

2006 3D Laser Scanner Hardware Survey

MANUFACTURER	3rdTech	3rdTech	Faro Technologies	I-SITE	I-SITE	Leica Geosystems
PRODUCT	DeltaSphere-3000	DeltaSphere-3000IR	Laser Scanner LS	I-SITE 4400	I-SITE 4400-LR	Leica ScanStation
PERFORMANCE						
Laser Wavelength (in nm)	670	780	785	905	905	532
Laser Power (in W,mW)	5mW	8mW	HE 80 22mW HE40 10.5mW	10mW	10mW	0.5mW
FDA Laser Classification (Class)	IIIa	3R	IIIR	IEC-60825-1 class 3R	IEC-60825-1 class 3R	3R
Beam Diameter at Specified Distance from the Scanner (0.Y ft at X ft/Ymm at X m)	[1]	[1]	3 mm @ exit	200 mm at 100 m	140 mm at 100 m	6 mm at 50 m [28]
Measurement Technique	Modulated beam TOF	Modulated beam TOF	Phase shift	Time of flight	Time of flight	Pulsed laser;TOF
Average Data Acquisition Rate (pps)	15,000	15,000	120 KH	4400	4400	Dependent on scan conditions
Maximum Data Acquisition Rate (pps)	43,000	43,000	120 KH	4400	4400	Up to 4,000 [29]
Distance Accuracy at Specified Distance (0.Y ft at X ft/Ymm at X m)	0.3 in at 40 ft	0.3 in at 40 ft	[13]	50 mm at 100 m	50 mm at 100 m	4 mm at 50 m [30]
Position Accuracy at Specified Distance (0.Y ft at X ft/Ymm at X m)	0.35 in at 40 ft	0.35 in at 40 ft	[13]	70 mm at 100 m	70 mm at 100 m	6 mm at 50 m [31]
Angular Accuracy (degrees-min-sec)	0.015°	0.015°	[14]	0.02°	0.02°	0.0034° (60 microradians)
Minimum Range (feet/m)	1 ft	1 ft	0.6 m	3 m	3 m	<1 m
Maximum Range (feet/m) at Specified Reflectivity (specify 4%, 10%, 30% or 80% targets)	[2]	[3]	HE 80 70m\ HE40 35m [15]	150 m at 4%, 400 m at 80%	150 m at 4%, 700 m at 80%	300 m/90%; 134 m/18%
Field of View (vertical angle) (degrees-min-sec)	290°	290°	320°	80°	80°	270°
Field of View (horizontal angle) (degrees-min-sec)	360°	360°	360°	360°	360°	360°
Minimum Vertical Scan Increment (degrees-min-sec)	0.05°	0.075°	0.009° [16]	0.108°	0.108°	0.0002° at 300 m
Minimum Horizontal Scan Increment (degrees-min-sec)	0.05°	0.075°	0.009° [16]	0.108°	0.108°	0.0002° at 300 m
Surface Reflectivity Range (%)	5 - 99%	5 - 99%	5 - 95%	1 - 95%	1 - 95%	1 - 100%
Onboard camera for aiming or for creating photomosaic, etc. (single image pixel resolution)	Yes [4]	Yes [4]	Yes, optional	Integral 40 megapixel camera	Integral 40 megapixel camera	Yes [32]
Is hardware interoperable with optical total stations and GPS? If yes, how?	Yes [5]	Yes [5]	[17]	Yes [24]	Yes [24]	Yes [33]
Is the scanner better for scanning topography or for as-built surveys?	As-built	As-built	As-built	Topography	Topography	Excellent for both
Is software technology for processing data from scanner manufacturer?	Yes, included	Yes, included	Yes	Yes	Yes	Yes, Cyclone
Can scanner be set up over a known point? (E.g., height of instrument, backsight point, etc.) If yes, can station information be entered?	Yes/No	Yes/No	Yes	Yes/yes	Yes/yes	Yes; yes [34]
Can the user specify the field of view and scan density?	Yes	Yes	Yes [18]	Yes	Yes	Yes
Maximum sample density (mm/ft)	20 pts/degree	15 pts/degree	1.5 mm @ 10m	190 mm at 100 m	190 mm at 100 m	1.2 mm at 300 m range
Does the scanner support scan filters (e.g., range, intensity, area of interest)?	Yes - range, intensity, FOV	Yes - range, intensity, FOV	Yes	Yes	Yes	Yes, range, intensity, area
Does the scanner have interchangeable parts that allow for upgrades (e.g., the camera, other modular components, etc.)	Yes	Yes	Yes, modular system	No	No	[35]
Communication Method (e.g., ethernet card, firewire, wireless)	Ethernet/Firewire for color	Ethernet/Firewire for color	Ethernet card	Ethernet	Ethernet	Ethernet or wireless
Does the scanner operate when out of level? Does it have compensators?	Yes/No	Yes/No	Yes [19]	Yes/yes	Yes/yes	Yes/yes, survey-grade [36]
ENVIRONMENTAL						
Storage Temperature Range (degrees F/C)	32 to 113°F	32 to 113°F	0 to 40°C	-40 to 60	-40 to 60	65 to -25°C
Operating Temperature Range (degrees F/C)	32 to 113°F	32 to 113°F	5 to 40°C	-10 to 50	-10 to 50	40 to 0°C
Humidity (%)	Non-condensing	Non-condensing	Non-condensing	Non-condensing	Non-condensing	Non-condensing
Ambient Light	[6]	[6]	Daylight to complete darkness	N/A	N/A	Any light conditions
GENERAL						
Scanner Dimensions (LxWxH) (inches/cm)	14 x 14 x 4 in	14 x 14 x 4 in	400mm * 160mm * 280mm	43 x 25 x 36 cm	43 x 25 x 36 cm	370 mm x 265 mm x 510 mm
Scanner Weight (pounds/kg)	22 lbs	22 lbs	14.5 kg	12 kg	12 kg	19.5 kg w/carry handle
Is scanner recommended for mounting on standard survey tripod? If no, what is recommended stand?	Yes [7]	Yes [7]	Yes	Yes	Yes	Yes
AC Power Requirements (volts/watts)	100-240 V (40 - 65 w)	100-240 V (40 - 65 w)	90v - 240v	N/A	N/A	100-240V, <80W avg
DC Power Requirements (volts/watts)	12 V (40 - 65 w)	12 V (40 - 65 w)	24	24V, 1.6W	24V, 1.6W	36V, <80W avg.
Batteries	Standard 12 V battery	Standard 12 V battery	Yes	[25]	24V 3800mAh NiMH rechargeable	2 with System
Battery Dimensions (LxWxH) (inches/cm)	Variable	Variable	420mm 330mm 120mm	Included in scanner dimensions	Included in scanner dimensions	236 mm x 165 mm x 215 mm
Battery Weight (pounds/kg)	Variable	Variable	15kg	2kg	2kg	12 kg
Battery Life (hours)	4 - 8 typical	4 - 8 typical	~ 8 hours	5 hours	5 hours	>3 hrs
Are batteries hot-swappable? (Y/N)	No	No	No	Scanner - no, tablet - yes	Scanner - no, tablet - yes	Yes
Computer Requirements for Control (handheld option?)	[8]	[8]	Pentium III [20]	[26]	[26]	[37]
Computer Requirements for Data Processing	[9]	[9]	Windows [21]	As supplied	As supplied	[38]
Standard Accessories (list)	[10]	[10][11]	[22]	Battery chargers, transport case	Battery chargers, transport case	[39]
Optional Accessories (list)	[12]	[12]	[23]	[27]	[27]	[40]
Warranty	12 months	12 months	12 months upgradeable	12 months	12 months	1 year

N/A=Not Applicable Numbers in brackets refer to notes (see pages 60-61).

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MANUFACTURER	Leica Geosystems	Leica Geosystems	Leica Geosystems	Measurement Devices Ltd	Optech Incorporated	RiegI
PRODUCT	Leica HDS3000	Leica HDS4500 (53m Model)	Leica HDS4500 (25m Model)	LaserAce Scanner	ILRIS	LMS Z210ii
PERFORMANCE						
Laser Wavelength (in nm)	532	690 mW	690 mW	905	1550nm	Near infrared
Laser Power (in W,mW)	0.5mW	14 mW - 23 mW	14 mW - 23 mW	N/A	N/A	1 mW
FDA Laser Classification (Class)	3R	3R	3R	1M	Class 1	1
Beam Diameter at Specified Distance from the Scanner (0.Y ft at X ft/Ymm at X m)	6 mm at 50 m [28]	8.5 mm at 25 m	8.5 mm at 25 m	300 mm at 100 m	29 mm @ 100 m	50 mm at 50 m
Measurement Technique	Pulsed laser; TOF	Phase shift	Phase shift	Time of flight	Time of flight	LADAR
Average Data Acquisition Rate (pps)	2150 [29]	125,000	125,000	250	2000	8,000
Maximum Data Acquisition Rate (pps)	Up to 4,000	Up to 500,000	Up to 500,000	250	>2000	12,000
Distance Accuracy at Specified Distance (0.Y ft at X ft/Ymm at X m)	4 mm at 50 m	<5 mm + 120 ppm, 100%	<3 mm at 25 m	5 cm at 700 m/2 at 2300'	7 mm @ 1000 m	15 mm at 400 m
Position Accuracy at Specified Distance (0.Y ft at X ft/Ymm at X m)	6 mm at 50 m [31]	<7.2 mm at 10 m, 100%	<6 mm at 10 m	20 cm at 700 m/8 at 2300'	8 mm @ 100 m	10 mm at 100 m
Angular Accuracy (degrees-min-sec)	0.0034° (60 microradians)	350 microradians	350 microradians	0.02	0.00115°	0.005
Minimum Range (feet/m)	<1 m	0.1 m	0.1 m	5 m/16'	2 m	4 m
Maximum Range (feet/m) at Specified Reflectivity (specify 4%, 10%, 30% or 80% targets)	300 m at 90%	53 m ambiguity resolution	25 m ambiguity resolution	700 m/2300'	1500 m @80%	650 m
Field of View (vertical angle) (degrees-min-sec)	270°	310°	310°	135° (-45 to 90°)	180°	80°
Field of View (horizontal angle) (degrees-min-sec)	360°	360°	360°	360°	360°	360°
Minimum Vertical Scan Increment (degrees-min-sec)	0.0003° at 200 m	0.018°	0.018°	0.01°	0.00115°	0.005
Minimum Horizontal Scan Increment (degrees-min-sec)	0.0003° at 200 m	0.01°	0.01°	0.01°	0.00115°	0.005
Surface Reflectivity Range (%)	1 - 100%	1 - 100%	1 - 100%	0.1 - 100%	Yes	5 - 100%
Onboard camera for aiming or for creating photomosaic, etc. (single image pixel resolution)	Yes [32]	[42]	[42]	No	Yes	10 megapixel
Is hardware interoperable with optical total stations and GPS? If yes, how?	Yes [33]	Yes [33]	Yes [33]	Yes	Yes, post-processing workflow	Yes
Is the scanner better for scanning topography or for as-built surveys?	Excellent for both	As-built & tunnel surveys	As-built & tunnel surveys	Topography	Both	Topography
Is software technology for processing data from scanner manufacturer?	Yes, Cyclone	Yes, Cyclone	Yes, Cyclone	Yes	[51]	Yes
Can scanner be set up over a known point? (E.g., height of instrument, backsight point, etc.) If yes, can station information be entered?	Yes; yes	[43]	[43]	Yes [46]	Yes	Yes
Can the user specify the field of view and scan density?	Yes	Yes	Yes	Yes	Yes	Yes
Maximum sample density (mm/ft)	1.2 mm at 300 m range	20,000 pts/row and column	20,000 pts/row vert & hor	250 points per second	2 mm @ 100 m	3.5 mm @ 50 m
Does the scanner support scan filters (e.g., range, intensity, area of interest)?	Yes, range, intensity, area	Yes, range, intensity, area	Yes, range, intensity, area	No	Yes	Yes
Does the scanner have interchangeable parts that allow for upgrades (e.g., the camera, other modular components, etc.)	Yes [41]	Yes [44]	Yes [44]	No	Yes	Yes
Communication Method (e.g., ethernet card, firewire, wireless)	Ethernet or wireless	Firewire	Firewire	Built-in	[52]	TCP/IP
Does the scanner operate when out of level? Does it have compensators?	Yes, 12° off-level/no	Yes/no	Yes/no	Yes/no compensators	Yes/yes	Yes
ENVIRONMENTAL						
Storage Temperature Range (degrees F/C)	65 to -25°C	65 to -25°C	65 to -25°C	-20 to 45°C (-4 to 113°F)	-20 to 50°C	-20 to 60°
Operating Temperature Range (degrees F/C)	40 to 0°C	40 to 0°C	40 to 0°C	-10 to 45°C (14 to 113°F)	0 to 40°C	-10 to 50°
Humidity (%)	Non-condensing	Non-condensing	Non-condensing	Non-condensing	Sealed, 100%	100%
Ambient Light	Any light conditions	Any light conditions	Any light conditions	Unaffected	Yes	Not affected
GENERAL						
Scanner Dimensions (LxWxH) (inches/cm)	370 mm x 265 mm x 510 mm	300 mm x 180 mm x 350 mm	300 mm x 180 mm x 350 mm	410 mm x 239 mm x 177 mm [47]	32 cm x 32 cm x 22cm	44 x 21
Scanner Weight (pounds/kg)	16 kg w/carry handle	13 kg	13 kg	8.1kg/ 17.9lbs	13kg	13
Is scanner recommended for mounting on standard survey tripod? If no, what is recommended stand?	Yes	Yes or w/scanner stand	Yes or w/scanner stand	Yes	Yes	Tripod or vehicle
AC Power Requirements (volts/watts)	100-240V, <80W avg	90 - 260V AC, 50 - 70W	90 - 260V AC, 50 - 70W	N/A	24 VDC	No
DC Power Requirements (volts/watts)	36V, <80W avg.	24V DC	24V DC	12V DC	24 VDC	12-28 VDC
Batteries	2 with System	2 with System	2 with System	12V DC		Marine battery
Battery Dimensions (LxWxH) (inches/cm)	236 mm x 165 mm x 215 mm	260 mm x 240 mm x 300 mm	260 mm x 240 mm x 300 mm	16 cm x 12 cm x 8 cm [48]	3 cm x 10 cm	12 x 11 x 8
Battery Weight (pounds/kg)	12 kg	16 kg	16 kg	2 kg/4.4 lbs	2 lbs	19
Battery Life (hours)	3 hrs	6 hrs each	6 hrs each	6 hours	4 batteries = 5 hours	14
Are batteries hot-swappable? (Y/N)	Yes	No	No	Yes	Yes	No
Computer Requirements for Control (handheld option?)	[37]	[37]	[37]	None	Wireless Pocket PC or laptop	1024 MB RAM
Computer Requirements for Data Processing	[38]	[38]	[38]	Standard PC	1 gb, Pentium 4 minimum	1024 MB RAM
Standard Accessories (list)	[39]	[45]	[45]	[49]	Carry case, AC power supply	Inclination sensor [54]
Optional Accessories (list)	[40]	[40]	[40]	[50]	[53]	Internal Sync Timer for GPS/INS
Warranty	1 year	1 year	1 year	12 months	1 year inclusive	12 months

N/A=Not Applicable Numbers in brackets refer to notes (see pages 60-61).

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MANUFACTURER	Riegl LMS Z390	Riegl LMS Z420i	Spatial Integrated Systems 3DIS 1500	Trimble Navigation Trimble GX	Trimble Navigation Trimble GS	Z+F Imager 5003-53500
PERFORMANCE						
Laser Wavelength (in nm)	Near infrared	Near infrared	780	532 nm	532 nm	780nm
Laser Power (in W,mW)	1 mW	1 mW	20 mW	< 1 mW	< 1 mW	32mW
FDA Laser Classification (Class)	1	1	IIIb	Class 2	Class 2	3R [69]
Beam Diameter at Specified Distance from the Scanner (0.Y ft at X ft/Ymm at X m)	25 mm at 100 m	25 mm at 100 m	0.4 in at 54 ft	1.5mm at 25m (autofocus)	1.5mm at 25m (autofocus)	0.14 at 3.3 (3.5mm at 1m)
Measurement Technique	LADAR	LADAR	Modulated beam, TOF	Time of flight	Time of flight	Phase shift AMCW
Average Data Acquisition Rate (pps)	8,000	8,000	3300	Depends on application	Depends on application	125,000
Maximum Data Acquisition Rate (pps)	12,000	12,000	3300	5000 pps	5000 pps	500,000
Distance Accuracy at Specified Distance (0.Y ft at X ft/Ymm at X m)	2 mm at 50 m	5 mm at 1000 m	0.2 in at 54 ft	7 mm at 100 m	8 mm at 100 m	< 0.20 (1.3-175.5 ft) [70]
Position Accuracy at Specified Distance (0.Y ft at X ft/Ymm at X m)	10 mm at 100 m	6 mm at 100 m	0.2 in at 54 ft	12 mm at 100 m	15 mm at 100 m	0.55 at 175.5 [71]
Angular Accuracy (degrees-min-sec)	0.0005	0.0005	[55]	12 horizontal / 14 vertical	14	±0.01°
Minimum Range (feet/m)	1 m	2 m	1 ft	1 m	1 m	1.3 ft / 0.4 m
Maximum Range (feet/m) at Specified Reflectivity (specify 4%, 10%, 30% or 80% targets)	300 m	1000 m	54 ft	[58]	[58]	175.5 ft / 53.5 m
Field of View (vertical angle) (degrees-min-sec)	90°	80°	320°	60°	60°	310°
Field of View (horizontal angle) (degrees-min-sec)	360°	360°	360°	360°	360°	360°
Minimum Vertical Scan Increment (degrees-min-sec)	0.001	0.002	0.03°	3	6	0.018°
Minimum Horizontal Scan Increment (degrees-min-sec)	0.002	0.002	0.05°	6	6	0.01°
Surface Reflectivity Range (%)	5 - 100%	5 - 100%	85%	1-99%	1-99%	5 - 99%
Onboard camera for aiming or for creating photomosaic, etc. (single image pixel resolution)	10 megapixel	10 megapixel	Yes	Yes	Yes	Yes, optional
Is hardware interoperable with optical total stations and GPS? If yes, how?	Yes	Yes	No	Yes [59]	Yes, through processing software	Yes, via custom survey targets
Is the scanner better for scanning topography or for as-built surveys?	As-built	As-built & topography	As-built	Both	As-built surveys	Both (within given max. range)
Is software technology for processing data from scanner manufacturer?	Yes	Yes	Yes	Yes	Yes	Yes
Can scanner be set up over a known point? (E.g., height of instrument, backsight point, etc.) If yes, can station information be entered?	Yes	Yes		Yes [60]	Yes, using standard survey tribrach	No
Can the user specify the field of view and scan density?	Yes	Yes	Yes	Yes	Yes	Yes
Maximum sample density (mm/ft)	3.5 mm @ 50 m	3.5 mm @ 50 m		105 points/sq.inch @ 100 m	105 points/sq.inch @ 100 m	20,000 points per 360°
Does the scanner support scan filters (e.g., range, intensity, area of interest)?	Yes	Yes	No	Yes	Yes	Yes
Does the scanner have interchangeable parts that allow for upgrades (e.g., the camera, other modular components, etc.)	Yes	Yes	No	No, all included	No, all included	Yes
Communication Method (e.g., ethernet card, firewire, wireless)	TCP/IP	TCP/IP	Ethernet	Ethernet, wireless	Ethernet	Firewire
Does the scanner operate when out of level? Does it have compensators?	Yes	Yes	Yes	Yes/yes (dual axis 6' range)	Yes/no	Yes (compensators not necessary)
ENVIRONMENTAL						
Storage Temperature Range (degrees F/C)	-20 to 60°	-20 to 60°	32 to 104°F	-20 to 50°C	-20 to 50°C	32 to 158°F (0 to 70°C)
Operating Temperature Range (degrees F/C)	-10 to 50°	-10 to 50°	32 to 104°F	0 to 40°C	0 to 40°C	32 to 104°F (0 to 40°C)
Humidity (%)	100%	100%	Non-condensing	Non-condensing	Non-condensing	Non-condensing
Ambient Light	Not affected	Not affected	[56]	[61]	[61]	[72]
GENERAL						
Scanner Dimensions (LxWxH) (inches/cm)	49 x 21	47 x 21	10 x 10.25 x 16.5 in	323 D x 343 W x 404 H mm	340 L x 270 W x 420 H mm	11.9 x 13.8 x 7.1 [73]
Scanner Weight (pounds/kg)	13	15	22 lbs	13 kg	13.6 kg	28.7 (13 kg)
Is scanner recommended for mounting on standard survey tripod? If no, what is recommended stand?	Tripod or vehicle	Tripod or vehicle	Yes	Yes	[68]	No [74]
AC Power Requirements (volts/watts)	No	No	100 - 240 V (50 - 70W)	90-240 V 50-60Hz	90-240 V 50-60Hz	120V/230V (80W)
DC Power Requirements (volts/watts)	12-28 VDC	12-28 VDC	12 V (50 - 70W)	24 V nominal	24 V nominal	24 V (80W)
Batteries	Marine battery	Marine battery		Yes	Yes	Sealed lead acid battery
Battery Dimensions (LxWxH) (inches/cm)	12 x 11 x 8	12 x 11 x 8		8 x 8 x 23 cm	8 x 8 x 23 cm	12.6 x 9.4 x 10.2 [75]
Battery Weight (pounds/kg)	19	19		3.1 kg	3.1 kg	34 lbs / 15 kg
Battery Life (hours)	14	14		3.5 hours [62]	3.5 hours [62]	8 h
Are batteries hot-swappable? (Y/N)	No	No	N/A	No	No	No
Computer Requirements for Control (handheld option?)	1024 MB RAM	1024 MB RAM	[57]	[63]	[63]	[76]
Computer Requirements for Data Processing	1024 MB RAM	1024 MB RAM	[57]	[64]	[64]	Same
Standard Accessories (list)	Inclination sensor [54]	Inclination sensor [54]	Traveling case, tripod	[65]	[66]	[77]
Optional Accessories (list)	Internal Sync Timer for GPS/INS	Internal Sync Timer for GPS/INS		[67]	[67]	Camera
Warranty	12 months	12 months	12 months	1 year - extendable	1 year - extendable	Limited 1 year

N/A=Not Applicable Numbers in brackets refer to notes (see pages 60-61).

2006 3D Laser Scanner Software Survey

MANUFACTURER/DISTRIBUTOR	3rdTech Inc.	Bentley Systems Inc.	Bitwyse Solutions Inc.	Faro Technologies	InnovMetric Software	I-SITE	I-SITE
NAME/FUNCTIONALITY OF MODULES OR COMPONENTS OF SUITE	SceneVision-3D	Bentley CloudWorx	LASERGen	Faro Scene	PolyWorks	I-SITE Studio 3.0	I-SITE Forensic 1.1
Price (list by modules or components)	Included w/ DeltaSphere [1]	[40]	\$9K annual subscription	70,000 €	On demand	\$24,000	\$24,000
Laser scanner brands and models from which data can be imported directly	DeltaSphere [2]	All [29]	All leading vendors [9]		[14]	I-SITE, Riegl	I-SITE, Riegl
Operating systems supported (if one is preferred, please state)	Win 2000/XP (pref)	Win 2000/XP	Win 2000/XP	Win 2000/XP	Win XP/2000/NT	Win X64 (pref), XP	Win X64 (pref), XP
Minimum CPU requirement	Pentium 4	Pentium 4 2GH	P4 3.0Ghz or equivalent	1 GHz	2 GH	1.8 GH	1.8 GH
Minimum RAM required	512 MB (1GB recommended)	512 MB	1 GB	1 GB	512 MB (2 GB recommended)	512 MB	512 MB
Space required on hard disk to properly run application, including swap space, etc. (list in Mb)	50 MB (512 MB swap)	[30]	[10]	1 GB	3 GB	2 GB	2 GB
Other hardware requirements	3D graphics card	[31]	[11]	[12]	[21]	[20]	[20]

CLOUD EDITING/ANALYSIS							
Can features be defined with user-created code libraries?	Planes, contours, lines, points	Yes, using CAD tools	Yes	No	Yes	No	Yes
Feature codes exportable to CAD software? (specify which software)	VRML model, lines	No, runs in CAD	MicroStation, AutoCAD, PDMs		Yes Microstation, AutoCAD	No	No
Can user compare cloud or shapes fitted to clouds to plan, or perform theoretical shape and interference checking? (State which, all or none.)	None	Yes, using CAD tools	Yes	Visually	All	All	All
Ability to make measurements such as distances, angles, areas, volumes, of lines, planes, shapes and other surfaces from cloud? (State which, all or none.)	[3]	Yes, using CAD tools	All	Distances	All	All	Angles, distances, planes
Can user overlay or drape a photograph from an external source (e.g., digital camera) on cloud or elements extracted from cloud?	Yes, FA	Yes, from Cyclone	No	Yes	No	No	No
Ability to register scans without the use of targets?	Yes, FA	N/A	Yes	No	Yes, using geometry	Yes (FA)	Yes (FA)
Ability to place several clouds from different scans in coordinated 3D space using total station or GPS survey data that has been used to determine positions of scanner and alignment of scans?	No	N/A	Yes	Yes	Yes	Yes (FA)	Yes (FA)
Analyze points in a cloud representing shapes such as planes, cylinders and spheres to detect measurement outliers?	Planes only	Yes (planes, cylinders)	Yes	Yes	Yes	Yes (FA)	Yes (FA)
Ability to integrate scans with floor plans, engineering drawings of objects and surveyed information? (State which, all or none.)	None	Yes, all	Yes	All	[15]	All	All
Automate decimation of points in selectable areas to make data files as compact as possible?	Yes, FA	N/A	SA	Yes	Yes	Yes (SA)	Yes (SA)
Is fitting of lines, planes and shapes to cloud done manually or automatically, or both?	Automatic plane fitting [4]	Both	Both	Both	Both	Both	Both
- For automatic and manual fitting, what techniques are used or available (e.g. least squares, taking average, etc.)?	Least squares	Least squares	Least squares	Least squares	[16]	Least squares	Least squares
Ability to automatically track lines or limits of areas by color or texture discrimination?	No	No	No	Yes	Yes	Yes (SA)	Yes (SA)
Ability to automatically calculate and list alignment of center line of shapes (such as a pipe) containing straight and curved segments such as elbows?	No	Yes, straight	Yes	Yes	Yes	No	No
Maximum number of points that can be loaded	100 million	N/A [35]	25 million	200 mil	[17]		
Automatic removal of noise (e.g., cars on road, vegetation, etc.)?	No	No	INT	No	Yes	Yes (SA)	Yes (SA)

RENDERING/CAD MODEL GENERATION/VIEWING							
Does software automatically or manually generate or create CAD models or model segments from point clouds and other known information? (Specify level of automation and intelligence.)	[5]	Yes [39]	Yes	Manually	FA, SA & INT methods	Yes (FA)	Yes (FA)
Are items (CAD models such as pipes, steel, flanges, elbow) fit to the point cloud using standard object tables/catalogs?	No	No	No	No	Using primitives such as cylinders	No	No
Create statistical quality assurance reports on the modeled objects?	No	Yes	No	No	No	Yes (FA)	Yes (FA)
Automatically compute, without user interaction, a full 3D polygonal mesh (not view-based) from a point cloud?	Yes, FA	No	Yes	No	Yes	Yes (FA)	Yes (FA)
Perform contour generation?	No	No	No	No	Yes	Yes (FA)	Yes (FA)
Perform volume calculation capabilities?	No	No	Yes	No	Yes	Yes (FA)	Yes (FA)
Perform solid modeling (volume generation) based on user-defined lines, planes and other surfaces as bounds?	No	No	No	No	No	Yes (FA)	Yes (FA)
Perform profile and cross-section generation along any cutting plane, family of planes or road alignment?	Yes	No	No	Yes	Yes	Yes (FA)	Yes (FA)
Have edge detection technology to determine boundaries of solids, planes and other shapes?	No	No	Yes	Yes	Yes	Yes (FA)	Yes (FA)
Perform automatic extraction of standard shapes from cloud (e.g. pipe fittings, structural steel members, etc.)?	No	SA; cylinders, planes.	Yes, pipe center lines	No	Pipe center lines	No	No
Can user view cloud or generated shapes or models from any viewpoint in 3D?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Are fly-throughs or walk-throughs supported?	Yes	Yes	Yes	Yes	Yes (video generation)	Yes (SA)	Yes (SA)
Have intelligent display of detail depending on scale of the view?	No	Yes	Yes	No	No	Not required	Not required
Can user select transparent/opaque surface for cloud and CAD shapes?	Yes	No	Yes	Yes	Yes	Yes	Yes
Which export formats are supported?	[6]	As MicroStation	BSF(BitWyse)	[13]	[18]	[22]	[22]
Specify other measurement tools (e.g., clearance, cut/fill, table of elevation differences)	Perpendicular point to plane	None	None	Point to point, object to object	[19]	Yes (SA)	Yes (SA)
Can the pointcloud be rendered with visualization effects (e.g., intensity mapping, elevation mapping, shading, silhouette)?	Yes [7]	No	Yes	No	Yes	Yes	Yes
Can the software automatically detect scan targets?	No	N/A	No	No	Yes	Yes (FA)	Yes (FA)

MISCELLANEOUS							
Provide high-speed thumbnail views of scans, clouds, photographic images and generated shapes?	No	N/A	Yes	Yes	No	No	No
Can client/server system support multiple users?	No	Yes	Yes	N/A	No	Yes	Yes
Is client/server system supported to enable several clients contributing to a single project?	No	Yes, simultaneously	No	N/A	No	Yes	Yes

OTHER FEATURES							
Describe	[8]	[38]					

N/A=Not Applicable Numbers in brackets refer to notes (see pages 60-61).

2006 3D Laser Scanner Software Survey

MANUFACTURER/DISTRIBUTOR	kubit GmbH	Leica Geosystems	Leica Geosystems	Leica Geosystems	Leica Geosystems	Measurement Devices Ltd.	RiegI USA
NAME/FUNCTIONALITY OF MODULES OR COMPONENTS OF SUITE	PointCloud [23]	Cyclone [27]	Leica CloudWorX for AutoCAD [42]	Leica CloudWorX for PDMS	Leica CloudWorX for Intergraph [43]	FastScanner Project Software	Phidias
Price (list by modules or components)	Starts from \$1,000	[28]	[28]	[28]	[28]	TBA	\$15,000
Laser scanner brands and models from which data can be imported directly	All [24]	All [29]	All [29]	All [29]	All [29]	MDL LaserKce Scanner [44]	All
Operating systems supported (if one is preferred, please state)	AutoCAD [25]	Win 2000/XP	Win 2000/XP	Win 2000/XP	Win 2000/XP	Windows XP	MicroStation
Minimum CPU requirement	Like AutoCAD	Pentium 4 2GH	Pentium 4 2GH	Pentium 4 2GH	Pentium 4 2GH	P4	
Minimum RAM required	Like AutoCAD	512 MB	512 MB	512 MB	512 MB	512	1024 MB
Space required on hard disk to properly run application, including swap space, etc. (list in Mb)	Like AutoCAD	[30]	[30]	[30]	[30]	10 MB	5 GB
Other hardware requirements	Like AutoCAD	[31]	[31]	[31]	[31]	Open GL	

CLOUD EDITING/ANALYSIS							
Can features be defined with user-created code libraries?	Yes	Yes [32]	Yes, using CAD tools	N/A	N/A	Yes	Yes
Feature codes exportable to CAD software? (specify which software)	N/A (already in CAD)	Yes, LandXML, ASCII	No, runs in CAD	N/A	N/A	Yes, via DXF	Yes
Can user compare cloud or shapes fitted to clouds to plan, or perform theoretical shape and interference checking? (State which, all or none.)	All	Yes, all	Yes, using CAD tools	Yes, all	Yes, all	None	Yes
Ability to make measurements such as distances, angles, areas, volumes, of lines, planes, shapes and other surfaces from cloud? (State which, all or none.)	All	Yes, all	Yes, using CAD tools	Yes, using CAD tools	Yes, using CAD tools	[45]	All
Can user overlay or drape a photograph from an external source (e.g., digital camera) on cloud or elements extracted from cloud?	No	Yes [33]	Yes, from Cyclone	Yes, from Cyclone	Yes, from Cyclone	Yes	Yes
Ability to register scans without the use of targets?	No	Yes [34]	N/A	N/A	N/A	Yes	No
Ability to place several clouds from different scans in coordinated 3D space using total station or GPS survey data that has been used to determine positions of scanner and alignment of scans?	Yes	Yes	N/A	N/A	N/A	Yes	Yes
Analyze points in a cloud representing shapes such as planes, cylinders and spheres to detect measurement outliers?	Yes	Yes	Yes (Pro: planes, cylinders)	No	No	No	Yes
Ability to integrate scans with floor plans, engineering drawings of objects and surveyed information? (State which, all or none.)	Yes	Yes, all	Yes, all	Yes, all	Yes, all	None	All
Automate decimation of points in selectable areas to make data files as compact as possible?	Yes	Yes	N/A	N/A	N/A	Yes	Yes
Is fitting of lines, planes and shapes to cloud done manually or automatically, or both?	Both	Both	Both	N/A	N/A	None	Both
- For automatic and manual fitting, what techniques are used or available (e.g. least squares, taking average, etc.)?	Least squares	Least squares; catalog	Least squares	N/A	N/A	N/A	Least squares
Ability to automatically track lines or limits of areas by color or texture discrimination?	No	Yes, segment by intensity	No	No	No	Yes	Yes
Ability to automatically calculate and list alignment of center line of shapes (such as a pipe) containing straight and curved segments such as elbows?	No	Yes, calculate	Yes, straight (Pro)	No	No	No	Yes
Maximum number of points that can be loaded	30 million [26]	Yes, SA	N/A [35]	N/A [35]	N/A [35]	>5 million	No limit
Automatic removal of noise (e.g., cars on road, vegetation, etc.)?	No		No	No	No	Integrated	

RENDERING/CAD MODEL GENERATION/VIEWING							
Does software automatically or manually generate or create CAD models or model segments from point clouds and other known information? (Specify level of automation and intelligence.)	SA	Yes [36]	Yes [39]	Yes, using CAD tools	No	No	Yes
Are items (CAD models such as pipes, steel, flanges, elbow) fit to the point cloud using standard object tables/catalogs?	SA	Yes	No	Yes, using CAD tools	No	No	Yes
Create statistical quality assurance reports on the modeled objects?	No	Yes	Yes	No	No	No	Yes
Automatically compute, without user interaction, a full 3D polygonal mesh (not view-based) from a point cloud?	No	Automatic shrinkwrap	No	No	No	Yes	No
Perform contour generation?	No	Yes	No	No	No	Yes	Yes
Perform volume calculation capabilities?	No	Yes	No	No	No	Yes	Yes
Perform solid modeling (volume generation) based on user-defined lines, planes and other surfaces as bounds?	Yes	Yes, volumes	No	No	No	No	Yes
Perform profile and cross-section generation along any cutting plane, family of planes or road alignment?	SA	Yes	No	No	No	Yes	Yes
Have edge detection technology to determine boundaries of solids, planes and other shapes?	No	Yes	No	No	No	No	Yes
Perform automatic extraction of standard shapes from cloud (e.g. pipe fittings, structural steel members, etc.)?	SA	Yes, SA	SA; cylinders, planes	No	No	No	Yes
Can user view cloud or generated shapes or models from any viewpoint in 3D?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Are fly-throughs or walk-throughs supported?	No	Yes	Yes	Yes	Yes	No	Yes
Have intelligent display of detail depending on scale of the view?	Yes	Yes	Yes	Yes	Yes	No	Yes
Can user select transparent/opaque surface for cloud and CAD shapes?	Like AutoCAD	Yes	No	No	No	Yes	Yes
Which export formats are supported?	Like AutoCAD	11 formats [37]	As AutoCAD	As PDMS	As SmartPlant	XYZ, DXF, VTK, PSI	Multiple
Specify other measurement tools (e.g., clearance, cut/fill, table of elevation differences)		All	None	None	None	N/A	Multiple
Can the pointcloud be rendered with visualization effects (e.g., intensity mapping, elevation mapping, shading, silhouette)?		Yes, all and more	No	No	No	[46]	Yes
Can the software automatically detect scan targets?	N/A	Yes, spherical & planar	N/A	N/A	N/A	Yes	No

MISCELLANEOUS							
Provide high-speed thumbnail views of scans, clouds, photographic images and generated shapes?	No	No	N/A	N/A	N/A	No	Yes
Can client/server system support multiple users?	Yes	Yes	Yes	Yes	Yes	No	No
Is client/server system supported to enable several clients contributing to a single project?	Yes	Yes, simultaneously	Yes, simultaneously	Yes, simultaneously	Yes, simultaneously	No	Yes

OTHER FEATURES							
Describe		[38]	[38]	[41]	[41]	[47]	Yes

N/A=Not Applicable Numbers in brackets refer to notes (see pages 60-61).

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MANUFACTURER/DISTRIBUTOR	Riegl USA	Spatial Integrated Systems	Trimble Navigation	Trimble Navigation	Z+F	Z+F	Z+F
NAME/FUNCTIONALITY OF MODULES OR COMPONENTS OF SUITE	RiScan Pro	3DIS Imager	RealWorks Survey	3Dipso	LFM Modeller	LFM Server	LFM Viewer
Price (list by modules or components)	N/C	Consult SIS	Consult Trimble dealers	Consult Trimble dealers	\$8,000	\$5,000	\$3,000
Laser scanner brands and models from which data can be imported directly	Riegl	3DIS 1500	Most available laser scanners	Most available laser scanners	Z+F, Cyra	Z+F, Cyra	Z+F, Cyra
Operating systems supported (if one is preferred, please state)	Microsoft	Windows XP	Win 2000/XP	Win 2000/XP	Windows, Linux	Windows, Linux	Windows, Linux
Minimum CPU requirement		Pentium, 1.6 GH	Minimum 2GH	Minimum 2GH	1.0 GH	1.0 GH	1.0 GH
Minimum RAM required	1024 MB	512 MB (1GB recommended)	1 GB	1 GB	512 MB		
Space required on hard disk to properly run application, including swap space, etc. (list in Mb)	5 GB	512 MB	2 GB	2 GB	20 MB		
Other hardware requirements		3D graphics card recommended	[48]	[48]	[58]	[58]	[58]
CLOUD EDITING/ANALYSIS							
Can features be defined with user-created code libraries?	No	No	Yes	Yes	No	No	No
Feature codes exportable to CAD software? (specify which software)	No	AutoCAD, Imageware	Yes	Yes [51]	No	No	No
Can user compare cloud or shapes fitted to clouds to plan, or perform theoretical shape and interference checking? (State which, all or none.)	Yes	None	Yes	Yes	All	All	All
Ability to make measurements such as distances, angles, areas, volumes, of lines, planes, shapes and other surfaces from cloud? (State which, all or none.)	Yes	Yes	All	All	All	All	All
Can user overlay or drape a photograph from an external source (e.g., digital camera) on cloud or elements extracted from cloud?	Yes	No	Yes [49]	Yes [49]	No	No	No
Ability to register scans without the use of targets?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ability to place several clouds from different scans in coordinated 3D space using total station or GPS survey data that has been used to determine positions of scanner and alignment of scans?	Yes	None	Yes	Yes	Yes	Yes	Yes
Analyze points in a cloud representing shapes such as planes, cylinders and spheres to detect measurement outliers?	Yes	None	Yes	Yes	Yes	No	No
Ability to integrate scans with floor plans, engineering drawings of objects and surveyed information? (State which, all or none.)	No	None	All	All	All	All	None
Automate decimation of points in selectable areas to make data files as compact as possible?	Yes	No	Yes	Yes	Yes	Yes	Yes
Is fitting of lines, planes and shapes to cloud done manually or automatically, or both?	Manually	Both	Both	Both	Both	Both	Both
- For automatic and manual fitting, what techniques are used or available (e.g. least squares, taking average, etc.)?	Least squares	Least squares	Least squares	Least squares	Least squares	Least squares	Least squares
Ability to automatically track lines or limits of areas by color or texture discrimination?	Yes	No	Yes	No	No	N/A	N/A
Ability to automatically calculate and list alignment of center line of shapes (such as a pipe) containing straight and curved segments such as elbows?	No	No	Yes	Yes [52]	Yes	N/A	N/A
Maximum number of points that can be loaded	No limit	CPU and RAM dependent	Infinite (within system limits)	Depends on system capacity	Hardware dependent	Hardware dependent	Hardware dependent
Automatic removal of noise (e.g., cars on road, vegetation, etc.)?		No	Yes	Yes [53]	Yes	Yes	Yes
RENDERING/CAD MODEL GENERATION/VIEWING							
Does software automatically or manually generate or create CAD models or model segments from point clouds and other known information? (Specify level of automation and intelligence.)	No	No	Yes	Yes [54]	SA	No	No
Are items (CAD models such as pipes, steel, flanges, elbow) fit to the point cloud using standard object tables/catalogs?	No	No	No	Yes [55]	Yes	Yes	N/A
Create statistical quality assurance reports on the modeled objects?	No	No	Yes	Yes	Yes	Yes	N/A
Automatically compute, without user interaction, a full 3D polygonal mesh (not view-based) from a point cloud?	Yes	No	Yes	Yes	FA	No	No
Perform contour generation?	Yes	No	Yes	No	Yes	Yes	Yes
Perform volume calculation capabilities?	Yes	No	Yes	Yes	Yes	No	No
Perform solid modeling (volume generation) based on user-defined lines, planes and other surfaces as bounds?	No	No	Yes	Yes	Yes	No	No
Perform profile and cross-section generation along any cutting plane, family of planes or road alignment?	Yes	No	Yes	No	Yes	Yes	Yes
Have edge detection technology to determine boundaries of solids, planes and other shapes?	Yes	No	Yes	Yes	Yes	No	No
Perform automatic extraction of standard shapes from cloud (e.g. pipe fittings, structural steel members, etc.)?	No	No	Yes	Yes [54]	SA	No	No
Can user view cloud or generated shapes or models from any viewpoint in 3D?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Are fly-throughs or walk-throughs supported?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Have intelligent display of detail depending on scale of the view?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Can user select transparent/opaque surface for cloud and CAD shapes?	No	No	Yes	Yes	Yes	Yes	Yes
Which export formats are supported?	Multiple	ASCII	dxg, dgn, asc, obj, ptc	[56]	[59]	[60]	ZFC
Specify other measurement tools (e.g., clearance, cut/fill, table of elevation differences)	Multiple		Full inspection tools available	Comparison to modeled surface	Available	Available	Available
Can the pointcloud be rendered with visualization effects (e.g., intensity mapping, elevation mapping, shading, silhouette)?	Yes		All	Yes, intensity, normals	Yes	Yes	Yes
Can the software automatically detect scan targets?	Yes	No	Yes	Yes	Yes	Yes	Yes
MISCELLANEOUS							
Provide high-speed thumbnail views of scans, clouds, photographic images and generated shapes?	Yes	No	Yes	Yes	No	No	No
Can client/server system support multiple users?	Yes	No	Yes	Yes	Yes	Yes	Yes
Is client/server system supported to enable several clients contributing to a single project?	Yes	No	Yes	Yes	Yes	Yes	Yes
OTHER FEATURES							
Describe	Yes		[50]	Macro system available [57]		[61]	

N/A=Not Applicable Numbers in brackets refer to notes (see pages 60-61).

2006 3D Laser Scanner Survey Notes

POB does not assume responsibility for any errors or omissions that may be contained within the survey.

HARDWARE

1. 0.1 in. at 1 ft., 0.28 in. at 30 ft.
2. 40 ft at 85% reflectance; 30 ft at 30% reflectance.
3. 54 ft at 85% reflectance; 35 ft at 30% reflectance.
4. Optional; for creating full color, texture-mapped, computer graphics models and 360° panoramic images.
5. Compatible; aligned with tribrach mount.
6. Interior lighting or shade to total darkness. Direct sunlight reduces the range.
7. Or photographic tripod.
8. Standard PC/laptop, Win 2000/XP, ethernet, IEEE 1394 (Firewire) for color option.
9. Standard PC/laptop, Win 2000/XP, 512 MB memory, 3D graphics card for display performance, 3-button mouse.
10. Wheeled shipping crate with handle, external power supply, auxiliary auto power cable, quick-release tripod mount, cables, SceneVision-3D software.
11. Safety glasses.
12. Calibrated professional digital camera and lens, camera mount, additional software, tripod, laptop stand, dolly, laptop, onsite training.
13. ±3 mm @ 20 m on 84% reflectivity Kodak Reference Paper orthogonal and averaged measurement.
14. 1 pixel @ depending on resolution, at 40,000 points over 360° = 0°, 0 min, 32.4 sec.
15. Measured on a nonmoving orthogonal Kodak 84% reflectivity reference paper in averging mode in 1 cm steps. More details upon request.
16. 40,000 3D-Pixel on 360°.
17. Using defined targets and Faro scene registration.
18. Point density is adjusted with set resolutions.
19. Built-in inclinometer option (accuracy 0.01°; resolution 0.001°; range ± 15°).
20. 700 MHz, 256 MB RAM 40GB hard disk; Win 2000/XP.
21. NT, 2000 or XP 1GHz Processor, 1GB RAM, graphics card with 32 MB and OpenGL hardware.
22. Transport vase, tripod, 1x Faro Scene with Scanner operation installed, standard Faro LS training course, 1 year warranty.
23. Color camera option, battery kit, battery charging pack, reference spheres, magnetic bases, survey prism.
24. I-SiTE scanners allow users to set up and align the scanner using a motorized optical survey telescope integrated within the instrument. Survey data from GPS or total station can be transferred and stored on the HHC control tablet for the I-SiTE scanners, and the scanner setup locations can be referenced directly to this data. Alternately, a GPS receiver can be fitted directly to the scanner, with automatic offsets to the center of the scanner made for GPS readings.
25. 24V 3800mAh NiMh rechargeable.
26. Handheld touchscreen tablet standard.
27. Cold weather package for -40° operation, underground photo light.
28. There are two common methods of reporting spot size. The "Gaussian" diameter is: 6mm at 50 m; 4 mm at 25 m; and 6 mm at <1 m; the "FWHM" method of reporting spot size results in values of 3 mm at 50 m; 2 mm at 25 m; 3 mm at <1 m.
29. Maximum instantaneous data acquisition rate.
30. Accuracy for a single pulsed range measurement (not averaged).
31. Accuracy for single pulsed position measurement; 2.0 mm target center pt accuracy (based on averaging technique).
32. 1 megapixel for 24° x 24°; 64 megapixels rectified for full scan; can also be used with external camera.
33. Via Leica's X-function, LandXML and ASCII.
34. HI, backsight, traversing, resectioning supported.
35. Fully integrated for highest system accuracy and minimized calibration frequency.
36. On/off dual axis compensator.
37. 1.4 GHz Pentium M or similar, 512 MB SDRAM, ethernet card, SXGA+, Win XP (Pro or Home Edition), Win 2000; handheld tablet PC option.
38. 2.0 GHz Pentium 4, 512 MB SDRAM, ethernet card, SXGA+, Win XP (Pro or Home Edition), Win 2000.
39. Instrument shipping case, tribrach (Leica Professional Series), tripod, ethernet cable, two power supplies, cables, power supply charger, Cyclone-SCAN software.
40. HDS scan targets and target accessories, service agreement, tablet PC or laptop.
41. HDS3000 can be factory-upgraded to include dual-axis compensator.
42. Any external digital camera can be used for photo-overlay using Leica Cyclone software.
43. Survey prism can be mounted on top of scanner.
44. Can be upgraded to Leica Geosystems GRP5000.
45. Instrument shipping case, tripod, firewire cable, two power supplies, cables, power supply charger, Cyclone-SCAN software.
46. No station info can be entered.
47. 16.1" x 9.4" x 7.0"
48. 6.3" x 4.7" x 3.1"
49. Battery pack, battery charger, tribrach optical plummet, standard tripod, download cable and power cable processing software to XYZ coordinates.
50. Red dot pointing laser and tribrach (no plummet).
51. Pre-processing software supplied by the manufacturer.
52. Wireless (802.11g) or wired (ethernet).
53. Batteries, pocket PC, backpack, GPS/camera adaptor kit.
54. Visit www.rieglusa.com for more information on basic scanner accessories, cables, power supply and reflectors.
55. Azimuth uncertainty: ±250 microradians, elevation uncertainty: ±195 microradians.
56. Fully dark to bright sunlight.
57. Standard PC/laptop, 1.6 GHz P4, 512 MB RAM (1 GB recommended), ethernet, SVGA or higher graphics capability, Win XP.
58. 200 m at 99%; 350 m w/ OverScan.
59. Through Trimble Connected Survey Site.
60. Dual axis compensator, height of instrument and PPM.
61. Fully operational under all light conditions.
62. Average, depending on external conditions.
63. Laptop PC or Trimble Recon handheld.
64. Ask Trimble dealer; depends on application.
65. Airline checkable transport case; super-compact power supply unit with AC cables; Trimble tribrach; ethernet cable for connection of scanner to data collector; 50 adhesive flat targets; Trimble 3D Scanner Field software installation kit
66. Airline checkable transport case; power supply unit with AC cables; carbon tripod, ethernet cable for connection of scanner to data collector; 50 adhesive flat targets; Trimble 3D Scanner field software installation kit.
67. Trimble Recon controller with PocketScape field software; Trimble 3D scanner backpack; car battery cable kit; target kits; (planar, spherical, traverse kit); batteries.
68. Can be used on a standard survey tripod, delivered with dedicated light carbon tripod.
69. 3R (d>6.6 ft/2 m) DIN EN 60825-1.
70. < 5 mm (04 - 53.5 m).
71. 14 mm at 53.5 m.
72. All conditions from darkness to daylight.
73. 30 x 35 x 18 cm.
74. Tripod supplied with scanner.
75. 32 x 24 x 26 cm.
76. 1.2 GHz, 512 MB RAM (Win2000, XP).
77. Dolly, tripod, laptop tray for tripod.

SOFTWARE

For questions pertaining to automation and to allow richer descriptions of features, applicable questions should/may be answered with FA (Fully Automatic); SA (Semi-automatic); INT (Interactive), or Yes, No and None.

Fully automatic: User may specify some parameters and/or interact with the 3D data for a short time, such as clicking on three points to begin process of best-fitting points to a plane, press 'Start,' and everything is computed without any additional user-intervention.

Semi-automatic: Some significant portion of the operation is done automatically, but user needs to interact with the 3D data for more than a short time, such as confirming each individual segment or element of step.

Interactive: Done manually, applying CAD techniques and mathematical functions.

1. Contact 3rdTech for pricing for other scanners.
2. Faro, Polhemus, Riegl.
3. Distances between points, lines, planes, perpendiculars; angles between lines and planes.
4. Also automatic intersection of planes to determine lines or contours.
5. Automatic VRML models from point clouds.
6. RTPI, VRML, ASCII XYZ, PIF.
7. Laser intensity, range, full color.
8. Create full-color, texture-mapped, photo-realistic CG models. Produce panoramic images. Create high-resolution, photo close-ups in the model. Many special features for forensics.
9. Visi Image 3Dguru; Trimble GX, GS200; Leica 2500, 3000, 4500; Quantapoint; Z+F 5003; Faro Iqvolution; Optech; Riegl.
10. 200 MB footprint, swap and user data dependent on size of point data and project.
11. AGP/PCIX 128 MB graphics card.
12. Mouse with 2 buttons and wheel; graphics card with 32 MB and OpenGL hardware; ethernet card for licensing.
13. VRML, DXF, XYZ text, XYZ binary, IGES, PTS, PTX, PTC.
14. Optech, Riegl, Callidus, Cyrax, Mensi, Z+F, iQvolution, and several others.
15. Engineering drawings and surveyed information.
16. Least squares, minimum circumscribed, maximum

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- circumscribing, orientation-constrained, position-constrained.
17. 100 million WinXP32 and 200 million WinXP64.
 18. TXT,IGES,DXF,STL,OBJ,VRML.Microstation plug-ins available for importing projects directly.
 19. Heights, lengths, angles, radii, volume.
 20. 3-button mouse, 128 MB graphics memory.
 21. Open GL graphics accelerator, 3-button mouse.
 22. Available file exports are: 3DP,DXF,DGN,DWG,OBJ,MA,VRML,txt,avi.
 23. PointCloud Base and additional extension for "Clash Detection," PointCloud "Free Edition" for users of data.
 24. Support ASCII Import for all kind of point sources, optimized imports for Riegl, FARO, Trimble, Z+F.
 25. PointCloud is an AutoCAD application. It supports all AutoCAD versions later than AutoCAD 2000.
 26. At one time PointCloud can work with up to 30 million points. But inside AutoCAD it could be referenced to multiple files of point clouds.
 27. Suite of 5 modules: Cyclone-SCAN; -REGISTER; -MODEL; -SURVEY; -SERVER.
 28. Contact Leica representative.
 29. All brands/makes can be imported via ASCII-based formats; these brands/makes can be imported natively: Leica HDS2500/HDS3000/HDS4500/ScanStation; Z+F - Imager; Riegl; 5003 (ZFS,ZFC); Riegl (3DD).
 30. 130 MB static footprint; swap dependent on size of point cloud and operation.
 31. Ethernet adapter for licensing; keyboard; mouse or other pointing device.
 32. Import codes from CAICE, etc.
 33. Can use images from internal camera on Leica scanners or any external camera.
 34. Using cloud-to-cloud registration on data from any scanner and/or via "free stationing" and traversing using scan data from Leica ScanStation.
 35. Cyclone-based applications could load approx. 40 million points at a time if required but the management system dynamically loads all necessary points real-time and never approaches that max.
 36. Automatic: Region Grow modeling tools; manual modeling tools; ability to apply attributes to modeled elements.
 37. DXF,COE (DWG,DGN), ASCII (XYZ,SVY,PTS,PTX,TXT, customized format).
 38. Clouds are not confined/restricted on a per-scan basis. Engine supports billions of points in a single data set with interactive performance. Limit box can be changed on-the-fly. Supports multiple windows. Multi-threaded; supports multiple processors. Has 64-bit data engine and virtual 64-bit graphics engine. Data stored in databases.
 39. Automatic: Region Grow modeling tools; manual modeling tools; ability to use intelligent CAD tools.
 40. Contact Bentley representative or Bentley SELECT program.
 41. Users can place D-Points along pipe run defined by cloud and model pipes in place via D-Points inside PDMS.
 42. Basic and Pro versions.
 43. Intergraph SmartPlant Review.
 44. And MDL Cavity Scanner.
 45. Lengths, areas, angles, volumes.
 46. Signal, height, slope, range.
 47. Rock face burden calculations.
 48. Graphic card (minimum 128 MB).
 49. From internal scanner camera and external source (digital camera).
 50. EasyProfile automatically extracts natural features in a point cloud and generates the associated profile/lines to be exported in CAD packages.
 51. For plant design software (included Intergraph PDS and AVEVA PDMS).
 52. With connection to Plant Design software available.
 53. Using comparison with a surface.
 54. Fully automatic for some elements (like pipelines using EasyPipe).
 55. Using standard and customized catalogs.
 56. dxf,dgn,asc,obj,AVEVA PDMS,Intergraph PDS, stl,vrml,sat,igs.
 57. Users can develop their own macro by either recording them or coding them.
 58. Nvidia GForce graphics card recommended.
 59. SAT,VRML,ASCII,ZFC,PTX.
 60. AutoCad, Microstation, PDS, PDMS, Autoplant.
 61. Point Cloud Server to AutoCad or Microstation, PDS, PDMS. Supports up to 6 billion points.