

2004 3D Laser Scanner Hardware Survey

MANUFACTURER	3rdTech Inc.	Cyra Technologies	Cyra Technologies	Cyra Technologies	Cyra Technologies	iQSun 880	I-SITE Pty. Ltd.
PRODUCT	DeltaSphere-3000	HDS2500	HDS3000	HDS4500	HDS450	iQvolution	I-SITE 4400 Scanner [5-8]
PERFORMANCE							
Laser Wavelength (in nm)	670	532	532	780	780	785	905
Laser Power (in W, mW)	5 mW	< 1 mW avg	< 1 mW avg	23mW	32mW	10 mW	10 mW avg over 100 seconds
FDA Laser Classification (Class)	IIIa	2	3R	3R	3R	3R/3A	3R (to IEC 60825)
Beam Diameter at Specified Distance (0.Y ft at X ft/Ymm at X m)	0.1 in at 0 ft, 0.28 in at 30 ft	< 6 mm from 0-50 m	< 6 mm from 0-50 m	3.5 mm at 1 m	3.5 mm at 1 m	0.01ft at exit/3mm at exit , circular	20 mm at 0 m, 600 mm at 300 m
Measurement Technique	Pulse time of flight	Time of flight	Time of flight	Phase shift	Phase shift	Phase difference measurement	Time of Flight
Average Data Acquisition Rate (pps)	19,200	1,000	1,000	125,000	125,000	240,000	4,400
Maximum Data Acquisition Rate (pps)	25,000	1,000	1,000	625,000	500,000	240,000	4,400
Distance Accuracy at Specified Distance (0.Y ft at X ft/Ymm at X m)	0.3 in at 40 ft	+/- 4 mm at 50 m	+/- 4 mm at 50 m	< 3mm at 0.4-25.2 m	< 5 mm at 0.4-53.5 m	0.01 ft at 33ft/3 mm at 10 m	+/- 50 mm at 300 m
Position Accuracy at Specified Distance (0.Y ft at X ft/Ymm at X m)	0.4 in at 40 ft	+/- 4 mm at 50 m	+/- 4 mm at 50 m	7mm at 25.2 m	14 mm at 53.5 m	0.012 ft at 33 ft / 3.5 mm at 10 m	+/- 35 mm at 100 m
Angular Accuracy (degrees-min-sec)	0.015	+/- 60 micro-radians	+/- 30 micro-radians	+/- 0.01	+/- 0.01	0.007 degrees	0.02 degrees
Accuracy Certification Standard	N/A	Factory certified	Factory certified	Factory certified	Factory certified	Proprietary	N/A
Minimum Range (feet/m)	1 ft	1.5 m	1 m	0.4 m	0.4 m	0.66 ft/0.2 m	2 m
Maximum Range (feet/m)	40 ft, [1]	100 m	100 m	25.2 m	53.3 m	250 ft/76 m	400 m
Field of View (vertical angle) (degrees-min-sec)	145	40 degrees	270 degrees	310 degrees	310 degrees	320 degrees	80 degrees
Field of View (horizontal angle) (degrees-min-sec)	360	40 degrees	360 degrees	360 degrees	360 degrees	360 degrees	360 degrees
Minimum Vertical Scan Increment (degrees-min-sec)	0.05	0.25 mm at 50 m	1.25 mm at 50 m	0.018	0.018	0.0011	0.1 degrees
Minimum Horizontal Scan Increment (degrees-min-sec)	0.05	0.25 mm at 50 m	1.25 mm at 50 m	0.01	0.01	0.00076	0.1 degrees
Surface Reflectivity Range (%)		5-100	5-100	5-100	5-100	5 - 95	5+
On Board Camera (for aiming? Or for creating photomosaic? Etc.?)	Optional, [2]	Yes	Yes	No	No	No	[1]
Is hardware interoperable with optical total stations and GPS? If yes, how?	Yes, [3]	Yes	Yes	Yes	Yes	Georeferencing	[2]
Is scanner effective when used to scan topography? (Y/N)	No	Yes	Yes	Yes	Yes	Yes	Yes
Is software technology for processing data from scanner manufacturer?	[4]	Yes	Yes	Yes	Yes	Yes	Yes
Is hardware designed to enable "stitching" of scans that must be observed from different stations? (Y/N)	Yes, [5]	Yes	Yes	Yes	Yes	Yes	Yes

ENVIRONMENTAL							
Storage Temperature Range (degrees F/C)	32 to 113 F	-25 to 65 C	-25 to 65 C	0 to 70 C	0 to 70 C	0 to 160 F	-20 to 50 C
Operating Temperature Range (degrees F/C)	32 to 113 F	0 to 40 C	0 to 40 C	0 to 40 C	0 to 40 C	32 to 113 F	-10 to 50 C
Humidity (%)	[6]	Non-condensing atmosphere	Non-condensing atmosphere	Non-condensing atmosphere	Non-condensing atmosphere	Non-condensing	< 95%
Ambient Light	[7]	[1]	[1]	[4]	[4]	[1]	Any light conditions OK

GENERAL							
Scanner Dimensions (LxWxH) (inches/cm)	14 x 14 x 4 in	40.1 x 33.7 x 42.9 cm	26.5 x 37 x 51 cm	30 x 18 x 35 cm	30 x 18 x 35 cm	15.75 x 6.3 x 9.85 in	430 x 250 x 330 mm
Scanner Weight (pounds/kg)	22 lbs	20.5 kg	16 kg	13 kg	13 kg	39 lbs/18 kg	14 kg (includes battery)
Is scanner recommended for mounting on standard survey tripod? If no, what is recommended stand?	Yes, [8]	Cyra provided tripod with either spiked feet or paddle feet	Yes	Yes	Yes	Yes	Yes
Power Supply Dimensions (LxWxH) (inches/cm)	5.75 x 3 x 1.75 in	31 x 28 x 24 cm	15.5 x 23.5 x 21.5 cm	[5]	[5]	5.9 x 2.75 x 1.4 in/15 x 7 x 3.5 cm	Included in scanner dimensions
Power Supply Weight (pounds/kg)	1.25 lbs	21 kg	12 kg	AC: 1 kg; Battery: 16 kg	AC: 1 kg; Battery: 16 kg	1.3 lbs/0.6 kg	2 kg
AC Power Requirements (volts/watts)	[9]	90-240 V; 50-60 Hz		120V/230V (80W)	120V/230V (80W)	100-240 V/100 W	N/A
DC Power Requirements (volts/watts)	[10]	12 V, nominal	36 V, nominal	24V (80W)	24V (80W)	24 V/60 W	24 VDC
Batteries	Standard 12 volt battery	Sealed lead acid	Sealed lead acid	Sealed lead acid	Sealed lead acid	Standard 24 V	NiMH rechargeable battery
Battery Life (hours)	4 to 8	8 at 20 C, with two batteries	8 at 20 C, with two batteries	8	8	6-8	4 continuous operation
Computer Requirements (Control)	[11]	500 MHz Pentium II, 256 MB RAM	500 MHz Pentium II, 256 MB RAM	[6]	[6]	No PC required (internal hard disk)	[3]
Computer Requirements (data processing)	[12]	500 MHz Pentium II, 256 MB RAM	500 MHz Pentium II, 256 MB RAM	[6]	[6]	1 GB memory recommended	[4]
Number of pieces of equipment/cases (complete system) when field-ready	[13]	2	2	4	4	1	1
Weight of complete field-ready system, in cases as described above (lbs/kg)	48 lbs, [14]	87 kg	70 kg	45 kg	45 kg	60 lbs / 27.5 kg (depending on case)	30 kg
Warranty	1 year	1 year manufacturers warranty	1 year manufacturers warranty	1 year manufacturers warranty	1 year manufacturers warranty	1 Year (Parts and Labor)	1 year
Optional Accessories	[15]	[2]	[3]	dolly, tripod, laptop tray for tripod	dolly, tripod, laptop tray for tripod	[2]	N/A
READER SERVICE NUMBER	1	2	3	4	5	6	7

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MANUFACTURER	Measurement Devices Ltd.	MENSI	MENSI	MENSI	MENSI	Optech Inc.	Optech Inc.
PRODUCT	LaserAce Scanner	MENSI GS100	MENSI GS200	MENSI S10	MENSI S25	ALTM 30/70	ILRIS-3D
PERFORMANCE							
Laser Wavelength (in nm)	905	532	532	635	635	1064	1540
Laser Power (in W, mW)		1 mW	1 mW	2.5 mW	2.5 mW	7 w	10 mW
FDA Laser Classification (Class)	1M	2 (US standard 21 CFR 81041.10)	2 (US standard 21 CFR 81041.10)	3R (IEC 60825.1)	3R (IEC 60825.1)	Class IV (FDA CFR 21)	Class I under all operating conditions [1]
Beam Diameter at Specified Distance (0.Y ft at X ft/Ymm at X m)	300 mm at 100 m	3 mm at 50 m	3 mm at 50 m			Dual: 20 cm dia at 1,000 m or 70 cm at 1,000 m	0.675 in at 100 ft/17 mm at 300 m
Measurement Technique	Time of Flight	Time-of-flight	Time-of-flight	Triangulation	Triangulation	Time of flight	LIDAR (Time of Flight)
Average Data Acquisition Rate (pps)	250	5,000	5,000	100	100	Variable 70,000, 50,000 or 33,000	2,000
Maximum Data Acquisition Rate (pps)	250	5,000	5,000	100	100	70,000 by 4 range measurements per pulse	3,000
Distance Accuracy at Specified Distance (0.Y ft at X ft/Ymm at X m)	10 cm at 600 m	3.2 mm at 50 m/ 5 mm at 100 m	1.5 mm at 50 m/ 2.5 at 100 m	Max: 0.2 mm at 1 m, -2.5 mm at 5 m, -6.6mm at 10 m	0.35+0.01 x D^2 mm with D in m	2 cm at 1,200 m	0.275 in at 330 ft/7 mm at 100 m, [2]
Position Accuracy at Specified Distance (0.Y ft at X ft/Ymm at X m)	20 cm at 600 m	3.2 mm at 50 m/ 5 mm at 100 m	1.5 mm at 50 m/ 2.5 at 100 m	Max: 0.2 mm at 1 m, -2.5 mm at 5 m, -6.6mm at 10 m	0.35+0.01 x D^2 mm with D in m	1/2000 x altitude	0.4 in at 330 ft/10 mm at 100 m, [2]
Angular Accuracy (degrees-min-sec)	0.02 degrees	6.6 seconds	6.6 seconds	4 seconds	4 seconds	Better than 0.01 degrees	0.0045 degrees (16 arc seconds), [2]
Accuracy Certification Standard		MENSI test protocol	MENSI test protocol	MENSI test protocol	MENSI test protocol		[7]
Minimum Range (feet/m)	5 m	1 m	1 m	0.8 m	2 m	200 m	10 ft/3 m
Maximum Range (feet/m)	700 m	Up to 150 m [1]	Up to 350 m [1]	10 m	25 m	3,000 m	>4,900 ft/> 1,500 m typical [3]
Field of View (vertical angle) (degrees-min-sec)	135 degrees (-45 to 90)	60°	60°	320°	320°	N/A	[8]
Field of View (horizontal angle) (degrees-min-sec)	360 degrees	360°	360°	46°	46°	50 degrees	40 degrees >270 w/optional pan/tilt accessories
Minimum Vertical Scan Increment (degrees-min-sec)	0.01 degrees	6.6 seconds	6.6 seconds	40 seconds	40 seconds	N/A	0.0015 degrees (5.4 arc seconds)
Minimum Horizontal Scan Increment (degrees-min-sec)	0.01 degrees	6.6 seconds	6.6 seconds	40 seconds	40 seconds	0.1 degrees	0.0015 degrees (5.4 arc seconds)
Surface Reflectivity Range (%)	Full range	albedo 2%-99% (depending on distance)	albedo 2%-99% (depending on distance)	albedo 2%-99% (depending on distance)	albedo 2%-99% (depending on distance)	[9]	0.1 to 100, [3]
On Board Camera (for aiming? Or for creating photomosaic? Etc.?)	No	Yes, for RGB scanning and Photomosaic	Yes, for RGB scanning and Photomosaic	Yes, for framing and Photomosaic	Yes, for framing and Photomosaic	Yes	Yes, standard onboard & optional offboard
Is hardware interoperable with optical total stations and GPS? If yes, how?	[2]	Yes, using specific targets	Yes, top adaptor feature or GPS, targets	Yes, using specific targets	Yes, using specific targets	Novatel GPS included & Applinix IMU included	Yes, via software
Is scanner effective when used to scan topography? (Y/N)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Is software technology for processing data from scanner manufacturer?	No	Yes	Yes	Yes	Yes	No	Yes, see options.
Is hardware designed to enable "stitching" of scans that must be observed from different stations? (Y/N)	Yes	Yes	Yes	Yes	Yes	Yes	Yes

ENVIRONMENTAL							
Storage Temperature Range (degrees F/C)	-20 to 45 C	-20° to 50° C	-20° to 50° C	0° to 35° C	0° to 35° C	-35 C	-4 to 122 F/-20 to 50 C, [4]
Operating Temperature Range (degrees F/C)	-10 to 45 C	0° to 40° C	0° to 40° C	0° to 40° C	0° to 40° C	-20 to 35 C	32 to 104 F/0 to 40 C, [4]
Humidity (%)		Non-condensing atmosphere	Non-condensing atmosphere	Non-condensing atmosphere	Non-condensing atmosphere	0-95% Non-condensing	5-95% RH Non-condensing
Ambient Light	[1]	No influence	No influence	[6]	[6]	Operation day or night	Unaffected, [5]

GENERAL							
Scanner Dimensions (LxWxH) (inches/cm)	21 x 24 x 42 cm	34 x 27 x 42 cm	34 x 27 x 42 cm	72 x 21 x 28 cm	102 x 21 x 28 cm	25 x 32 x 56 cm	12.25 x 12.25 x 8 in/ 312 x 312 x 205 mm
Scanner Weight (pounds/kg)	10.2 kg	13.6 kg	13.6 kg	16.3 kg	18.6 kg	20 kg	25 lbs/12 kg
Is scanner recommended for mounting on standard survey tripod? If no, what is recommended stand?	Yes	Yes	Yes	N/A (dedicated tripod)	N/A (dedicated tripod)	Mount in aircraft	Yes
Power Supply Dimensions (LxWxH) (inches/cm)	16 x 12 x 8 cm	10.5 x 20 x 6.5 cm	10.5 x 20 x 6.5 cm	N/A (embedded)	N/A (embedded)	59 x 58 x 49 cm	11 x 8 x 4 in/280 x 205 x 100 mm
Power Supply Weight (pounds/kg)	6.3 kg	1.5 kg	1.5 kg			55 kg	10 lbs/4.5 kg
AC Power Requirements (volts/watts)		90 to 240 VAC, 50 to 60 Hz	90 to 240 VAC, 50 to 60 Hz	110 to 220 V, 50/60 Hz	110 to 220 V, 50/60 Hz	N/A	85-240 VAC 50/60 Hz / 380W
DC Power Requirements (volts/watts)	12 VDC	24 V, nominal	24V, nominal	24V, nominal	24 V, nominal	35 Amp at 28 VDC	18-36 VDC, 80 W
Batteries	12V external battery	Standard or premium available	Standard or premium available	N/A	N/A	N/A	240 W.HR NiMH
Battery Life (hours)	6	3	3			N/A	>2.75 per pair [6]
Computer Requirements (Control)	None	PocketPC or LaptopPC	PocketPC or LaptopPC	Included	Included	Dell Latitude Laptop	[10]
Computer Requirements (data processing)	None	[3]	[3]	[3]	[3]	730 GB dual CPU server	[11]
Number of pieces of equipment/cases (complete system) when field-ready	2	1	1	2	2	5	One single ruggedized field carrying case with wheels
Weight of complete field-ready system, in cases as described above (lbs/kg)	26.3 kg instrument and case 20 kg tripod 6.3 kg	16.1 kg [2]	16.1 kg [2]	31 kg	31 kg	137 kg	70 lb / 32kg - shipping wt.
Warranty	12 months return to base	1 year	1 year	1 year	1 year	1 year	1 year [12]
Optional Accessories	Red dot pointing laser	[4]	[5]	Nuclear version	Nuclear version	Waveform digitizer	[13]
READER SERVICE NUMBER	8	9	10	11	12	13	14

N/A=Not Applicable
Numbers in brackets refer to notes (see page 25).

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MANUFACTURER	Riegl USA	Riegl USA	Riegl USA	Riegl USA	Visi Image Inc.	Zoller+Frohlich GmbH (Z+F)
PRODUCT	LPM 800 HA	LMS Z210i	LMS Z360	LMS Z420	3Dguru	IMAGER 5003-53500
PERFORMANCE						
Laser Wavelength (in nm)	904	904	904	1000	650	780
Laser Power (in W, mW)	1 mW	1 mW	1 mW	1 mW	10 mW (max)	32 mW
FDA Laser Classification (Class)	1	1	1	1	Class 3R	3R (d > 6.6ft / 2m)
Beam Diameter at Specified Distance (0.Y ft at X ft/Ymm at X m)	50 mm at 50 m	50 mm at 50 m	20 mm at 50 m	15 mm at 50 m	3 mm at 15 m	DIN EN 60825-1 0.14 at 3.3 (3.5 mm at 1 m)
Measurement Technique	LiDAR	LiDAR	LiDAR	LiDAR	CW	Phase shift
Average Data Acquisition Rate (pps)	1,000	8,000	8,000	6,600	210,000	125,000
Maximum Data Acquisition Rate (pps)	2,000	12,000	12,000	10,000	210,000	500,000
Distance Accuracy at Specified Distance (0.Y ft at X ft/Ymm at X m)	15 mm at 800 m	15 mm at 400 m	6 mm at 200 m	10 mm at 800 m	0.25 mm at 20 m RMS	< 0.20in (1.3ft/175.5ft)
Position Accuracy at Specified Distance (0.Y ft at X ft/Ymm at X m)	6.3 mm at 20 m	6 mm at 100 m	6 mm at 100 m	6 mm at 100 m	1.8 mm at 32 m RMS	(< 5mm [0.4ft/5.3m]) 0.55 at 175.5 (14mm at 53.5m)
Angular Accuracy (degrees-min-sec)	0.01	0.002	0.002	0.002	± 3.9 arc seconds	+/- 0.01°
Accuracy Certification Standard	NIST Traceable	NIST Traceable	NIST Traceable	NIST Traceable		Factory certified to EU standards
Minimum Range (feet/m)	10 m	4 m	1 m	2 m	0.2 m	1.3 (0.4 m)
Maximum Range (feet/m)	1,000 m	500 m	300 m	1,000 m	36.5 m	175.5 (53.5 m)
Field of View (vertical angle) (degrees-min-sec)	160	80	90	80	262	310°
Field of View (horizontal angle) (degrees-min-sec)	360	360	360	360	360	360°
Minimum Vertical Scan Increment (degrees-min-sec)	0.01	0.002	0.002	0.002	0.0152°	0.018°
Minimum Horizontal Scan Increment (degrees-min-sec)	0.01	0.002	0.002	0.002	0.00015°	0.01°
Surface Reflectivity Range (%)	5 to 100	5 to 100	5 to 100	5 to 100	3-95%	5-99%
On Board Camera (for aiming? Or for creating photomosaic? Etc.?)	6 megapixel	6 megapixel	6 megapixel	6 megapixel	Mar-04	No
Is hardware interoperable with optical total stations and GPS? If yes, how?	Yes	Yes	Yes	Yes	Yes, via software	Yes (Z+F scans are tied to a control survey)
Is scanner effective when used to scan topography? (Y/N)	Yes	Yes	Yes	Yes	Yes	Conventional instrumentation: Yes; GPS: No
Is software technology for processing data from scanner manufacturer?	Yes	Yes	Yes	Yes	Yes	Yes
Is hardware designed to enable "stitching" of scans that must be observed from different stations? (Y/N)	Yes	Yes	Yes	Yes	Yes	Yes

ENVIRONMENTAL						
Storage Temperature Range (degrees F/C)	-20 to 70 C	-20 to 60 C	-20 to 60 C	-10 to 50 C	-10 to 60 C	32 to 158° F (0 to 70° C)
Operating Temperature Range (degrees F/C)	0 to 50 C	-10 to 50 C	-10 to 50 C	0 to 40 C	2 to 45 C	32 to 104° F (0 to 40° C)
Humidity (%)	Non-condensing	Non-condensing	Non-condensing	Non-condensing	<100%	Non-condensing
Ambient Light	Not affected	Not affected	Not affected	Not affected	All lighting	All conditions

GENERAL						
Scanner Dimensions (LxWxH) (inches/cm)	28 x 30 x 32	44 x 21	49 x 21	47 x 21	19 x 7.5 x 6.5 in	11.9 x 13.8 x 7.1 (30 x 35 x 18 cm)
Scanner Weight (pounds/kg)	15	13	13	15	15.8 lbs	28.7 (13 kg)
Is scanner recommended for mounting on standard survey tripod? If no, what is recommended stand?	Yes	Tripod or Vehicle	Tripod or Vehicle	Tripod or Vehicle	Yes	Yes
Power Supply Dimensions (LxWxH) (inches/cm)	12 x 11 x 8	12 x 11 x 8	12 x 11 x 8	12 x 11 x 8	21 x 14 x 9 in	[1]
Power Supply Weight (pounds/kg)	19	19	19	19	37 lbs	AC: 22 (1 kg) DC: 35.3 (16 kg)
AC Power Requirements (volts/watts)	No	No	No	No	80-265 v	120 V/230 V (80 W)
DC Power Requirements (volts/watts)	12-28 VDC	12-28 VDC	12-28 VDC	12-28 VDC	18 v 60 w	24 V (80 W)
Batteries					Yes - Li-on	Sealed lead acid battery
Battery Life (hours)	8	8	8	8	8 hours continuous scanning	8
Computer Requirements (Control)	1000 MB Ram	1000 MB Ram	1000 MB Ram	1000 MB Ram	PC/laptop	[2]
Computer Requirements (data processing)	1000 MB Ram	1000 MB Ram	1000 MB Ram	1000 MB Ram	PC/laptop	IEEE1394-interface (FireWire)
Number of pieces of equipment/cases (complete system) when field-ready	2	2	2	2	3	
Weight of complete field-ready system, in cases as described above (lbs/kg)	70 lbs	70 lbs	70 lbs	70 lbs	65 lbs	[3]
Warranty	1 year	1 year	1 year	1 year	1 year, plus extended	Limited one (1) year
Optional Accessories	Yes	Yes	Yes	Yes	Video mapping March 2004	Dolly, Tripod, Laptop Tray for Tripod
READER SERVICE NUMBER	15	16	17	18	19	20

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MANUFACTURER/DISTRIBUTOR	InnovMetric Software	iQvolution	I-SITE Pty Ltd.	Kubit GmbH	Leica Geosystems/Cyra	Leica Geosystems/Cyra	MDL
NAME/FUNCTIONALITY OF MODULES OR COMPONENTS OF SUITE	PolyWorks	iQscene	I-SITE Studio2.3	PointCloud	Cyclone (REGISTER, MODEL, SURVEY, SERVER)	Cyclone CloudWorx (Basic, Pro); Bentley CloudWorx***	Laser Cloud Viewer
Price (list by modules or components)	On demand	\$5,000		900 EUR	\$7,500-\$12,500	\$995-\$3,500	\$1,500
Laser scanner brands and models from which data can be imported directly	[1]	iQsun 880, Riegl, Cyra pts, all others via ASCII	I-SITE, Riegl, Optech - All models, also GPS, total station data	All	[1]	[3]	MDL LaserAce Scanner
Operating systems supported	Windows NT/2000/XP	Windows XP, NT	Windows 2000, XP	<small>Plug in AutoCAD 2000/2002/2004</small>	Windows 2000, XP	Windows 2000, XP	Windows XP/NT
Minimum hardware CPU/speed	1 G (2CPU recommended)	Pentium, 1GHz	P4, 2GHz	Like used AutoCAD version	500 MHz Pentium II	500 MHz Pentium II	2.4 GHz
Minimum RAM required	512 MB (2GB recommended)	512MB	512 MB	Like used AutoCAD version	256 MB	256 MB	512
Space required on hard disk for application (list in MB)	215 MB (1 GB Swap)	25	300 MB	Like used AutoCAD version	75	80	2 MB
Other hardware requirements	Open GL, 3-button mouse		32 MB OpenGL graphics card, [1]	Like used AutoCAD version	Ethernet card [2]	Ethernet card (for licensing)	

CLOUD EDITING/ANALYSIS							
Can user definable feature code library be used to identify features?	Yes	No	Yes		Yes	Yes (using CAD feature code or symbol tools and picking points)	No
Feature codes exportable to CAD software? (specify which)	Microstation, AutoCAD	Microstation, AutoCAD	Text, dgd or dxf format		All, generic via customizable ASCII	N/A (already in CAD)	Points and Polylines
Can user compare cloud or shapes fitted to clouds to "plan," or perform theoretical shape and interference checking?	Yes	Yes	Yes	Yes	Yes	Yes	No
Ability to make measurements such as distances, angles, areas, volumes, of lines, planes, shapes and other surfaces from cloud?	Yes	Yes	Yes	Yes	Yes	Yes (using CAD feature code tools and picking points)	Yes
Can user overlay or drape photograph on cloud or elements extracted from cloud?	Coming Q2 2004	No	Yes		[4]	[4]	Yes
Ability to match common points from different scans and create merged ("stitched") cloud?	Yes	Yes	Yes	Yes	Yes	No	Yes
Ability to place several clouds from different scans in coordinated 3D space using survey data from conventional and GPS instrumentation for positions of scanner and direction or angles to points in the cloud?	Yes	Yes	Yes	Yes	Yes	No	No
Analyze points in a cloud representing shapes such as planes, cylinders and spheres to detect measurement outliers?	Yes	Yes	Yes		Yes (region grow)	Y (planes, cylinders)	No
Ability to integrate scans with floor plans, engineering drawings of objects, surveyed information, etc.?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Automate decimation of points in selectable areas to make data files as compact as possible?	Yes	Yes	Yes		No	No	No
Is fitting of lines, planes and shapes to cloud done manually or automatically, or both?	Both	Both	Automatic	Manually	Both	Both	
- If automatic, what techniques are used (e.g. least squares, taking average, etc.)?	Least squares	Mixed	Least squares		Least squares	Least squares	

RENDERING/CAD MODEL GENERATION/VIEWING							
Does software generate or create CAD models from point clouds and other known information?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Allow semi-automatic generation of CAD models from point clouds?	Yes	Yes	Yes	Yes	Yes	Yes	No
Perform contour generation?	Yes	Yes	Yes		Yes	No	No
Perform volume calculation capabilities?	Yes	No	Yes		Yes	No	No
Perform volume generation based on user-defined lines, planes and other surfaces as bounds?	No	No	Yes		No	No	No
Perform profile and cross-section generation along any cutting plane or family of planes?	Yes	No	Yes		Yes	No	No
Have edge detection technology to determine boundaries of solids, planes and other shapes?	Yes	Yes	Yes		No	No	No
Perform automatic extraction of standard shapes from cloud (e.g. pipe fittings, structural steel members, etc.)?	No	No	No	Yes	Yes	Yes (pipe fitting, planar patches)	No
Can user view cloud or generated shapes or models from any viewpoint in 3D?	Yes	Yes	Yes		Yes	Yes	Yes
Are fly-throughs or walk-throughs supported?	Yes (video generation)	Yes	Yes	Yes	No	No	No
Have intelligent display of detail depending on scale of the view?	No	Yes	Not required	Yes	Yes	Yes	Yes
Can user select transparent/opaque surface for cloud and CAD shapes?	Yes	Yes	Yes	Yes	Yes	No	No
Can software display scanner's color detection capabilities?	Yes	Yes	Yes		Yes	Yes	Yes
Which export formats are supported?	TXT, ICGES, DXF, STL, OBJ, VRML	[1]	[2]		[5]	[6]	DXF, ASCII

MISCELLANEOUS							
Provide high-speed thumbnail views of scans, clouds, photographic images and generated shapes?	No	Yes	Yes		No	No	No
Can client/server system support multiple users?	No	Yes (iQworks)	No		Yes	Yes	
Is client/server system supported to enable several clients contributing to a single project?	No	Yes (iQworks)	No		Yes	Yes	
READER SERVICE NUMBER	21	22	23	24	25	26	27

N/A=Not Applicable
Numbers in brackets refer to notes (see page 25).

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MANUFACTURER/DISTRIBUTOR	MDL	MENSI	MENSI	Optech	Zoller+Frohlich GmbH (Z+F)	Zoller+Frohlich GmbH (Z+F)
NAME/FUNCTIONALITY OF MODULES OR COMPONENTS OF SUITE	Demon	RealWorks Survey	3Dipsos	REALM	LFM Modeller	LFM Viewer
Price (list by modules or components)	\$10,000	Consult MENSI	Consult MENSI	Included with system	\$12,000	\$3,000
Laser scanner brands and models from which data can be imported directly	[1]	All	All	ALTM only	Z+F, Cyra	Z+F, Cyra
Operating systems supported	Windows XP/NT, Mac	Windows 2000Pro/NT4/XP	Windows 2000pro/NT4/XP	Windows NT/2000 Compatible	Windows, Linux	Windows, Linux
Minimum hardware CPU/speed	2.4 GHz	1.2	1.2	1 GHz	1.0 GHz	1.0 GHz
Minimum RAM required	512	512	512	2	512	
Space required on hard disk for application (list in MB)	2	35 [1]	25	60 GB	20	
Other hardware requirements					[1]	[1]

FEATURE	MDL	MENSI	MENSI	Optech	Zoller+Frohlich GmbH (Z+F)	Zoller+Frohlich GmbH (Z+F)
CLOUD EDITING/ANALYSIS						
Can user definable feature code library be used to identify features?	No	Yes	No	N/A	No	No
Feature codes exportable to CAD software? (specify which)	Points and Polylines	Yes, AutoCAD, MicroStation	No	N/A	No	No
Can user compare cloud or shapes fitted to clouds to "plan," or perform theoretical shape and interference checking?	Yes	Yes	Yes	N/A	Yes	Yes
Ability to make measurements such as distances, angles, areas, volumes, of lines, planes, shapes and other surfaces from cloud?	Yes	Yes	Yes	N/A	Yes	Yes
Can user overlay or drape photograph on cloud or elements extracted from cloud?	Yes	Yes	Yes	N/A	No	No
Ability to match common points from different scans and create merged ("stitched") cloud?	Yes	Yes	Yes	Yes	Yes	Yes
Ability to place several clouds from different scans in coordinated 3D space using survey data from conventional and GPS instrumentation for positions of scanner and direction or angles to points in the cloud?	Yes	Yes	Yes	Yes	Yes	Yes
Analyze points in a cloud representing shapes such as planes, cylinders and spheres to detect measurement outliers?	No	Yes	Yes	No	Yes	No
Ability to integrate scans with floor plans, engineering drawings of objects, surveyed information, etc.?	Yes	Yes	Yes	No	Yes	No
Automate decimation of points in selectable areas to make data files as compact as possible?	Yes	Yes	Yes	Yes	Yes	Yes
Is fitting of lines, planes and shapes to cloud done manually or automatically, or both?	Automatically	Both	Both	N/A	Both	Both
- If automatic, what techniques are used (e.g. least squares, taking average, etc.)?	Least squares	Least Squares	Least squares		Least squares	Least squares

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RENDERING/CAD MODEL GENERATION/VIEWING						
Does software generate or create CAD models from point clouds and other known information?	Yes	No	Yes	No	Yes	No
Allow semi-automatic generation of CAD models from point clouds?	No	No	Yes	No	Yes	No
Perform contour generation?	Yes	Yes	Yes	No	Yes	Yes
Perform volume calculation capabilities?	Yes	Yes	Yes	No	Yes	No
Perform volume generation based on user-defined lines, planes and other surfaces as bounds?	Yes	Yes	Yes	No	Yes	No
Perform profile and cross-section generation along any cutting plane or family of planes?	Yes	Yes	Yes	No	Yes	Yes
Have edge detection technology to determine boundaries of solids, planes and other shapes?	Yes	Yes	Yes	No	Yes	No
Perform automatic extraction of standard shapes from cloud (e.g. pipe fittings, structural steel members, etc.)?	No	No	Yes	No	No	No
Can user view cloud or generated shapes or models from any viewpoint in 3D?	Yes	Yes	Yes	Yes	Yes	Yes
Are fly-throughs or walk-throughs supported?	Yes	Yes	Yes	No	Yes	Yes
Have intelligent display of detail depending on scale of the view?	Yes	Yes	Yes	No	Yes	Yes
Can user select transparent/opaque surface for cloud and CAD shapes?	Yes	Yes	Yes	No	Yes	Yes
Can software display scanner's color detection capabilities?	Yes	Yes	Yes	Yes	N/A	N/A
Which export formats are supported?	[2]	ASCII, txt, dgn, dxf, bmp	[3]	ASCII XYZ or LAS binary output	SAT, ZFC	ZFC

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MISCELLANEOUS						
Provide high-speed thumbnail views of scans, clouds, photographic images and generated shapes?	No	Yes	Yes	No	No	No
Can client/server system support multiple users?		N/A	N/A	Yes	Yes	Yes
Is client/server system supported to enable several clients contributing to a single project?		N/A [2]	N/A	Yes	Yes	Yes
READER SERVICE NUMBER	28	29	30	31	32	33

2004 3D Laser Scanner Survey Notes

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

HARDWARE:

Cyra

1. Fully operational between bright sunlight and complete darkness.
2. Special scan targets and target accessories, wheeled base for tripod, standalone battery charger, service and maintenance contracts.
3. Special scan targets and target accessories.
4. All conditions from darkness to daylight.
5. AC: 13 x 16 x 19 cm; Battery: 32 x 26 x 24 cm.
6. 600 MHz (Win2000, NT), IEEE1394-interface (FireWire).

iQvolution

1. Clouded sky does not harm, but full sun on target object will disturb measurement.
2. Traveling case, additional hard drives, custom spheres.

MAPTEK

1. Yes, integrated panoramic digital camera for setup and high resolution texture mapping.
2. Yes, field setup and software integration to use GPS and total station data.
3. Touchscreen tablet data recorder and I-SITE HHC software supplied with scanner.
4. P4 2GHz, 512 MBRAM, 32Mb OpenGL graphics card.
5. I-SITE 4400 scanner also includes motorised survey telescope (magnification 16x, FOV 3deg) and a red diode laser pointer for survey alignment.
6. I-SITE 4400 scanner is levelled by 20" plate bubble level and digital tilt compensator with resolution 10".
7. I-SITE 4400 scanner is controlled using I-SITE HHC software on touch screen tablet data recorder.
8. Accuracy may be improved by automated multiple sampling of a scene.

MENSI

1. Maximum range using OverScan capability.
2. When using transportation backpack.
3. Average Configuration: Processor PC:

Pentium PIII, 1.4 GHz- RAM: 512 MB- Video Card: Nvidia GeForce 2 MX400 - Operating System: Windows 2000 Pro, Windows NT 4.0 or Windows XP- Mouse: Three buttons with wheel.

4. Batteries (standard or premium), upgradeable firmware.
5. WiFi ready, batteries (standard or premium), (check www.mensi.com for detailed specifications), upgradeable firmware.
6. May be influenced by bright light conditions.

Measurement Devices

1. Works in full sun (max range may be affected).
2. Yes. Standard survey control observations can be made in conjunction with scans by a simple coding system.

Optech

1. True Class 1 operation; Eyesafe under all field operating conditions, including locked scanners.
2. Accuracy specified at 1 sigma.
3. Typical ranges for diffuse objects that are to be imaged at this distance. Single reflective points can be detected much further away.
4. For extended storage and operation down to -30C / -22F, consult Optech.
5. Equally effective in bright sunlight and total darkness.
6. Batteries can be added or hot swapped in pairs - up to 4 batteries on a single holder provides for uninterrupted operation.
7. Verified by field ground truth with total station calibration to DIN 18723/ISO 12857.
8. 40 degrees standard; 360 w/optional pan/tilt accessories.
9. Surface diffuse reflectivity range for making a measurement.
10. Palm PDA (supplied) or Win NT/2000/XP laptop.
11. Windows NT4.0, 2000, XP; OpenGL graphics adapter; 3-button mouse; 256MB RAM; 500MB free disk and swap space.
12. Extended warranty options available.
13. Complete modelling and analysis software (from a wide variety of software manufacturers); Texture mapping (Optech photogrammetry software); Direct data point-cloud visualization into AutoCAD software options; Multiple windows with different resolutions in a single scanning field; Photovoltaic solar charging array; Multi-mode wired or wireless remote network scanner control and data collection.

3rdTech

1. Farther for reflective surfaces.
2. For creating full color, texture-mapped models.
3. Compatible and aligned with Tribrach mount.
4. Software supplied for control, data measurement and annotation, mesh creation, and export in different formats. Color mapping software included with color option. 3rd party software required for scan alignment and data simplification.
5. Compatible with PolyWorks, RapidForm, and I-SITE Studio.
6. Performs in humid, not rainy, environments.
7. Performs in outdoor environments; direct sunlight will reduce range.
8. Or photographic tripod.
9. 100-240v, 65w max, 40w typical.
10. 12 volts, 65w max, 40w typical.
11. Standard PC or laptop; Windows 2000/NT/XP; ethernet; 128mb memory, large storage for scans; IEEE 1394 (Firewire) for scan option.
12. Standard PC or laptop; Windows 2000/NT/XP; ethernet; 512Mb memory, large storage for scans; 3D graphics card for display performance.
13. One airline-checkable case (supplied) for system and power supply. Laptop, tripod, color camera option, battery are separate.
14. System and power supply in case.
15. Calibrated professional digital camera, mount and software.

Zoller+Fröhlich

1. AC: 5.1 x 7.5 x 6.3 (13 x 19 x 16 cm) DC: 12.6 x 9.4 x 10.2 (32 x 24 x 26 cm).
2. 1.2 GHz, 512 MB RAM (Win2000, XP).

3. Scanner (incl. base)/Laptop/Tripod/Battery: 35.3/8.8/19.8/55.3 (16 kg/4 kg/9 kg/16 kg).

SOFTWARE:

Innovmetric

1. Optech, Riegl, Callidus, Cyra, Z&F, iQvolution, Mensi, and several others.

iQvolution

1. Microstation, AutoCAD, .dxf, IGES, ASCII, proprietary, VRML, others.

I-SITE

1. nVidia GeForce recommended.
2. 3dp, 3dv, txt, dxf, obj, ma, vml, 00t, dgd.

Leica/Cyra

1. Cyrax 2400, Cyrax 2500/HDS2500, HDS3000, HDS4500, Riegl (.3dd format).
2. For interface to scanner; for licensing.
3. Cyrax 2400, Cyrax 2500/HDS2500, HDS3000, HDS4500, Riegl (.3dd format) via Cyclone.
4. No, however true-color point clouds are supported; image is used to 'paint' each point on point cloud.
5. ASCII, DWG and DGN (via COE format and free data transfer plug-ins), BMP, JPEG, TIFF.
6. N/A (CAD-integrated product; removes data transfer issues).

MDL

1. MDL CDU, MDL FSC, Cyra Point Cloud, Cyra Range Image, Wavefront, Callidus Range Image, MENSI Neutral File, Riegl 3DD, DXF, ASCII txt.
2. Cyberware, Wavefront, Stereolithography, 3D Dxf, POV-ray, VRML97, Octopus, Cyra.

MENSI

1. Including samples, otherwise 25MB.
2. Collaborative work practices enabled with RealWorks Viewer and RealWorks Survey Lite.
3. ASCII, txt, dgn, dxf, PDS, PDMS, rf, stl, vml, sat, acis, iges, ps, obj, arc+, jpg, rgb.

Zoller + Fröhlich

1. Nvidia GeForce Graphics card recommended.

Participating Manufacturers

3rdTech
www.3rdtech.com

Cyra Technologies/Leica Geosystems
www.cyra.com

iQsun GmbH
www.iQsun.com

i-SITE Pty. Ltd./MAPTEK Pty. Ltd.
www.isite3d.com

InnovMetric Software
www.innovmetric.com

Kubit GmbH
www.kubit.de

Measurement Devices Ltd.
www.mdl.co.uk www.laserace.com

MENSI
www.trimble.com

Optech Inc.
www.iliris-3d.com

Riegl USA
www.rieglusa.com

Visi Image Inc.
www.3d-gurus.com

Zoller + Fröhlich GmbH
www.zf-laser.com

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