Zoller+Fröhlich

Z+F IMAGER®

5016 | 5016A | Z+F FlexScan® 22

Z+F IMAGER® 5016 | 5016A
3D Laser Scanner

Reaching new levels
The Z+F IMAGER® 5016 combines compact and lightweight design with state-of-the-art laser scanning technology - allowing the user to reach new levels. The phase-based laser scanner is equipped with an integrated HDR camera, internal lighting and positioning system resulting in even better scanning results and a more efficient workflow.

Technical features
Due to innovative developments, the maximum range of the new Z+F IMAGER® 5016 has been extended to up to 360 m (1,180 ft) - thus establishing new opportunities and applications. The maximum measurement rate of more than 1 Mio. points/sec. and more than 2 Mio. points/sec. enable highly accurate results even at long distances.

Its 360° x 320° field-of-view assures great coverage of the scanned area, reducing the number of necessary scan positions to a minimum. The scanner is classified as „eye-safe“ according to laser class 1 and can therefore be used in public areas without any restrictions.

The Z+F IMAGER® 5016 is equipped with an integrated positioning system, which allows the automatic registration in the field, with or without targets. All preprocessing tasks can be taken care on the fly, increasing efficiency.The positioning system supports different satellite systems such as GPS & Glonass.

In addition, the scanner comes with an integrated HDR camera, which allows the user to quickly capture colour information - even in challenging lighting conditions.

Rapid picture capturing
Capturing colour information is very important in many fields of application. Generating a full HDR panorama (80 MPixel) only takes about 2:00 min. Combined with quick scanning times, this allows the user to rapidly generate geometric and colour data.

Integrated LED spots
The HDR camera of the Z+F IMAGER® 5016 is equipped with integrated LED spots, which grant additional flexibility when scanning. No more external lighting sources are necessary when capturing images in dark environments.

Internal data storage and data transfer
The scanner has internal storage capacities for 128GB of data. Data can rapidly be transferred either by using the SD-card slot, ethernet link or WiFi connection. The WiFi operates to the 802.11a/n/g standard and in the frequency range of 2.4GHz / 5GHz.

Real-Time Registration

blue workflow®

Together with the positioning sensors inside the Z+F IMAGER® 5016, Z+F LaserControl® Scout is able to automatically place and register your scan data during your field work - on the fly.

Automatic registration

Z+F LaserControl® Scout keeps a constant link to the scanner. After a scan is finished, the data is downloaded onto the tablet PC automatically. Once completed, the software immediately attempts a preliminary registration. If the automatic process is not possible, Z+F LaserControl® Scout provides easy tools for manual adjustments by simply dragging the scan into the approximate position. Scout further provides a new tool for complex geometries to manually align scans quickly in 3D.

Registration Guard

One of the most common reasons for frustrations with cloud-to-cloud based registration algorithms is poor overlap between different scanning positions. Realizing such a problem in the office can be fatal to a project. Hence, Z+F LaserControl® Scout will assist you with early detection of these problems in the field already, in order to fill gaps immediately with additional scans.

Brand new look and feel

Z+F LaserControl® Scout is optimized for Windows® touch tablets. Its intuitive user-interface is simple to use and has all major tools always at hand for you.

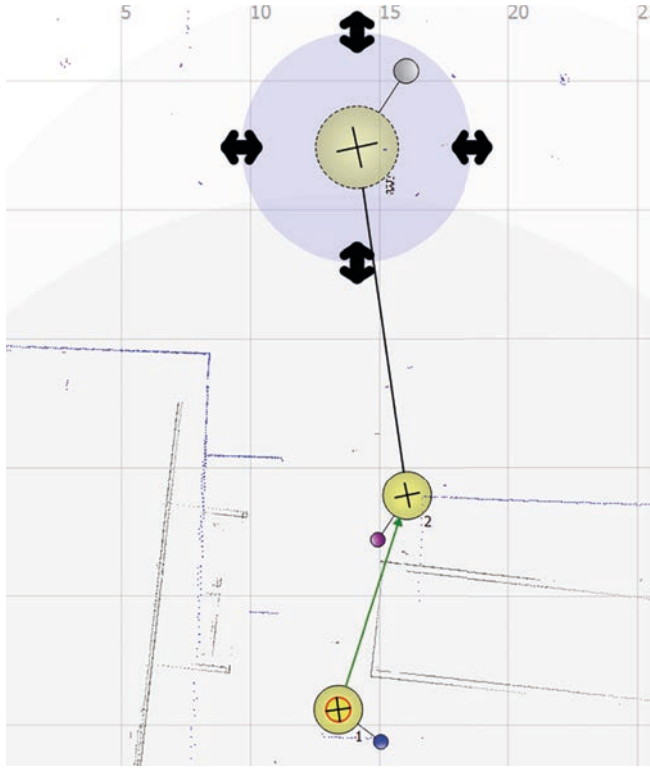
Stay updated through advanced synchronization
Z+F LaserControl® Scout will automatically synchronize all scan data locally and, after registration, update all scans on the scanner accordingly. Therefore, at any time, the scanner and tablet display the same results.

Remote Scanner Control

Free yourself of time pressure to hectically hide from the scanner. Control the instrument and check its status comfortably from a distance.

Quick insights with detailed top view profiles

Z+F LaserControl® Scout will creates a detailed top-view, outlining the features in the scene for easy orientation and verification of the positioning.



Z+F IMAGER® 5016 | 5016A
3D Laser Scanner

Multi-Scanner Feature
The blue workflow® is further enhanced by using multiple scanners in parallel, working on the same project.

With the multi-scanner approach, all scan teams work on the same project file and the tablet is used to synchronise the projects between multiple scanners. There are two main workflows available: Single and Multi-Tablet Mode.

Single Tablet Mode
At the site, there are two scanning teams, each equipped with its own scanner. Additionally, there is a project coordinator who uses a tablet. The coordinator‘s responsibilities involve working closely with both teams.

The process unfolds as follows:

1. The project coordinator starts by accompanying Team A and assists in downloading their scan data onto the tablet. They meticulously verify the alignment and accuracy of the scans. Subsequently, the coordinator syncs the validated results back to Team A‘s scanner.

2. Next, the coordinator moves to Team B, where they download the scans that Team B has acquired in the meantime. These scans are then integrated with the data from Team A. The coordinator once again scrutinizes the alignment and ensures everything is accurate. Finally, the updated results are synchronized with Team B‘s scanner, making the registered scan positions from Team A available on Team B‘s device.

3. The coordinator then returns to Team A to retrieve the newly collected scans. Once obtained, they go back to Team B to repeat the process of integrating and verifying the data. This back-and-forth exchange continues as data collection progresses.

This iterative procedure allows for the continuous sharing of registered scan positions between Team A and Team B, ensuring that both teams are working with the most up-to-date and synchronized information.

Multi Tablet Mode
In this scenario, each scanning team operates independently with their own tablet for registration while performing scanning tasks. Unlike the previous scenario, there is no dedicated coordinator present on-site. Instead, the teams manage their data exchange periodically, often during breaks or at the end of the workday.

The process unfolds as follows:

1. Each team, A and B, utilizes their respective tablets for registration during the scanning process.

2. At certain intervals, such as lunch breaks or the end of the workday, the operator from Team A connects to the scanner used by Team B. During this connection, the operator downloads the data collected by Team B.

3. In return, the operator from Team A uploads their own registration data to the scanner used by Team B.

This intermittent data exchange allows both teams to share information efficiently without the need for a dedicated coordinator. It ensures that each team has access to the data collected by the other, enhancing collaboration and coordination between the two teams as they work independently on their scanning tasks.

Innovative Design

The Z+F IMAGER® 5016 combines compact and lightweight design with state-of-the-art laser scanning technology - allowing the user to reach new levels.

Weight

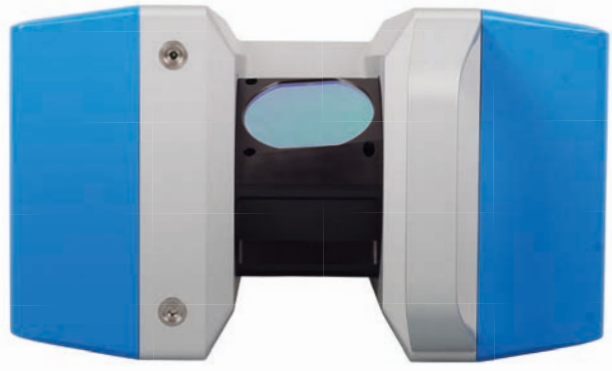
+ Scanner without battery: 6.5 kg (14.3 lbs)
+ Scanner with 2 batteries: 7.5 kg (16.5 lbs)
  (hot swappable batteries, operating time 5h)
+ Ideal weight for stable setup

Housing

+ Ergonomic streamline design
+ Additional grip with two handles
+ Makes setups with high tripods or overhead applications easy
+ Usable in smallest spaces
+ Carry-on luggage size
+ Hand baggage size
+ Protection class IP 54, protection against splash water and dust
+ Operation temperature -10 °C ... +45 °C (14°F ... 113°F)
+ Visual feedback by illuminated power switch
+ Easily accessible plugs for external power supply or ethernet data exchange

Z+F IMAGER® 5016A-Upgrade

+ Max. 2.187 million pixels/sec. instead of max. 1.1 pixels/sec. (Z+F IMAGER® 5016)
+ Inertial Measurement IMU:
  The IMU ensures that the scanner operates correctly in the scanner is correctly aligned in inclined aligned.



Z+F FlexScan® 22
Mobile Scanning-Platform

Acquisition efficiency
Highly accurate measurement results require static scans from multiple angles, whereas mobile solutions focus on efficiency.

The Z+F FlexScan® platform developed by Zoller + Fröhlich combines the advantages of static scan quality with the efficiency of mobile systems. The perfect complement for any time-sensitive or large-scale application: AEC, facilitiy management, process industries, heritage documentation and forensics.

Flexible mounting
The Z+F FlexScan® 22 can be used flexibly on different mobile systems. If the area or terrain is difficult to pass, the system can be used as a backpack to be able to climb stairs and ladders without any problems. If there are no big obstacles, the Z+F FlexScan® 22 also allows installation on mobile systems like on a trolley. For static scans, the scan sensor can be switched from the platform to a tripod by using the new quick-acting closure Z+F Quick Mount.

Project efficiency
A project-adaptive approach allows for efficient customization of the Z+F FlexScan® 22 to meet the specific requirements of each project, saving time and resources. Utilizing this flexible system can optimize cost structures, as both the scanner and support system can be adapted according to the project‘s scope and nature. With a project-adaptive and cost-effective approach, companies and surveying offices can enhance their competitiveness while improving the profitability of their scanning projects.

Camera system
The Z+F FlexScan® 22 is equipped with a panoramic camera to color map the mobile scan data.

Easy data collection
Static and mobile data is backed up locally and will be passed on for processing from there.

Offline data processing
Process your data without additional hidden costs and without a transfer to a third party.

Measurement accuracy for the highest demands
The Z+F FlexScan® 22 benefits from the very high quality and range of the static high-end scanner Z+F IMAGER® 5016 and achieves an accuracy of up to 2.5 mm in the SLAM result.1 Each profile scanned with the Z+F FlexScan® 22 has 10,000 points, which ensure finest details in the 3D model. For very high accuracy requirements, the SLAM data can be improved by adding control points or static scans.

Z+F FlexScan® 22

+ Turns your Z+F IMAGER® 5016/A into a mobile system through SLAM technology
+ Suitable indoors and outdoors
+ Cutting edge camera system
+ Accurate SLAM-system
+ Add-on platform for IMAGER® 5016/A

[1] 3D comparison result of SLAM point cloud to a mesh of static Z+F IMAGER® 5016 scans, approx. 550 m², SLAM data downsampled to 1cm, 80% of compared points within 2.5 mm. To optimize the result, only multiple loop closures have been used. The result of 2.5 mm is a not guaranteed benchmark. The accuracy highly depends on multiple situational factors, such as the scene geometry and well-distributed static features, the data acquisition process, postprocessing of the dataset and additional support data, such as targets or static scans.

Z+F IMAGER® 5016 | 5016A | Z+F FlexScan® 22

Technical data comparison

Product Overview Z+F IMAGER® series			
	Z+F IMAGER® 5016	Z+F IMAGER® 5016A	Z+F FlexScan® 22
Measurement range	0,3 m - 365 m	0,3 m - 365 m	Min. 0,6 m
Data acquisition rate	Max. 1,1 Millionen Pixel/Sek.	Max. 2,187 Mio. Pixel/Sek.	550.000 Pixel/Sek.
Resolution	Max. 100.000 Pixel/Profil	Max. 100.000 Pixel/Profil	10.000 Pixel/Profil
Tilt sensor	Dynamic Compensator	Dynamic Compensator IMU	
Laser class	1 (IEC 60825 - 1) eye-safe	1 (IEC 60825 - 1) eye-safe	1 (IEC 60825 - 1) eye-safe
Protection class	IP 54 (IEC 60529) dust- / splash-proof	IP 54 (IEC 60529) dust- / splash-proof	IP 54 (IEC 60529) dust- / splash-proof
Operating time	ca. 5 h (high/balanced scans)	ca. 5 h (high/balanced scans)	3-4 h scanning time (4 batteries)

Z+F IMAGER® 5016
Data sheet

Laser system			
Laser class	1		
Beam diameter / divergence	~ 3.5 mm @ 1m / ~ 0.3 mrad (1/e², half angle)		
Measurement range	0.3 m ... 365 m (ambiguity interval)		
Range resolution	0.1 mm		
Data acquisition rate	Max. 1.1 million pixel/sec.		
Linearity error [1]	≤ 1 mm + 10 ppm/m		
Range noise	black 14 %	grey 37 %	white 80 %
- at 10 m [1 2]	0.30 mm rms	0.25 mm rms	0.20 mm rms
- at 25 m [1 2]	0.39 mm rms	0.28 mm rms	0.25 mm rms
- at 50 m [1 2]	0.8 mm rms	0.5 mm rms	0.3 mm rms
- at 100 m [1 2 3]	2.6 mm rms	1.1 mm rms	0.7 mm rms
- at 200 m [1 2 3]	9.6 mm rms	3.6 mm rms	1.7 mm rms
Temperature drift	negligible		

Deflection unit	
Deflection system	completely encapsulated rotating mirror with integrated HDR camera and LED spots
Vertical field of view	320°
Horizontal field of view	360°
Angular resolution, vertical	0.00026° (0.93")
Angular resolution, horizontal	0.00018° (0.65")
Vertical accuracy [1]	0.004° (14.4") rms
Horizontal accuracy [1]	0.004° (14.4") rms
Rotation speed	max. 55 rps (3,280 rpm)

Resolution					
		Scan duration			
Angle resolution	pixel/360° horizontal & vertical	"less quality" [6]	"normal quality" [6]	"high quality" [6]	"premium quality" [6]
"preview" [4]	1.250	---	0:22 min	---	---
"low"	2.500	0:22 min	0:45min	1:31 min	---
"middle"	5.000	0:45 min	1:31 min	3:03 min	6:06 min
"high"	10.000	1:31 min	3:03 min	6:06 min	12:13 min
"super high"	20.000	3:03 min	6:06 min	12:13 min	24:26 min
"ultra high" [5]	40.000	---	12:13 min	24:26 min	48:57 min
"extremely high" [5]	100.000	---	---	76:22 min	152:30 min

Z+F IMAGER® 5016
Data sheet

Miscellaneous		
Dynamic Compensator	resolution: 0.001° measurement range: +/- 0.5° accuracy: < 0.004° selectable on/off	The Dynamic Compensator will correct angular tilt for each pixel during scan acquisition.
Levelling display	electronic level in onboard display and Z+F LaserControl® Scout	
Laser plummet	laser class: 2 accuracy of plummet: 0.5 mm/1m laser spot diameter: < 1.5 mm at 1.5 m	
WiFi link	802.11 a/n/g standard, dual band, up to 240 MBits/s	
Ethernet link	1GB ethernet (scanner socket)	
Data storage	128 GB SATA (internal, additional 128 GB SD card)	
Integrated control panel	5.7“ touch screen, multi-touch color display for device control, browsing scan data and color images, data measuring / navigation features implemented	
Interfaces	Micro D-Sub connector for additional accessories (PPS pulse, odometer, line sync, etc.).	

Power supply	
Input voltage	24 V DC (scanner); 100 – 240 V AC / 12 - 24 V DC (power unit)
Power consumption	≤ 45 W (scanning) / ≤ 75 W (scanning and battery charging)
Operating time	ca. 5 h (high/balanced scans)

Ambient conditions	
Operating temperature	-10 °C … +45 °C
Storage temperature	-20 °C ... +50 °C
Lighting conditions	independent of lighting conditions
Humidity	non-condensing
Protection class	IP 54

Dimensions and weights	
Scanner Dimensions (w x d x h) Weight	 150 x 258 x 328 mm 6.5 kg
Two Batteries, each Dimensions (w x d x h) Weight	 150 x 80 x 45 mm 0.5 kg
AC power unit Dimensions Weight	 35 x 67 x 167 mm 0.54 kg

HDR camera	
Type	HDR, automatic, up to 11 exposures
Recording time	approx. 2:30 min, parallax free
Focus area	1m - ∞
Panorama resolution	ca. 80 MPixel
Illumination system	integrated LED spotlights, 700 lm

Scan Positioning System	
Task	The scan positioning system estimates the position and the orientation of the scanner for automatic in-field registration (Z+F LaserControl® Scout)
Integrated sensors	Altimeter
	Inertial Measurment Unit (IMU)
	Compass
	GNSS (GPS, GLONASS, Galileo, Beidou)

Workflow	
Blue Workflow[7]	Real-time registration on-site, Data and target verification, Multi-scanner support
Office Link[7]	Data synchronisation between office and field, Report and comment functions, Annotation tools
Combine Scan	For automatic removal of dynamic objects
Additional modes	Traverse, 1-Target Orientation
Profiler Mode	For mobile mapping support

System Requirements of Z+F LaserControl® Scout

Minimum System Requirements	Recommended System Requirements
Windows 8.1 (64 Bit)	Windows 10 (64 Bit)
Intel i5 CPU	Intel i7 CPU
128 GB SSD	512 GB SSD
8 GB RAM	8 GB RAM
10“ Full HD	12“ Full HD
WLAN	Dualband WLAN

1. Detailed explanation on request – please contact info@zf-laser.com
2. Data rate 136.719 px/sec (equivalent to “High Resolution / high quality” setting), 1 Sigma range noise, unfiltered raw data
3. Not fully production tested, only verified for a small number of specimens.
4. Not intended for surveying purposes! To be used only for preview / selection scan definition.
5. Huge amounts of data will be generated! Recommended for high resolution, small area selection scans only.
6. Choosing the next higher quality setting will double scanning time and reduce range noise by a factor of 1.4.
7. Using Z+F LaserControl® Scout

Z+F IMAGER® 5016A
Data sheet

Laser system			
Laser class	1		
Beam diameter / divergence	~ 3.5 mm @ 1m / ~ 0.3 mrad (1/e², half angle)		
Measurement range	0.3 m ... 365 m (ambiguity interval)		
Range resolution	0.1 mm		
Data acquisition rate	Max. 2.187 million pixel/sec.		
Linearity error [1]	≤ 1 mm + 10 ppm/m		
Range noise	black 14 %	grey 37 %	white 80 %
- at 10 m [1 2]	0.30 mm rms	0.25 mm rms	0.20 mm rms
- at 25 m [1 2]	0.39 mm rms	0.28 mm rms	0.25 mm rms
- at 50 m [1 2]	0.8 mm rms	0.5 mm rms	0.3 mm rms
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Resolution					
		Scan duration			
Angle resolution	pixel/360° horizontal & vertical	“speed+“ [6]	“balanced“ [6]	“quality+“ [6]	“quality++“ [6]
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Miscellaneous		
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Inertial measurement unit IMU	Measuring range: +/- 180° Accuracy: < 0.06°	Used for static tilt measurement, if the measuring range of the compensator is exceeded.
Levelling display	electronic level in onboard display and Z+F LaserControl® Scout	
Laser plummet	laser class: 2 accuracy of plummet: 0.5 mm/1m laser spot diameter: < 1.5 mm at 1.5 m	
WiFi link	802.11 a/n/g standard, dual band, up to 240 MBits/s	
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Data storage	128 GB SATA (internal, additional 128 GB SD card)	
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7. Using Z+F LaserControl® Scout

Z+F FlexScan® 22
Data sheet

Z+F IMAGER® 5016 [2]	Static scans	SLAM mode
Measuring range	0.3 m - 365 m	Min. 0.6 m
Data acquisition rate	Max. 1.1 million pixels/s [3]	550,000 pixels/s
Resolution	Max. 100,000 pixels/profile	10,000 pixels/profile
Laser class	1 (IEC 60825 - 1) eye-safe	

Operational data	
Mounting	a) Cart-setup b) Backpack-setup
Connector system	5/8” thread screw or 4x M5 Compatible with Z+F IMAGER® Quick Mount
Camera	2x 20 MP, minimum distance 0.5 m
Data storage	1TB internal SSD, USB 3.0 connection for external backup
Connectivity	Wifi 802.11 n/g standard, 1 GBit Ethernet
Accuracy	Up to 2.5 mm relative accuracy [1]
Adjustment data	Reference points, static scans
Export formates	E57, LAS/LAZ, PLY, PTS, ASC, ZFDB

Ambient conditions	
Environment	Indoor and outdoor
Operating temperatur	-10 °C ... +45 °C
Storage temperature	-20 °C ... +50 °C
Protection class	IP 54 (IEC 60529) dust- / splash-proof

Power	
Batteries	Min. 2 / max. 4 batteries IMAGER® 5016
Operating time	3-4 hours scanning time (4 batteries)
External Power	24 V DC, 5 A (Z+F IMAGER® power supply)

Dimensions and weights	
Cart setup with camera	262 x 262 x 146 mm, 3.7 kg 351 x 262 x 612 mm, 4.9 kg
Backpack setup with camera	380 x 421 x 628 mm, 6.3 kg 380 x 421 x 1015 mm, 7.3 kg
Imager 5016 / A, with Quick Mount	150 x 258 x 333 mm, 6.8 kg
Operation with two or four batteries	each 0.5 kg

1. 3D comparison result of SLAM point cloud to a mesh of static Z+F IMAGER® 5016 scans, approx. 550 m², SLAM data downsampled to 1cm, 80% of compared points within 2.5 mm. To optimize the result, only multiple loop closures have been used. The result of 2.5 mm is a not guaranteed benchmark. The accuracy highly depends on multiple situational factors, such as the scene geometry and well-distributed static features, the data acquisition process, postprocessing of the dataset and additional support data, such as targets or static scans.
2. More details see Z+F IMAGER® 5016/A data sheet
3. Z+F IMAGER® 5016 A

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