PACxxx-90-y-zz Pulse Array Camera Sensor

Multi-Layer Laser Scanner

- Up to 4 scan layers scanning – Semi 3D

- Long range up to 300 m

- Wide horizontal field of view

- Small spot size

- High lateral resolution

- Fast scan rate

- Very high accuracy in range and angle

- Tough and robust housing, rate IP67

- Multi-echo evaluation technology

- Operating with rain and snow

- Real time Ethernet

PACxxx-90-y-zz Applications

Compact and tough, PACxxx-90-y-zz is ready to face the difficulties of harsh outdoor environments. Its multi-layer technology offers a wide field of view, avoiding any sensor movement.

- Mining
- Traffic
- Airport
- Landfill
- Container Terminals
- Agriculture
- People Counting
- Harbor
- Warehouse
- Industrial Automation

Sensor	PAC300-90-4-18	PAC250-90-4-18	PAC150-90-4-18	PAC100-90-4-1.5*n
Order No.	3400	3300	3200	3000
SCAN PLANES				
Number of scan planes		**4** (optional 2 or 3)		
Angle between outer scan planes ϑ (°) @ middle of scan angular range; no tilting	18	18	18	1.52*
Angle between inner scan planes α (°) @ middle of scan angular range; no tilting	6	6	6	0.51*
WORKING RANGE				
Maximum Range @ R = 100%, lambertian Reflector (m)	**300**	**250**	**180**	**> 100**
Maximum Range @ R = 10%, lambertian Reflector (m)	95	80	57	32
Minimum Range (m)		1.6		
ACCURACY DATA				
Resolution (mm)		1		
Repeatability 1σ @ strong signal (mm)	**5**	**4**	**4**	**7**
Repeatability 1σ @ weak signal (mm)		15		
Accuracy (systematic error) (mm)	≤ 4	≤ 3	≤ 3	≤ 5
SPOT PROPERTIES				
Divergence in scan direction (°)	**0.115**	**0.076**	**0.048**	**0.076**
Divergence in scan direction (mrad)	2	1.33	0.83	1.33
Divergence perpendicular to scan direction (°)	0.029	0.020	0.020	0.020
Divergence perpendicular to scan direction (mrad)	0.5	0.3	0.3	0.3
Spot close to the sensor window (mm)		12 x 16		
Focusing distance (m)	45	45	45	17
SCAN AND PROFILE PROPERTIES				
Maximum Scan and Profile Angle		90°		
Scan Mirror Type		4 Mirror Polygon		
Maximum Scanning Duty Cycle		50%		
OPERATIONAL MODES				
Normal Mode				
Beam Scan Angle Step (°)	0.09	0.09	0.09	0.09
Measurements in 90° Scan	1000	1000	1000	1000
Scan Rate (Hz)	20	20	20	20
Scan Time @ 90° Scan (ms)	25	25	25	25
Gap between Spots in Scan (°)	Overlap 0.025	0.014	0.042	0.014
Fast Mode				
Beam Scan Angle Step (°)		0.18		
Measurements in 90° Scan		500		
Scan Rate (Hz)		40		
Scan Time @ 90° Scan (ms)		12.5		
Gap between Spots in Scan (°)	0.065	0.104	0.132	0.104

PACxxx-90-y-zz Pulse Array Camera Sensor

Sensor	PAC300-90-4-18	PAC250-90-4-18	PAC150-90-4-18	PAC100-90-4-1.5*n
MULTI-ECHO EVALUATION				
Echoes evaluated		4		
Selectable echoes		First or last		
TARGET SURFACE TEMPERATURE				
Temperature Range	T < 500°C	T < 500°C	T < 500°C	T < 500°C
LASER DATA				
Measurement Laser				
Measurement Laser Type		Pulse Laser Diode		
Wave Length (nm)		905		
Safety Class; EN 60825-1; 94,96,01	1M	1M	1	1
Measurement or Pulse Rate (kHz)		40		
Red Laser Marker				
Red Laser Marker (indicating the spot)		DC Laser Diode		
Wave Length (nm)		645		
Safety Class; EN 60825-1; 94,96,01		2		
INTERFACES				
Ethernet		UDP 100 Mb/s		
RS232 for Sensor Programming		115 kBaud, 8n1		
Discrete Switching Outputs		2; programmable		
External Encoder Inputs		Incremental Encoder; A, B		
POWER SUPPLY				
Power Voltage		24 VDC ± 5 VDC		
Direct Power Supply		yes		
POE Supply		yes		
Power Consumption		7 W; 30 W with optional heater		
Start-up Time (s)		< 30		
SENSOR PROTECTION				
Ingress Protection		IP67		
Operating Temperature Range		-10°C to +50°C		
Temperature Range with optional Heater		-30°C to +50°C		
Temperature Range for Storage		-30°C to + 80°C		
Enclosure		Aluminum, Die Cast; Seawater resistant		
Enclosure Finish		Powder coated		
Front Screen		AR-coated glass		
Function in strong Sunshine		Ambient light control		
DIMENSIONS & WEIGHT				
Height x Width x Length (mm)		247 x 121 x 109		
Weight (kg)		2.6		

PAC100-90-4-1.5*n (with n=1, 2 or 3) is the sensor dedicated to *People Counter* application. The angle between outer scan planes ϑ (°) @ middle of scan angular range is available in three configurations: $\vartheta_1 = 1.5°$ (n=1), $\vartheta_2 = 3.0°$ (n=2), $\vartheta_3 = 4.5°$ (n=3).

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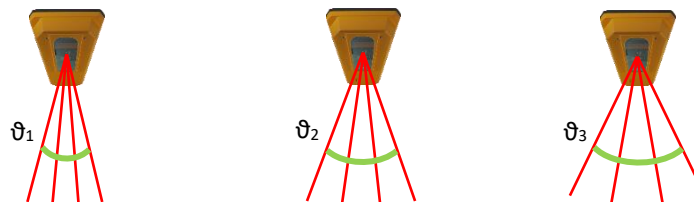
PACxxx-90-y-zz Options

Options	PAC300-90-4-18	PAC250-90-4-18	PAC150-90-4-18	PAC100-90-4-1.5*n
Number of scan planes available *See description for more details*	2 ($\alpha=\vartheta > 0$) 3 ($\alpha=0$; $\vartheta > 0$) 4 ($\alpha=\vartheta/3$; $\vartheta > 0$)			
Angle between outer scan planes ϑ (°) @middle of scan angular range *See ϑ definition below*	$1.5° \leq \vartheta < 18°$	$1.5° \leq \vartheta < 18°$	$1.5° \leq \vartheta < 18°$	$\vartheta_n = n*1.5°$ with n=1, 2, 3
Angle between inner scan planes α (°) @middle of scan angular range *See α definition below*	$1° < \alpha < 18°$ with $\alpha \leq \vartheta$	$1° < \alpha < 18°$ with $\alpha \leq \vartheta$	$1° < \alpha < 18°$ with $\alpha \leq \vartheta$	$\alpha = \vartheta_n/3$
Focusing distance (m)	From 3 to 45	From 3 to 45	From 3 to 45	n.a.
Enlarged beam divergence	up to 0.17°x0.17°	up to 0.09°x0.09°	up to 0.048°x0.048°	n.a.
Internal Heater	For T $\geq$ -30°C			
Spirit level				

PACxxx-90-y-zz Accessories

| Accessories	PAC300-90-4-18	PAC250-90-4-18	PAC150-90-4-18	PAC100-90-4-1.5*n
Window protection tube for PAC				
Developer kit for PACxxx-90-y-zz				
Power Over Ethernet Injector in: 100-240 VAC out: 24 VDC				
Serial, Power multifunction cable				
8 pin Ethernet data cable with POE support				
Sensor holder				
Tribrach with adaptor				

PACxxx-90-y-zz Application Software

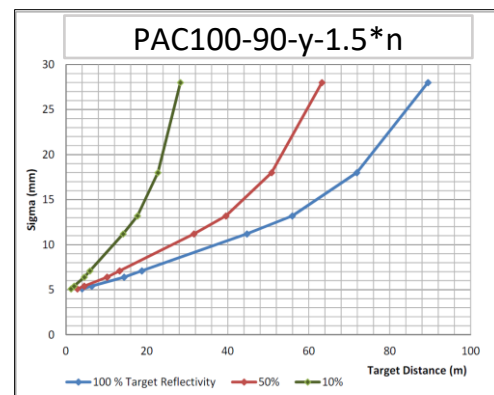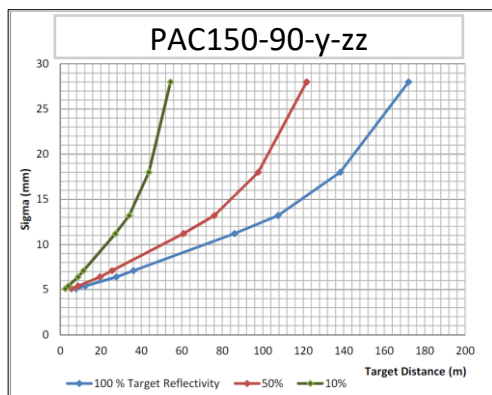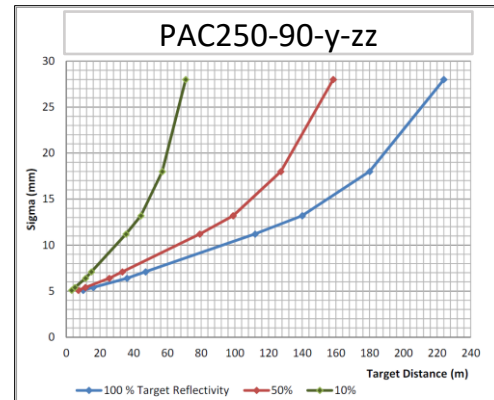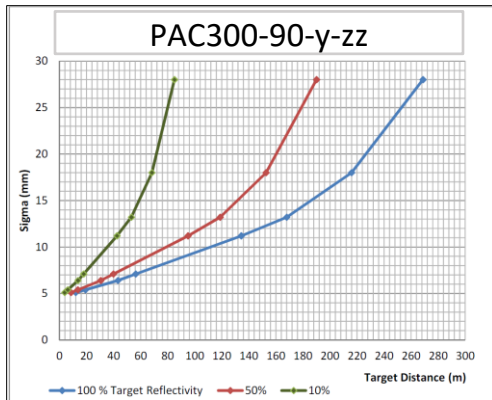For several applications a dedicated software is necessary to reach the system goals.

On purpose, Triple-IN gives the possibility to implement it in the sensor and offers a customer service for integration support provided by Triple-IN Application Centre (TAC) at tac@triple-in.de

An example is the so-called *People Counter* of Lase Industrielle Lasertechnik GmbH.
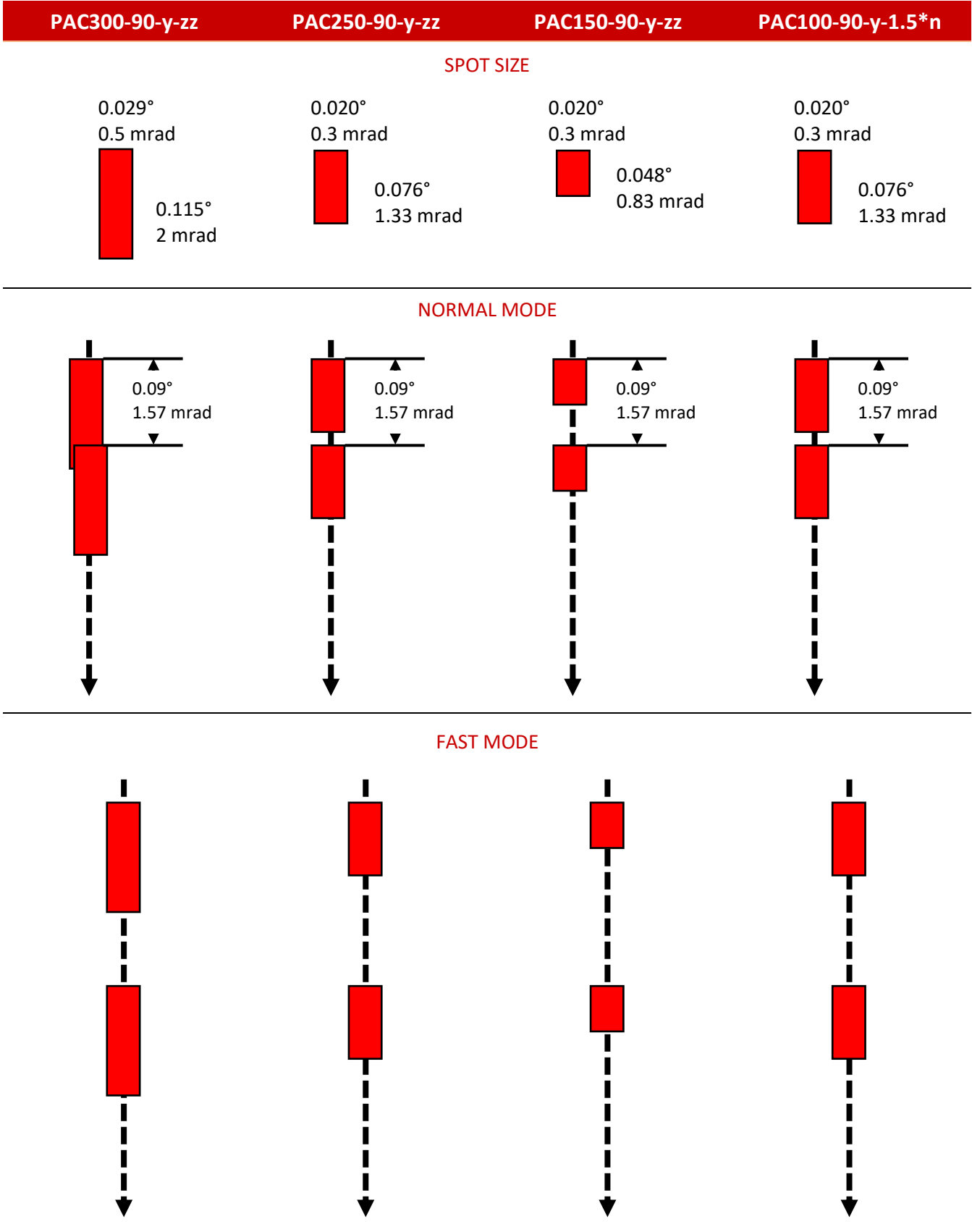
PACxxx-90-y-zz Pulse Array Camera Sensor

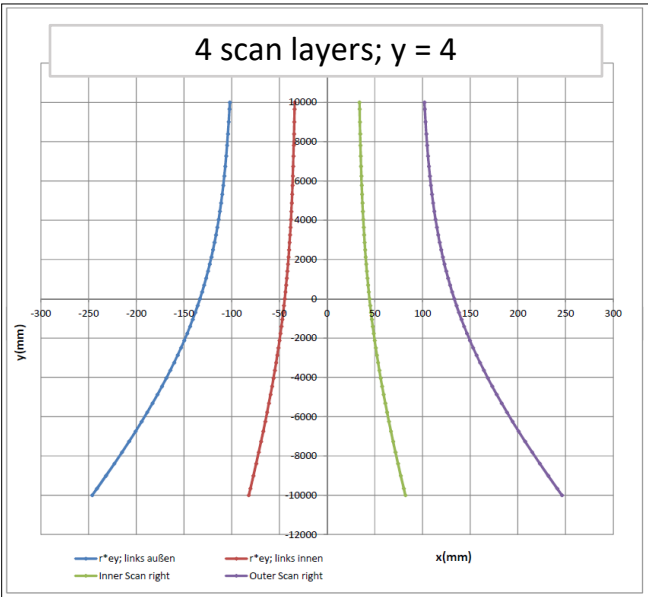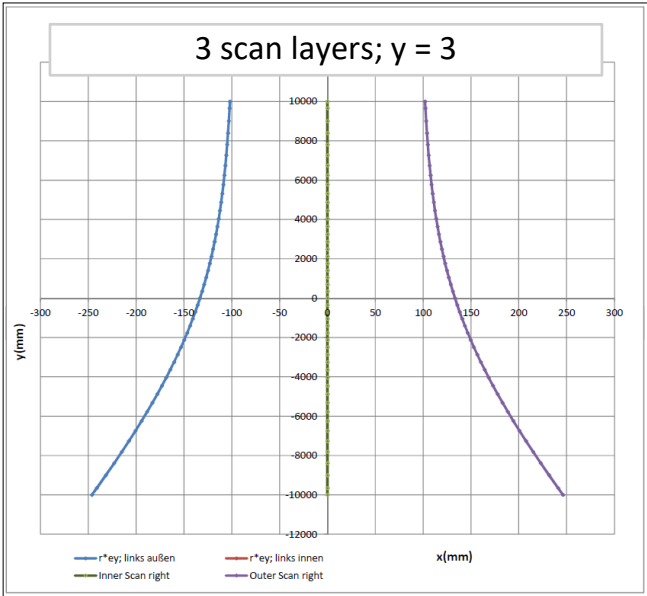# PACxxx-90-y-zz Spot Size as function of Target Distance

PAC300-90-y-zz

PAC250-90-y-zz

PAC150-90-y-zz
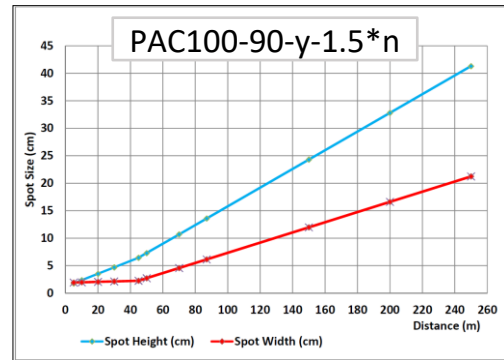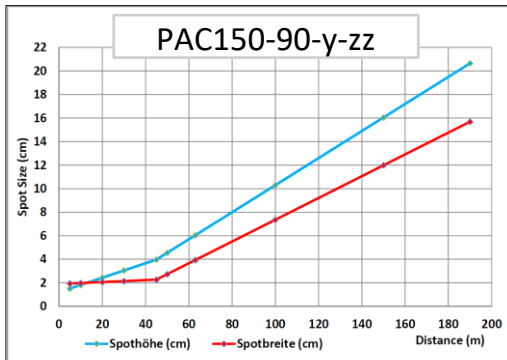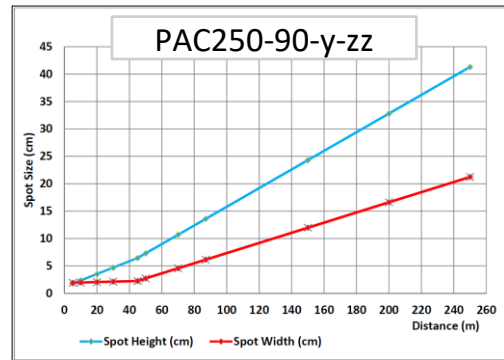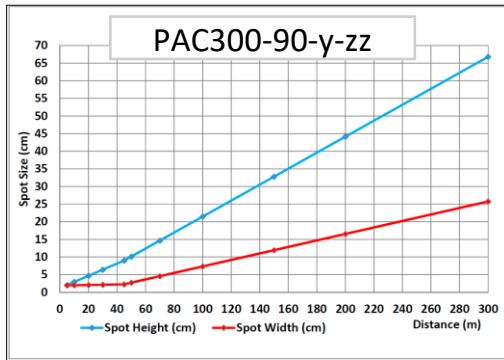
PAC100-90-y-1.5*n

PACxxx-90-y-zz Sigma as function of Target Distance

PAC300-90-y-zz

PAC250-90-y-zz

PAC150-90-y-zz

PAC100-90-y-1.5*n

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PACxxx-90-y-zz Spot Size comparison in different Scan Modes

PAC300-90-y-zz	PAC250-90-y-zz	PAC150-90-y-zz	PAC100-90-y-1.5*n

SPOT SIZE

0.029° 0.5 mrad	0.020° 0.3 mrad	0.020° 0.3 mrad	0.020° 0.3 mrad
0.115° 2 mrad	0.076° 1.33 mrad	0.048° 0.83 mrad	0.076° 1.33 mrad

NORMAL MODE

0.09° 1.57 mrad	0.09° 1.57 mrad	0.09° 1.57 mrad	0.09° 1.57 mrad

FAST MODE

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2 scan layers; y = 2

3 scan layers; y = 3
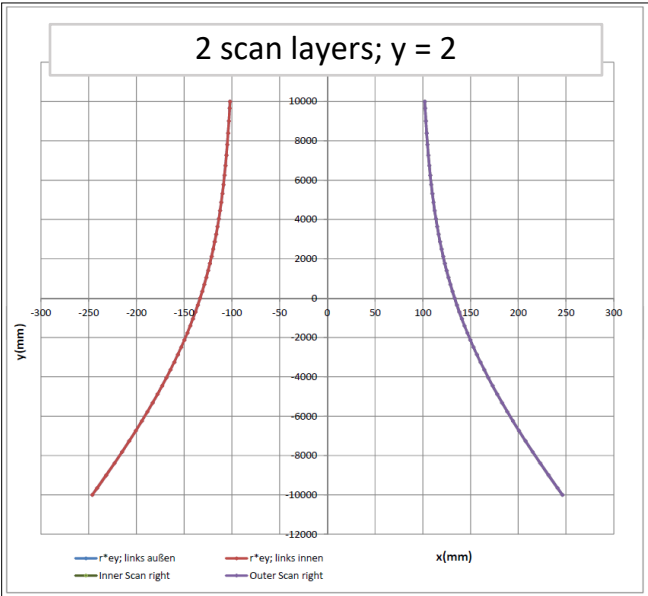
4 scan layers; y = 4

Measurements of a PAC100-90-y-1.5, mounted perpendicular to the floor at a distance of 10 m.

The angle ϑ in the specification is the angle between the outer scan layers measured in the middle at y = 0.

In the pictures the width in the middle is 267 mm at a height of 10 m and leads to ϑ = 1.52°. This angle substitutes *zz* in the name of the sensor.

The angle α in the specification is the angle between the inner scan layers measured in the middle at y = 0. In the pictures: α = 0.51° = ϑ/3.

For the calculation of the unit vectors of the outgoing beam, as a function of distance and angle, and for the curves of the projected scans on the floor, as a function of mounting height and tilt angle, a math-package is available.
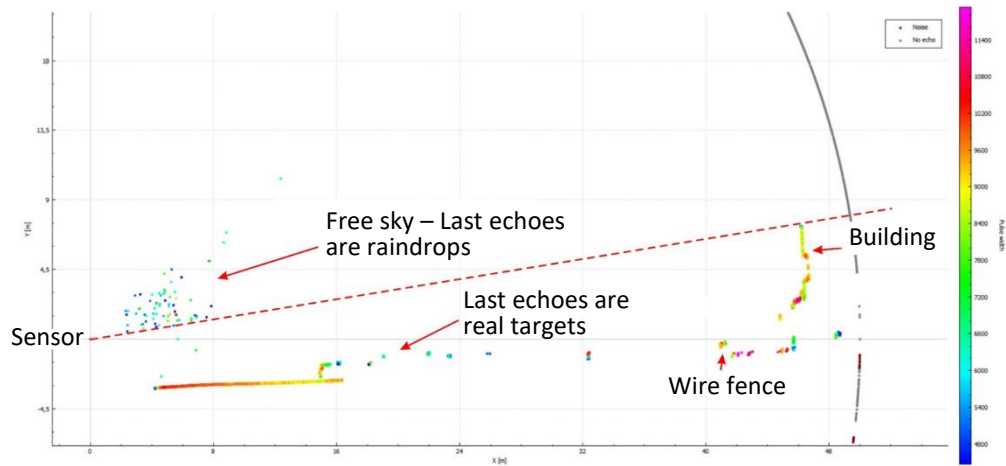
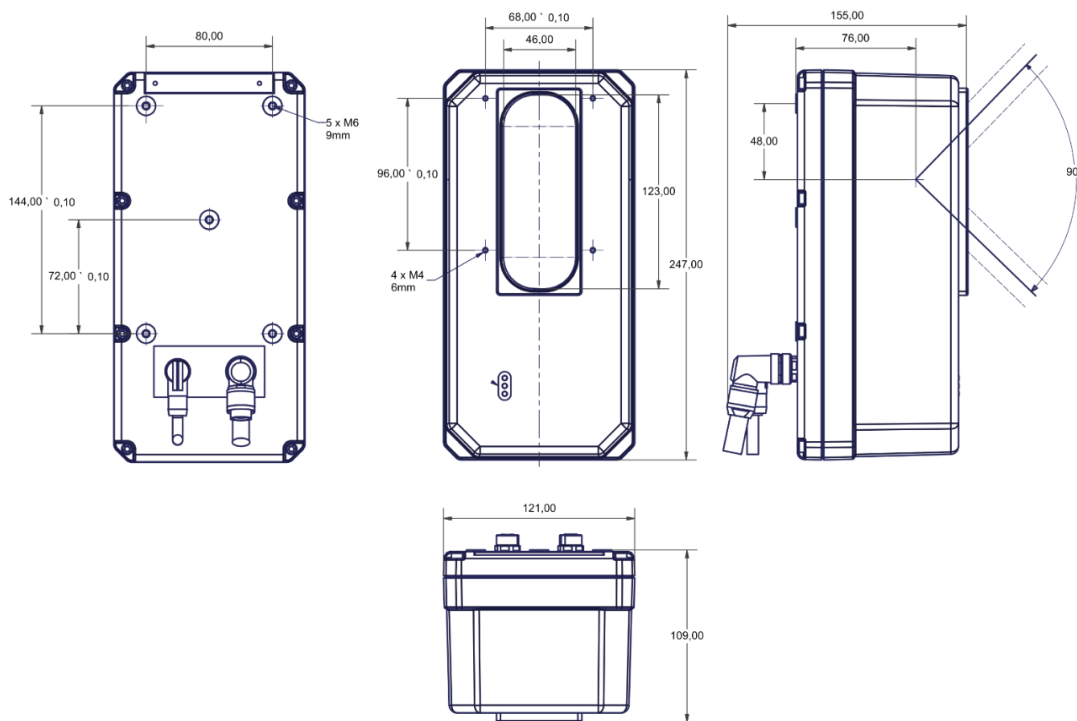**Scan pattern projected from 10 m height to the floor**
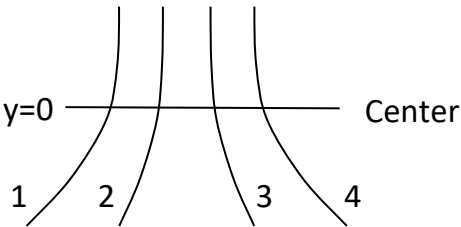
Sequence of scans
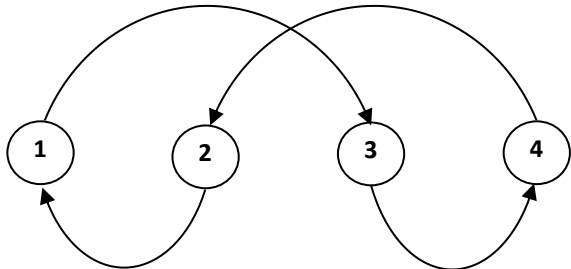
The numbering of the scans is noted in the header of the scan data.
Sequence: 1, 3, 4, 2, 1, 3, 4, 2, 1, … The order does not change when 2 or 3 scan planes are selected.
In case of 2 scan layers 2 goes to 1 and 3 to 4. In case of 3 scan layers 2 and 3 move into the middle.

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PACxxx-90-y-zz Dimensions Drawings