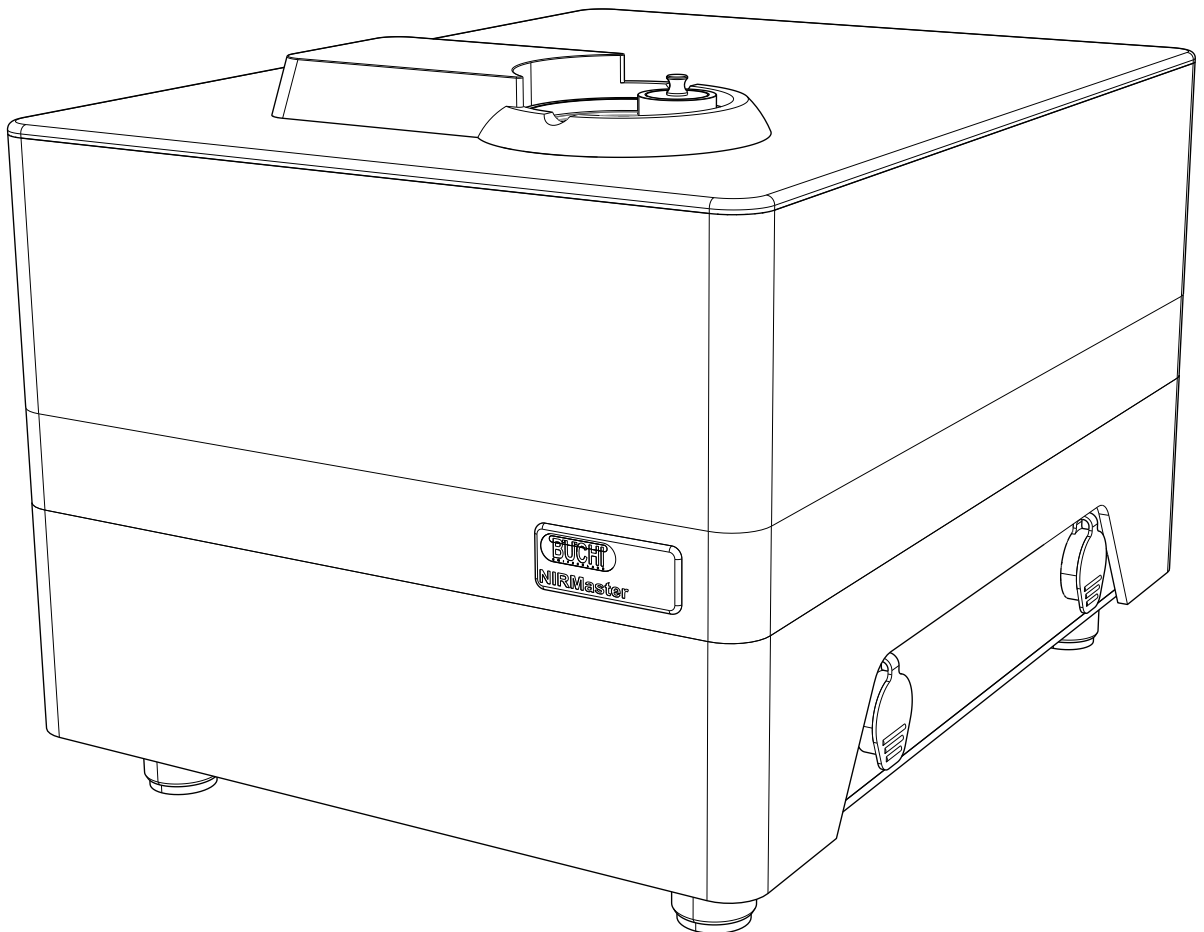




## NIRMaster™ Essential

### Technical data sheet

The NIRMaster™ Essential 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 stand-alone equipment is required. The NIRMaster™ Essential is designed to be controlled by a separate instrument PC.



## Scope of delivery

|                        | NIRMaster™ Essential |
|------------------------|----------------------|
| NIRMaster™ Essential   | •                    |
| Easy-Spin Drive        | •                    |
| XL add-on              | •                    |
| External reference     | •                    |
| NIRWare Basic Software | •                    |
| Hardware manual        | •                    |
| Food grade PMMA IP54   | •                    |

## Order code

**1 1 0 7 1 1 9 0** NIRMaster™ Essential

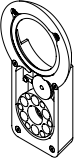
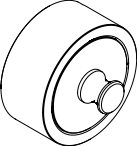
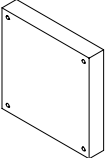


## Technical data

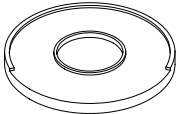
### NIRMaster™ Essential

| Specification  | NIRMaster™ Essential  |
|--|---|
| Dimensions (W x D x H)   | 420 x 560 x 360 mm  |
| Weight   | 43 kg   |
| Minimum clearance on all sides                                   | 150 mm  |
| Connection voltage   | 100 – 240 VAC ± 10 %  |
| Frequency  | 50 / 60 Hz  |
| Power consumption  | 150 W   |
| IP Code  | 54  |
| Internal fuse  | 4A / 240V   |
| Type of interferometer   | Polarisation interferometer with TeO <sub>2</sub> wedges  |
| Spectral range   | 800 – 2500 nm<br>12 500 – 4000 cm <sup>-1</sup>   |
| Resolution<br>(with boxcar apodization)                          | 8 cm <sup>-1</sup>  |
| Wavenumber accuracy<br>(at an ambient temperature of 25°C ± 5°C) | ± 0.2 cm <sup>-1</sup>  |
| Signal-to-noise ratio  | 10000<br>(peak-to-peak noise of a linear corrected base-line between 5600–6000 cm <sup>-1</sup> ) |
| Number of scans/sec.   | 2 - 4   |
| Illumination spot diameter                                       | 9 mm  |
| Analog digital converter   | 24 bit  |
| Lamp type  | Tungsten-halogen  |

| Specification       | NIRMaster™ Essential   |
|---------------------|--|
| Average life (lamp) | 6000 h   |
| Type of laser       | 12 VDC HeNe, wavelength at 632.992 nm  |
| Connection voltage  | 100 – 240 VAC ± 10 %   |
| Detector            | Extended range InGaAs (temperature controlled)   |
| Internal reference  | Gold plate   |
| External reference  | Spectralon®  |
| Sample rotation     | Easy-spin drive, a magnetic spinner is included for high performance measurement of inhomogeneous sample |

## Spare parts

|                                      | Order no. | Image   |
|--------------------------------------|-----------|---|
| Spinner                              | 11056771  |   |
| External reference                   | 11056371  |  |
| Outer filter holder with pads, 2 pcs | 11056672  |  |
| Set spare filter pads 10 pcs         | 11056773  |   |
| Inner filter pads, 10 pcs            | 11056917  |   |
| Ferrit sleeve 5 mm                   | 11056714  |  |
| Ferrit sleeve 6 mm                   | 11056715  |  |

|   | Order no. | Image   |
|---|-----------|---|
| Housing-key   | 11056766  |    |
| Plug bushing 3-6mm 10 pcs   | 11056665  |    |
| Plug bushing 6-9mm 10 pcs   | 11056666  |    |
| Set round cord 10 pcs   | 11056667  |    |
| Spinner (inlay-) ring   | 11056772  |  |
| Replacement Window HPSC   | 046246    |  |
| Primary lamp module   | N560-001  |  |
| Adapter plate for gold cell<br>For both High Performance Transflectance Cells 11056994 or 11056995. | 11056793  |  |

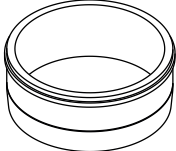
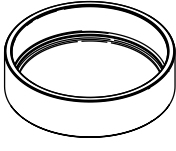
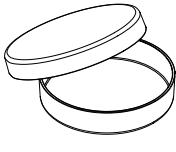
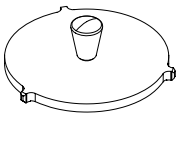
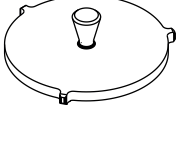
## Accessories

### Compatibility

| Sample holding accessories               | Easy-Spin Magnetic spinner* | XL* glass spacer | Adapter plate for gold cell |
|--|-----------------------------|------------------|-----------------------------|
| 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", page 8.

|   | Order no. | Image   |
|---|-----------|---|
| High performance cup  | 046259    |   |
| Robust cup  | 11055058  |  |
| Glass petri dishes 10 pcs. (up view)<br>Not suitable for use with Transfectance Cover | 11072073  |  |
| Transflectance cover 0.3 mm<br>Not suitable for use with robust cup                   | 041636    |  |
| Transflectance cover for robust cup   | 11055998  |  |

|   | Order no. | Image   |
|---|-----------|---|
| Pressing Stamp<br>To compress and compact samples like ground meat or cheese.<br>Stainless steel, approx. 1.8 kg. | 11057584  |  |
| XL-Add-On   | 11056784  |  |

## Description of function

The instrument 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 instrument is a single-beam polarization interferometer, generating its interferogram in four steps:

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.

2. Beam splitting and orthogonal polarization

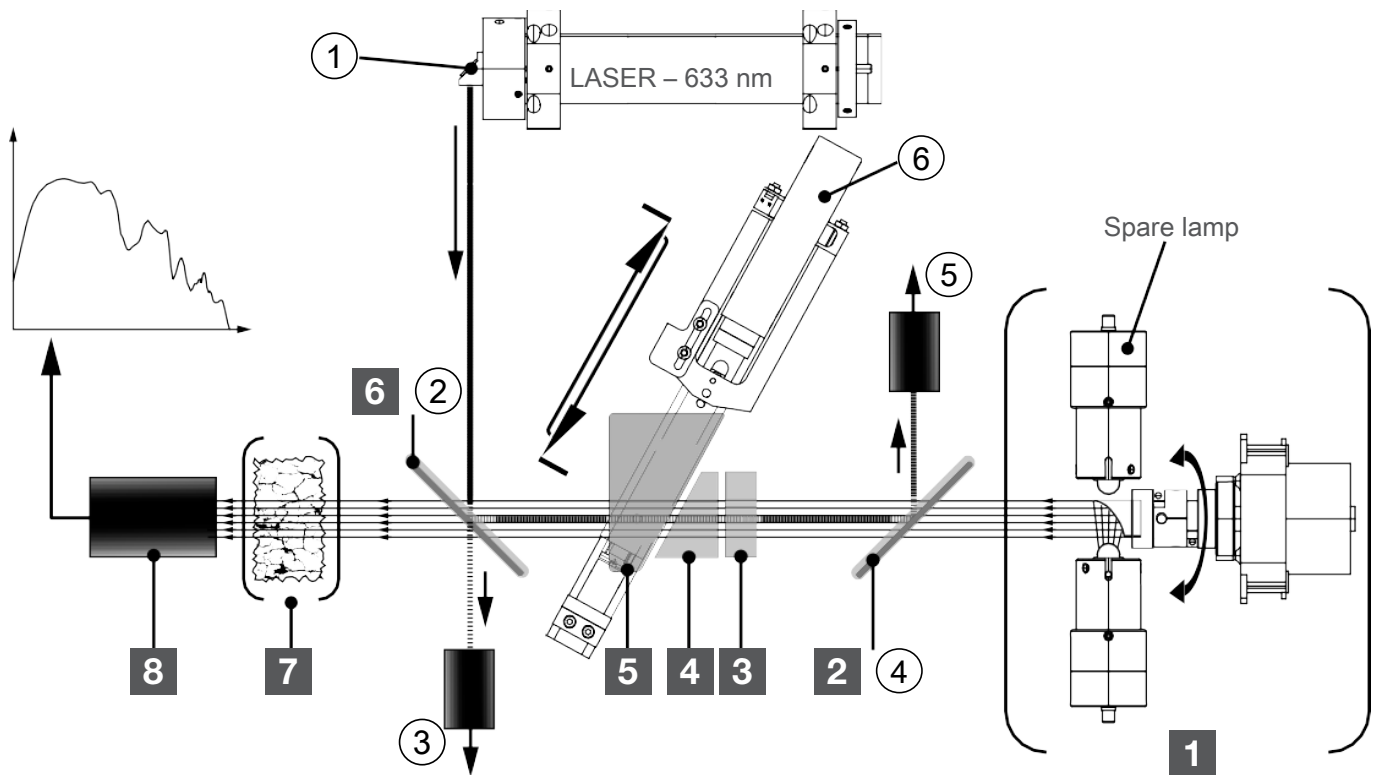
The polarized light enters a double refracting block (comparator) ③. Here, the light is broken down into two, orthogonally polarized components with a small, static phase shift.

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.

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

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

### Reference laser signal path

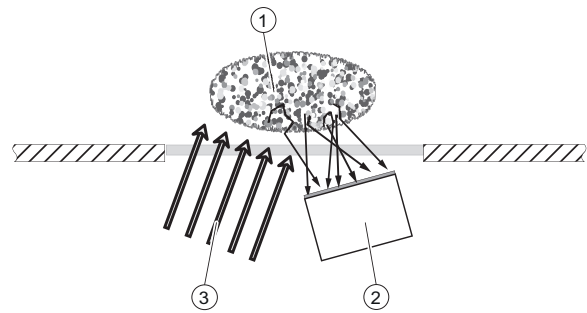
| Number | Explanation   |
|--------|---|
| ①      | Laser output window                                       |
| ②      | Second polarizer (works as a beam splitter for the laser) |
| ③      | Laser output-power sensor                                 |
| ④      | First polarizer   |
| ⑤      | Laser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

## Measurement modes

### Diffuse reflection mode

Non-translucent materials can be analyzed via diffuse reflection.

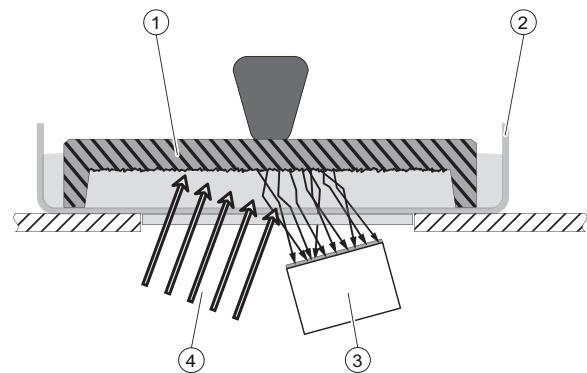
NIR light penetration is limited by the sample material. It interacts with the sample, is refracted and diffusely reflected into the sensor. The reflected rays contain the spectral information of the sample.



- ① Sample
- ② Sensor
- ③ Light

### 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 through the sample a second time. The transflected rays contain the spectral information of the sample.



- ① Transflectance cover
- ② Sample cup
- ③ Sensor
- ④ Light