

AMS 3000 / AMS 5000

Goniophotometers for
large lamps and modules





AMS 5000 goniophotometer system.

Key features at a glance

- ▲ CIE Type A goniophotometer for large test samples
- ▲ Fast, robust and precise
- ▲ Automated set-up mode and sequential measuring procedures
- ▲ Data export in IES, KRS, CSV formats
- ▲ Conformity with GTB and SAE J1330 photometry precision requirements for type testing of vehicle lights

01 \ Fast – robust – precise

The AMS 3000 and the AMS 5000 of the Optronik line are Type A goniophotometers in accordance with CIE 121-1996 and IES-LM-75-01 for the measurement of photometric and colorimetric data in the far field. Due to their highly dynamic servo drives and robust design, they are suitable for measuring all typical vehicle headlamps, signal lamps in traffic engineering and airfield lighting up to a nominal load of 20 kg (AMS 3000) and 50 kg (AMS 5000).

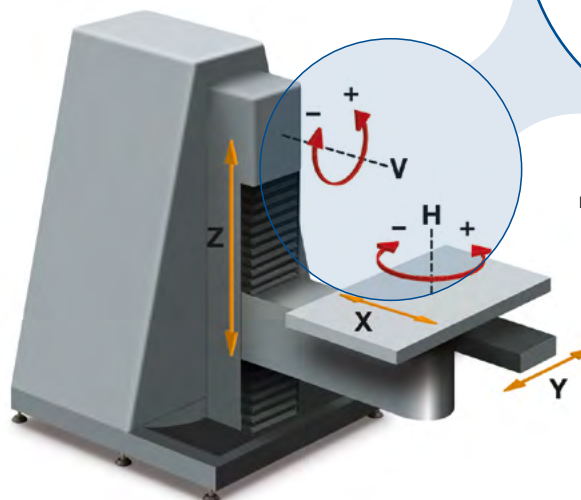
All parameters relevant for the test objects can be determined with maximum precision. Depending on the measuring task, different equipment versions are possible, e.g. with the following devices:

- ▲ DSP 200 photometer
- ▲ Colorimeter
- ▲ Luminance meter
- ▲ Retroreflectometer
- ▲ Spectroradiometer

The resulting goniophotometer systems fulfill all requirements of EN, DIN, CIE, SAE, UN-ECE and other standards committees for all type tests of vehicle headlamps.



Direction of rotation of a Type A goniometer.



Moveable axes of the AMS 3000 and AMS 5000 goniometers.

02 \ Equipment and function

The AMS 3000 and AMS 5000 goniometers consist of a sample stage that can be moved in three linear axes in addition to the two rotational axes for the attachment of the test sample, as well as the AMS controller, the central control system of the goniophotometer. The AMS 5000 goniometer has a control unit with touchscreen on the sample stage. In addition, the RecoCAN hand-held remote control is optionally available for the two systems.

The photometer head belonging to the system is beyond the photometric limit distance in a stray light tube adjusted to the measuring distance and sample size. The basic configuration can be extended by further modular detectors, e.g. a spectrometer optical probe or tristimulus colorimeter head.

Designed for heavy samples

The test sample is moved in the horizontal and vertical direction in relation to the fixed detector. Both axes can be operated simultaneously and positioned without vibration, even if heavy samples are moved at high speed. The extremely torsion-resistant frame and high-precision transmission bearings guarantee a high degree of reproducibility and absolute positioning accuracy better than 0.05° . This means that the most stringent measurement requirements for type testing vehicle headlamps in accordance with ECE and SAE are fulfilled, as confirmed by test reports from independent institutes such as TÜV Rheinland. The latter applies to all samples that do not exceed a nominal load of 20 kg (AMS 3000) or 50 kg (AMS 5000). In the case of lower requirements for absolute

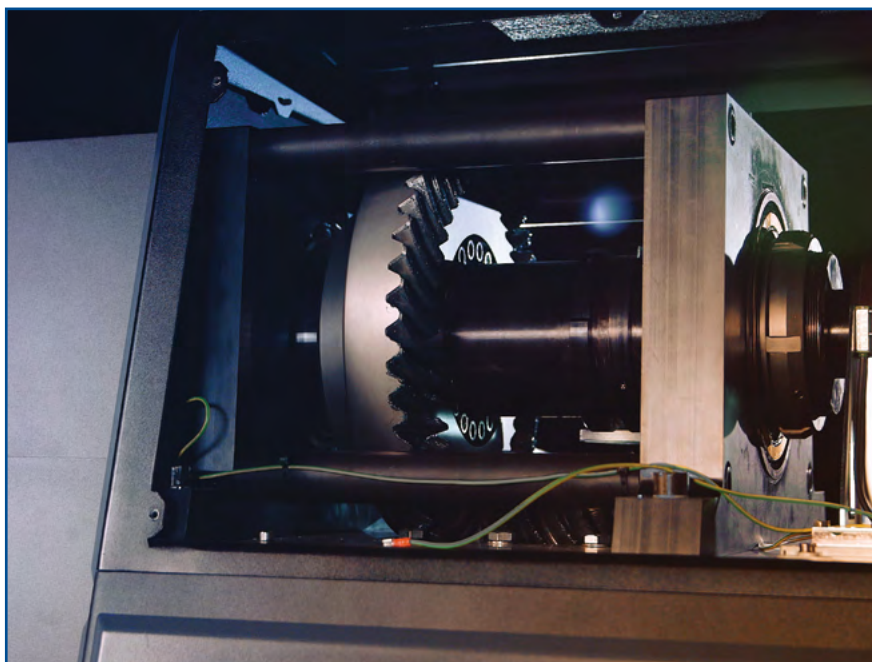
accuracy and precise reproducibility, samples up to 40 kg (AMS 3000) or 80 kg (AMS 5000) can be measured.

“On-the-fly” quick raster measurement

The rotational speed of $50^\circ/\text{s}$ permits extremely fast “on-the-fly” scanning of complete light distributions or specific zones with a high degree of accuracy and efficiency. The combination of dynamic motor drives with the fast DSP 200 photometer enables the light distribution to be scanned with high-angle resolution and speed during goniometer movement. Integration and filter parameters are thereby automatically adjusted to the respective light source. The shortened total measurement time makes a far higher number of tests possible within the working day than previous goniophotometer systems.

The movement range of the H-axis is $\pm 200^\circ$ and for the V-axis $\pm 100^\circ$ at a resolution of the angle transmitter of 0.01° .

Even in standard measurements in accordance with ECE or SAE standards, the AMS goniophotometers have the advantage of high measurement accuracy. Typical standard measurements, such as ECE R112 (asymmetrical low beam), are completed within a few minutes.



▲ Gearwheel of the V-axis of the AMS 5000. Travel range of the H-axis is $\pm 200^\circ$, of the V-axis $\pm 100^\circ$, at an angle sensor resolution of 0.01° .

03 \ Components and connections of the sample stages

The goniometer systems have a sample stage with mounting grooves and locating pin sockets for holding the test samples. The electrical connection of the samples

is realized via a lamp multiplexer mounted directly on the sample stage. This ensures that the cables move synchronously with the sample during operation.

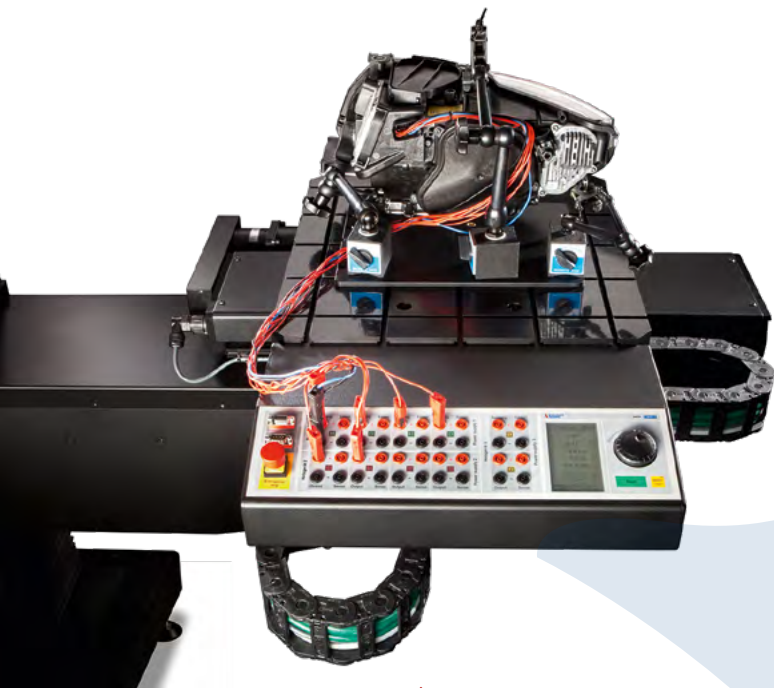
Sensor lines are used to measure the electrical operating data of the sample and stabilize it directly on the sample. The operator switches manually between the individual channels via the SNT 10 power supply units or remote controlled via the LightCon software program.

Dimensions and equipment		
	AMS 3000	AMS 5000
Sample stage size	35 x 50 cm	50 x 50 cm
Mounting grooves	4 x 5 T-grooves suitable for slot nuts size 8 DIN 508	5 x 5 T-grooves suitable for slot nuts size 8 DIN 508
Lamp multiplexer	9-channel	10-channel

In a single measurement routine, all functions in multifunctional lamps can be measured, e.g.:

- ▲ Low beam
- ▲ High beam
- ▲ Indicator lamp
- ▲ Brake light
- ▲ Rear light
- ▲ Rear fog lamp
- ▲ Reversing light

For this purpose, the respective test sample positions are first of all stored in the database of the software and automatically called up by the system during the measurement process.



▲ Sample stage with lamp multiplexer.



▲ RecoCAN-XL controller (AMS 5000).

The sample connector of the AMS 5000 also offers the option of selecting a power supply and power supply channel directly by touchscreen and channel buttons on the lamp multiplexer and to set voltage and current. This is enabled by the CAN bus integration of all system components.

On the lamp multiplexer of both goniometer systems a CAN bus can be used for integrating further functions, e.g. for the temperature measurement of an LED module. During the lamp burn-in, the temperature and light intensity profiles can be recorded simultaneously. An optional PWM

generator can also be connected, and an additional Sub-D socket is freely assignable with CAN or LIN, e.g. for the control of AFS (adaptive front lighting) or ADB (adaptive driving beam) and matrix beam functions.

04 \ Sample positioning

The sample to be measured is aligned to the rotation center of the H-axis and V-axis by means of the three linear axes. An adjustment laser in the rotation center of the V-axis facilitates the alignment of the sample. The table shows the different travel ranges of AMS 3000 and AMS 5000.

This enables easy control of all functions of customary vehicle lights and headlamps: either using

the keypad of the AMS controller per direct input or with the optional RecoCAN remote control. The positions are then adopted in the LightCon software via the simple "Get Position" command and saved in the database for the respective test sample. If a similar test sample is measured again, no repeat set-up is required. The RecoCAN remote control also shows the active measuring channel and current measurement value.

In addition, the AMS 5000 integrates a RecoCAN-XL touchscreen control unit on the sample stage, which also enables often-used positions ($\pm 90^\circ$, 0° H-positions) to be approached directly. Furthermore there is the possibility to enter any angular or linear position via the figure pad of the touchscreen. Otherwise the positioning functions of the RecoCAN-XL control unit are identical to the RecoCAN remote control.



▲
RecoCAN remote control – Enables rapid movement as well as fine adjustment with 0.1 mm / 0.01° accuracy.

Travel range		
	AMS 3000	AMS 5000
Width X	± 150 mm	± 300 mm
Depth Y	± 75 mm	± 200 mm
Height Z	-50 to -450 mm	-50 to -650 mm

05 \\ Carrying out the measurement

The AMS controller is the central control unit of the goniophotometer and provides detailed display options on the modern LCD panel.

The controller comprises the following functions:

- ▲ Display of the goniometer angular positions
- ▲ Display of the X-Y-Z linear axes position
- ▲ Manual input of an angular or linear axis position via the keypad
- ▲ Display of the photometric value of the connected DSP 200 photometer
- ▲ Switching between different measurement distances
- ▲ Switching between units of measure (lx, cd, cd/m²)

The basic equipment consists of a control cabinet with 33 height units which provides ample space for the complete range of accessories.

This way, a remote display for retroreflectometer, tristimulus colorimetric device and SNT 10 power supply units, for example, can be stored in a rack.

The safety controller integrated in the control cabinet ensures the necessary safety during operation of the machine. It is used to enable the drives and to switch between manual and automatic mode. The safety controller is also used to regulate the optionally available safety system which comprises two laser scanners, integrated in the goniophotometer frame, which monitor the safety area around the device. They can be individually adjusted to the ambient conditions at the installation site. Alternatively, other safety devices based on pressure-sensitive mats or light fences are available.



AMS controller.

Rack for AMS 3000 and AMS 5000.

06 \ The goniophotometer: the core piece of the light laboratory

The AMS 3000 and AMS 5000 goniophotometers can be combined with different devices in order to cover all the necessary measurement tasks in a light laboratory. The accessory range of the Optronik product line is ideally matched to the requirements of the automotive industry in the light channel and fulfills all the relevant standards.

Conventional configuration with the DSP 200 photometer

Normally, the systems are operated in combination with the fast Optronik line of DSP 200 photometers which are particularly suitable for scanning “on-the-fly” measurements. Like other detectors, they can be configured for measurement tasks at various distances outside the photometric limiting distance. A stray light tube protects the photometer from any unwanted straylight that might cause false results.

DSP 200 photometers use very fast silicon photodiodes with a broad measuring range. With a $V(\lambda)$ filter these are precisely adjusted to the spectral luminous efficiency of the human eye. This allows measurement of all traditional light sources such as halogen, incandescent and discharge lamps. Thanks to adaptive filtering and digital signal processing of the DSP 200 photometer pulse-width modulated LED light sources with PWM frequencies of 80 Hz to 10 kHz can also be measured.



DSP 200 with photometer head.

Stand for stray light tube, photometer and DSP 200.

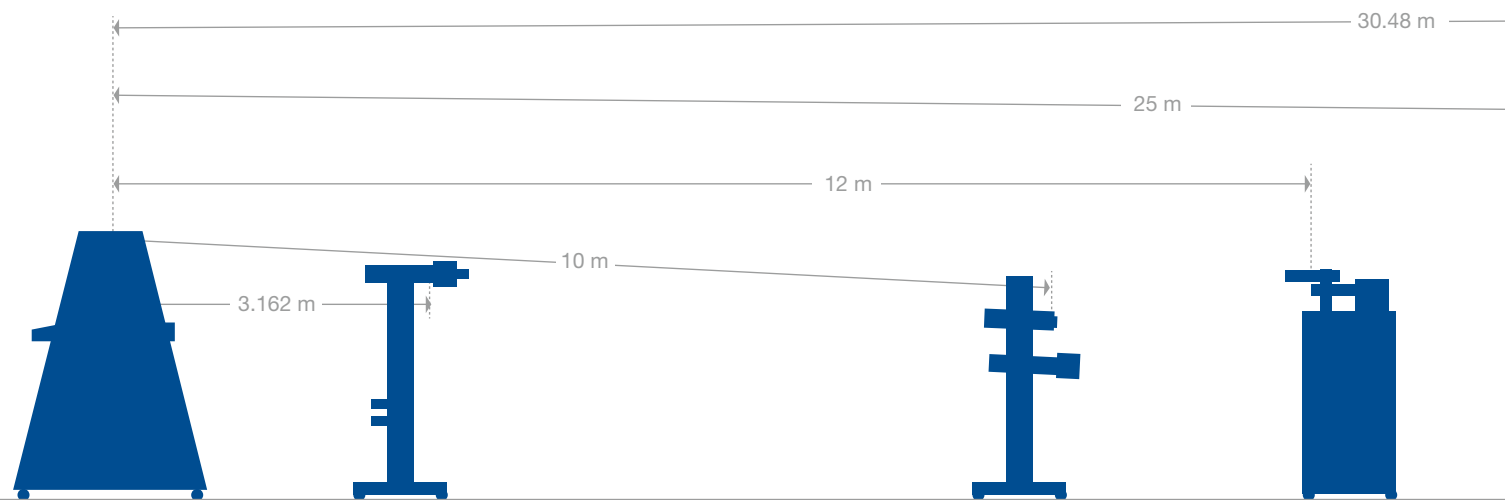
Integrated power supply with sensor lines

To meet the high-precision requirements of the automotive and similar industries, a DC power supply integrated in the system via CAN bus was developed. Two SNT 10 power supply units can be connected. The sample is connected to the sample stage, electrical operating data is collected and the test sample stabilized. This ensures that precisely the electric current and voltage programmed by the user is applied.

Layout of a light laboratory

Instrument Systems creates for customers an individual lab layout tailored to the structural requirements and desired application spectrum. The positions/ distances of goniometer, photometer, control cabinet, sensors and accessories (e.g. tube positioning unit, imaging colorimeter and retroreflectometer) are specified therein.

Side view:



AMS goniometer

for rapid scans of light distributions

TPU positioning unit, DSP photometer & CM colorimeter

for signal lamps / license plates

Stand with DSP photometer & CM colorimeter

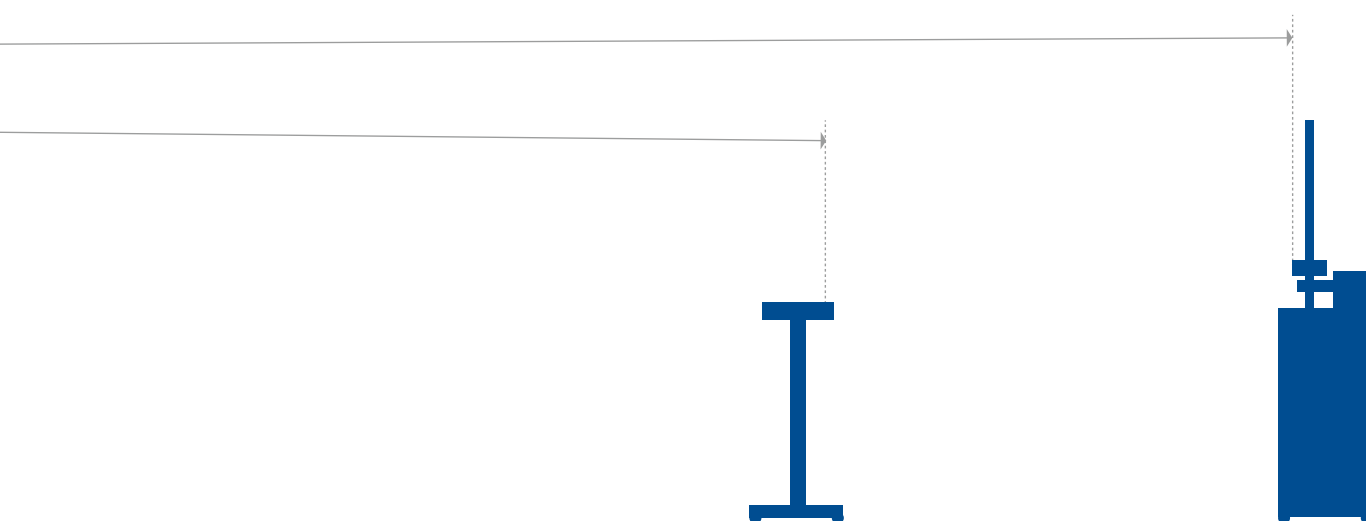
for headlamps

Colorimeter with projector

for color of retroreflectors

Top view:





Stand with DSP photometer
for headlamps

RMS retroreflectometer
for retroreflectors



Photometric limiting distance

According to the definition, the light intensity distribution in the far field must be measured at a distance at which the test sample can be seen as a point light source. The distance of the detector from the test sample from which this criterion is fulfilled is called the photometric limiting distance. It depends on the size of the light source to be measured and the light-sensitive surface of the detector, as well as the required measurement deviation.

The minimum distance to be observed between test sample and detector is often stated as being a multiple of the maximum expansion of the sample and varies depending on the normative rule applied. As a rule of thumb, it is ten times the greatest expansion of the illuminated surface of the sample. For very directional sources such as vehicle headlamps, a significantly greater distance should be selected. The distances we recommend are consistent with standard practice in the relevant laboratories that carry out product approval tests.

Recommended measurement distances for automotive and similar applications:

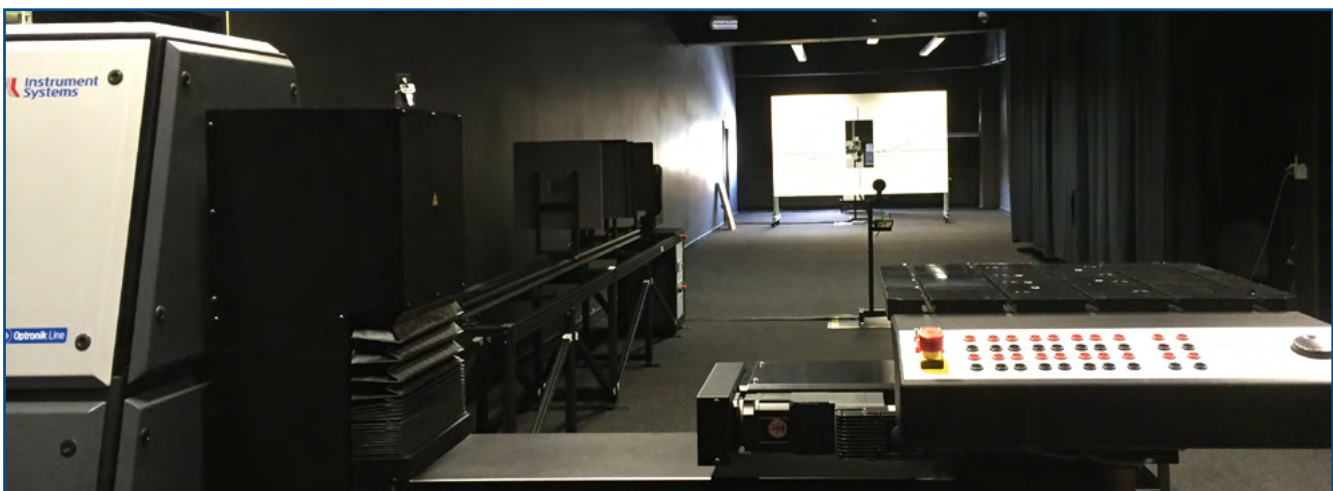
- ▲ Signal lamps: ≥ 3 m
- ▲ Gradient measurement low beam: 10 m
- ▲ Main headlamps: 25 m
- ▲ Retroreflection (SAE): 30.48 m (100 ft)
- ▲ Retroreflection (ECE): 10 m or 30.48 m
- ▲ Retroreflection (ISO 20471 and road construction): 15 m
- ▲ Measurements of the color space of the cut-off line: 10 m or 25 m
- ▲ Measurement of the light color of signal lamps: ≥ 3 m

07 \ Service and after-sales support

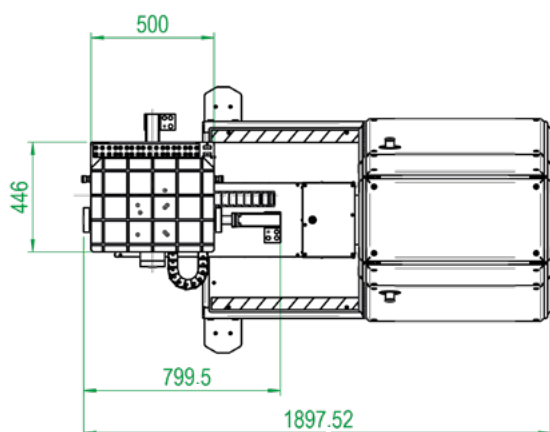
The Instrument Systems customer service supports customers in all phases of laboratory planning and implementation. Our extensive service portfolio features the following services:

- ▲ Support in the preparation of construction plans for a light laboratory
- ▲ Installation services on site
- ▲ User training sessions, optionally in partnership with accredited certification labs
- ▲ Re-calibrations in our own calibration laboratory or at the installation site
- ▲ Conformity tests
- ▲ Repair and hardware upgrades as well as software updates with standard support
- ▲ Maintenance contracts

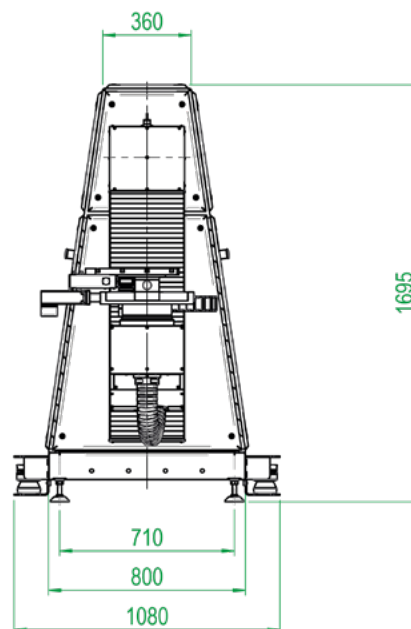
Example of a light channel.



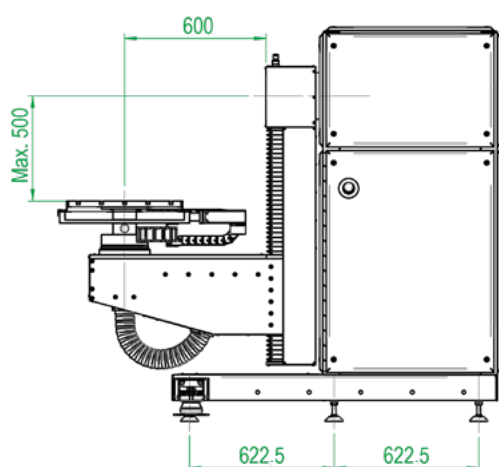
08 \ AMS 3000 goniometer – Dimensions



▲ Dimensions of AMS 3000 – top view.



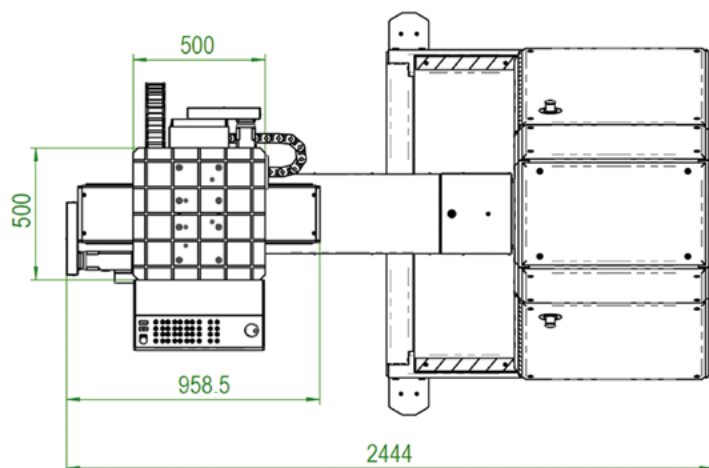
▲ Dimensions of AMS 3000 – front view.



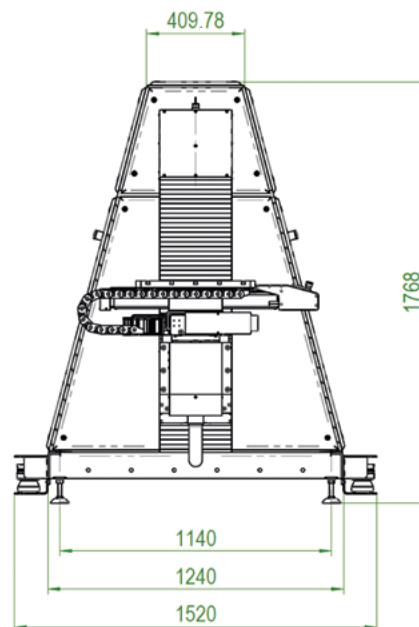
▲ Dimensions of AMS 3000 – side view.



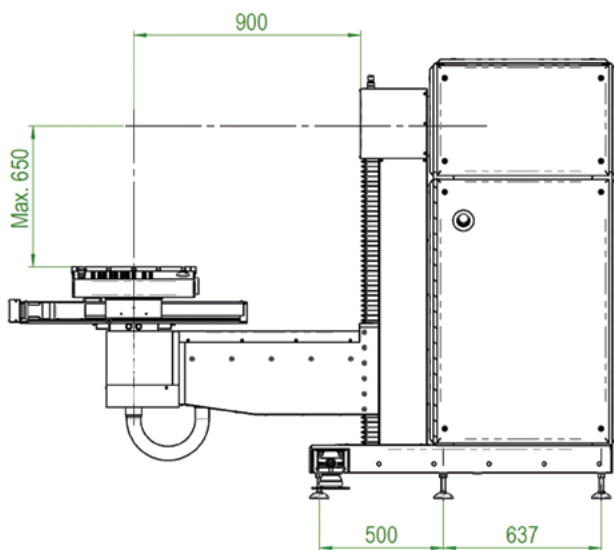
09 \ AMS 5000 goniometer – Dimensions



▲
Dimensions of AMS 5000 – top view.



▲
Dimensions of AMS 5000 – front view.



▲
Dimensions of AMS 5000 – side view.



10 \\ Technical specifications

	AMS 3000 Goniophotometer	AMS 5000 Goniophotometer
CIE / IES goniometer type	Type A in accordance with IES LM-75-01 and CIE 121-1996	Type A in accordance with IES LM-75-01 and CIE 121-1996
Height	1695 mm	1768 mm
Length	1898 mm (for middle position of the sample table)	2444 mm (for middle position of the sample table)
Width	800 mm (without laser scanner) 1080 mm (with laser scanners)	1240 mm (without laser scanner) 1520 mm (with laser scanners)
Clear width	600 mm (distance of rotation center H-axis to swivel arm V-axis)	900 mm (distance of rotation center H-axis to swivel arm V-axis)
Sample stage	500 mm x 350 mm 5x4 mounting grooves for slot nuts size 8 DIN 508 and 5 fitting bushes for 8 mm locating pins DIN 6325	500 mm x 500 mm 5x5 mounting grooves for slot nuts size 8 DIN 508 and 5 fitting bushes for 8 mm locating pins DIN 6325
Maximum sample expansion	Approx. 1180 mm with central mounting of the test piece	Approx. 1780 mm with central mounting of the test piece
Nominal load	20 kg	50 kg
Maximum sample weight	40 kg	80 kg
Weight (without control cabinet)	Approx. 770 kg	Approx. 1240 kg
Optical axis height	1400 mm	1500 mm
Height adjustability	± 25 mm via adjustable feet	± 25 mm via adjustable feet
Action and safety area	3600 mm x 4400 mm	4100 mm x 4800 mm
Minimum room height	2600 mm	2950 mm
H-rotation / resolution	± 200° with limit switches with 0.01° resolution	± 200° with limit switches with 0.01° resolution
H-axis speed	3°/s to 50°/s (16 speeds)	3°/s to 50°/s (16 speeds)
V-rotation / resolution	± 100° with limit switches with 0.01° resolution	± 100° with limit switches with 0.01° resolution
V-axis speed	0.6°/s to 10°/s (16 speeds)	0.6°/s to 10°/s (16 speeds)
H-axis reproducibility	≤ 0.05° (below standard weight) (type < 0.02°)	≤ 0.05° (below standard weight) (type < 0.02°)
V-axis reproducibility	≤ 0.05° (below standard weight) (type < 0.02°)	≤ 0.05° (below standard weight) (type < 0.02°)
X-axis / resolution	± 150 mm with 0.1 mm resolution	± 300 mm with 0.1 mm resolution
X-axis speed	100 mm/s	125 mm/s
Y-axis / resolution	± 75 mm with 0.1 mm resolution	± 200 mm with 0.1 mm resolution
Y-axis speed	83 mm/s	166 mm/s
Z-axis / resolution	-50 to -450 mm with 0.1 mm resolution	-50 to -650 mm with 0.1 mm resolution
Z-axis speed	18 mm/s	18 mm/s
H-/V-/X-/Y-/Z-axes drive	Synchronous servo motors	
H, V, X, Y, Z	Digital position controller, motorized movability of all goniometer axes PC control of all axes via LightCon PC program, AMS controller and RecoCAN remote control	
Machine safety	Emergency stop button on both sides of goniometer, on sample stage and AMS controller; separate safety controller for enabling the machine. Optional safety devices with 2 laser scanners, light fence, pressure-sensitive mats	
Electrical connection	Lamp multiplexer configured for low voltage with 9 channels / 9 sensor lines for max. 50 V, max. 20 A	Lamp multiplexer configured for low voltage with 10 channels / 10 sensor lines for max. 50 V, max. 20 A

	AMS 3000 Goniophotometer	AMS 5000 Goniophotometer
Additional connections on the sample table	Sub-D output, freely assignable with CAN or LIN bus for integration of ADB, AFS, matrix beam functions, CAN bus for optional temperature measurement, LED module, optional PWM signal generator	
AMS controller		
Functions	Control of the goniometer drives, display of angle positions, display of photometric measurement value in lx, cd, cd/m² for the use of a DSP 200 photometer	
Interfaces	RS232-C for the connection of a PC, CAN bus for integration with DSP 200 photometer, SNT 10 power supply	
Power supply	230 V, 50 Hz (optional 115 VAC), power consumption 120 W	
Dimension (HxWxD); weight	133 mm x 482 mm x 370 mm plus 130 mm for rear connections; approx. 7 kg	
Safety controller		
Functions	Main switch for goniometer power supply, start button for releasing drives, emergency stop button, switching of operating modes	
Connections	CAN bus for goniometer and AMS controller. Goniometer power supply, 15-pin Sub-D for emergency stop, 25-pin Sub-D for safety, 2 power sockets	
Power supply	230 V, 50 Hz (optional 115 VAC), max. power consumption 3 kW	
Dimension (HxWxD); weight	133 mm x 482 mm x 370 mm plus 130 mm for rear connections; approx. 7 kg	
Control cabinet		
Functions	19" control cabinet, 33 HE for AMS controller, safety controller, SNT 10 power supplies, CM 10 colorimeter; RMS 1200 retro remote display and other devices; integrated 9x3-pin shockproof plug strip	
Dimension (HxWxD); weight	Approx. 1700 mm x 550 mm x 600 mm; from approx. 60 kg to 98 kg (fully-equipped)	
Standard conformity		
Product safety	RL 2006/42/EC, DIN ISO 12100, RL 2006/95/EC, DIN EN 61010-1	
EMC	RL 2004/108/EC, DIN EN 61326-1	
Photometry	EN 13032-1, DIN 5032-7, CE 3874 (2005) GTB Photometry Accuracy Guidelines, SAE J1330	

Instrument Systems is constantly striving to develop and improve its products. Technical changes, errors or printing mistakes do not justify claims for damages. In all other cases, our terms and conditions shall apply.

11 \ Ordering information

Order number	Description
AMS5000-110	Five-axis goniometer, CIE Type A, with angle measurement system and control cabinet, 33 height units with laser adjustment and lamp multiplexer with 4+4+2 channels, including RecoCAN-LX operating unit with touchscreen on the sample stage
AMS5000-300	Optional 115 VAC power supply
AMS5000-320	RecoCAN handheld remote control for AMS 5000
AMS5000-400	Safety pressure-sensitive mats for AMS 5000
AMS5000-402	Safety light barrier around the danger area
AMS5000-404	2 safety laser scanners
AMS3000-100	Five-axis goniometer, CIE Type A, with angle measurement system and control cabinet, 33 height units with laser adjustment and lamp multiplexer with 4+4+1 channels
AMS3000-300	Optional 115 VAC power supply
AMS3000-320	RecoCAN handheld remote control for AMS 3000
AMS3000-400	Pressure-sensitive safety mats for AMS 3000
AMS3000-402	Safety light barrier around the danger area
AMS3000-404	2 safety laser scanners
AMS-210	Relay option: 2 switching contacts for control of laboratory light and warning lights, etc., switching capacity 230 VAC / 6 A respectively
AMS-220	Audible warning signal during movement of the goniometer
AMS-310	Device for the support of license plate dummies and license plate illumination
AMS-311	License plate dummies for measurement in accordance with ECE-R4 (3 pcs., Type A, B, C)
AMS-312	License plate dummies for measurement in accordance with SAE-J587 (2 pcs., Type 01, 02)
AMS-313	License plate dummies for measurement for Chinese GB standard (5 pcs.)
AMS-314	License plate dummy for measurement in accordance with Brazilian standard (1 pc.)
AMS-320	USH 30 universal headlamps and lamp holders
AMS-330	Clamp set (adjustable) for slotted table 8 (2 pcs.)
AMS-450	Vehicle test lamp for type testing of vehicle lamps in accordance with ECE regulations, report on luminous flux, and filament included
AMS-470	Rolling trolley for spectral radiometer
AMS-480	PWM generator
AMS-500	Motorized positioning unit for the automated positioning of 3 different photometer heads; optical axis 1400 mm, incl. position set
AMS-501	Motorized positioning unit for the automated positioning of 3 different photometer heads; optical axis 1500 mm, incl. position set
SW-600	AMS 3000/5000 LightCon software for Windows

An extensive additional accessory range is available for the AMS goniophotometer.



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