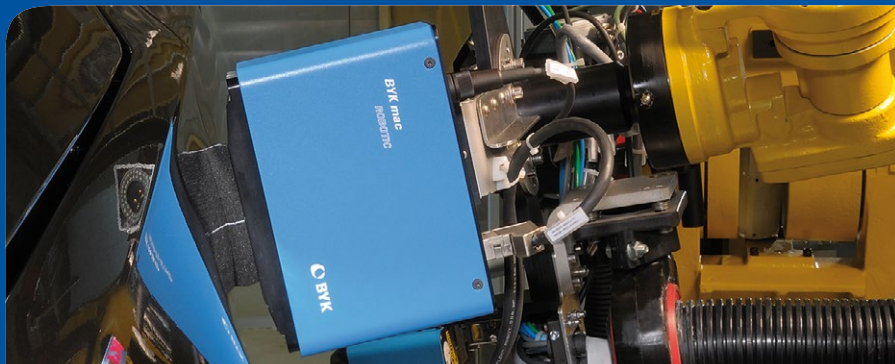


Measure what you see.

BYK-mac i ROBOTIC



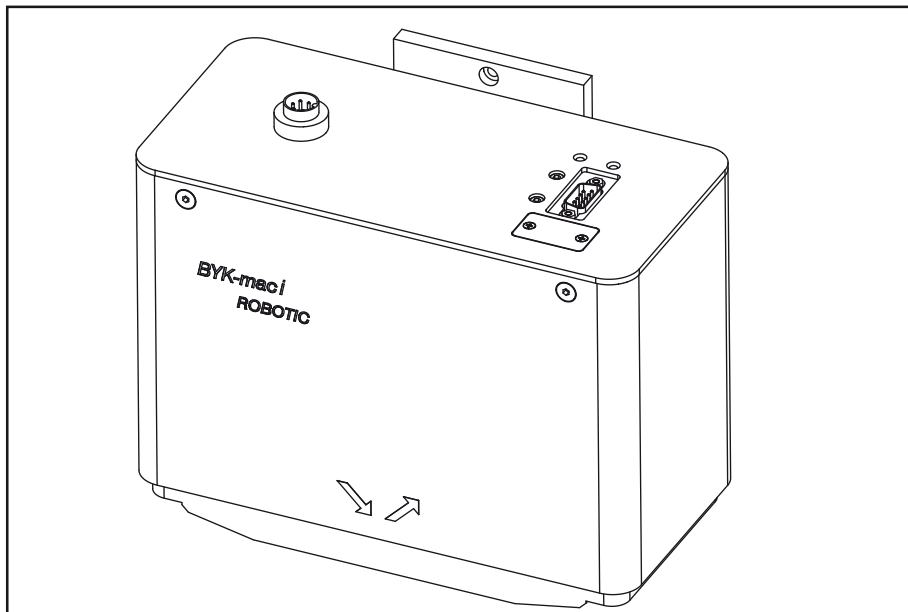
Manual

A member of  **ALTANA**

 **BYK**
Additives & Instruments

BYK-mac i ROBOTIC

Manual



Patent pending

300 000 877 1309

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www.byk.com/instruments

Dear customer,
thank you for having decided for a BYK-Gardner product. BYK-Gardner is committed to providing you with quality products and services. We offer complete system solutions to solve your problems in areas of color, appearance and physical properties. As the basis of our worldwide business, we strongly believe in total customer satisfaction. Therefore, in addition to our products, we offer many VALUE-ADDED services:

- Technical Sales Force
- Technical & Application Support
- Application and Technical Seminars
- Repair & Certification Service

BYK-Gardner is part of Altana AG and a direct subsidiary of BYK-Chemie GmbH, a leading supplier of additives for coatings and plastics. Together, we offer complete and unique solutions for you, our customer.

Thank you for your trust and confidence. If there is anything we can do better to serve your needs, do not hesitate to let us know.

Your BYK-Gardner Team

Inhaltsverzeichnis

1. Safety instructions	5
2. System description and delivery notes	10
3. Mounting and Manual Measurements	11
3.1 Mounting of instrument	11
3.2 Mounting of standards	12
3.3 Manual measurement	12
4 Power supply	13
5 Emergency stop	14
6 Interface	15
7 Calibrating the instrument	16
8 Standards	18
9 Technical Data	19
10 Cleaning and Maintenance	20
11 Service and Certification	22
12 Copyright	24

1. Safety instructions

- Before operating the instrument the first time, please read the operating instructions and take particular notice of the safety instructions.
- If you use the unit and accessories properly, there are no hazards to fear.
- This product is equipped with safety features. Nevertheless, read the safety warnings carefully and use the product only as described in these instructions to avoid accidental injury or damage.
- No claims of product liability or warranty can be honored if the device is not operated in accordance with the operating instructions.
- Keep these instructions for future reference.
- If you pass this instrument to somebody else, make sure to include these instructions.

The following symbols and terms are used.



This symbol warns of the danger of injury.



This symbol warns of the danger of injury caused by electricity.



This sign points out additional information.

DANGER

The term **DANGER** warns of possible severe injuries and danger to life.

WARNING

The term **WARNING** warns of injuries and severe material damage.

CAUTION


The term **CAUTION** warns of slight injuries or damage.

DANGER injuries possible



- Defects and extraordinary loads
If safe operation can no longer be presumed, shut down the device and secure it against unintended operation.

The device must be presumed unsafe to operate:

- if visible damage is evident
 - if the instrument is no longer working
 - if it has been stored for long periods under adverse conditions
 - after harsh treatment during shipping.
- 
- For operation with the external power supply, care should be taken to ensure the nominal voltage of the power supply unit (see the manufacturer's plate on the power supply unit) matches the voltage supplied by the power outlet.
 - Do not perform any repairs on the unit yourself. The unit must be opened by trained professionals only. Please contact our customer service department in such cases.
 - The measurement device and accessories may be disconnected from the power supply as follows:
Instrument:
by disconnecting the plug from the device.



WARNING severe material damage

- The measurement unit consists of sensitive optical and electronic precision parts. Prevent it from being dropped, bumped or shaken!
- Avoid exposure to continuous humidity and condensation. Avoid splashing with water, chemicals or other liquids.
- Please use only accessories that are available for the unit.
- Only devices that meet the requirements for low-voltage safety may be connected to the RS 422 interface.

CAUTION material damage

- Do not allow any foreign objects to get into the measurement opening.
- Do not expose the unit to direct sunlight for extended periods of time. Do not store it in a hot or dusty environment. Use the instrument case for storage.

- Avoid prolonged high relative humidity and do not allow condensation water.
- **Do not use any acetone for cleaning the unit!** The unit housing is resistant to many solvents. For cleaning you should use a soft, moist cloth. Excessive dirt and dust can be removed with ethanol or cleaning alcohol.

Additional information on use:

- You will find the technical data for all system components such as the measurement unit and battery compartment on the respective manufacturer's plates and in the section Technical Data



- This symbol means: Do not dispose of this product together with your household waste. Please refer to the information of your local community or contact our dealers regarding the proper handling of end-of life electric and electronic equipment.

Recycling of this product will help to conserve natural resources and prevent potential negative consequences for the environment and human health caused by inappropriate waste handling.

2. System description and Delivery notes

BYK-mac i ROBOTIC measures color traditionally at five aspecular angles (15°/25°/45°/75°/110°) with a 45° illumination. Additional color measurement "behind" the gloss for color travel of interference pigments is implemented at -15°. To simulate sparkle under direct sunlight additional illuminations are used at 15° /45° and 75°. Diffused illumination for graininess evaluation is created by two white coated hemispheres. Detection is performed by a high resolution camera situated perpendicular to the surface. Additional out-of-plane sensors detect fluorescent light excited in the visible range and quantify it by the Intensity Emission value.

The instrument complies with the following standards: DIN 5033, 5036, 6174, 6175-2; DIN EN ISO 11664, ISO 7724; ASTM D2244, E308, E2194, E 1164, SAE J1545.

BYK - mac i ROBOTIC 7036

Comes complete with:

Multi-angle spectrophotometer, white calibration standard with certificate, cyan and effect checking reference, light protection cover, BYKWARE smart-process software, communication software, installation kit, operating manual on CD, carrying case, training.

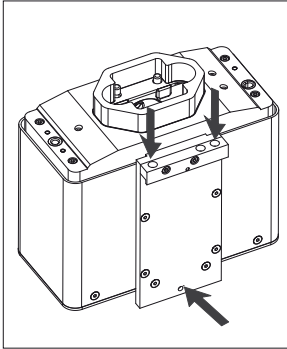
Accessories and spare parts

Light Protection Cover	6417
BYKWARE smart-process	4831
BYKWARE smart-lab	4862
Manual Measurement Adapter	281 021 621

3. Mounting and Manual Measurements

Before operating the instrument for the first time, please read the operating manual and take particular notice of the Safety Instructions.

3.1 Mounting of instrument



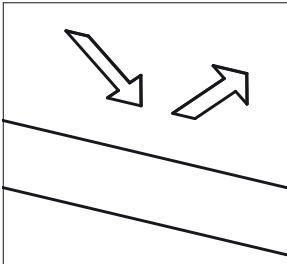
The measuring instrument is fixed on the mounting board with three screws (arrow).

The millings on the fixing bar and a nib ensure proper attachment.

A drawing, that contains all dimensions for producing the mounting board, is enclosed with each instrument. The drawing also describes the measurement plane.

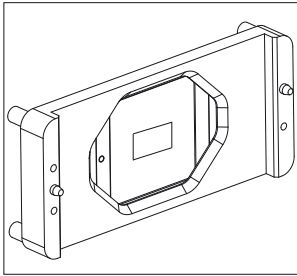
In order to be able to do the fine positioning of the instrument, a prepositioning to $< \pm 2$ mm distance to the measurement plane is necessary.

The 4 pins measure the distance to the surface and pass this value as well as the tilting and transverse angle on to the robotic control.



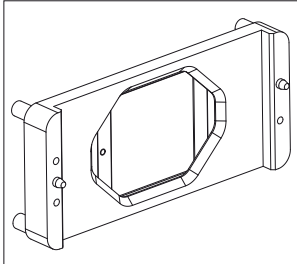
Attention must be paid to the measurement direction (see illumination direction on instrument housing).

3.2 Mounting of standards



The instrument is supplied with a white calibration standard and a cyan and effect checking reference. The standards are to be installed perpendicularly in order to avoid getting dirty. Please make sure that the four round rubber-bonded metal attachments are in place on the backside. These attachments provide the necessary elasticity when putting the instrument on the standards.

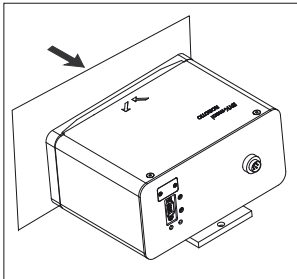
White standard



The drilling scheme for the attachment of the standards, as well as the alignment between instrument and standard are explained on a drawing which is supplied with the instrument.

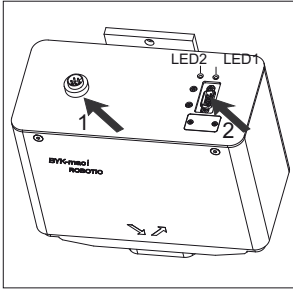
Cyan and effect reference

3.3 Manual measurement



In order to perform a manual measurement e.g. on a master panel, the manual measurement adapter (optional) has to be installed on the instrument to guarantee the correct measurement plane. Put the panel on the adapter and press it slightly until the panel is aligned flat.

4 Power supply



The instrument is supplied by an external AC power adapter.

Power supply and data transmission are combined in a 9-pole sub D plug.

In order to connect the measuring instrument, first check the wiring and the matching of the power supply.

Then plug in the emergency stop plug (1).

Subsequently plug in the sub D plug (2), and switch on power.

The light-emitting-diode LED1 signals the connected power supply.

The light-emitting-diode LED2 is green during the measurement.

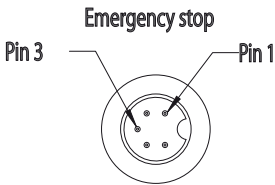
If an error occurs during measurement, it is signalled by a red blinking light-emitting-diode LED2.

5 Emergency stop

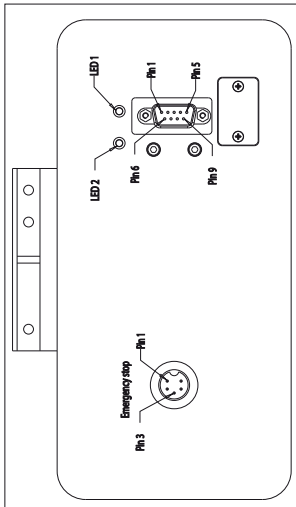
The instrument is equipped with an emergency stop system.

To ensure proper functionality it is important that the bottom plate of the instrument is pressed in not more than 9 mm from the zero position.

If during a malfunctioning the instrument is pressed too strongly against the surface, the instrument recognizes this and cuts off the robot.



- Pin 1: Common
- Pin 2: NO (normally open)
- Pin 3: NC (normally closed)

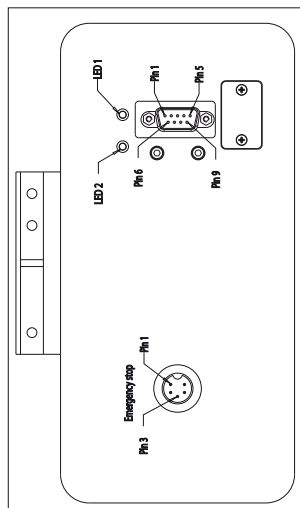
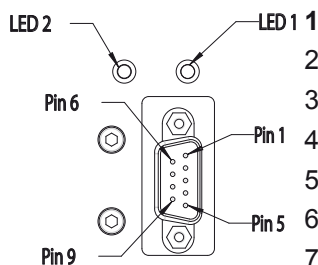


6 Interface

Power Supply and Communication

Robotic	PC or
SUBD9pin	RS422
Male	Converter

Pin	Signal	Signal
1	RxD+ (B)	TxD+ (B)
2	RxD- (A)	TxD- (A)
3	TxD+ (B)	RxD+ (B)
4	TxD- (A)	RxD- (A)
5	GND [*]	GND [*]
6	U_in	
7	GND	
8	U_in	
9	GND	



[*] optional:

U_in at Pin 6,8 and GND at Pin 7,9 for power supply.

Cable:

8 wires, 4 twisted-pairs; 0,20mm²

RxD+ ; RxD- und TxD+ ; TxD- and two pairs for U_in ; GND

e.g. LifYCY (4*2)*0.20 (e.g. <http://www.metrofunk.de/>)

Power Supply:

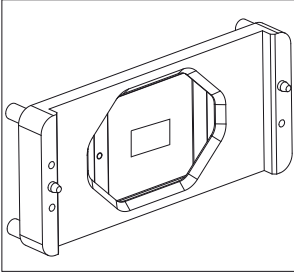
Input: 24V $\overline{=}$; max. 0.5A



Attention: Please pay attention to tension and pin assignment precisely. The instrument can be damaged without functional connection. No product liability and guarantee claims can be put forward if the instrument is not properly power supplied.

7 Calibrating the instrument

7.1 Calibration Information

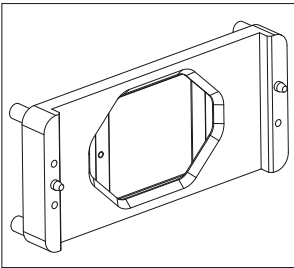


White standard

Standards

The instrument is supplied with a white calibration standard and a cyan and effect checking reference. Black calibration is done internally by the instrument.

Mount the test tiles at the position intended for the instrument test.



Cyan and effect reference

Cyan and effect check are recommended to be done every day.

White calibration must be accomplished at least every month.

During the white calibration it must be ensured that the bottom plate is pressed in for 4.5 ± 1 mm from the zero position. This guarantees that the standard is aligned flat and the pins are calibrated properly, i.e. a proper positioning in the measurement plane is ensured.

To ensure a precise instrument test, only original checking standards from the manufacturer should be used. Their surface must not be touched and must be protected against scratches. Due to environmental influences, however, the values of checking standards can change over time even if they are handled gently. For this reason, they should be checked by the manufacturer at regular intervals (annual checks are recommended).

7.2 Calibration Notes

- The standards should be cleaned periodically. For cleaning procedure see section "Cleaning and Maintenance". Please make sure that the standards are not scratched.
- Do not move the instrument while taking a calibration measurement. If motion is detected, an error message will be displayed and calibration is aborted.
- When moving from cold to warm environment, there is a danger of condensation. For this reason, you should wait for an appropriate amount of time to allow the optical components to adjust before calibrating and using the unit.

8 Standards

DIN 5033	Colorimetry; basic concepts.
DIN 5036	Radiometric and photometric properties of materials; definitions characteristic.
DIN 6174	Colorimetric evaluation of colour differences of surface colours according to the CIELAB formula.
DIN 6175-2	Tolerances for automotive paints Part 2: Goniochromatic paints
DIN EN ISO 11664	Colorimetry
ISO 7724	Paints and varnishes - Colorimetry
ASTM D 2244	Standard Test Method for Calculation of Color Differences From Instrumentally Measured Color Coordinates.
ASTM E 308	Standard Practice for Computing the Colors of Objects by Using the CIE System.
ASTM E 1164	Standard Practice for Obtaining Spectrophotometric Data for Object-Color Evaluation.
ASTM E 2194	Standard Practice for Multiangle Color Measurement of Metal Flake Pigmented Materials
SAE J 1545	Instrumental Color Difference Measurement for Exterior Finishes, Textiles and Colored Trim

9 Technical Data

Color

Measuring Geometry	Illumination 45°, -15°, 15°, 25°, 45°, 75°, 110° aspecular viewing
Measuring Area	87 x 23 mm
Spectral Range	400 - 700 nm, 10 nm resolution
Measurement Range	0 to 600 % reflectance
Repeatability	0.01 dE* 10 consecutive readings on white tile
Reproducibility	Grey BCRA tiles: avg. dE* < 0.10 Chromatic BCRA tiles: avg. dE* < 0.25
Color Scales	dE*; dE CMC; dE 94; dE 2000; dE 99; dE DIN 6175 and customer specific scales
Index	Flop; Int-Em
Illuminants	A; C; D50; D65; F2; F7; F11; F12
Observer	2°; 10°

Effect	
Measurement Geometry	15°, 45°, 75° and diffused illumination perpendicular viewing
Effect Parameters	dS; dS_a; dS_i; dG
Repeatability	S_a / S_i: 5% or > 0.50 / G = ± 0.05
Reproducibility	S_a / S_i: 10% or > 1.00 / G = ±0.15
Object Curvature	Radius > 400 mm
Measuring Time	< 6 seconds
Memory	1000 Standards/Samples
Language	English, German, French, Italian, Spanish
External Power Supply	24V --- ; max. 0.5A
Interface	RS 422
Robotic Requirements	Vibration-free operation
Operating Temperature	10 to 42 °C (50 to 110 °F)
Relative Humidity	up to 85%, 35 °C (95 °F) non-condensing
Dimensions	21 x 12.5 x 17.5 cm (8.3 x 5 x 6.9 in.)
Weight	approx. 3.5 kg (7.7 lbs)

10 Cleaning and Maintenance



- Before cleaning, the instrument and accessories must be disconnected from the power supply as described in the safety instructions.



- Do not insert any objects into the measurement aperture for cleaning. The instrument could get damaged.



- **Do not use any acetone for cleaning the unit!** The instrument housing is resistant to a number of solvents, but cannot be guaranteed to withstand all chemicals. You should therefore use a soft, moist cloth for cleaning. For cleaning excessive dirt, use ethanol or cleaning alcohol.



- Do not attempt to make any repairs yourself! If a malfunction occurs on your measuring device, our Customer Service department will be happy to help you as quickly as possible.

10.1 Cleaning standards



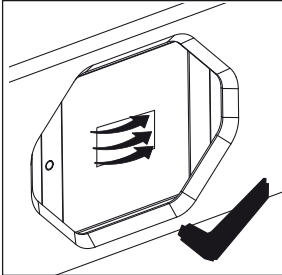
Do not use any acetone!

The accuracy of the measurement can be significantly impacted by using dirty or damaged standards.

Since the surfaces of the standards are highly sensitive, cleaning must be undertaken with great care.

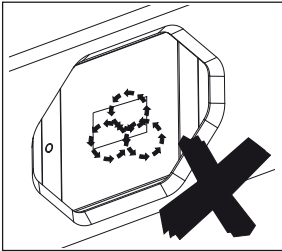
To clean standards, use a new lint-free cloth, dust-free lens paper or an optical cloth.

Apply only slight pressure as you clean and make certain there are no large particles stuck in the cloth that could damage the surface.



The best cleaning results are achieved when moving the optical cloth from left to right, not wiping.

For dirt that is difficult to remove, use an optical cloth dipped in liquid (e.g. propanol). Wipe the tile in one pass several times and wipe it again with a dry cloth after the propanol has been evaporated.



It is highly recommended to handle the standards with great care. They should always be stored enclosed.

10.2 Light protection cover

The measurement aperture of the instrument is surrounded by a light protection cover made out of rubber. It acts as a protection against ambient light. Keep the cover always clean and exchange it when being dirty or damaged.

11 Service and Certification

Service

Besides the repair of your instrument we offer the following additional services:

First diagnosis on the telephone or by e-mail

Call us or send us an e-mail and we will try to solve your problem. If this is not successful, please send us the instrument for repair.

Preventive maintenance, calibration and recertification

For precautionary reasons we recommend regular preventive maintenance. We carry out this preventive maintenance automatically when you send us your instrument for maintenance and recertification. We clean the optics, check all functions, test and, if required, adjust the measured values by using reference standards. You will receive a certificate, which includes the retraceability to international standards.

Loaners

During the period of repair we furnish you with a loaner on request and availability.

Maintenance agreement

In case you want to make sure that the necessary maintenance is being done on a regular basis and on time, we recommend a maintenance agreement.

Extended warranty contracts

Furthermore, you can request an extended warranty contract for additional 12 months.

Ordering information:

107207036 Preventive Maintenance BYK-mac i ROBOTIC

107307036 Extended warranty BYK-mac i ROBOTIC

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12 Copyright

This instruction manual is an important part of this instrument. It contains essential information about setting up, placing in service and use. If you pass the device on to another user, please ensure that the instruction manual is included with the instrument. The manual must be studied carefully before working with the equipment. Please contact your regional service office if you have any questions or require additional information about the device.

The technology and fittings are based on state-of-the art optic and electronic technology. New developments and innovations are constantly being integrated into the equipment. Thus, the diagrams, dimensions, and technical data used in this manual may have changed as a result of adapting the device to new information and improvements.

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BYK-Gardner GmbH offers no guarantee that the software will function without error or that the functions incorporated therein can be executed in all applications and combinations selected by you.

No liability other than as provided by law is assumed for direct or indirect damage sustained in association with the use of the instrument, the software or documentation.

BYK-Gardner GmbH reserves the right to update the software and written documentation without prior notice.

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