SPECTROstar *Nano*

Operating Manual

Revision C

The SPECTROstar Nano is an absorbance microplate and cuvette reader that performs a wide variety of applications for full spectrum absorbance. The SPECTROstar Nano has high-end performance in all plate and cuvette formats. By using proprietary technology in a variety of important parts, the SPECTROstar Nano delivers high-end results.

SPECTROstar *Nano*

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This manual was designed to guide the SPECTROstar Nano user through the basic hardware features of this microplate reader instrument.

Although these instructions were carefully written and checked, we cannot accept responsibility for problems encountered when using this manual. Suggestions for improving this manual will be gratefully accepted.

BMG LABTECH reserves the right to change or update this manual at any time. The revision number is stated at the bottom of every page.

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TABLE OF CONTENTS

1   Technical Specifications

Detection Mode   - UV/Vis Absorbance Spectra

Measurement Modes   - Endpoint and Kinetic measurements
                                - Well Scanning

Microplate Formats   - 6 to 1536-well plates, user definable

Microplate Carrier   - Auto lock microplate carrier
                                - Robot compatible
                                - All microplate formats up to 1536-well
                                  Microplates should adhere to the SBS specification and non-SBS
                                  formats should fit: (l x w x h) (mm) max: 128x86x20; min: length 124

Cuvette Port   - Cuvette port for cuvettes with 10 mm path length
                                - Micro cuvettes, Traycell compatible
                                - Beam height 8,5 mm

Light Source   - High energy xenon flash lamp

Detector   - Spectrometer with CCD

Spectral Range   - 220 - 1000 nm for ABS (Absorbance Spectrometer)

Sensitivity   - ABS with Spectrometer Selectable
                                  Spectral resolution: 1 nm, 2 nm, 5 nm, 10 nm
                                  OD range: 0 – 4 OD
                                  Accuracy: < 1% at 2 OD
                                  Precision: < 0.5% at 1 OD and < 0.8% at 2 OD

Read Times   - Full spectrum from 220 to 1000 nm in less than 1 sec/well

Shaking   - Linear, orbital, and double-orbital with user-definable time and
                                  speed

Incubation   +3°C above ambient up to 45°C for microplate and cuvette

Software   - Multi-user Reader Control and MARS Data Analysis Software
                                  included

Computer interface   - USB 2.0, compatible to USB 1.1

Power requirements   - External Power Supply: Type: XP Power AEF120PS24
                                - Input Voltage: 100 or 115 or 230 V, 50/60 Hz, auto ranging
                                - Output Voltage: 24V DC / 5A

Power consumption	- Standby 0 W (<0,5W) - Idle Mode 5 W - Measuring 15 W - Maximum 60 W
Ambient conditions	- Operating temperature: 15°C to 35°C - Storage temperature: -10°C to 50°C - Humidity of atmosphere: 20 % to 80 % - Non-condensing environment
Instrument conformity	- Over voltage category II; - Contamination class II - Protection class III
Dimensions	- Width: 36 cm, depth: 50 cm, height: 16 cm - Weight: 11 kg
Options	- Gas Vent: system to inject an atmosphere or to pull a vacuum into the reader - External manual barcode reader - 1536 well format - LVis Plate: microplate for low volume (2 µL) absorbance measurements and instrument performance testing

Limit of detection was calculated according to the IUPAC standard: $3(SD_{blank})$/slope.
Specifications are subject to change without notice.

2   Safety Information

2.1   Description of warnings

The warning signs used throughout this manual adhere to the description set forth in DIN 4844-2.

A general warning calls attention to a condition which is further described and must be strictly followed by the operator

Warning for optical radiation

2.2   General Information

This instrument must be installed and used as lined out in this Operating Manual. Installation, service and any operation which requires opening the instrument must be performed only by trained and certified personnel from BMG LABTECH. Failure to comply with these instructions will impair or even invalidate the warranty and can lead to unsafe operation of this equipment

The area designated for the instrument should be free of dust, liquids and acidic vapour. The surface of the table should be flat and even. Avoid areas subject to vibrations and direct sunlight

Prior to turning the instrument on the first time let the instrument adapt to room temperature for at least 3 h to avoid condensation causing a short circuit.
BMG LABTECH will void the warranty if damage occurs to electrical and/or mechanical parts in case the instrument was turned on before the recommended accommodation time

Handling and operation of the equipment must be carried out only by qualified personnel and staff trained by an official BMG LABTECH representative

Samples and reagents, be it in solid, liquid, or gaseous form, must be removed from the instrument immediately after measurement to avoid corrosion and accumulation of hazardous substances inside the instrument

2.3 Environmental Safety Standards

The environmental safety standards for operation under norm IEC 61010-1 are met under the following conditions:

- Indoor use (adhere to the Occupational Exposure Limit Values for ECM, UPS, vibration, and sunlight when setting up the instrument in the laboratory)

- Altitude (up to 2000 m)

- Temperature (+15°C to +35°C)

- Relative Humidity (Maximum 80% at 31°C non condensing then decreasing linearly to 50% at 40°C)

- Mains supply voltage fluctuation (+/- 10%)

- Overvoltage category (II) acc. to IEC 60364-4-443

- Pollution degree (2) acc. to IEC 61010-1

2.4 Electrical Safety

- Connect the unit only to an earthed supply socket. The instrument is class 3 construction and must be earthed.

- Connect the unit only to a power supply with a designated voltage rating corresponding to the label on the back of the instrument.

Xenon high power flashlamp – emits ultraviolet light during operation at levels that could injure the eye. Thus avoid looking at the light directly. During normal operation the user will not encounter any light from the xenon flash lamp

2.5 Chemical and Biological Safety

Daily routine with this instrument may involve the handling and use of compounds that are toxic, flammable, or biologically harmful. When working with materials and compounds as stated, make sure to observe the following precautions:

- Handle all samples, be it liquid, solid, or in gaseous form according to good laboratory practice.

- Adhere to the maximum workplace concentration (MAC) and to laboratory safety regulations (e.g. BGI 850-0, formerly BGR120 in Germany).

- Wear safety goggles since spilling of liquids may occur.

- Contact your safety officer to dispose of hazardous waste solutions and when working with flammable liquids.

Gas vent connection – for the standard gas purge vent use a regulator followed by a flow restrictor to set the flow rate. The instrument should be housed in an atmospheric gas tight bag (e.g. Aldrich® AtmosBag, Z530220-1E) to prevent spillage of gas

Use only mild detergent or 70% ethanol for cleaning the instrument. Make sure the instrument is always in the OFF position for cleaning and servicing

2.6 Cleaning and Instrument Disinfection

Please follow all instructions carefully for a successful disinfection of this instrument.

All parts of the instrument, which have the possibility of contacting patient sera or positive samples, have to be handled as if they are hazardous. For this reason, it is recommended that gloves be worn while maintaining or working with the instrument.

It is very important that the instrument is thoroughly disinfected before maintenance or before removing the instrument from the laboratory. Be sure that the instrument is disinfected before you send it to your distributor or to the manufacturer. For safety reasons, you have to fill out the Disinfection Certificate, or the instrument may not be accepted by the service center or by customs authorities.

Use suitable disinfectants, e.g. Alcohol (70%).

Authorized personnel wearing disposable gloves and protective clothing should only perform the disinfection procedure. The location should be well ventilated.

Disinfection Steps

1. Disconnect the instrument from the main power supply.

2. Remove the USB cable from the connector.

3. Clean all outside surfaces of the instrument carefully with cotton wool, which has been soaked in disinfecting solution.

4. Place the instrument in a large plastic bag along with the cotton wool that has been soaked in disinfecting solution. Ensure that the wool does not touch the instrument.

5. Close and seal the bag.

6. Keep the instrument in the plastic bag for at least 24 hours.

7. After the disinfection time has lapsed, remove the instrument from the plastic bag and clean all outside surfaces of the instrument with cotton wool that has been soaked in alcohol solution.

8. Repeat the procedure for disinfection on any accessories, which will be returned with the instrument.

9. Complete the Disinfection Certificate.

Disinfection Certification

This instrument and its inventory have never been in contact with any dangerous biological material, or if so, the instrument and its inventory have been disinfected according to the instructions given in the Operating Manual.

Name: _____

Firm:

_____

_____

_____

_____

Date, Signature: _____

2.7 Disposal and Instrument Takeback / Recycling Program

We strongly recommend storing the transport box in case you need to ship the instrument back for upgrade or repair. In case of disposing the unit please adhere to these guidelines:

2.7.1 Disposal of Transport Packing

Straps to fix the packing on pallet, edge protection, air cushion styrofoam, and plastic foil must be disposed of and recycled according to your local "plastic recycling" policy.
Transport cardboard box must be disposed of and recycled according to your local "paper recycling" policy.

2.7.2 WEEE Compliance

The European Union Waste Electrical and Electronic Equipment Directive (WEEE) is a Producer Responsibility Directive aimed at reducing the waste from electrical equipment, increasing recovery and recycling rates of WEEE and improving environmental performance of all operators involved in the life cycle of electrical and electronic equipment.

The directive specifies that, as of August 13, 2005, manufacturers of specified electronic equipment will be obliged to take back these products at the end of their useful life.

BMG LABTECH will comply with the WEEE take back requirements for BMG LABTECH branded product sold in the EU after August 13, 2005.

BMG LABTECH customers based in Europe can take advantage of the BMG LABTECH Takeback and Recycle Program. Please check BMG LABTECH's website for country-specific availability.

This Takeback and Recycle Program ensures that you can ship the product back to BMG LABTCH for proper handling at the end of its useful life. Disposal will be carried out in an environmentally safe manner using processes that comply with all current eWaste regulations where applicable.

Upon completion of the recycling process BMG LABTECH will provide, on request, a Certificate of Destruction (COD). This will release your business from any further liability for the equipment.

The program is accessible via the web
at www.bmglabtech.com/support/countryselect.cfm?page=support.cfm

3   Overview

3.1   Front and Keypad Control of SPECTROstar Nano

The front of the SPECTROstar Nano is divided into three sections: the Microplate Carrier, the Cuvette Port, and the Keypad Control (figure 1). Each section is described below.
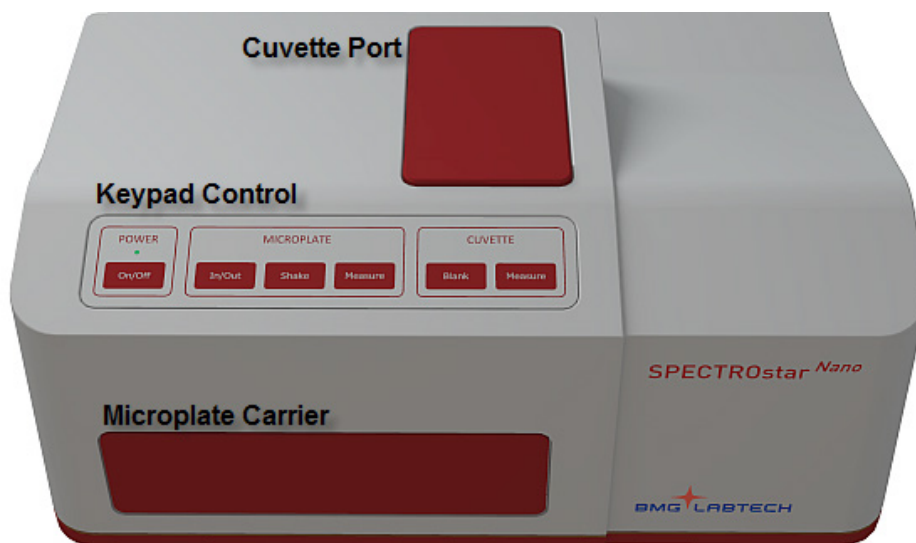

Figure 1: Front view of SPECTROstar Nano

3.1.1   Microplate Carrier

The Microplate Carrier is designed for standard SBS microtitre plates from 6 – 1536 well format as well as for BMG LABTECH´s LVis Plate (for low volume measurements down to 2 µL and for instrument performance testing).

3.1.2   Cuvette Port

The SPECTROstar Nano comes with an integrated cuvette port for standard cuvettes with 10 mm path length, for micro cuvettes, and is also compatible with low volume cuvettes such as the Traycell.
Open the cuvette port by briefly pressing on the lever of the lid. The door opens automatically and shows the cuvette port. An arrow inside the cuvette port displays the direction of the light path. Hence a cuvette must be placed so the light can pass through (figure 2.). Close the cuvette port by pressing on the lid until it resides flat.
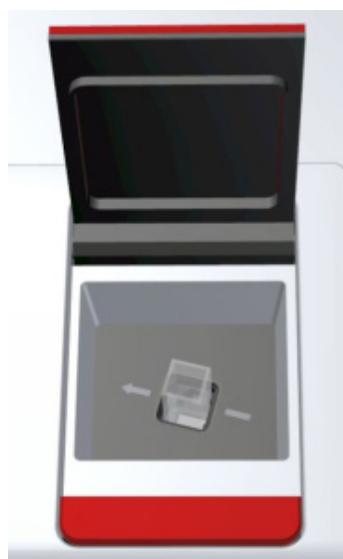

Figure 2: The SPECTROstar Nano Cuvette Port

3.1.3 Keypad Control

The Keypad Control of the SPECTROstar Nano consists of easy single push button operated pad controls for the basic operation of the instrument (figure 3). Each button and its function are described below:
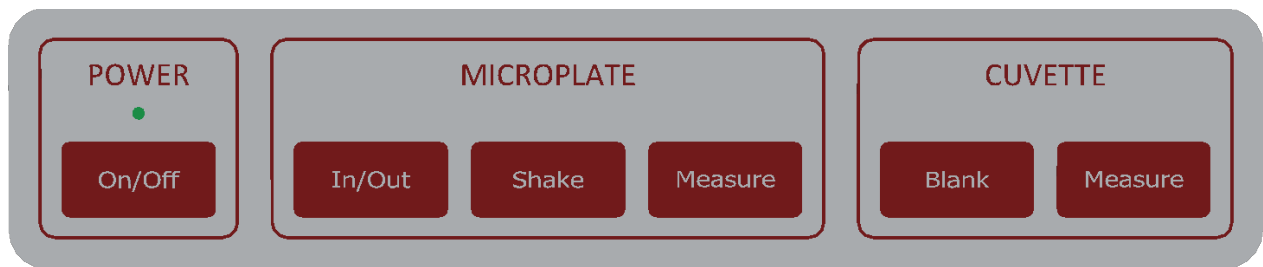

Figure 3: The SPECTROstar Nano Keypad Control

- POWER On/Off
  - Reader is OFF
    - ➢ Short click: reader will be switched On
  - Reader is ON
    - ➢ Double click: reader will be initialized (e.g. after error)
    - ➢ Long click: reader will be switched Off
  - LED Status
    - ➢ LED On green: reader is switched On and in standby
    - ➢ LED flashing green: reader is busy, e.g. measurement operation
    - ➢ LED flashing red: reader error has occurred

- MICROPLATE In/Out
  - Reader is in standby
    - ➢ Short click: microplate carrier will move In/Out
    - ➢ Long click (≥ 3 sec): microplate carrier will move to transport lock position

- MICROPLATE Shake
  - ➢ First short click: pre-set 10 sec shaking (700 RPM, orbital), user definable
  - ➢ Second short click (while running): shaking will stop
  - ➢ Long click: shaking will be performed as long as button is pressed

- MICROPLATE Measure
  - ➢ Short click: starts test protocol which is assigned to the Re-Run button in the reader Control Software
  - ➢ Double click (while running): test protocol will be stopped

- CUVETTE Blank
  - ➢ Short click: starts cuvette measurement (0/100% absorbance values)

- CUVETTE Measure
  - ➢ Short click: starts cuvette measurement which is assigned to the Cuvette Measure button in the reader Control Software
  - ➢ Double click (while running): cuvette measurement will be stopped

3.2 Back of SPECTROstar Nano

The backside of the SPECTROstar Nano depicts the power connector, the USB connection to a PC, and the gas purge vent to control the atmosphere inside the instrument (figure 4).
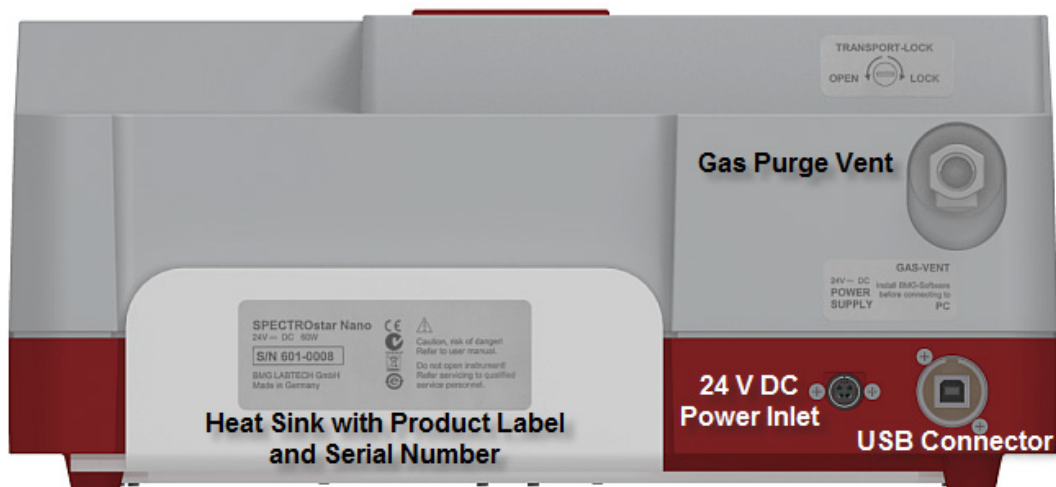

Figure 4: Backside view of SPECTROstar Nano

4 Unpacking and Installation

This chapter includes the initial important points that must be followed before a measurement can be performed. Please follow these steps.

When unpacking the instrument check to ensure that all parts are included.
The shipping box should contain:

SPECTROstar Nano instrument

- Control and MARS Data Analysis software (CD ROM in a cover inside the manual)
- Manual (also on CD ROM)
- Power cord + External Power Supply
- USB cable
- Slotted 5,5 mm screwdriver

Call BMG LABTECH immediately if any of these items are missing.

The area designated for the instrument should be free of dust, liquids and acidic vapours. The table's surface should be flat and even. Avoid areas subject to vibrations and direct sunlight. Behind the instrument there should be a minimum distance of 10 cm.

⚠️ **The operator of the SPECTROstar Nano microplate reader is assumed to be trained in the correct operation of the instrument and the safety issues. Throughout this manual the word "you" refers to this trained operator**

⚠️ **Upon unpacking and positioning the reader, make sure to unlock the transport lock before any power connection**

4.1 Transport Lock

When the SPECTROstar Nano microplate reader is shipped, the transport lock for the plate carrier is in the locked position and must be unlocked prior to using the instrument. Once the instrument is placed at its designated lab bench position unlock the plate carrier.

If the SPECTROstar Nano has to be moved or shipped to another location, it is very important to lock and secure the transport lock in order to avoid damage to the microplate carrier system

Unlocking the Plate Carrier

The transport pin that locks the plate carrier can be accessed from the top of the instrument. Locate the silver screw located next to the label "Transport Lock" (figure 5). Use the supplied 5,5 mm slotted screwdriver and unlock the pin by turning the screw counter clockwise. The plate carrier is unlocked if the screw moves freely up and down. Once the SPECTROstar Nano has been turned on, press the In/Out button (figure 10) briefly and the plate carrier should move out.
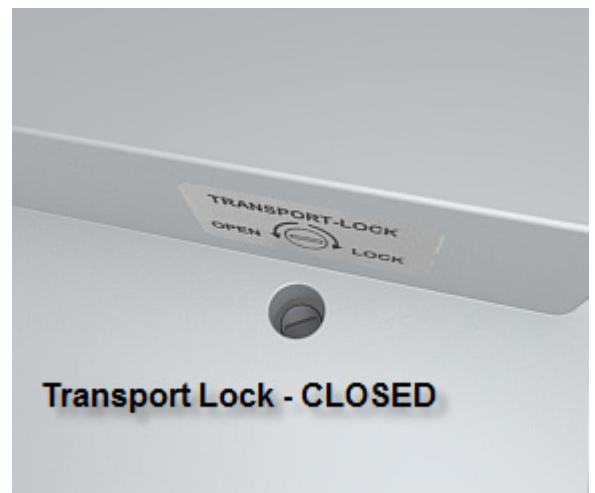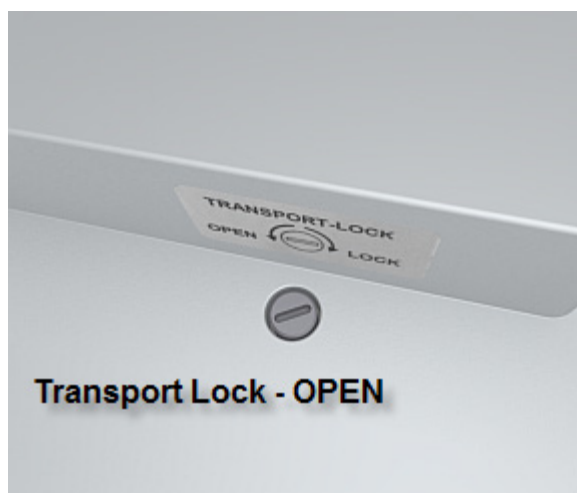

Figure 5: Transport Lock position

Locking the Plate Carrier

Upon closing the Control Software or pushing the plate carrier In/Out button for more than three seconds (figure 10), the plate carrier will move into the respective lock position. Slowly and carefully push the screw down with the slotted 5,5 mm screwdriver and turn it clockwise to fasten and to lock the plate carrier. The screw has to be tight and must not be moving as it was in the unlocked position.

4.2   Software Installation

The Control and MARS Data Analysis software must be installed first on the PC/laptop before connecting the SPECTROstar Nano.

Insert the supplied CD-ROM for the SPECTROstar Nano and follow the instructions for both installing the Reader Control and MARS Data Analysis software.

4.3   Power and Communication Connections

Connect the supplied 24 V / 5 A power supply to the SPECTROstar first before connecting the other end to the mains power outlet.

Connect the supplied USB cable to the USB connector located at the backside of the SPECTROstar Nano.

Connect the other end of the USB cable to a standard USB port of a PC/laptop.

Switch on the SPECTROstar Nano by briefly pushing the "Power On" button and power up the PC/laptop. The Power LED shows a steady green light, indicating that the SPECTROstar Nano is now turned On and in standby.

Double click the SPECTROstar Nano icon. A window will appear and upon clicking "Run" for the standard "user" the Control Software will automatically recognize the SPECTROstar Nano and will establish a connection.

You can verify the connection by going into the "Settings" menu and perform a "Connection" manually.

Once the SPECTROstar Nano has been connected, it is not necessary anymore to power on the instrument before starting the Control Software. The reader will be switched On by simply starting the Control Software.

5   General Warnings for Operation

Do not obstruct the heat sink with any objects and avoid placing thermal sources (e.g. external power supply) near the heat sink

Connect only the supplied DC power supply to the SPECTROstar Nano. Keep the DC power supply at a dry, cool, and protected location

Never open the plate carrier door while measuring