Zoller+Fröhlich

How we build reality

Z+F IMAGER® 5010 | Z+F PROFILER 5010

Zoller+Fröhlich

Zoller+Fröhlich GmbH was founded in Wangen in Allgäu in 1963. At first the company concentrated on the design and implementation of individual control systems for the automobile and engineering industry.

The construction of the company's own switch cabinet was the reason behind the invention of ferrules with plastic sleeves to simplify the wiring of control systems. Due to a constant process of development and innovation, the first machines for the manufactoring of crimp contacts and cable assembly were born. These machines are sometimes very complex, therefore a great deal of attention is given to their operation. The people who use these machines serve as a permanent control mechanism to ensure that they run smoothly. To achieve this, simulation studies and several specific operator simulations were carried out to create an ergonomic design and to optimize the manual working processes and environment. Today Zoller+Fröhlich stands for innovation and quality in the electrical engineering world far beyond the borders of Europe.

The first compact device: Z+F IMAGER 5003

Apart from these areas, the development and production of sensor systems with matching CAD software packages for 3D environment modelling represents a new and innovative cornerstone to secure the company's viability in the future. Laser measurement technology is an area that Zoller+Fröhlich began exploring in the 90s. In particular, the company's visual laser radar was awarded the Dr. Rudolf Eberle prize, "Innovations in Baden-Württemberg" in December 1998. Already at the beginning of the 90s, the first laser system for measuring rail track and tunnels was developed. This was followed in 1996 by the first "visual 3D laser measurement system for assessing the condition of objects". In 2002, Zoller+Fröhlich launched the IMAGER 5003, the first compact device produced in series with a range of 53.5 m and a maximum data capture rate of 500,000 pixel/sec.

In 2006, the success story of the IMAGER series was continued with the Zoller+Fröhlich IMAGER 5006. Thanks to its integrated control panel, powerful internal PC, hard disk and internal battery, the IMAGER 5006 was the first 3D laser measuring device where the stand-alone concept was realized 100%.

Making visions come true

Explosion proof: IMAGER 5006EX

Upgrades to the 5006i and 5006h versions followed in 2008 and in 2010.
With a data acquisition rate of 1,016,027 pixel/sec., the Z+F IMAGER 5006h is the fastest 3D laser measuring device in the world.
As well as the Z+F IMAGER for 3D laser scanning, other devices were also developed. The Z+F PROFILER, a 2D laser measuring device for kinematical use, also appeared on the market in 2002. These instruments are often employed for use on rail track or in vehicles. The development stages of the PROFILER are identical to those of the Z+F IMAGER.
In 2009 the IMAGER 5006EX was presented. Based on the IMAGER 5006, it was the first explosion proof 3D laser scanner worldwide. Due to its ATEX classification, this device could be used in environments where explosions may occur, e.g. in mines or in the chemical industry.
Zoller+Fröhlich scanners come equipped with many accessories. In addition, numerous innovative solutions are offered to increase efficiency in differing areas of use.

When it comes to data evaluation and data processing, Zoller+Fröhlich also provides numerous solutions. The software packages LFM and LaserControl can also be employed in various fields of application, and are well equipped with tools for processing point clouds.
Visionary ideas together with down-to-earth expertise are the cornerstones of the company's success.

Zoller+Fröhlich have always encouraged innovative thinking and turned this into future-oriented products. The great number of patents and prizes awarded to the company only underline this.

What is especially important for Zoller+Fröhlich is the cooperation with customers and partners.

Customers and users worldwide appreciate our personal service and technical support.
Today Zoller+Fröhlich is one of the leading enterprises in the field of contact-free laser measuring technology, and thanks to years of practise and countless successfully concluded projects. We have a wealth of experience at our disposal. At present, Zoller+Fröhlich is represented in 40 different countries with branches in England and USA, and many sales co-operations throughout the world.

The success of Zoller+Fröhlich can be attributed to first-class service and personal advice.

In operation in Angkor Wat: Z+F IMAGER 5006i

Technical Data

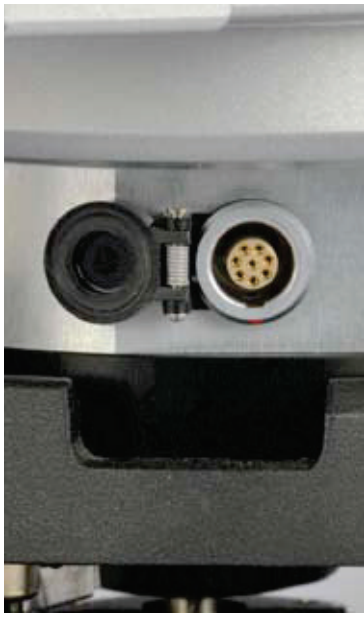
Compact, high-speed, phase-based laser scanner with great precision, range and spherical field of view. Unique stand-alone concept with integrated battery and color display with touch screen. Built-in dual-axis compensator and laser plummet. This device is also available as the Z+F PROFILER 5010 in the 2D version for kinematical applications (see also page 13).

Laser system	IMAGER and PROFILER		
Laser class	1		
Beam divergence	< 0.3 mrad		
Beam diameter	approx. 3.5 mm (at 0.1 m distance)		
Range	187.3 m (unambiguity interval)		
Minimum distance	0.3 m		
Resolution range	0.1 mm		
Data acquisition rate	Max. 1.016 million pixel/sec.		
Linearity error[1]	≤ 1 mm		
Range noise	black 14 %	gray 37 %	white 80 %
Range noise, 10 m[1 2]	0.5 mm rms	0.4 mm rms	0.3 mm rms
Range noise, 25 m[1 2]	1.0 mm rms	0.6 mm rms	0.5 mm rms
Range noise, 50 m[1 2]	2.7 mm rms	1.2 mm rms	0.8 mm rms
Range noise, 100 m[1 2 3]	10 mm rms	3.8 mm rms	2.0 mm rms
Temperature drift	negligible		

Deflection unit	IMAGER	PROFILER
Vertical system	completely encapsulated rotating mirror	
Horizontal system	device rotates about its vertical axis	
Vertical field of view	320°	320°
Horizontal field of view	360°	
Vertical resolution	0.0004°	0.0016°
Horizontal resolution	0.0002°	
Vertical accuracy[1]	0.007° rms	0.007° rms
Horizontal accuracy[1]	0.007° rms	
Scanning speed	max. 50 rev/s (3000 rev/min)	max. 100 rev/s (6000 rev/min)

Deflection unit	IMAGER	IMAGER and PROFILER				PROFILER
		Scan duration				
Angle resolution	pixel/360° horizontal & vertical	low quality[6]	normal quality[6]	high quality[6]	premium quality[6]	pixel/360° vertical
"preview"[4]	1,250	0:13 min	0:26 min	0:52 min	1:44 min	1,280
"low"	2,500	0:26 min	0:52 min	1:44 min	3:24 min	2,560
"middle"	5,000	0:52 min	1:44 min	3:22 min	6:44 min	5,120
"high"	10,000	1:44 min	3:22 min	6:44 min	13:28 min	10,240
"super high"	20,000	3:28 min	6:44 min	13:28 min	26:56 min	20,480
"ultra high"[5]	40,000	6:56 min	13:28 min	26:56 min	53:20 min	40,960
"extremely high"[5]	100,000	---	1:21 h	2:42 h	3:24 h	---

Miscellaneous	IMAGER	PROFILER
Dual-axis compensator	resolution: 0.001° measurement range: +/- 0.5° accuracy: < 0.007° choice of on / off	---
Laser plummet	laser class: 2 accuracy of plummet: 0.5 mm / 1m laser point diameter: < 1.5 mm at 1.5 m	---
Levelling display	electronic level in onboard display and LRC	---
Communication	Ethernet / W-LAN	Ethernet
Data storage	internal 64 GB flash card, 2 x external 32 GB USB flash drive	
Data transmission	Ethernet or USB 2.0	
Integrated operating panel	touch screen operation, colour display to view 3D laser data and colour pictures with measuring and navigation functions	
Interfaces	2 x USB, LEMO 9-pin und LEMO 7-pin connections for M-Cam and external sensors like GPS, odometer, etc.	



Power supply	IMAGER	PROFILER
Input voltage	24 V DC (scanner) 100 – 240 V AC (power unit)	24 V DC (scanner) 100 – 240 V AC (power unit
Power consumption	< 65 W (on average)	< 75 W (on average)
Operating time	> 2.5 h (internal battery)	unlimited

Ambient conditions	IMAGER and PROFILER
Operating temperature	-10° C … +45° C
Storage temperature	-20° C … +50° C
Lighting conditions	operational in all conditions, even in bright sunlight or pitch darkness
Humidity	non-condensing
Protection class	IP 53

Dimensions and weights	IMAGER	PROFILER
Scanner Dimensions (w/d/h) Weight	170 x 286 x 395 mm 9,8 kg	170 x 286 x 395 mm 9,8 kg
Battery Dimensions (w/d/h) Weight	170 x 88 x 61 mm 1,2 kg	---
AC power unit Dimensions Weight	35 x 67 x 167 mm 0,54 kg	35 x 67 x 167 mm 0,54 kg

1) Detailed explanation on request – please contact info@zf-laser.com
2) Data rate 127,000 pixel/sec. (equivalent to "high resolution, high quality" scan), 1 Sigma range noise, unfiltered raw data, in high power mode
3) All values extrapolated
4) Resolution not recommended for exact measurements, only for positioning higher resolution scan selections!
5) Only recommended for scan selections because of the enormous amount of data
6) Doubling ("low quality") and halving ("high quality") the data rate (pixel/sec.) theoretically increases the range noise on each pixel by 40% ("low quality") or decreases it by 40% ("high quality") compared to "normal quality". Depending on the roughness of the surface measured, in reality this difference could be less, especially when scanning objects with a bright surface at short distances, e.g. indoors

Z+F PROFILER 5010

The PROFILER 5010 is based on the IMAGER 5010 and is the fastest 2D profiling laser measurement system in the world.

With its scan rate of 1 million points per second and maximum scan speed of 100 rev/sec., very short distances between profiles can be achieved even at high speeds. At the highest point density of 40,960 points/360°, even the smallest of objects can be registered and processed by the software.

Since the new laser measurement system belongs to laser class 1, the scanner can be used in urban environments without restriction.

A hardware-assisted pixel-by-pixel synchronization, already tried and tested in previous models, makes it possible to process external signals to determine the position of the scan data. Using the LEMO connections, GPS, displacement sensors and counters can be attached, and the external timing pulses directly fed into the scan data stream.
Synchronization with a pulse from the scanner can also be managed using one of the connections. The new 1 GBit Ethernet interface allows the scan data to be transmitted online to an external PC if a real-time evaluation or visualization of the data is required.

The PROFILER 5010 is also equipped with a colour touch screen and intuitive operating concept. With only two clicks, the PROFILER can be configured and started.

The PROFILER is also suitable for use on fast-moving mobile platforms like trains.

Mounting bracket for overhead use of the PROFILER available as accessory (see www.zf-laser.com)

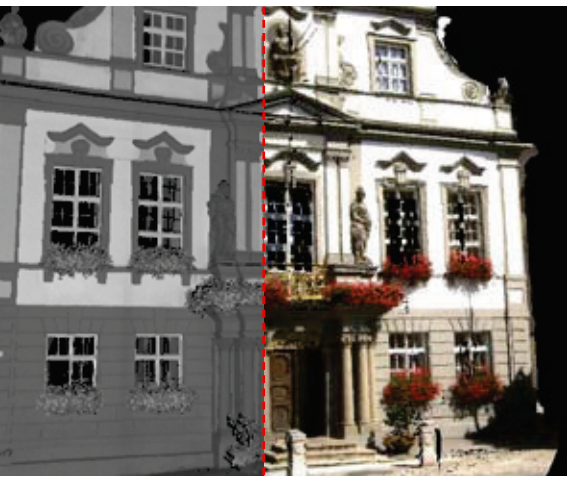
LaserControl Software

Z+F LaserControl (32-bit or 64-bit) is the visualization and evaluation software for scan data for all Z+F IMAGER models.

The LaserControl software is used to control the scanner. Using the download manager, scan data can be transmitted directly to a computer and made ready for further use.

Filters

The filter function in LaserControl clean up unwanted pixels in point cloud data like mixed and single pixels, i.e. points which do not belong to any object. As well as that, the point cloud can be restricted to interesting areas using range and rectangle filters, thus reducing the amount of data. All filters are placed in a layer structure without altering the original scan data. All filter parameters can be configured individually by the user.



Colour mapping with M-Cam Wangen town hall

Registration

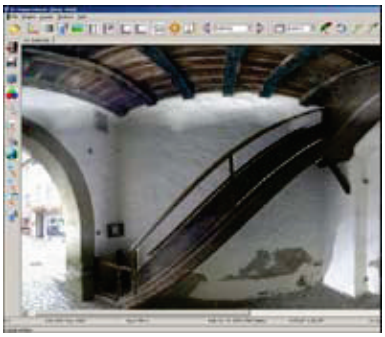
Before further evaluation, the individual points in almost all projects have to be transferred to a common coordinate system. To a great extent, this can be carried out automatically with Z+F AutoTargets.
In the case of conventional black and white targets, the target centres can be calculated quickly and easily to within less than a pixel in Z+F 2D-View – in other words, without a laborious search for the points in the 3D point cloud. The transformation parameters are calculated using bundling adjustment, taking into account the coordinates of the tachymeter. Thorough and clear calculation protocols guarantee that the required precision is maintained.

Colour mapping

Superimposing the point clouds with picture information leads to a considerably better way of interpreting the scan data. The Z+F LaserControl Color plug-in offers various kinds of colorizing.
In batch-mode, the data from the M-Cam is automatically processed with geometric precision, and the panoramic pictures of a nodal-point adapter or a Spheron camera can be effortlessly superimposed over the scan data. For small areas, individual pictures from any viewpoint can be colored.

Import/Export

A great variety of import and export formats are supported by Z+F LaserControl. As well as many ASCII-based exchange formats, the new binary standard formats OSF and PTG can also be used for export.



Visualization and evaluation of scan data using Z+F LaserControl. Interior view of Martin's Gate Wangen

Additional functions

There are various additional functions for extracting more information from the scan data, or doing evaluations of selected areas while on site:

- Measuring functions, rapid calculation of 3D paths and right-angled dimensions (width, ceiling height)
- Creation of orthophotos and rectification of single pictures
- Generation of animations with the point cloud
- Link management for georeferencing additional data (digital file)
- Forensic plug-in for reconstructing trajectories of bullets and checking evidence given by witnesses (view from eye function)

LFM
Continual Innovation.
Support.

Light Form Modeller

The benefits of 3D Laser scanning cannot be fully realised without the best in 3D Laser scanning software.
LFM provides a powerful turn-key solution from registration of laser scan data through working with massive data sets to as-built modelling.

LFM was one of the first 3D laser scanning software packages to be launched.
Since 1998 it has been engaged in a cycle of continuous innovation which means it is now one of the most powerful and efficient 3D laser scanning suites available.

LFM is CAD vendor neutral.
Surveyors and service providers can use LFM to create any number of CAD deliverables. Engineering companies and Owner / Operators can work with LFM laser scan data in CAD packages from Autodesk, AVEVA Bentley, Intergraph or VR Context.

LFM is compatible with the latest of the IMAGER series of 3D laser scanners.
LFM also accepts 3D laser scan data from previous generations and other hardware systems. This has cost saving implications for LFM customers. If the hardware system changes, the software solution does not have to, avoiding expensive switching costs.

LFM customers are loyal and longstanding owing to the powerful solution that meets their needs and the exceptional level of support which they receive.

The LFM Suite

LFM Register
Automatically find targets and register scans. LFM reduces the need for control survey work.

LFM Server
Bring laser scan data into any number of leading CAD packages. Create a database containing an unlimited number of high resolution scans using Infinite Core™ technology. Automatically detect clashes between a CAD design and as-built laser scan data.

LFM NetView
Securely share laser scan data with colleagues and clients around the world.

LFM Modeller
Rapidly create 3D Intelligent CAD models in an intuitive true-to-life BubbleView™.

LFM is driven by the BubbleView™. Make annotations and measurements, create 3D models and view clashes in the BubbleView™

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