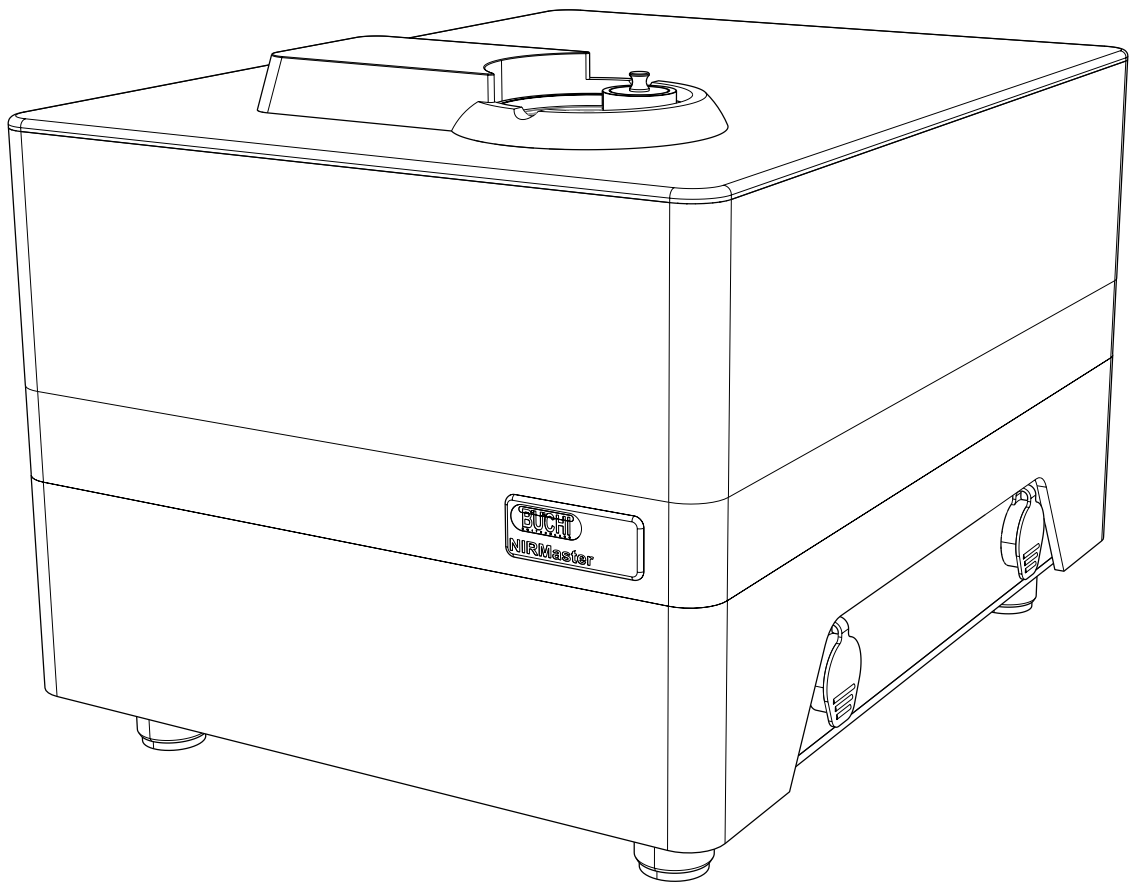




NIRMaster

Technical data sheet

The NIRMaster™ is the at-line version of BUCHI's proven FT-NIR spectrometer. Its hygienic clean design satisfies the needs of the food and feed industry especially in the production environment where rugged and protected standalone equipment is required.



Scope of delivery

Different working environments demand different types of instrument protection. To supply a FT-NIR spectrometer which suits your needs, BUCHI offers the NIRMaster in three models including a stainless steel and a food-grade PMMA housing version with ingress protection.

	NIRMaster	NIRMaster Pro	NIRMaster Pro IP65
NIRMaster	●	●	●
Embedded PC	●	●	●
Easy-Spin Drive	●	●	●
XL add-on	●	●	●
External reference	●	●	●
NIRWare Basic Software	●	●	●
Quick-Start Calibrations preloaded*	●	●	●
Hardware manual	●	●	●
Housing		●	●
Food grade PMMA IP54	●		
Stainless steel IP54		●	
Stainless steel IP65			●

*For routine use of BUCHI Quick Start calibrations, additional licenses are required

Order code

For assistance in choosing the right package, please contact your local BUCHI representative.

1	1	0	5	7	0	0	0	NIRMaster
1	1	0	5	7	1	0	1	NIRMaster Pro
1	1	0	5	8	8	1	5	NIRMaster Pro IP65

Contact us for any other applications

Technical data

NIRMaster - all configurations

Dimensions (W x D x H)	360 x 420 x 540 mm
Weight	Approx 43 kg (NIRMaster and NIRMaster Performance Certified) and 49 kg (NIRMaster Pro and NIRMaster Pro IP65)
Spectral range	800 – 2500 nm 12 500 – 4000 cm ⁻¹
Resolution	8 cm ⁻¹ (with boxcar apodization)
Type of interferometer	Polarisation interferometer with TeO ₂ wedges
Wavenumber accuracy	± 0.2 cm ⁻¹ at an ambient temperature of 25 °C ± 5 °C
Signal-to-noise ratio	10000 (peak-to-peak noise of a linear corrected baseline between 5600–6000 cm ⁻¹)
Number of scans/sec.	2 - 4
Illumination spot diameter	9 mm
Operating temperature	5-35°C
Relative humidity	< 80% for T < 31°C, linearly decreasing to 67% at 35 °C
Type of lamp/lifetime lamp (MTBF)	Tungsten halogen with the twin lamp safeguard module/ 12000 h (2 x 6000 h)
Type of laser	12 VDC HeNe, wavelength at 632.992 nm
Detector	Extended range InGaAs (temperature controlled)
Electric power supply	100 – 240 VAC ± 10%, 50/60 Hz, 150 W
Embedded PC	Intel Core 2 Duo
Housing materials	Food-grade PMMA or stainless steel
System protection	IP 54 or IP65
Internal reference	Gold plate
External reference	Spectralon®
Sample rotation	Easy-spin drive, a magnetic spinner is included for high performance measurement of inhomogeneous sample

Accessories

NIRMaster - all configurations

	Easy-Spin Magnetic spinner*	XL* glass spacer	Adapter plate for gold cell
Sample holding accessories			
Max. number of samples per sequence	1	1	1
Measurement based on diffuse reflection**	●	●	
Measurement based on transfectance**	●	●	●
Compatible with:			
Petri dishes	●		
High performance cup	●		
Unbreakable cup	●		
Small plastic bags		●	
High performance transfectance gold cell			●
Sample dimensions	100 mm	Adaptable	35 mm

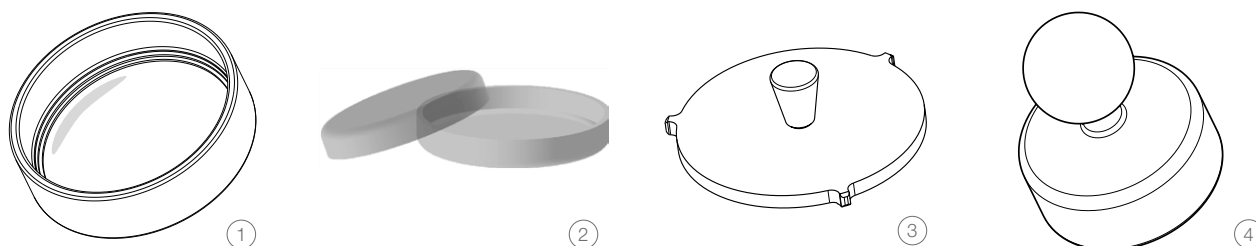
*Included in system as described in „Scope of Delivery“

**See section „Measurement modes and setup“

Articles	Details	Order code	Picture
Touchscreen IP65	19" touchscreen IP 65 protected. Resolution 1280 x 1024, DVI input.	11057815	
High Performance Sample Cup	Tightly specified glass for optimized signal reproducibility	46259	
Unbreakable Sample Cup	Silicone rubber rim and hardened glass for production environment	11055058	①
Set of 10 petri dishes	Schott cups made in optical glass for routine use	41583	②
Transflectance cover	For measuring liquid samples in transflectance with a thickness of 0.3 mm. Prescription to be used with code 46259.	41636	③
Transflectance cover for the unbreakable cup	For measuring liquid samples in transflectance with a thickness of 0.3 mm. Prescription to be used with code 11055058.	11055998	
Pressing Stamp	To compress and compact samples like ground meat or cheese. Stainless steel, approx. 1.8 kg.	11057584	④
High Performance Transflectance Gold Cell 0.3 mm	Transflectance cell for liquid samples measurement with 0.3 mm calibrated path-length. Adapter plate 11056793 included.	11056994	

Articles	Details	Order code	Picture
High Performance Transflectance Gold Cell 0.5 mm	Transflectance cell for liquid samples measurement with 0.5 mm calibrated path-length. Adapter plate 11056793 included.	11056995	
Adapter plate for gold cell	For both High Performance Transflectance Cells 11056994 or 11056994.	11056793	

Accessories pictures



Functional principle

The NIRMasteR is a benchtop Fourier Transformation Near Infrared spectrometer (FT-NIR) to identify and quantify analytes of interest. It generates an invisible near infrared interferogram beam which interacts with the molecules of a sample, generating a characteristic feedback. The feedback is picked up via a measurement cell by a detector and mathematically processed via Fourier transformation into a spectrum. This spectrum is characteristic for a given sample and allows identification as well as quantification of its components.

How the interferogram is generated

An interferogram is an interference pattern of phase-shifted beams. The NIRMasteR is a single-beam polarisation interferometer, generating its interferogram in four steps:

Step 1: Polarization of the light source output

The polarizer ② generates a well-defined polarization output of the undefined polarized light, emitted by the light source ①. Thus, only diagonally polarized light is transmitted.

Step 2: Beam splitting and orthogonal polarization

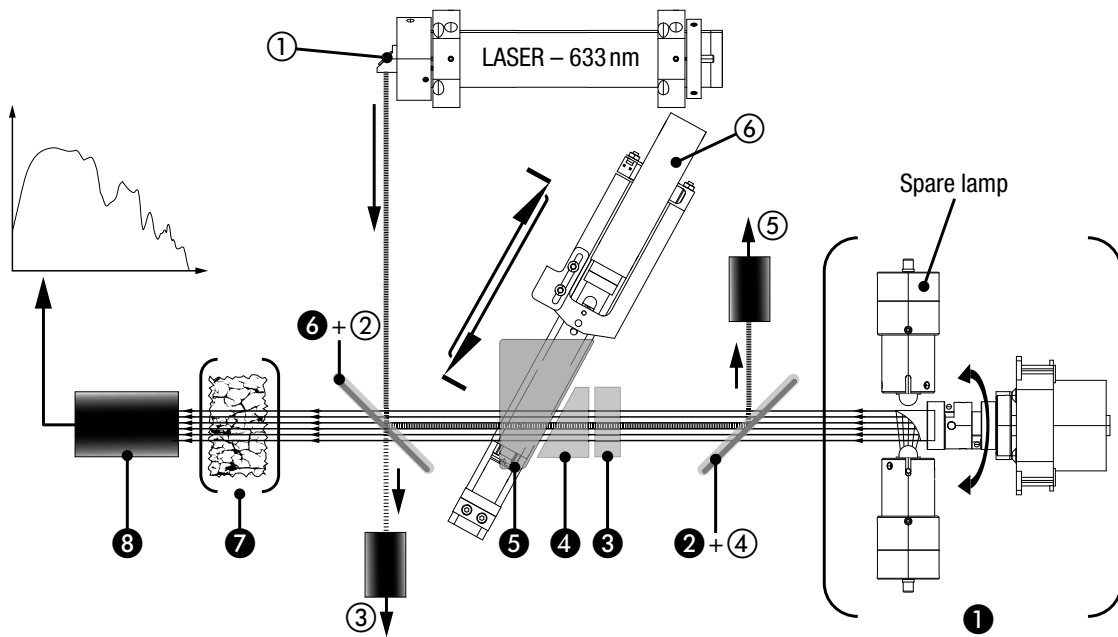
The polarized light enters a double refracting block (comparator) ③. Here, the light is broken down into two, orthogonally polarized components with a small, static phase shift.

Step 3: Generating the ongoing phase shift

An assembly of two double refracting wedges is arranged after the comparator. Wedge ④ is stationary, while wedge ⑤ is constantly shifted back and forwards by a fast linear-drive. The movement and the geometric arrangement provides a change of thickness in the light path. This leads to an ongoing phase shift between the light beams.

Step 4: Beam recombination and interferogram output

A second polarizer ⑥ converts the phase shifted beams into a single light output with intensity variation – the interferogram



Effective NIR light path

- ① NIR light source assembly with spare lamp and motorized parabolic reflector
- ② First polarizer
- ③ Comparator (double refracting block)
- ④ Stationary double refracting wedge
- ⑤ Moving double refracting wedge
- ⑥ Second polarizer
- ⑦ Sample
- ⑧ Interferogram detector

Reference laser signal path

- ① Laser output window
- ② Second polarizer (works as a beam splitter for the laser)
- ③ Laser output-power sensor
- ④ First polarizer
- ⑤ Laser feedback detector
- ⑥ Linear motor for wedge movement

Measurement modes and setups

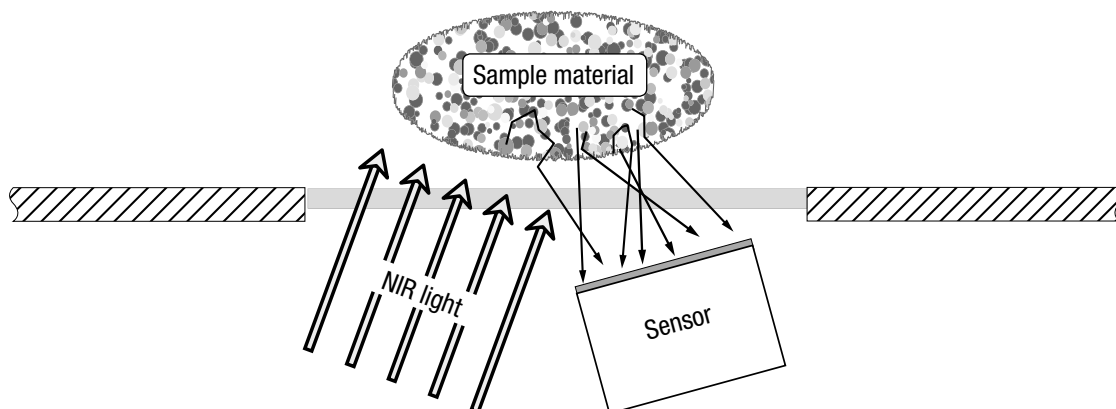
At the NIRMasteR, different measurement setups can easily be attached to the basic instrument to meet the individual sample requirements. To choose the best setup for a specific range of samples the optical properties of the sample material must be known.

Mode overview and application

Sample characteristics (for NIR light)	Measurement setup	Typical application
Diffuse reflection	Adequate sample cup	Predominantly non-translucent solids such as powders, pellets and cereals
Transflectance	Sample cup / petri dish+ matching transflectance cover	Liquids with weak diffuse reflection and medium transmission rate characteristics (e.g. transparent to opaque liquids or sludges)

Diffuse reflection

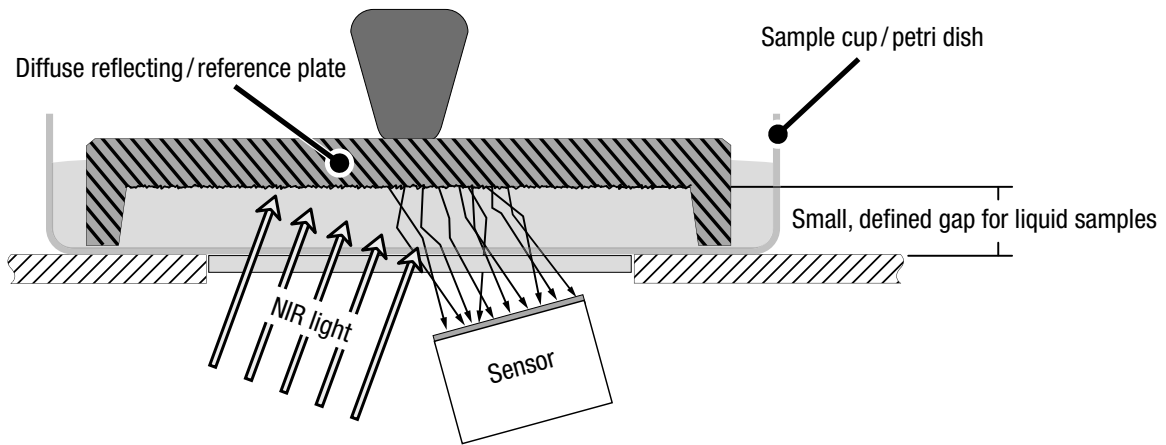
Most non-translucent materials (e.g. solids such as powders, pellets and cereals) can be analyzed via diffuse reflection. The NIR light penetration is limited by the sample material. It interacts with the sample, is refracted and diffusely reflected into the sensor. The reflected rays contain the spectral information of the sample.



The samples should either be measured at a constant temperature or the temperature influences must be considered during calibration. Coarse grained samples should be milled before carrying out the measurement. Recommended number of scans for a quantitative calibration: 16 - 32; granules: 64.

Transflectance mode

Translucent and opaque liquids can be analyzed via transflectance mode. The light penetrates the liquid, is diffusely reflected by the reference plate and passes the sample a second time. The transflected rays contain the spectral information of the sample.



The samples should either be measured at a constant temperature or the temperature influences must be considered during calibration. Recommended number of scan for quantitative calibration: 16–32 Most liquid sample materials can be constantly analyzed with the help of a flow-cell adapter available on demand.