

Biosystems Division

The Leica Microsystems Biosystems Division brings histopathology labs and researchers the highest-quality, most comprehensive product range. From patient to pathologist, the range includes the ideal product for each histology step and high-productivity workflow solutions for the entire lab. With complete histology systems featuring innovative automation and Novocastra™ reagents, Leica Microsystems creates better patient care through rapid turnaround, diagnostic confidence, and close customer collaboration.

Medical Division

The Leica Microsystems Medical Division's focus is to partner with and support surgeons and their care of patients with the highest-quality, most innovative surgical microscope technology today and into the future.

The statement by Ernst Leitz in 1907, "with the user, for the user," describes the fruitful collaboration with end users and driving force of innovation at Leica Microsystems. We have developed five brand values to live up to this tradition: Pioneering, High-end Quality, Team Spirit, Dedication to Science, and Continuous Improvement. For us, living up to these values means: **Living up to Life**.

Active worldwide

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