SPECTRO-LAB SYSTEMS

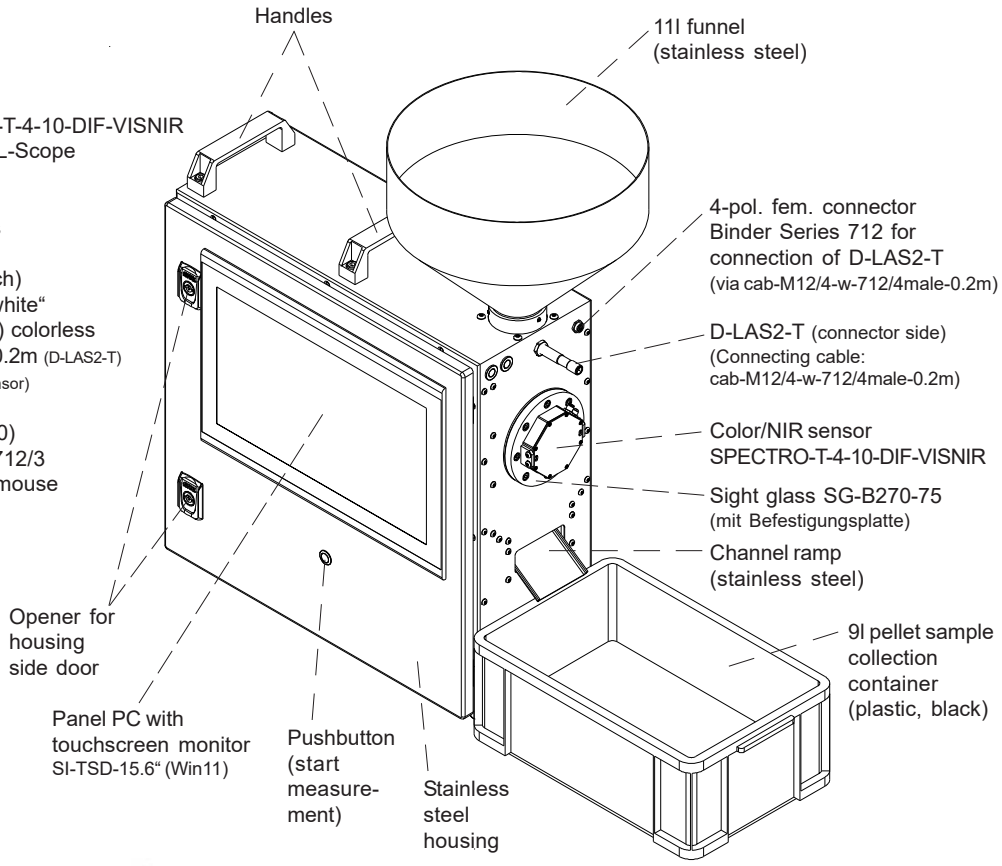
SPECTRO-T-4-LAB-VISNIR

- **Laboratory measurement system for identifying various plastic granules and flakes in the visible range (VIS) and near-infrared range (NIR)**
- 4 light sources:
  In the VIS range, a white light source and an integrated triple receiver for the red, green, and blue components (true-color detector)
  In the NIR range, three NIR light sources with different wavelengths (1300 nm, 1550 nm, 1650 nm) and a broadband NIR detector
- Sequential pulse mode; scan frequency
- Working distance (object distance): The granulate to be measured is located directly behind the sight glass
- Half-value width for INTnir: typ. 12 mm (of the detection range)
- Half-value width for INTvis: typ. 8 mm (of the detection range)
- Insensitive to outside light due to pulse mode
- Scan frequency max. 5 kHz
- Averaging can be activated (from 1 to over 32,000 values)
- RS232 interface (USB converter included in the delivery scope, Ethernet converter available as an option)
- Windows® PC software SPECTRO-T-4-DOCAL-Scope
- Factory calibration and on-site calibration possible
- Temperature compensation for ambient temperatures from 10°C to 45°C

Design

Product name:

SPECTRO-T-4-LAB-VISNIR
(Laboratory measurement system)
incl. Color/NIR sensor (hybrid sensor) SPECTRO-T-4-10-DIF-VISNIR
incl. Windows® software SPECTRO-T-4-DOCAL-Scope
incl. Sight glass SG-B270-75
incl. Offline unit FW-B270-75-OFL
incl. Protective cover for sensor and sight glass
incl. Stainless steel funnel system (capacity 11l)
incl. 2 pellet sample collection containers (9l each)
incl. RAL plastic color card „RAL 9010-P pure white“
incl. Aluminum card in RAL format (148x105mm) colorless
incl. Connecting cable cab-M12/4-w-712/4male-0.2m (D-LAS2-T)
incl. Connecting cable cab-las8-M8/4fem-2m (sensor)
incl. USB converter cab-4/USB-2m
(optional: Ethernet converter cab-4/ETH-500)
incl. External power supply PS-24V-3,3A/80W-712/3
incl. Logitech wireless keyboard with wireless mouse



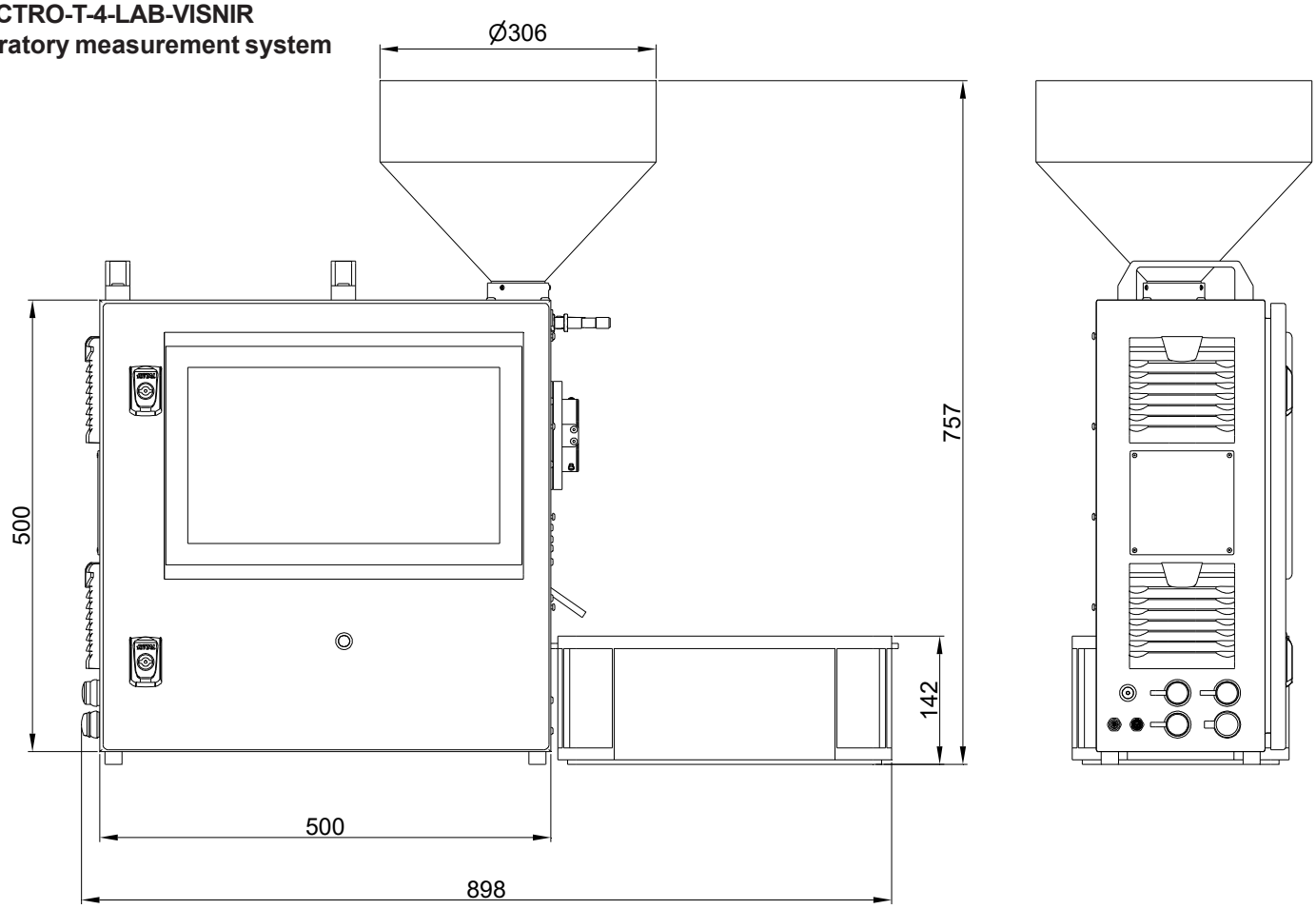
100 % reparierbar/ reparable*
* ausgenommen Totalschaden/ excluding total loss

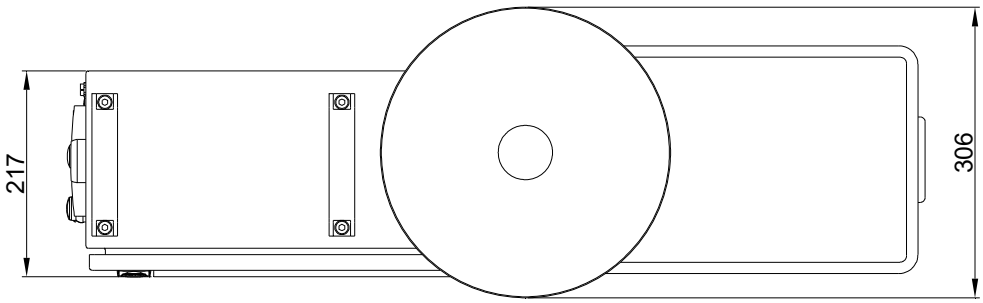
Technical Data

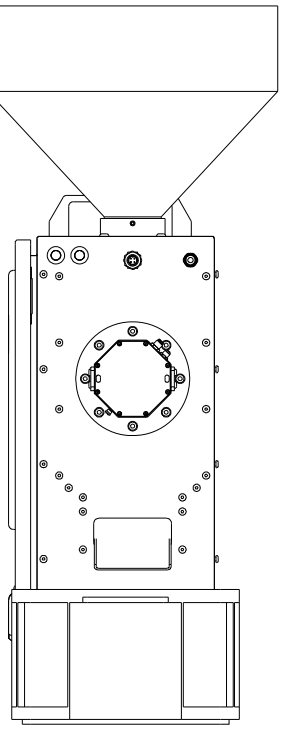
Type	SPECTRO-T-4-LAB-VISNIR
Voltage supply	+24VDC (±10%), reverse polarity protected, overcurrent protected
Current consumption	< 1A
Max. switching current	100 mA, short circuit proof
Interface	RS232 USB converter included in the sope of delivery (ETHERNET converter available as an option)
Pulse lengthening	0 ... 100 ms, adjustable via PC software
Averaging	max. 32768 values, adjustable via PC software SPECTRO-T-4-DOCAL Scope
Scan frequency	max. 5 kHz
Measuring spot diameter	see diagrams
Transmitter (light source)	VIS range: 6 sunlight LEDs, with volumetric diffuser NIR range: 3x 6 NIR emitters with three different wave lengths (1300 nm, 1550 nm, and 1650 nm), with volumetric diffuser
Receiver	VIS range: true-color detector NIR range: broadband NIR detector (900 nm ... 1700 nm)
Receiver gain setting	8 steps (AMP1 ... AMP8), adjustable via PC software
Ambient light	max. 5000 Lux
Working distance (object distance)	The granulate to be measured is located directly behind the sight glass
LED indicator	LED red = Pellet sample collection container missing LED green = Pellet sample collection container in position
Housing dimensions	LxWxH ca. 898 mm x 306 mm x 757 mm
Housing material	Stainless steel, attachments made of aluminum, anodized in black Hybrid sensor: aluminum, anodized in black Sight glass SG-B270-75: aluminum, anodized in black Offline unit FW-B270-75-OFL: aluminum, anodized in black Funnel system: stainless steel, rust-proof Protective cover for hybrid sensor and sight glass: stainless steel, rust-proof
Enclosure rating	IP54
Connecting cables	USB: cab-4/USB-2m (optional: Ethernet converter cab-4/ETH-500) Power Supply (+24V): PS-24V-3,3A/80W-712/3 (length 1.5m) Connection of sensor: cab-las8-M8/4fem-2m Connection of D-LAS2-T (inside the housing): cab-M12/4-w-712/4male-2m
Type of connector	3x USB 1xEthernet 1x 8-pole fem. connector Binder Series 712 (connection to sensor) 1x 3-pole fem. connector Binder Series 712 (connection to power supply PS-24V-3,3A/80W-712/3)
Operating temp. range	-20°C ... +55°C
Storage temperature range	-20°C ... +85°C
EMC test acc. to	DIN EN 60947-5-2 CE

Dimensions

SPECTRO-T-4-LAB-VISNIR
laboratory measurement system



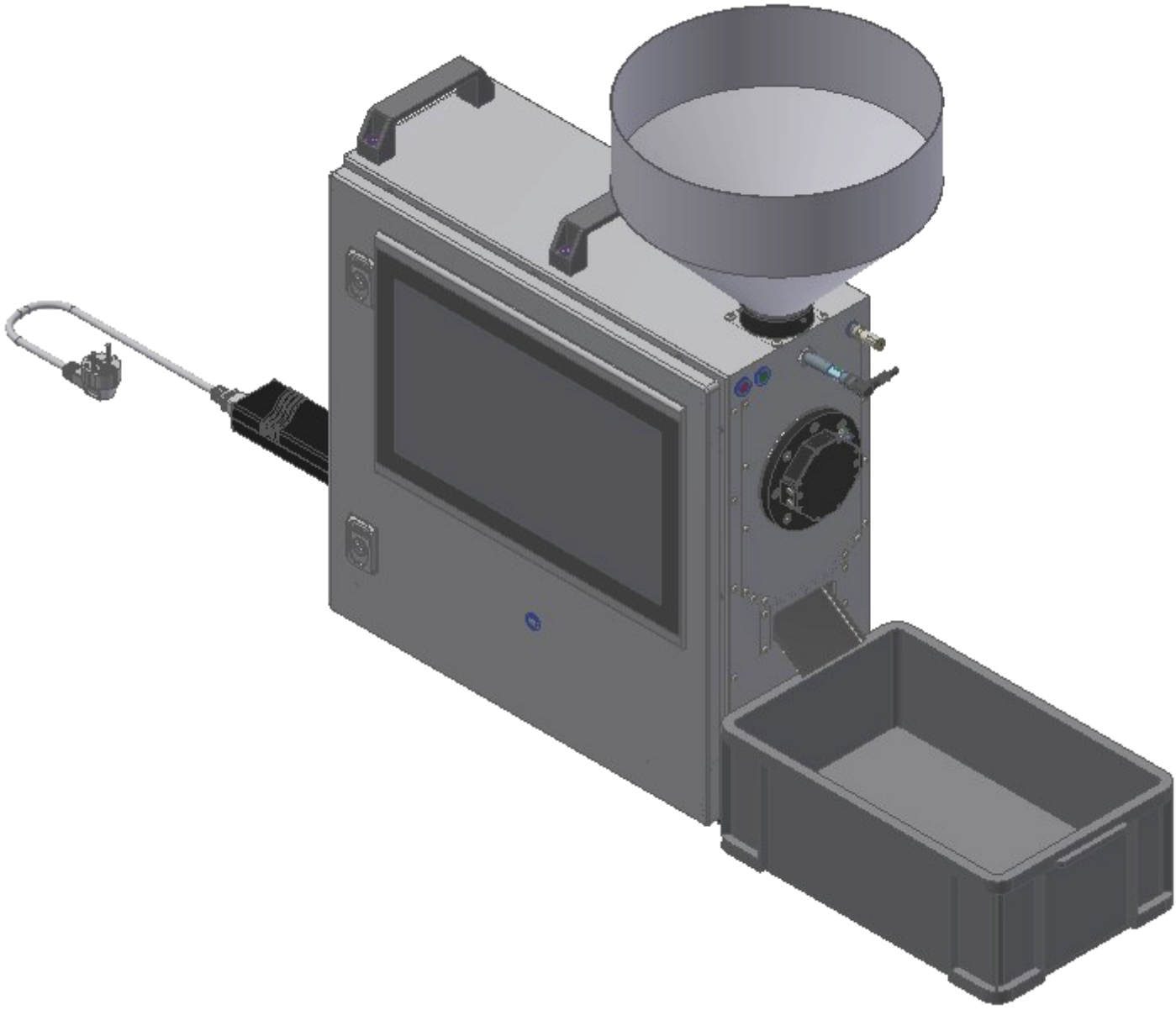




All dimensions in mm

System Setup

SPECTRO-T-4-LAB-VISNIR laboratory measurement system
(view of optics side with pellet sample collection container)

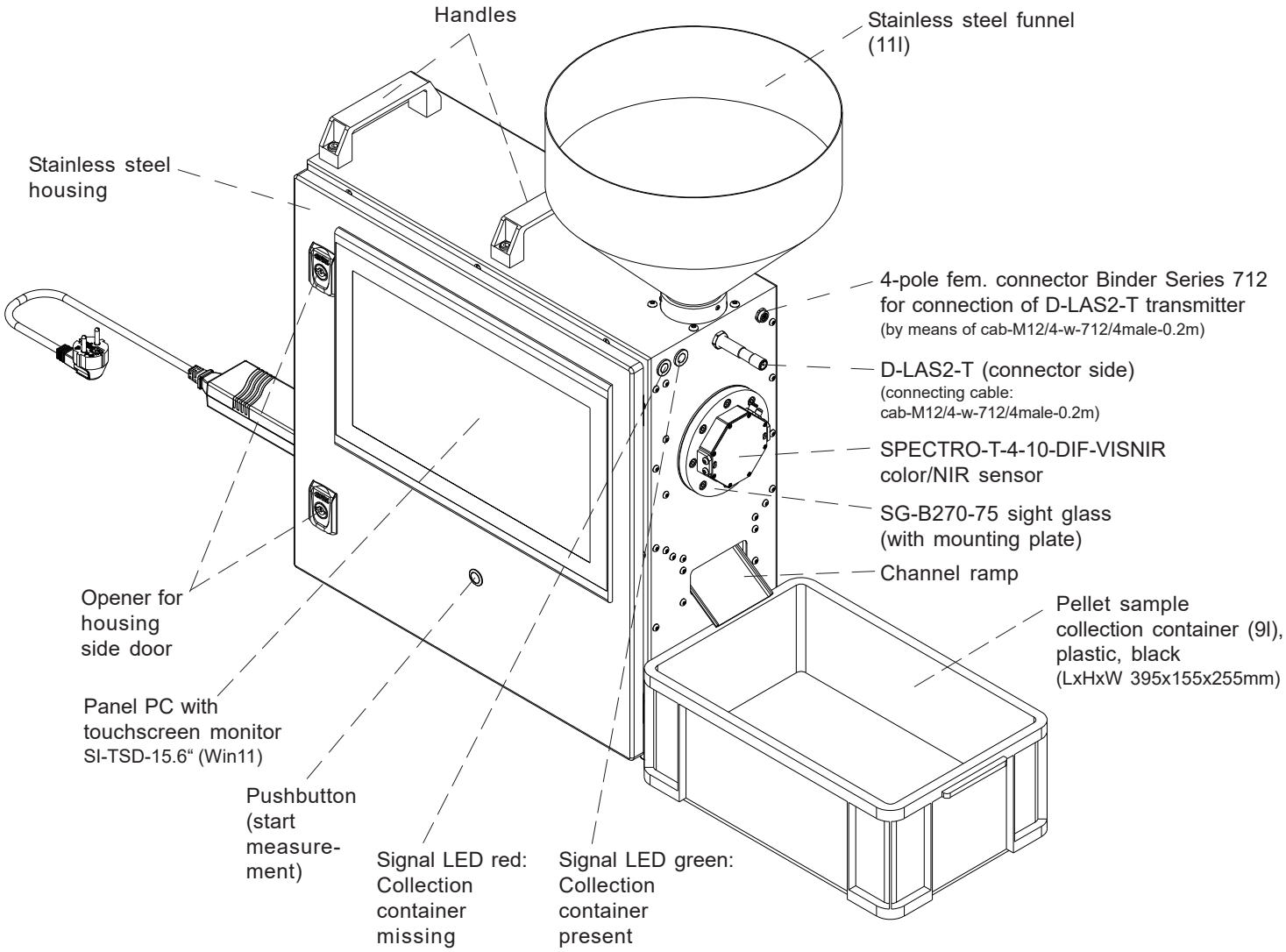


Measuring Principle

Measuring principle of the SPECTRO-T-4-LAB-VISNIR laboratory measurement system

With the help of the SPECTRO-T-4-10-DIF-VISNIR color/NIR sensor, the L*a*b* value (color value) and the N*i*r* value (NIR value) are determined almost simultaneously from the same recycled sample. This is achieved by combining a three-range color detector with a white light LED (similar to D65) ring illumination, a NIR broadband detector, and a NIR LED illumination ring consisting of three groups of LEDs with different wavelengths (1300 nm, 1500 nm, 1650 nm). This (NIR) is also a three-range method; the N*i*r* value is determined using the same algorithms as those used to calculate the L*a*b* value. Both illumination rings are preceded by so-called volume scattering discs (frosted glass discs), which ensure diffuse and homogeneous light distribution in the measuring range.

The SPECTRO-T-4-10-DIF-VISNIR sensor is mounted on the actual evaluation device by means of a sight glass. A transparent crown glass plate separates the interior of the device from the exterior. During the measurement, the individual pellets are arranged as densely as possible immediately behind the glass wall of the sight glass facing the interior.

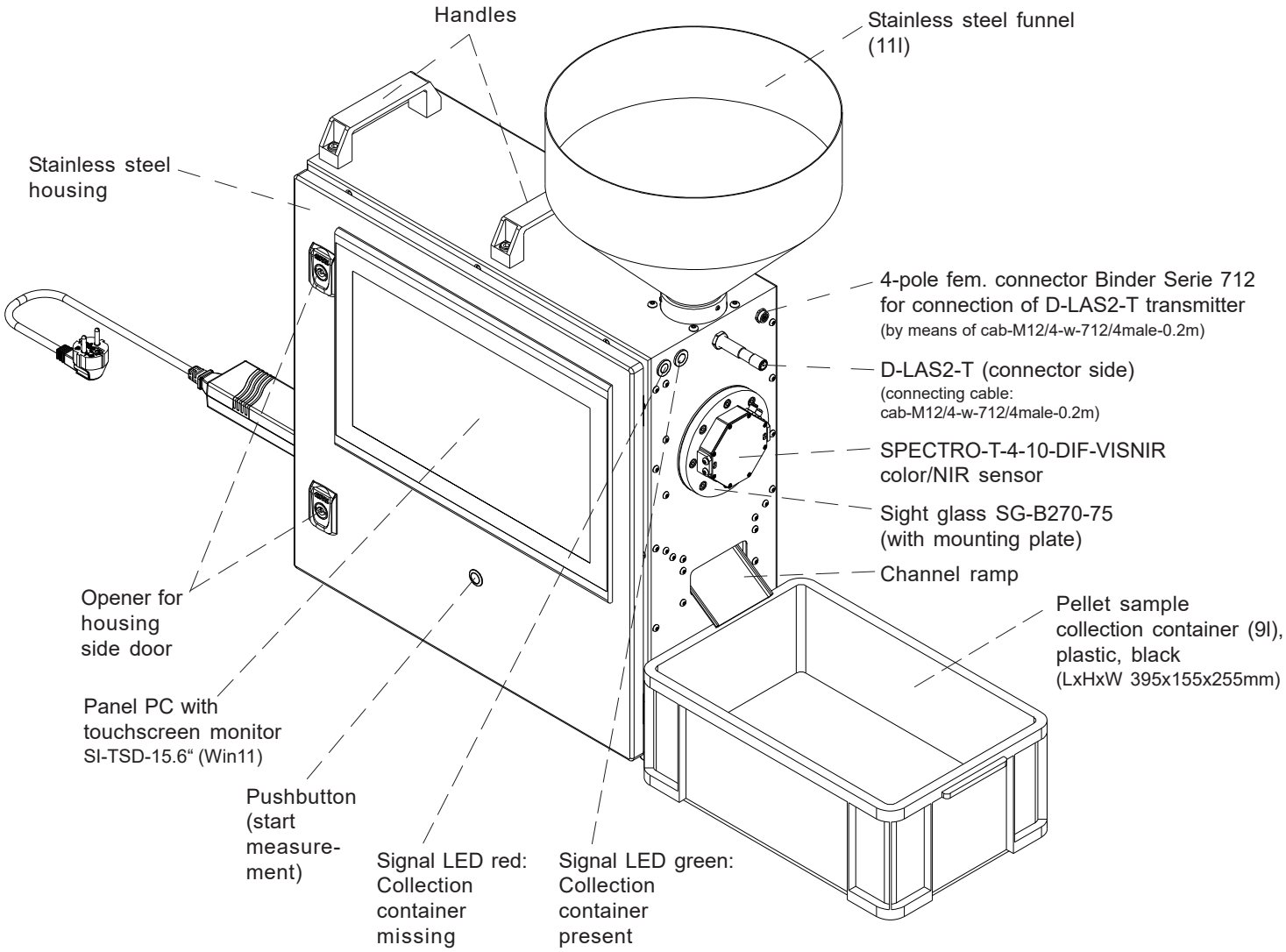


Measuring Procedure

Measuring procedure of the SPECTRO-T-4-LAB-VISNIR laboratory measurement system

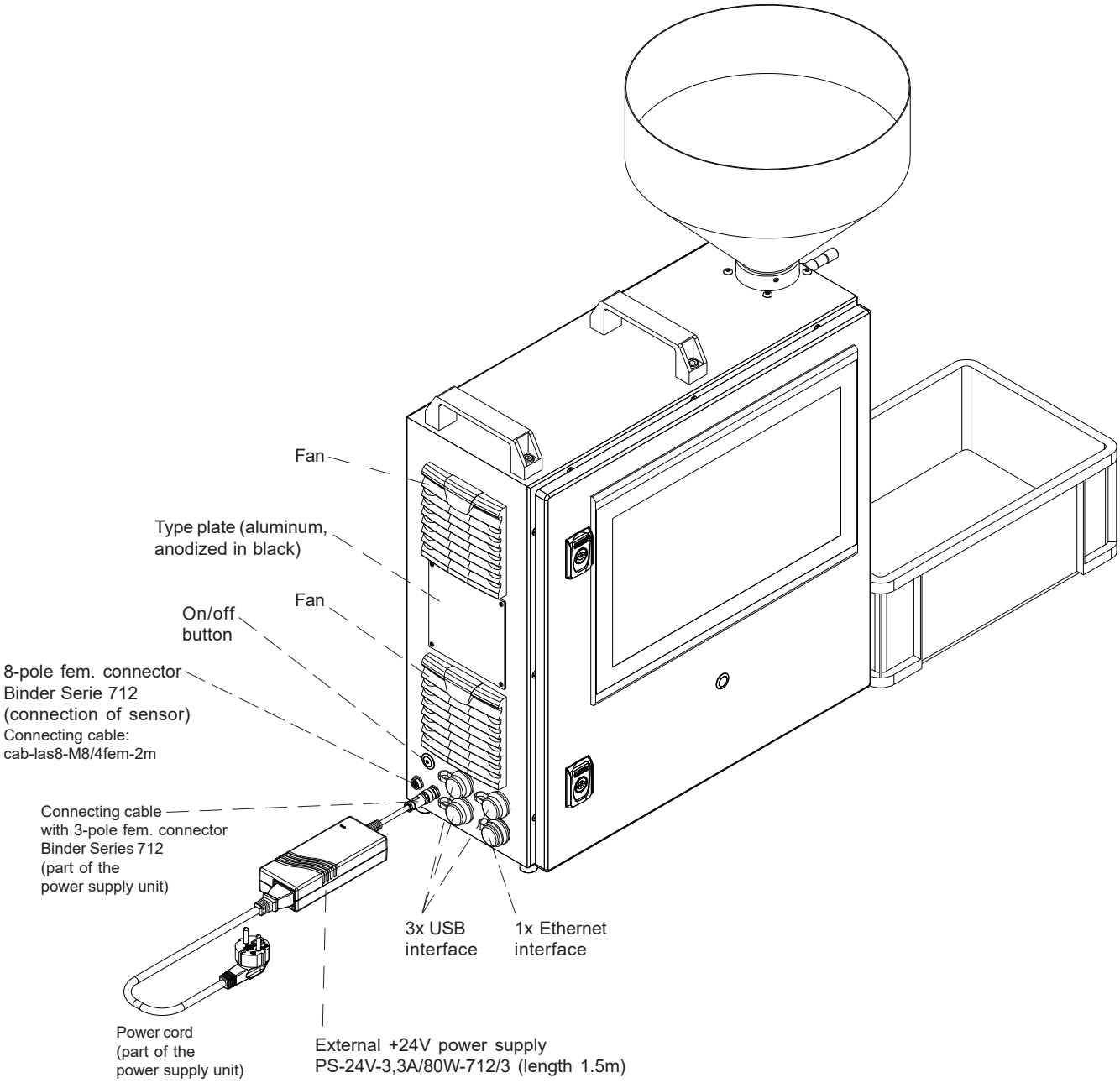
At the start of each measurement, an empty pellet sample collection container (included in the scope of delivery) is placed centrally below the channel ramp. The touch panel PC, as well as the sensor and other electronics, are activated via the on/off button on the connector side of the housing (lateral). The Windows® software can be started by clicking on the DOCAL icon. A signal LED (green) located on the upper edge of the housing indicates that the collection container has been positioned correctly. If the container is missing, the red signal LED, which is located immediately next to the green LED, lights up.
In the next step, material is poured into the funnel via another collection container (which is identical in design to the collection container already in place and is also included in the scope of delivery) that has already been filled with the recyclate material to be examined. The measurement can then be activated by pressing the pushbutton on the front. This activates the flap mechanism via a linear adjustment unit integrated in the stainless steel housing, allowing the recycled material in the hopper to pass through the measuring channel. At the same time, the measurement is activated by a light barrier attached internally to the flap mechanism (provided that the collection container is in position and there is also recyclate material in the hopper). The measurement is automatically stopped after the laser light barrier (arranged transversely to the pellet channel) has detected that the channel is clear. The full collection container can then be removed and replaced with the now empty second collection container.

The SPECTRO-T-4-DOCAL-Scope software can be conveniently operated using the Logitech wireless keyboard and mouse included in the scope of delivery (the laboratory measuring system has three USB ports).



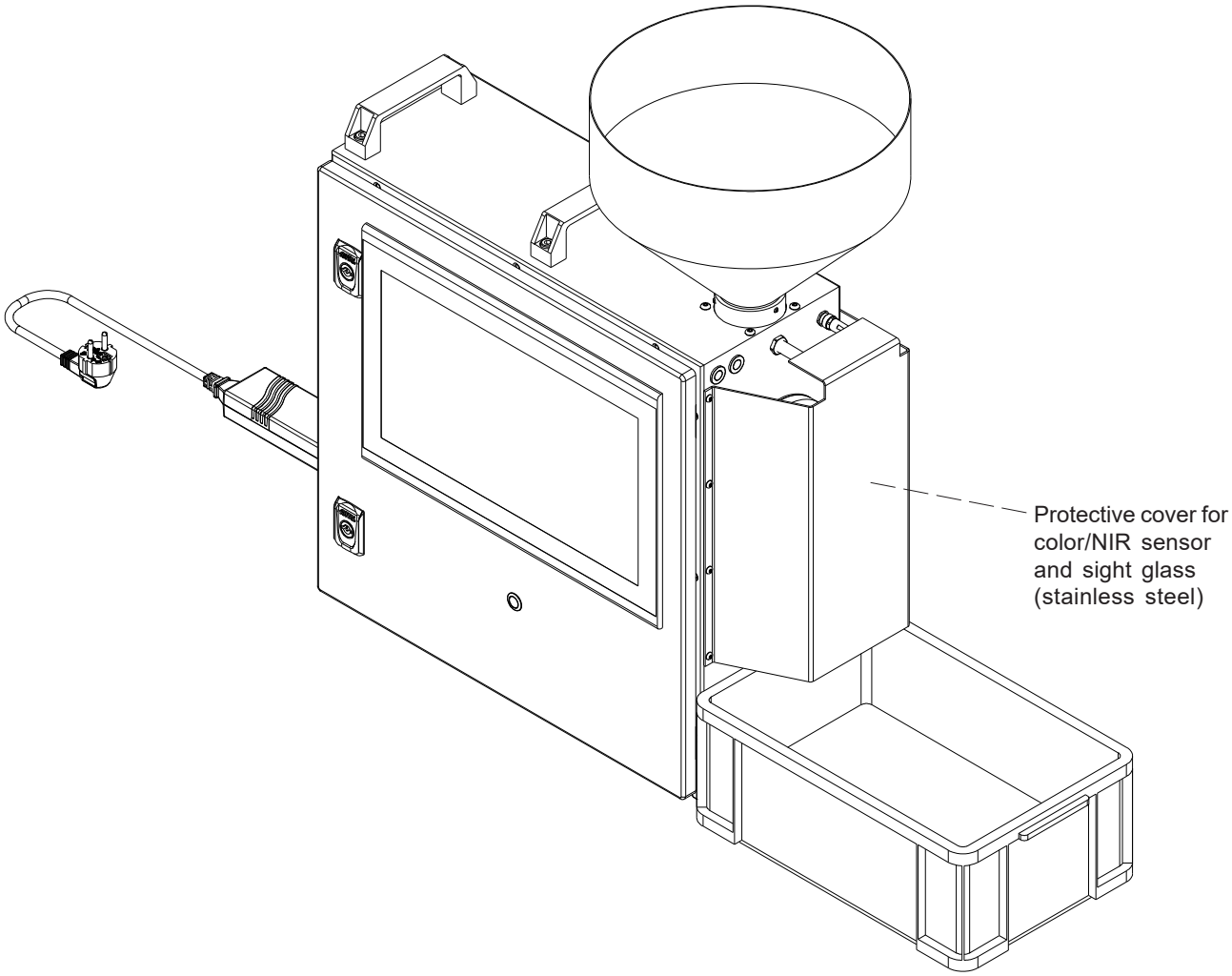
System Setup

SPECTRO-T-4-LAB-VISNIR laboratory measurement system
(view of connector side)



System Setup

SPECTRO-T-4-LAB-VISNIR laboratory measurement system
(view of optics side with protective cover)



Connectors

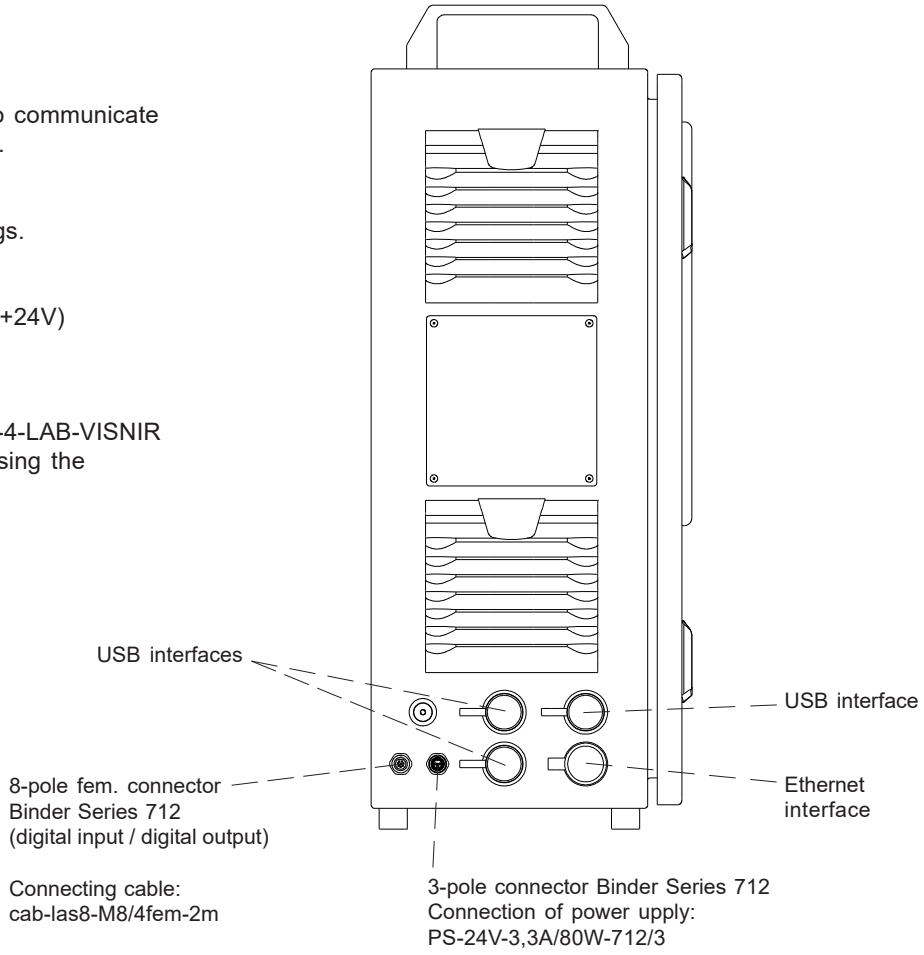
The SPECTRO-T-4-LAB-VISNIR laboratory measurement system provides the following connections:

– 1x Ethernet:
The RJ45 connection allows the computer to communicate with a 10/100/1000 Base-T Ethernet network.

– 3x USB:
USB devices are connected using type A plugs.

– 1x 8-pole fem. connector Binder Series 712:
Digital input (0V/+24V) and digital output (0V/+24V) (sensor).

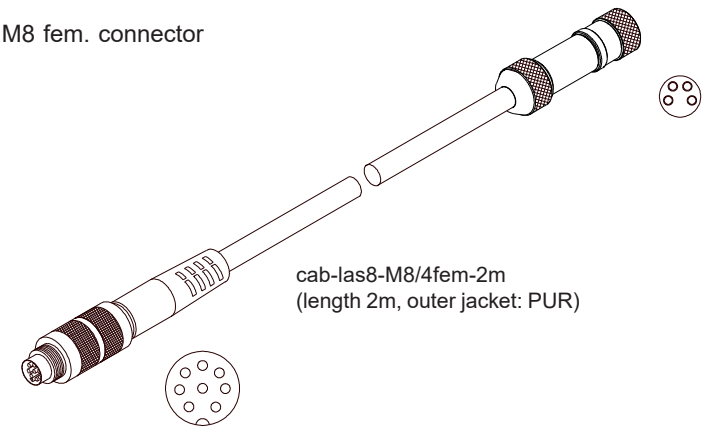
– 1x 3-pole connector Binder Series 712:
This port is used to connect the SPECTRO-T-4-LAB-VISNIR measurement system to the power supply using the PS-24V-3.3A/80W-712/3 power supply unit.



Connecting cable cab-las8-M8/4fem-2m (digital input / digital output)
(included in the scope of delivery)

cab-las8-M8/4fem-2m (connection to sensor)
8-pole connector Binder Series 712/702 and 4-pole M8 fem. connector

Pin:	Assignment:
1	GND (0V)
2	**+24VDC (+Ub)**
3	IN0
4	OUT0
5	not connected
6	not connected
7	not connected
8	not connected



Connecting Cables

USB connecting cable cab-4/USB-2m
(Included in the scope of delivery, including driver software „Self Installing Executable“)

This USB converter cable enables the system to be connected to a PC with a serial interface

- Galvanically isolated power supply:
  +24VDC via sensor
  +5V via USB hub
- 4-pole circular connector Binder Series 707
- Optionally available in 5m length

cab-4/USB-2m

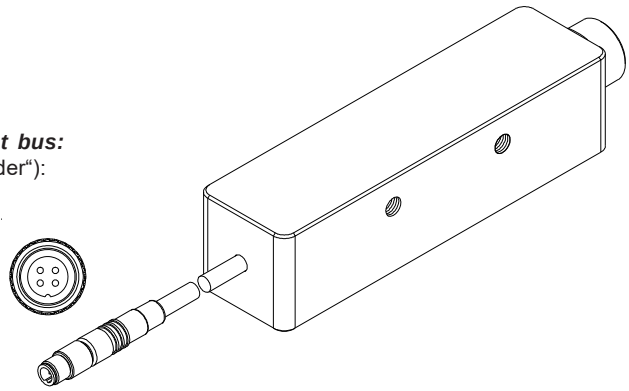
cab-4/USB-2m:
4-pole circular connector Binder Series 707

Pin:	Assignment:
1	+24VDC (+Ub, OUT)
2	GND (0V)
3	RxD
4	TxD

Alternative:

Connection to local network via “Ethernet bus:
Ethernet converter (incl. software „SensorFinder“):
cab-4/ETH-500
(standard length 0.5m)

Optional: External CAT5 cable, e.g.
cab-eth/M12D-RJ45-flx-(length)
(available lengths: 2m, 5m, 10m, 20m)



cab-4/ETH-500
(length 0.5m, outer jacket: PUR)
4-pole M12 fem. connector
(D-coded) for connection to an
external CAT5 cable, e.g.
cab-eth/M12D-RJ45-flx-(length)

Power supply PS-24V-3,3A/80W-712/3
(included in the scope of delivery)

This power supply unit enables the system to be connected to the mains power supply..

- Secondary side 24VDC; current max. 3,3A; power 80W
- Mains voltage: 100...240Veff.; 50...60Hz; 550mA
- Secondary side 3-pole circular connector Binder Series 712
- Cable length 1.5m

PS-24V-3,3A/80W-712/3 (Power supply):
3-pole circular connector Binder Series 712

Pin:	Assignment:
1	GND (0V)
2	+24VDC
3	not connected

PS-24V-3,3A/80W-712/3

Calibration

Calibration of the SPECTRO-T-4-LAB-VISNIR laboratory measurement system

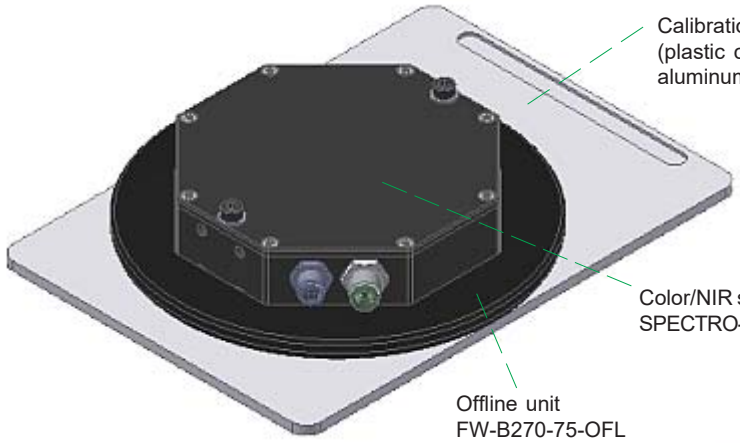
The following cards are required for white light calibration (included in the scope of delivery):

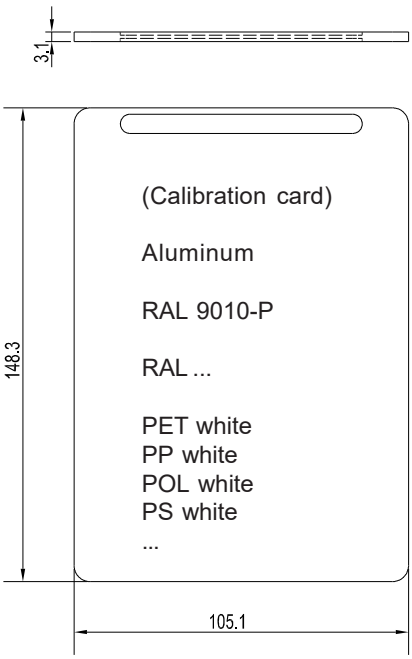
Color: RAL plastic color card „RAL 9010-P pure white“
NIR: Aluminum card in RAL format (148x105mm) colorless

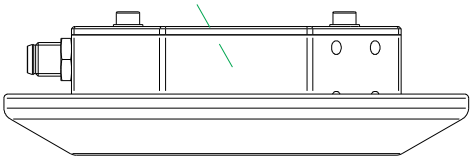
In addition, plastic color cards can be used that are similar in color or material to the recyclates to be inspected.

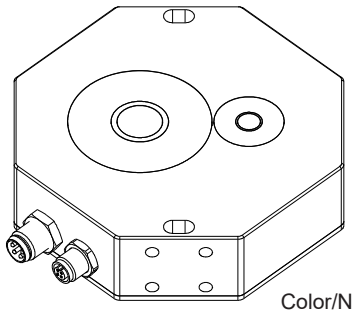
Calibration is not performed directly on the laboratory device. Instead, the SPECTRO-T-4-10-DIF-VISNIR color/NIR sensor is removed from the laboratory measurement system (by loosening the two Allen screws) and mounted on an FW-B270-75-OFL offline unit. Calibration is performed using the SPECTRO-T-4-DOCAL-Scope Windows® software. In interactive mode, the CAL menu item requests the cards to be calibrated. The color and NIR values are entered into the calibration table together with the measured data. The SPECTRO-T-4-DOCAL-Scope software then determines the correction factors and transmits them to the sensor system. The sensor calibrated in this way is then removed from the FW-B270-75-OFL and reattached to the laboratory device.

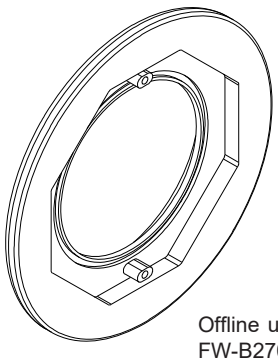
Calibration arrangement:



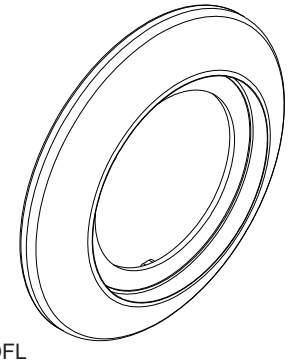






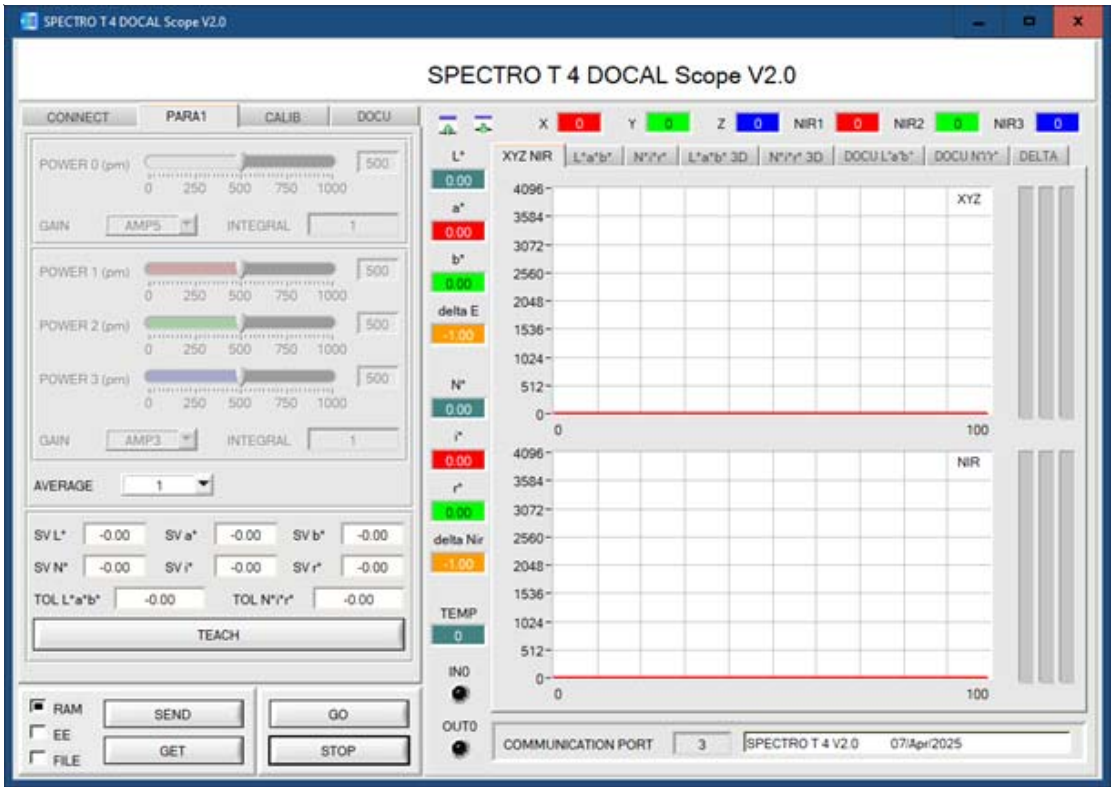


View:
Sensor mounting side



View:
Optics placement side

DOCAL Software

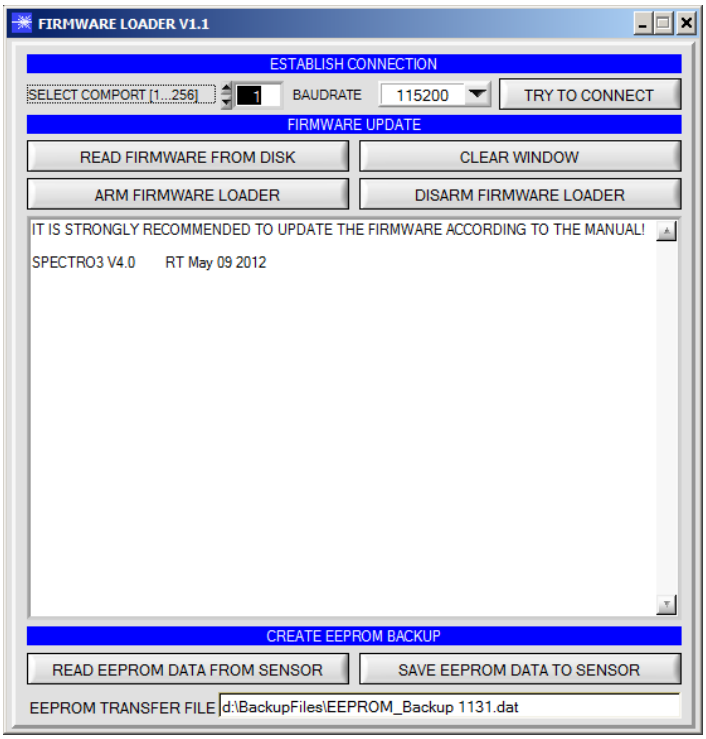


The SPECTRO-T-4-DOCAL-Scope software enables data to be recorded and also allows the measurement data to be viewed during recording.

Furthermore, trends in deviations from the respective reference value are displayed, and any exceedance of the respective tolerance values is indicated by a colored frame around the affected measurement values.

Firmware Update

Firmware update by means of the software „Firmware Loader“:



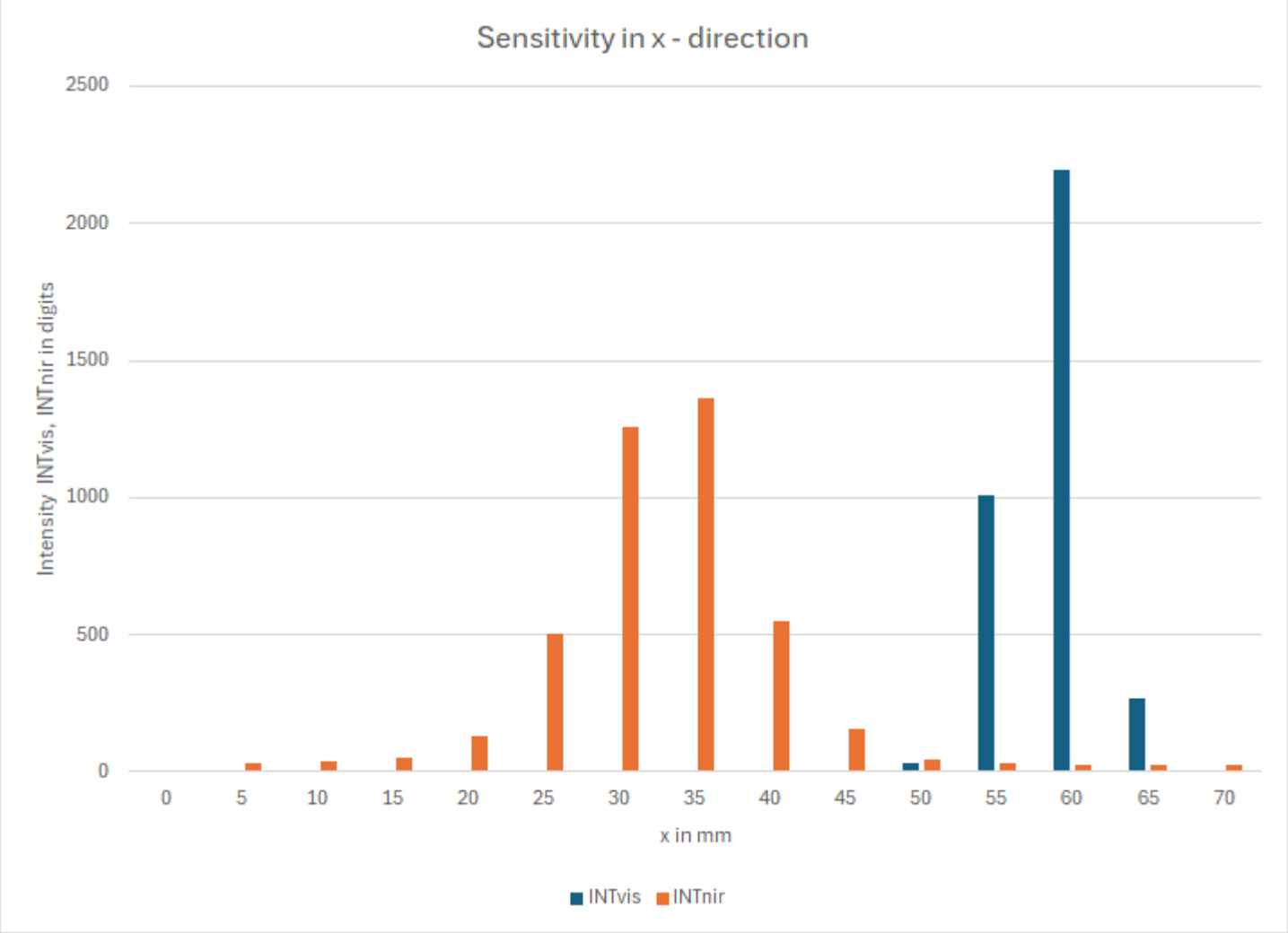
The software „Firmware Loader“ allows the user to perform an automatic firmware update. The update will be carried out through the RS232 interface.

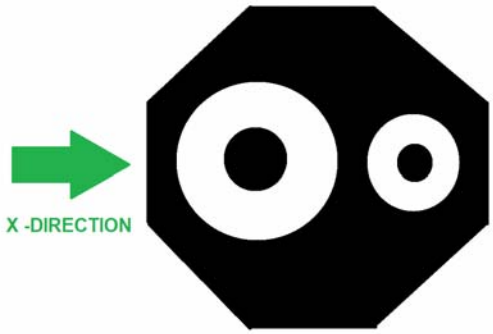
An initialisation file (xxx.ini) and a firmware file (xxx.elf.S) are required for performing a firmware update. These files can be obtained from your supplier. In some cases an additional firmware file for the program memory (xxx.elf.p.S) is also needed, and this file will be automatically provided together with the other two files.

Diagrams

Diagrams: **Sensitivity in x-direction**
SPECTRO-T-4-10-DIF-VISNIR color/NIR sensor

AMP4 INT2 (color)
AMP2 INT2 (NIR)



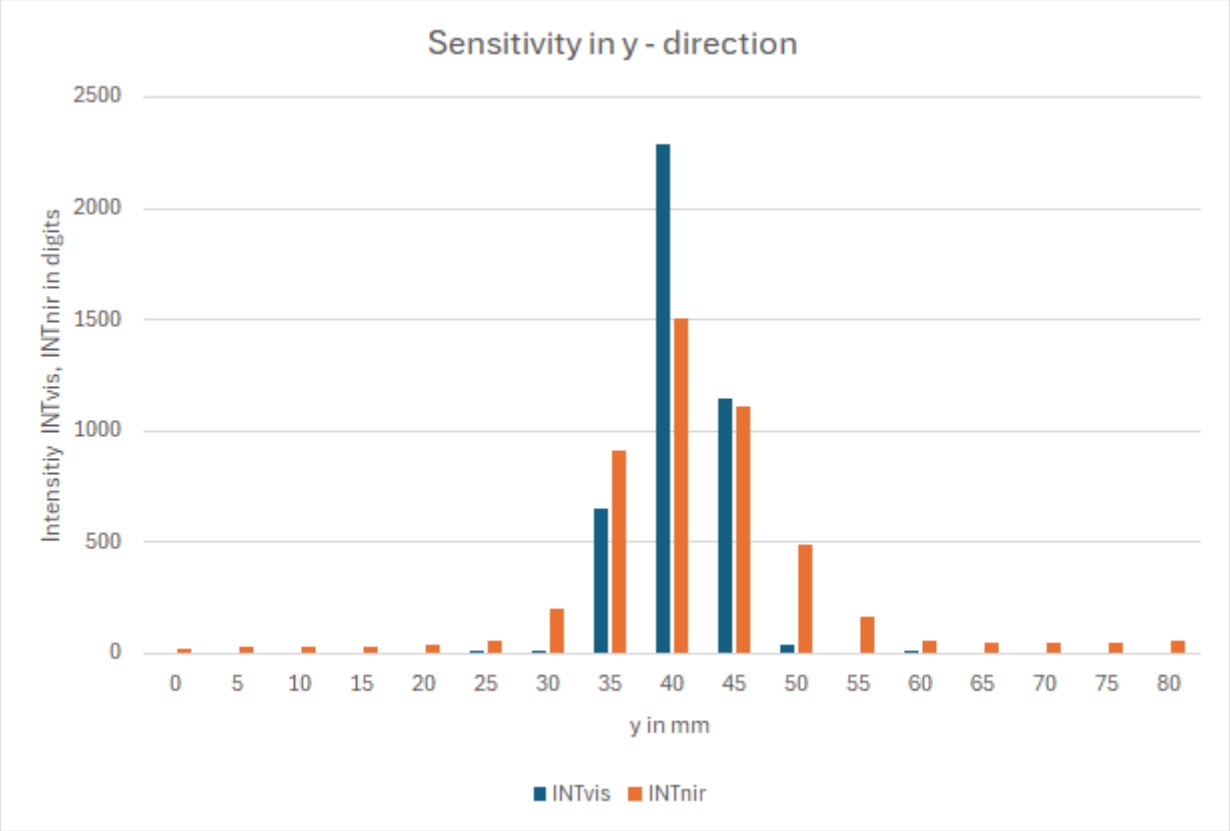


Half value width for INTnir: typ. 12 mm (of the detection range)
Half value width for INTvis: typ. 8 mm (of the detection range)

Diagrams

Diagrams: **Sensitivity in y-direction**
SPECTRO-T-4-10-DIF-VISNIR color/NIR sensor

AMP4 INT2 (color)
AMP2 INT2 (NIR)



Half value width for INTnir: typ. 12 mm (of the detection range)
Half value width for INTvis: typ. 8 mm (of the detection range)

Calibration Cards

Calibration cards

(included in the sope of delivery)

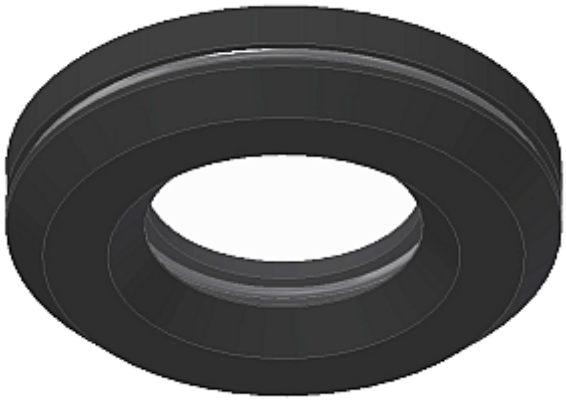
A **RAL plastic color card „RAL 9010-P pure white“** as well as an **aluminum card in RAL format (148x105mm) colorless** are included in the scope of delivery of the SPECTRO-T-4-LAB-VISNIR laboratory measurement system.

RAL plastic color card „RAL 9010-P pure white“

Aluminum card in RAL format (148x105mm) colorless

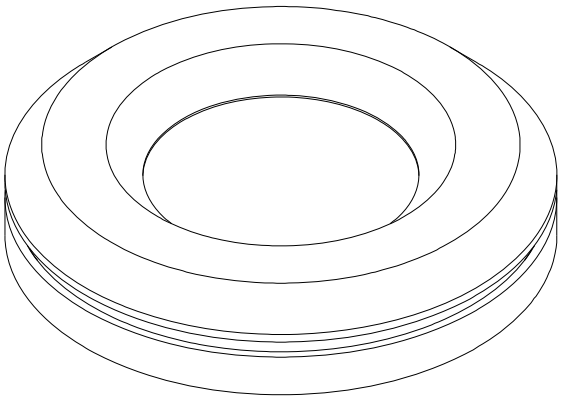
Sight Glass

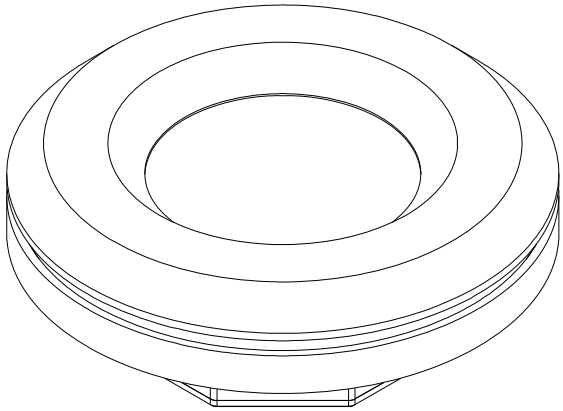
SG-B270-75 (sight glass)
(included in the sope of delivery)

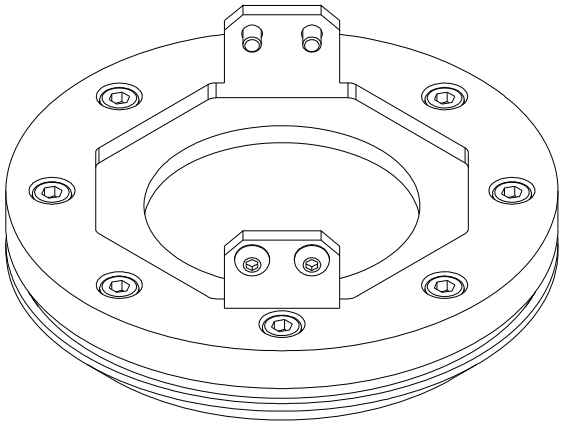


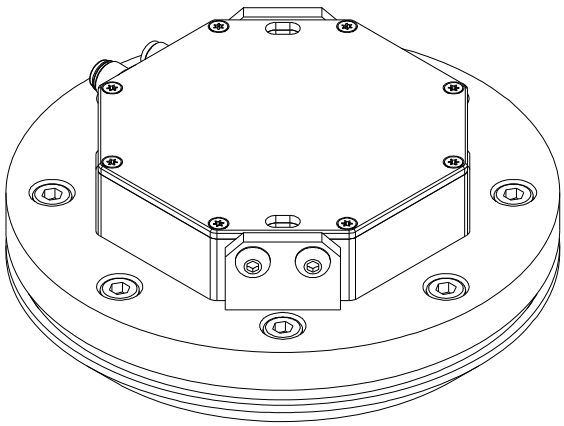
SG-B270-75 (sight glass)

SG-B270-75 (sight glass)
with SPECTRO-T-4-10-DIF-VISNIR







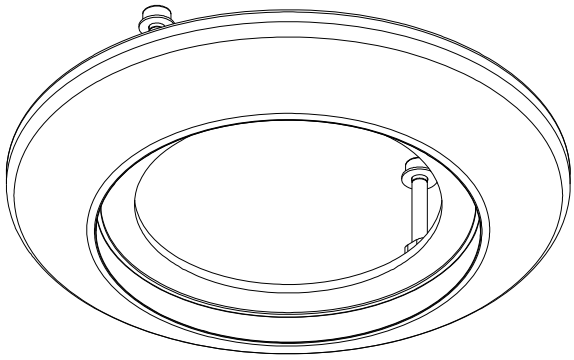


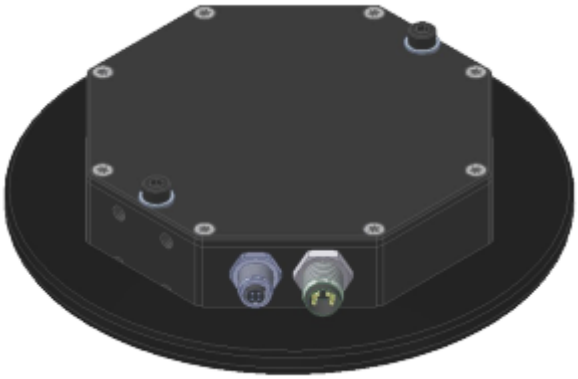
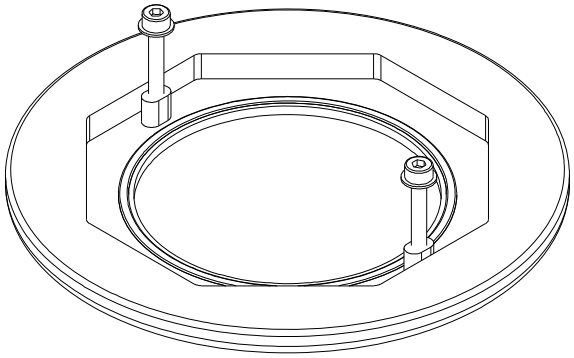
Offline Unit

FW-B270-75-OFL (offline unit)
(included in the sope of delivery)

FW-B270-75-OFL (offline unit)

FW-B270-75-OFL (offline unit)
with SPECTRO-T-4-10-DIF-VISNIR





FW-B270-75-OFL (offline unit)
with SPECTRO-T-4-10-DIF-VISNIR