The image features a detailed view of a compact goniometer system. It consists of a central black cylindrical motor unit mounted on a silver perforated metal base. Surrounding this central unit are several black detector arms, each equipped with a lens and connected to a network of black cables. A separate black control box is positioned to the left of the main assembly. The entire setup is presented against a blue background with a pattern of water droplets.

# ALV / CGS-8F Compact Goniometer Series

ALV / CGS-5022F \*

ALV / CGS-5050F \*

High Quality Laser Light Scattering  
Simultaneous DLS / SLS

**ALV**® \*

[www.alvgmbh.de](http://www.alvgmbh.de)



# The ALV / CGS-8F Compact Goniometer Series

## ALV / CGS-5022F

22mW HeNe laser

1 ALV-High QE APD module

1x



## ALV / CGS-5050F

50 mW 532 nm SLM laser

2 ALV-High QE APD modules

with beam splitting device

2x

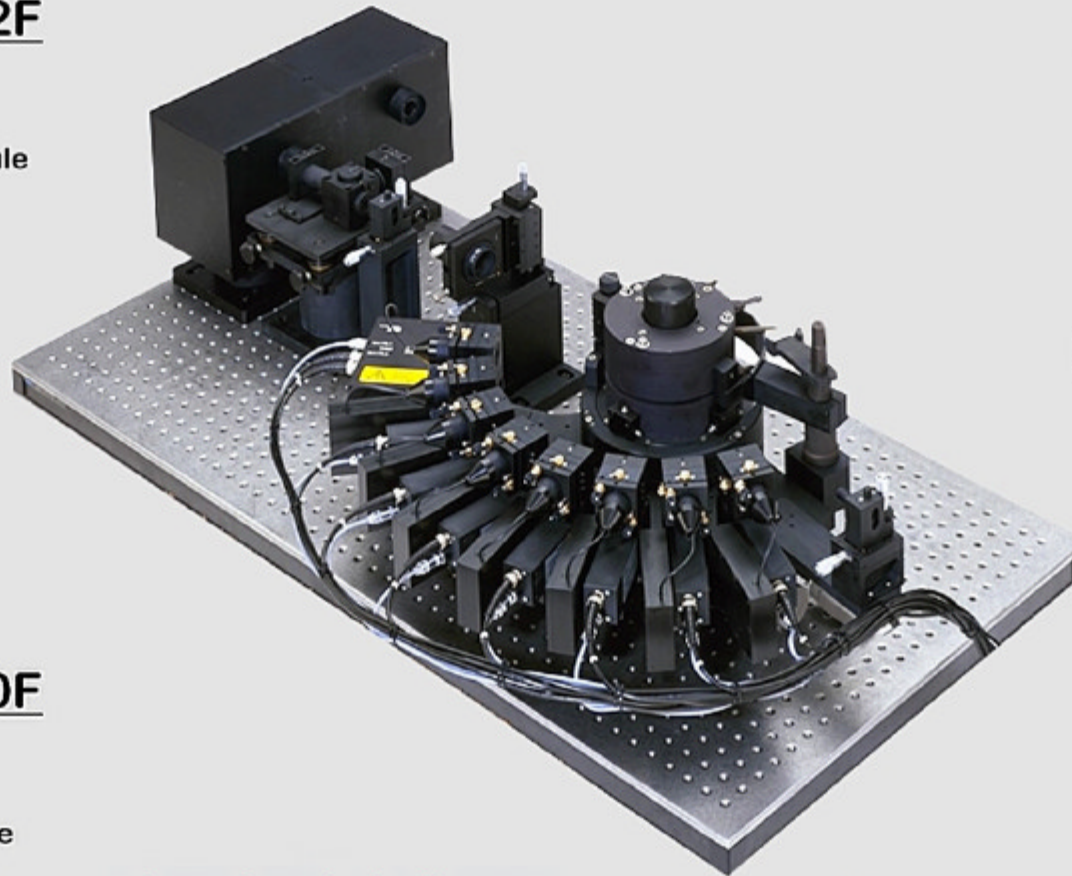


## ALV / CGS-5000F

laser to be integrated

1 ALV / SO-SIPD module

1x



## ALV / CGS-8F

laser to be integrated

1 ALV / SO-SIPD module

7 ALV-SIPC modules

1x



+ 7x



standard delivery:

## **ALV / CGS-8F COMPACT GONIOMETER SYSTEM SERIES**

***System for SIMULTANEOUS angular dependent determination of Dynamic (DLS) and Static (SLS) Light Scattering***

### **GENERAL INFORMATION**

ALV Company has been developing LLS goniometers for angular dependent **simultaneous** determination of DLS and SLS under focused laser light conditions since 1981. ALV Company has been at the forefront of the design of LLS equipment and goniometer systems for research and routine measurement, including digital correlators with totally new architecture, i.e. introducing Multiple Tau structure and Symmetric Normalisation with the ALV-3000 Correlator/Structurator already in 1984; followed by the the most complete software, and, the appropriate state-of-the-art detection units. ALV Company developed and introduced in 1989 the first commercially available ISA-bus based PC-board digital correlator to the world market, the

ALV-5000 Multiple Tau Digital Correlator / Real Time.

In the 1980s and 90s ALV's design of LLS equipment and goniometer systems evolved several times and with each new design, new levels of performance were achieved.

Since 1995 ALV Company offers an extensive line of precision Compact Goniometer Systems based on the use of near mono-mode fiber optical detection units. Since 1999 we offer a unique goniometer design allowing besides the principle detection unit up to a total of 8 such detection unit mounted on the rotary table positioned under 17° spacing to each other; the use of stepper motor drive for the rotary table with spindle and gear under control of a Multiturn Angular Encoder allows for methodical alignment of all components and modules of the system and ease of laser beam adjustment to the optimum position. Additional detection units may certainly be installed at any time in retrospect - for this purpose already at the first delivery of the basic goniometer unit the stepper motor drive can rotate the rotary table a full 360°-turn under control of the Multiturn Angular Encoder.

The entire design of the ALV Compact Goniometer System quoted herein is based on these 2 decades of experience in manufacturing those LLS goniometers for **simultaneous** determination of DLS and SLS; all components of the goniometer are based on designs and engineering performed in-house of ALV Company, using CAD, DXF and CAM (ALV used CAD design-techniques already from the early 1980s on). Since the 1990s, we have expanded our production facilities with the most modern CNC production equipment available. Manufacturing in the workshop is performed on most modern CNC-controlled lathe-machines and machining centers completed with a CAD-CAM design center, and is to the highest standards of craftsmanship, controlled to the most stringent specification tolerances set by ALV Company. Over the years, we have assembled a staff of talented, skilled craftspeople dedicated to producing very high quality products. They take personal pride in their accomplishments and in your satisfaction. At ALV Company, we are fully committed to the production and development of LLS equipment. Our goal is the produce the highest possible quality components and to keep them affordable.

The entire hard- and software is also in-house design of ALV Company; more than 600 units out of the family of the ALV-5000, ALV-5000/E and ALV-5000/E/WIN Multiple Tau Digital Correlator / Real Time inclusive dedicated ALV-software are by now in use world-wide, the number of all kind of ALV Goniometer Systems installed has recently reached 200 units.

Before an ALV Goniometer System is cleared passing for packing, each system is completely mantled on an optical table at our works and set to full function, followed by a complete final test performed and documented, including a Sine Theta test measurement of toluene under simultaneous DLS and SLS detection condition, and DLS-measurements

of standard-samples of known particle diameters and scattering intensity ratios over the RR of the solvent.

The herein described ALV/Laser light scattering measurement system is in its overall design manufactured to the highest standards of workmanship, quality of materials and components; the performance of many modules of the system are **state-of-the-art**.

Nowadays the substantial performance advantages of a "coherent" fiber-optical detection over a "partial coherent geometric optics" detection, using refractive optics are proven and clearly described in literature, e.g. by J. Ricka Ph.D. of University of Bern/Switzerland, or elsewhere.

Already at a very early state we at ALV investigated on the basis of fundamental research in this new and very promising technology. The more than 5 years of experience with fiber-optical detection taught all of our academically educated personnel involved, how to take full advantage of this new and superior detection technique, and, moreover important to the users of our equipment, to combine handling of the fiber-optical detection with a very high degree of ease and further to achieved long-time stability of measurement performance. Another goal we met is the great ease of adjustment of all modules - even in the micrometer range - including the positioning of the laser to optimum condition and the appropriate positioning of the detection system. All this can be performed by the user at any time should this be required. It was this goal that forced our engineers to base the ALV Goniometer Systems on such opto-mechanical devices only that had been particularly designed by us for these requirements and to manufacture all those devices according to the very high quality standards set.

The ALV/CGS-8F Goniometer, as a commercially available unit, is still without substitute in using fiber-optical detection unit(s) and HIGH QE APD-detection, and, unique in its feature to be expandable to up to 8 detection units on the rotational support (arm) of the rotary table separated by a 17°-spacing to each other, thus allowing - when 8 such detection units are installed - either to perform angular dependent measurements at the same total number of angles measured 8-times faster compared to a single-detector system, or to perform time-dependent studies of e.g. structure changes of the probe material under 8 different angles simultaneously, yet the absolute angles can be chosen by user within a 17°-increment based on rotating the goniometer (arm) with the detection units.

The alignment procedure of each of the eight fiber-optical detection units of the ALV/CGS-8F Goniometer to the optimum alignment position of the laser beam is also unique and further patented to ALV Company in Germany, USA and Japan - EU-patent is pending.

A great number of complete ALV / DLS/SLS-5000F Goniometer Systems with one principal detector (PMT or HIGH QE ALV based detection units) and ALV-5000/E/WIN Multiple Tau Digital Correlator/Realtime with the most complete ALV-software, as well as a few systems complete with 8 fiber-optical detector systems and ALV-digital correlators inclusive the all dedicated ALV-software are already in use by customers.

Any delivered ALV/CGS-8F Goniometer can easily be expanded in retrospect in field by the user, adding the required number of complete fiber-optical/electrical detection units, as all provisions are already included part of the basic the goniometer at first delivery, such as re-positioning tools for the factory pre-aligned detection units, etc..

Any ALV/CGS-8F Goniometer based instrument quoted as standard version uses state-of-the-art detection technology to reduce the required laser power - greatly increasing safety and making the use of light scattering techniques far more accessible to students. Basis to this achievement is besides the use of the low-power laser, the entire shielding of the laser beam along its propagation paths up to the cell housing, in tubes and other safety measures as included part of the design of all the ALV Goniometer Systems, certainly including the ALV/CGS-8F Goniometer System.

The above named combination (plus special optical additions, e.g. the integrated "ALV / Optical Optimization Unit") is a milestone development, not only due to the use of a specially to ALV standards selected High QE active quenched Avalanche Photo Diode detection unit.

Cylindrical low-power HeNe-Lasers are for many decades already in daily use, further these are field proven for reliability and very long life-time, and, moreover important to the user of LLS-systems, HeNe-Lasers are inexpensive even at absolute price, and definitely compared to the water- or air-cooled ...-ION-Lasers, or frequency-doubled Nd-YAG-Lasers at  $\lambda = 532 \text{ nm}$ . The particular HeNe-Laser chosen by ALV Company is among the best performing lasers of not only such kind with respect to laser beam profile, beam pointing and Coherence stability.

Alternatively ALV Company uses a (low-power) 50mW Single Longitudinal Mode 532nm Laser for more advanced systems; many units of this laser are integrated to ALV Goniometer Systems and are already for nearly 2 years in daily use, further these are field proven for reliability and long life-time, and, moreover important to the user of LLS-systems, this laser is an item still be in an affordable price range - extended warranty can be optionally purchased. The particular laser chosen by ALV Company is among the best performing lasers of the 532nm wavelength family with respect to laser beam profile, beam pointing stability and stability of all for LLS important coherence parameters.

**Two different systems are available as standard version, one as a non-standard version:**

### **ALV / CGS-5022F COMPACT GONIOMETER SYSTEM**

#### **HeNe-Laser and single ALV / HIGH QE APD-detection unit:**

The resulting counting intensity (sensitivity) is extremely high and would require compared to using photo-multiplier detection an equivalent laser power of  $\geq 400 \text{ mW}$  at  $\lambda = 532 \text{ nm}$ . With the 22 mW HeNe-Laser the scattering intensity  $I_{sc}$  for toluene as standard under  $90^\circ$  scattering angle is  $> 30 \text{ kHz}$  using a lens of 200 mm focal length, resp.  $> 21 \text{ kHz}$  using a focusing lens of 300 mm focal length.

The combination of the 22 mW HeNe-Laser and the single ALV / High QE APD detection unit offers the best bargain and promises the longest possible life-time of lasers.

or

### **ALV / CGS-5050F COMPACT GONIOMETER SYSTEM**

#### **532nm Single Longitudinal Mode 50 mW Laser and "Pseudo-Cross Correlation detection mode, using 2 off ALV / HIGH QE APD-detection unit and appropriate light splitting device:**

The resulting counting intensity (sensitivity) is extremely high and would require compared to using photomultiplier detection an equivalent laser power of  $\geq 1 \text{ W}$  at  $\lambda = 532 \text{ nm}$ . With the 50 mW 532nm-Laser the scattering intensity  $I_{sc}$  for toluene as standard measured under  $90^\circ$  scattering angle is  $> 80 \text{ kHz}$  using a lens of 200 mm focal length, resp.  $> 50 \text{ kHz}$  using a focusing lens of 300 mm focal length.

The combination of the 50 mW 532 nm-Laser and the 2 off ALV / HIGH QE APD-detection unit and appropriate light splitting device offers the best performing instrument and can even be used for smallest particle determination at very low concentration, and measurement of SLS simultaneously.

## **Non-standard ALV / DLS/SLS Compact Goniometer Systems for use of high power Lasers\***

and the state-of-the-art ALV / SO-SIPD / DUAL Small Outline - Single Photon Detection Unit in combination with fiber-optical detection using the ALV / STATIC and DYNAMIC Enhancer are available on request.

### **Please note: \***

optimum performance when integrated to an ALV Goniometer Systems cannot be achieved with each high power laser - in your own interest we kindly request you to discuss this matter with us prior to your decision of purchasing a laser; our experience over years in testing various lasers will certainly be offered to you as a free of charge support helping you to select an appropriate laser for integration to the Goniometer System.

**System expansion by the use of 2 lasers with different wavelengths**, either sequentially or simultaneously measured, requiring different detection units etc. is available, or can be added to the system at any time in retrospect - if required, please do not hesitate to discuss such extensions with our academically educated personnel.

### **Clarification on the performance advantages and limitations of the ALV / HIGH QE APD-detection unit (using one APD):**

The **ALV / HIGH QE APD-detection unit** is selected to pass the stringent specifications set by ALV Company for integration to an ALV / Goniometer System with a 22mW HeNe-Laser for simultaneous measurement of DLS and SLS. These specifications are quite similar to such requirements for a detection unit based on a very good single photomultiplier; the main specifications of the single APD for use in auto-correlation are:

quantum efficiency @ 632.8nm:	≥ 50%
background count rate:	150 cps (typical)
	≤ 250 cps (upper limit)
correlation measurements:	800 nsec starting time
typ. count rate linearity: (important for SLS measurements)	up to 750 kHz within +/- 1.5 % error

The major performance advantage of an APD is the very high quantum efficiency QE in the red wavelength range, e.g. approx. >65% for 632nm; for the 632.8nm wavelength an overall sensitivity ratio of approx. 1:25 results between a PMT with a S-20 photocathode and an APD.

The recent introduction of the ALV/APD-Secure Overload Protection Unit by ALV Company, as part of, respectively as added unit to the ALV / HIGH QE APD-detection unit greatly increases the safe operation of the APD, even under condition of misuse.

All detection units based on single detectors, may these be PMT or HIGH QE APD based, have limitations with respect to wavelength dependent quantum efficiency, overall sensitivity, count rate linearity, dead time and pair resolution, and the introduction of distortions or other effects, such as after-pulsing etc.; optimising the performance of a few parameters may finally be to the expense of others.... As a claim for example: even with the very best and certainly very expensive single photomultipliers available such disadvantages remain (of course at a (much) less magnitude, but still....).

The only way out in order to achieve FAST correlation detection is to use 2 off detectors in one detection units or in two separate units, with equally split light trace input to each detector, and then to operate the 2 detection units in (pseudo-) CROSS correlation mode; just to clarify it is the CROSS correlation mode operation that improves the performance, thus to allow fast correlation detection, while still the performance of each single detector remains unchanged.

Already in 1996 ALV Company made a 12.5nsec detection unit commercially available, using 2 off photomultipliers, the state-of-the-art ALV / SO-SIPD / DUAL Single Photon Detector.

After a 10 months test-period ALV Company has recently released a similar solution for using

2 off APDs in split-input and combination with 2 off ALV/APD-Secure Overload Protection Units, as an optional sales item, for operation in (pseudo-) CROSS-correlation mode. All the above described advantages over a single APD apply and this detection combination of 2 APDs allows indeed fast correlation detection and improves other performance parameters.



## ALV / CGS-5022F and ALV / CGS-5050F COMPACT GONIOMETER SYSTEM

*SIMULTANEOUS Angular Dependent Dynamic (DLS) and Static (SLS)  
Light Scattering Measurement Systems*

**Reducing the laser power and still keeping the measurement sensitivity !**

In comparison to goniometer systems with detection units based on geometric (refractive) optics and photomultiplier detectors, the laser power requirements for the ALV / CGS-5022F Compact Goniometer System, respectively the ALV / CGS-5050F Compact Goniometer System are substantially reduced. **Due to the use of the ALV / STATIC and DYNAMIC Enhancer and a special Avalanche Photo Diode Detection Unit selected to special ALV standards**, the resulting counting intensity (sensitivity) is extremely high and comparably low power lasers are fully sufficient, even for very counting intensity critical sample systems.

Using a 22 mW HeNe-Laser ( $\lambda = 632,8$  nm), respectively a 50 mW Single Longitudinal Mode-Laser ( $\lambda = 532$  nm), with all the advantages of such lasers, namely low power consumption, very high light purity in transversal and longitudinal modes and long durability; e.g. the scattering intensity  $I_{sc}$  for Toluene under  $90^\circ$  scattering angle @  $\lambda = 632,8$  nm is as high as up to  $\geq 30$  kHz. Traditional goniometer systems without using the **ALV / STATIC and DYNAMIC Enhancer Technology** and furthermore using photomultiplier tubes instead of the **Avalanche Photo Diode Detection Unit** would require an equivalent laser power of more than 400 mW at  $\lambda = 532$  nm (e.g. frequency-doubled NdYAG) compared to the 22 mW HeNe-Laser / ALV / HIGH QE APD detection system, as above described, to achieve approx. the same scattering intensity, respectively sensitivity.

**A complete system which includes all what is required for simultaneous DLS/SLS !**

The ALV / CGS-5022F and the ALV / CGS-5050F Compact Goniometer System are complete „ready to measure“ systems which include all items required for high quality **simultaneous** DLS / SLS measurements. Still it is a fully modular design which allows the optional introduction of extra modules for special applications (e.g. depolarized SLS/DLS, non-ergodic sample measurement, etc..). In the standard delivery, the systems consist of the following items :

### Standard Delivery, The Hardware

- ♦ **ALV / CGS-5022F Compact Goniometer System:**  
Cylindrical 22 mW HeNe-Laser,  $\lambda = 632.8$  nm plus a very special laser stand
- ♦ **ALV / CGS-5050F Compact Goniometer System:**  
50 mW Single Longitudinal Mode-Laser,  $\lambda = 532$  nm plus laser stand
- ♦ **Goniometer Unit, ALV / CGS-8F based**, central unit ready to accept up to 8 detection units positioned with  $17^\circ$ -spacing and starting with the first (*principle*) detection unit (DET-1) positioned at  $17^\circ$  goniometer angle reading; rotary table with worm gear/spindle and stepper motor drive (plus 2 limit switches) under control of an ALV/ME-5000 Multiturn Encoder, for automatic angular dependent measurements.
- ♦ **Standard Cell Housing**, Model 88/AL, with two stainless steel heat exchangers, black anodized (temperature range :  $-6^\circ$  to  $+50^\circ$  C); heat exchangers with hose couplings for



connection to an external heating/cooling circulator; plus hose coupling for ventilation of the external surfaces of the VAT using dry and oil-free air or N<sub>2</sub> to prevent wetting or icing (for measurements at sub-ambient temperatures), as e.g. icing of the external surfaces of the VAT will distort optical transmission conditions. Ventilation release is through the viewing slit of the cell housing.

- ♦ **Index Matching Quartz VAT**, with plane-entry- and exit-window, MLC-anti-reflection coated; the two windows and the bottom plate of the vat are optically insulated from the main cylinder, and are fused together, using black quartz "fritte". The cylinder is polished to approximately  $\lambda/2$  optical cylinder quality.

### Standard Delivery, The Detection

- ♦ **ALV / STATIC and DYNAMIC Enhancer**, fiber optical near monomode selective detection system, with suppression of additional long time fluctuations of the transmitted light intensity (normally caused by the physical fiber properties); further optimized for simultaneous DLS/SLS measurements under focused laser beam conditions using the "ALV / Optical Optimization Unit"; detailed description see enclosed report: *Arguments for using ALV/Compact Goniometer system for simultaneous SLS/DLS measurements...* (for polarization dependent detection, see "options/accessory": Glan-Thompson prism)

#### ALV / CGS-5022F Compact Goniometer System:

- ♦ **1 off ALV / HIGH QE APD Detection Unit**, one active quenched diode detection unit, QE at  $\lambda = 632.8 \text{ nm} > 55 \%$ , TTL at 50  $\Omega$  output electronics. Selected for best count-rate linearity and stability for SLS; includes the ALV / APD-Secure Overload Protection Unit.

#### ALV / CGS-5050F Compact Goniometer System:

- ♦ **2 off ALV / HIGH QE APD Detection Unit** with appropriate beam splitting device, as one active quenched diode detection unit, QE at  $\lambda = 532 \text{ nm} > 45 \%$ , TTL at 50  $\Omega$  output electronics. Selected for best count-rate linearity and stability for SLS; includes the ALV / APD-Secure Overload Protection Unit.

### Standard Delivery Hardware ( ... continued ... )

- ♦ **Laser Beam Folding/Adjustment Unit I**, for one Laser, using two laser mirrors, each held in an orthogonal, coplanar high-resolution adjustment gimbal holder.
- **Laser Beam Optimization Unit**, focusing the laser beam to an optimum waist diameter and Rayleigh-length, optimized for use of cylindrical 10 mm outer diameter cuvettes and fiber-optical detection (for all type of lasers); unit is positioned between Laser Beam Folding/Adjustment Unit I and the cell housing.
- **ALV / LSE-5001 Light Scattering Electronics**, computer interface for data transfer to the PC-computer via RS-232C, includes: motor logic/power drive for stepper motor, control of two angular limit switches, plus encoder logic.
- ♦ **Temperature Measurement Unit**, for temperature measurement of the index-matching liquid in the VAT, data transfer to ALV-5000/E/WIN digital correlator; consisting of

ALV-3027 (electronics for temperature measurement; temperature measurement and laser monitoring are displayed in the software), and 1 off Pt-100 platinum temperature probe, encased in stainless steel tube.

- ♦ **(additional) Pt-100 Temperature Probe**, allows regulation of external heating/cooling circulator to set temperature of the index matching liquid in the VAT (provided the circulator allows connection of an external Pt-100 temperature probe).
- ♦ **Monitor Diode Unit**, for measurement of laser beam intensity and pointing combined with profile; unit is mounted on an adjustable stand, which further accepts a beam attenuator, such as the Linear Compensated Attenuator NEWPORT, Models 925B or M-925B; the unit consists of:

ALV-3028 module (1 quadrant-diode with electronics in a housing) with data transfer directly to ALV-5000/E/WIN digital correlator), a beamsplitter plate in interferometric quality (to transfer a fraction of the laser beam power after passing through the attenuator to the photodiode), plus an adjustment holder with lens.

- ♦ **ALV-5000/E/WIN Multiple Tau Digital Correlator/Real Time**, (see separate description) or
- ♦ **ALV-5000/EPP Multiple Tau Digital Correlator/Real Time** (see separate description)

#### ALV / CGS-5050F Compact Goniometer System:

includes the additional

- ♦ **ALV-5000/FAST Tau Extension Board (12,5 nsec STC)**, see separate description

#### **Standard Delivery, The Software**

- ♦ **ALV-5000/E for WINDOWS Software (WIN-95/98)**, see separate description
- ♦ **ALV / Static & Dynamic FIT and PLOT program (WIN-95/98)**, see separate description
- ♦ **ALV / WinAlign Utilities (WIN-95/98)**, see separate description

(Demo versions of the above software are available on our homepage at [www.alvgmbh.de](http://www.alvgmbh.de))

#### **Standard Delivery, The Alignment Tools**

An optical system such as the ALV / CGS-5022F, respectively the ALV / CGS-5050F Compact Goniometer System are always just as good as the mechanical and optical adjustment of the modules of the system and the laser beam allows. The standard delivery already includes all required tools for performing these adjustments/alignments at utmost precision. In combination with the **ALV / WinAlign Utilities Software**, certainly also included in the delivery of the ALV / CGS-5022F, respectively ALV / CGS-5050F Goniometer Systems, comprehensive, objective and precise adjustment/alignment procedures are available which allow even the unskilled user to perform in shortest time those at optimum quality for **simultaneous** DLS/SLS measurements.

- ♦ **Alignment Tools:** Double Needle Adjustment Unit (**DNAU**), Centricity Needle, Calibration Disk, Double Dial-Gauge Unit (**DDGU**) with one vertical and one horizontal dial gauge for the adjustment of the cell housing/cuvette holder using the calibration disk, plus the VAT Adjustment Unit (**VAU**) with one dial gauge and one feeler gauge.
- ♦ **Laser Beam Height Definition Needle (LHDN)**, with a conical collar similar to the size of the cuvette-holder; the height of the laser beam at the rotational axis of the rotary table is prefixed by the LHDN when positioned instead of the cuvette holder, in the conical bore of the upper heat-exchanger of the cell housing (the tip of the needle has a diameter of 3  $\mu\text{m}$ , thus allowing optimum alignment even of a focused laser beam with a waist-diameter of less than 100  $\mu\text{m}$ ).

- ♦ **Projection Optics System**, used during any adjustment of the laser beam to project magnified images of the diffraction patterns of the appropriate "needle in the laser beam" in the 'far field', for easier interpretation of diffraction patterns, respectively their symmetry.
- ♦ **90°- (or 270°-) mirror unit to Projection Optics System**, allows a 90° or 270° horizontal folding of the laser beam respectively the projected and magnified laser beam, or diffraction patterns to a screen in the far field.

### Standard Delivery, Laser Beam Attenuation

- ♦ **Linear Laser beam attenuator**, either Model 925B or M-925B compensated attenuator of NEWPORT Company, attenuation range from zero and 0.01 - 3 ND, manually operated.

### Standard Delivery, The Cuvette Holders

- ♦ 1 cuvette holder for cylindrical cuvettes with  $\varnothing = 10.0$  mm (outer diameter)
- ♦ 1 cuvette holder for cylindrical cuvettes with  $\varnothing = 20.0$  mm (outer diameter)

( for other cuvette holders, see "Options/Accessories": *Glassware and Cuvette Holders* )

<b><i>For special purpose measurements, the Options and Accessories</i></b>
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### Measurements at High Temperature

- ♦ **High Temperature Cell Housing, Model 2000**; all outer parts of the cell housing are made of fiber compound material for measurement at temperatures up to +140° C; can also be used for sub-ambient measurement temperatures down to -12° C.

### Depolarized Light Scattering

- ♦ **Glan-Prism/Laser**, prism in interferometric quality, to increase ratio of polarization of the laser beam; MLC-coated, angular off-set: ca. 2 minutes of arc, usable diameter: 7.5 mm, length: 16 mm; housed in an adapter for 25 mm outer diameter, plus a rotator-unit accepting the 25 mm adapter, plus an appropriate adjustable stand with Y/Z and tilt and turn adjustments.
- ♦ **Glan-Thompson-Prism for polarization dependent detection**; prism in interferometric quality, MLC-coated, angular off-set:  $\leq 2$  seconds of arc, optical opening diameter: 7.5 mm, length: 16 mm; housed in an adapter with 25 mm outer diameter, plus a rotator-unit accepting the 25 mm adapter, mounted on stand.

## Measurement of Non-Ergodic Samples

**ALV-Cuvette Rotation Unit**, fits in to the bore of the upper heat exchanger of the standard and high temperature cell housing and allows the software controlled continuous and/or stepwise rotation and/or up/down movement of the cuvette at extremely high precision. Speed of rotation and up/down movement can be selected.

Unit accepts cylindrical cuvettes with outer  $\varnothing = 10$  mm only; version for  $\varnothing = 20$  mm available on request.

## Glassware and Cuvette Holders

All cuvette holders are made of black (graphitised) PTFE to ensure the most careful handling of the outer surface of cuvettes, when positioned in the holder. The design of the cuvette holder centers at a time both the holder and the cuvette and accepts outer cuvette diameter tolerances within  $\pm = 0.1$  mm of the given e.g. 10.0 or 20.0 mm mean diameter.

- **Extra Cuvette Holders for cylindrical cuvettes**, made of black PTFE, machined to customer order for a single specified cuvette diameter; request list of available diameters. (max. allowed cuvette diameter = 27.2 mm).
- **Extra Cuvette Holder for 12,5 mm x 12,5 mm square cuvettes**, made of black PTFE are available on request, however; inserting of those require strictly to obey special precaution measures - to avoid reflection in to the laser !!
- ♦ **BSG-10T** cylindrical cuvettes made of glass, with 10 mm outer diameter and PTFE-stopper, for routine DLS measurements only.
- ♦ **QT-10 / QT-20** cylindrical quartz glass cuvettes, with 10 mm/20 mm outer diameter and PTFE-stopper, for SLS/DLS measurements;  $RI = 1.45709$  ( $T = 23^{\circ}C$ ,  $\lambda = 632,8$  nm).



**! IMPORTANT INFORMATION !**  
**Separate Purchase Items for Purchase by the User**

We strongly recommend that the user purchases the (required) below items locally, because of the local warranty and/or price advantages. These items are :

- ◆ PC-Computer with the following minimum configuration :

CPU :	P-II 233 MHz or faster (up to date, P-III @ 800 MHz is the fastest tested)
RAM :	min. 64 Mbyte RAM (128 Mbyte or more are recommended)
Harddisk :	min. 10 Mbyte free harddisk-space
Bus-System :	<b>ISA-Bus slots mandatory</b> , minimum two free slots to insert LONG TYPE ISA boards for ALV-5000/E/WIN <b>PCI Bus slot</b> , minimum one free slot (33 MHz, 32 bit, 5V) for ALV-5000/EPP/WIN
Graphics :	min. 1024 x 768 (256 colours)
Monitor :	17" Monitor is strongly recommended
Other :	min. 1 free serial RS-232 port, Mouse
Operating System :	MS-WINDOWS-95/98/NT-4.0
Printer :	Any type of printer with appropriate printer driver for MS-WINDOWS-95/98/NT, colour printing is supported by the software.

- Optical table/breadboard (minimum dimensions: 900 x 1800 mm, min. 2" better 3" thick) with grid pattern of **METRIC M6 threaded mounting holes in 25 mm grid square.**
- ◆ Heating/cooling circulator, with provision for connection of an external Pt-100 temperature probe.