SPECTRO-MOBILE SYSTEMS

SPECTRO-T-4-MOBILE-VISNIR

- **Inline measurement system for identifying various plastic granules and flakes as well as textiles made from natural and synthetic fibers 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
- Working distance (object distance): typ. 10 mm ± 1 mm
- 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
- Available as an option: TABUN-13“ (battery-powered tablet PC for the power supply of the sensor)

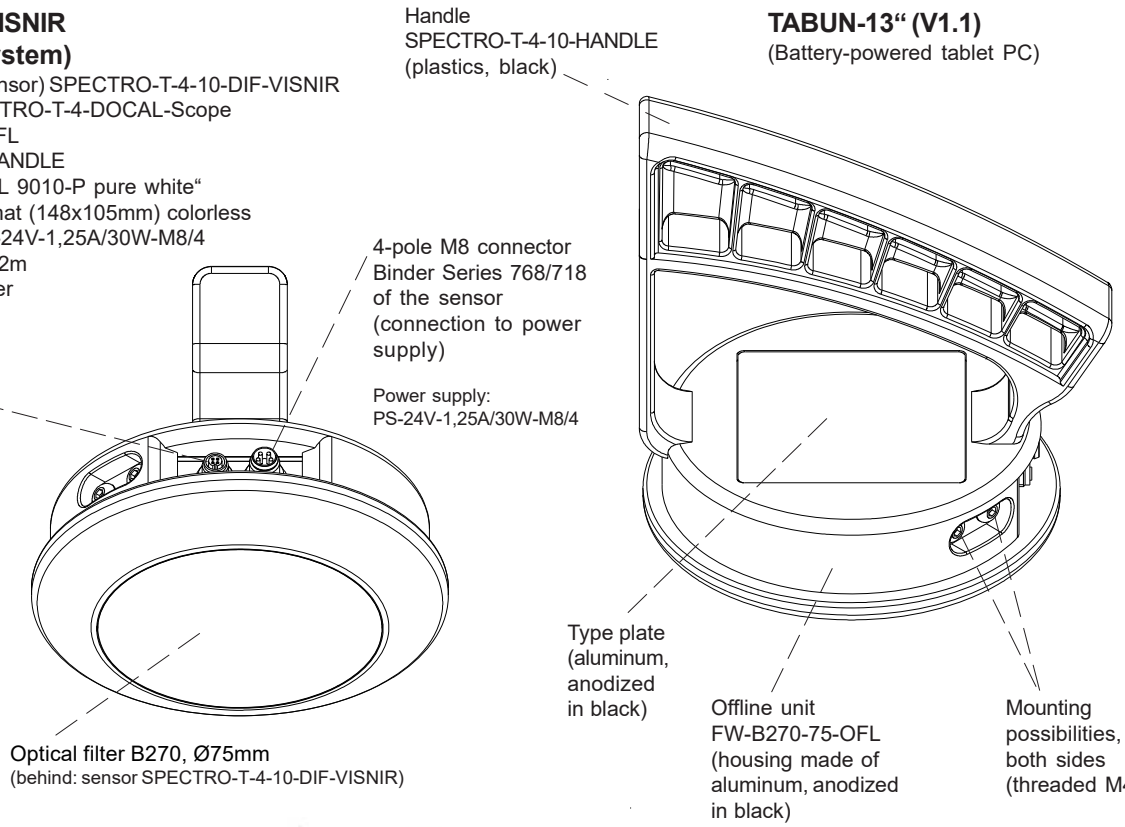
Design

Product name:

SPECTRO-T-4-MOBILE-VISNIR
(Mobile measurement system)
incl. Color/NIR sensor (hybrid sensor) SPECTRO-T-4-10-DIF-VISNIR
incl. Windows® software SPECTRO-T-4-DOCAL-Scope
incl. Offline unit FW-B270-75-OFL
incl. Handle SPECTRO-T-4-10-HANDLE
incl. RAL plastic color card „RAL 9010-P pure white“
incl. Aluminum card in RAL format (148x105mm) colorless
incl. External power supply PS-24V-1,25A/30W-M8/4
incl. USB converter cab-4/USB-2m
(optional: Ethernet converter cab-4/ETH-500)

Accessories: (p. 14)

TABUN-13“ (V1.1)
(Battery-powered tablet PC)



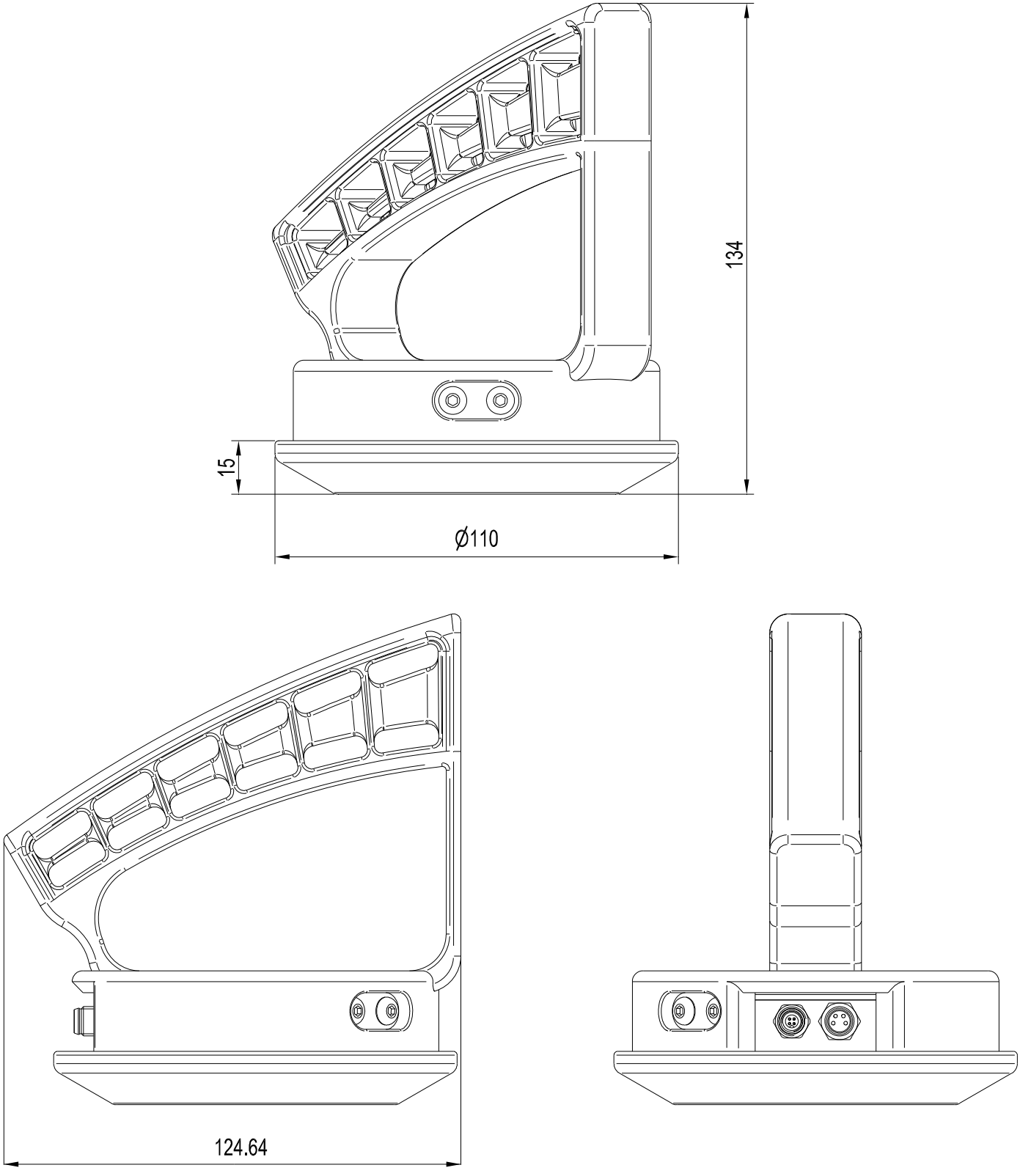
100 % reparierbar/ reparable*
* ausgenommen Totalschaden/ excluding total loss

Technical Data

Type	SPECTRO-T-4-MOBILE-VISNIR
Voltage supply	+24VDC (±10%), reverse polarity protected, overcurrent protected
Current consumption	< 300 mA
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)	typ. 10 mm ± 1 mm
Housing dimensions	LxBxH approx. 124.64 mm x 110 mm (Ø) x 134 mm
Housing material	Hybrid sensor SPECTRO-T-4-10-DIF-VISNIR: aluminum, anodized in black Handle SPECTRO-T-4-10-HANDLE: Plastics, black Offline unit FW-B270-75-OFL: aluminum, anodized in black
Enclosure rating	IP54
Connecting cables	USB: cab-4/USB-2m (optional: Ethernet converter cab-4/ETH-500) Power Supply (+24V): PS-24V-1,25A/30W-M8/4 (length 1.5m)
Type of connector	1x 4-pole fem. connector Binder Series 707 (connection to RS232) 1x 4-pole M8 connector Binder Series 768/718 (connection to power supply PS-24V-1,25A/30W-M8/4)
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

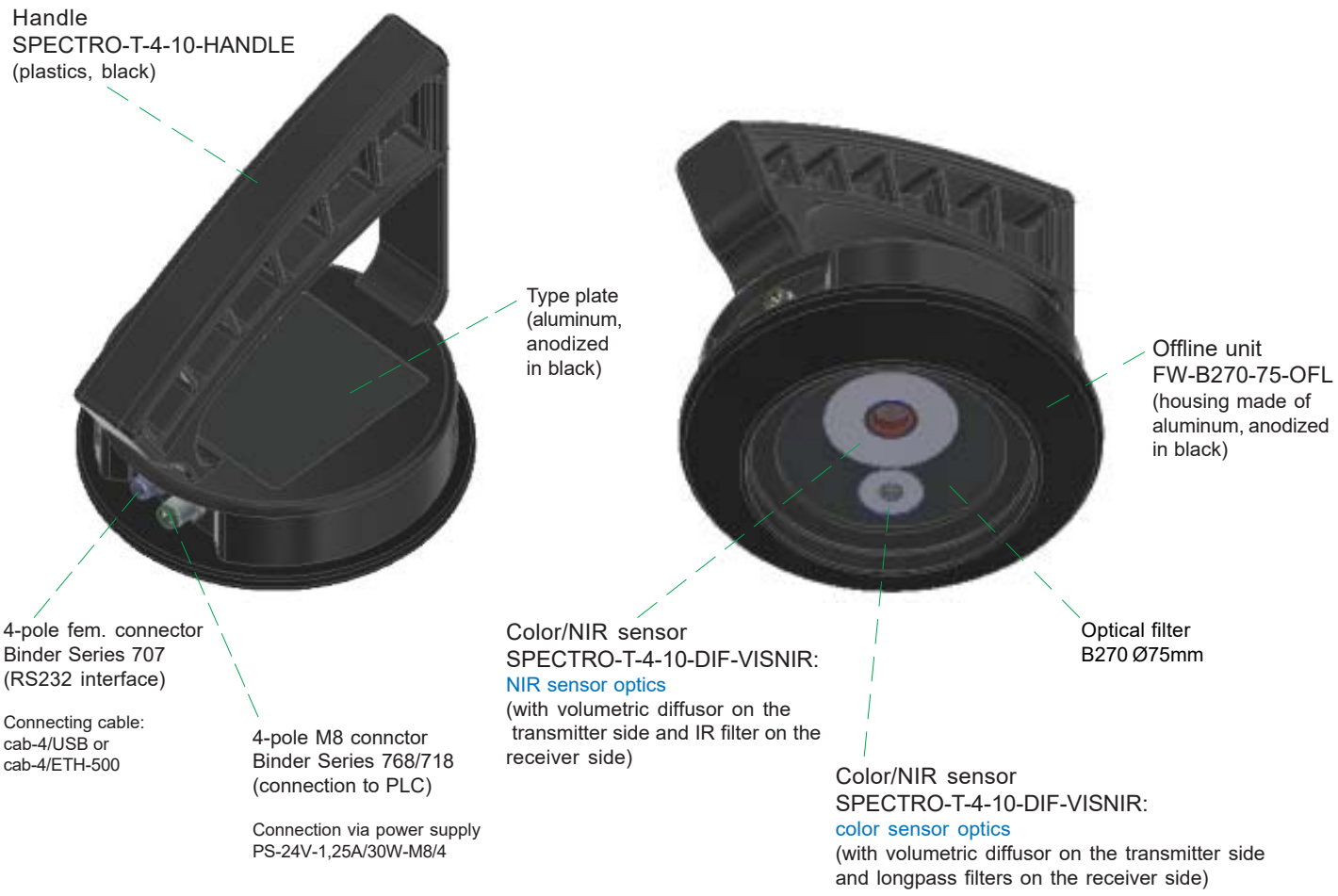
SPECTRO-T-4-MOBILE-VISNIR mobile measurement system



All dimensions in mm

System Setup

SPECTRO-T-4-MOBILE-VISNIR mobile measurement system



Measuring Principle

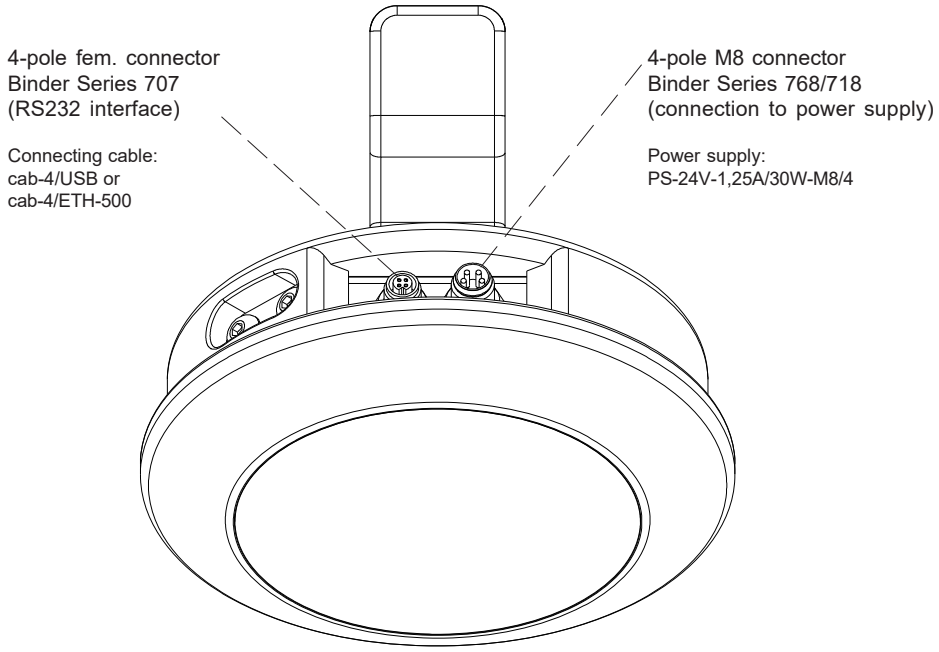
Measuring principle of the SPECTRO-T-4-MOBILE-VISNIR mobile measurement system

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) of the same recyclate sample are determined almost simultaneously. This is achieved by arranging a three-range color detector in conjunction with a white light LED (D65-similar) ring illumination as well as 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. So-called volume diffusion discs (frosted glass discs) are placed in front of both illumination rings to ensure diffuse and homogeneous light distribution in the measuring area.

The FW-B270-75-OFL offline unit is installed in front of the SPECTRO-T-4-10-DIF-VISNIR sensor, and a handle is also mounted. During measurement, the individual pellets are arranged as densely as possible immediately behind the glass wall of the sight glass facing away from the sensor.

Connectors

Connectors of the SPECTRO-T-4-MOBILE-VISNIR mobile measuring system



Connection of the SPECTRO-T-4-MOBILE-VISNIR mobile measurement system to power supply

Power supply PS-24V-1,25A/30W-M8/4
(included in the sope of delivery)

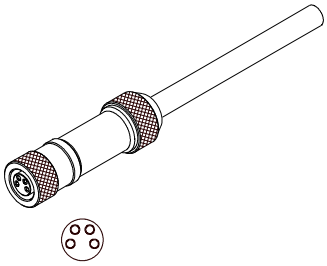
This power supply unit enables the system to be connected to the mains power supply.

- Secondary side 24VDC; current max. 1.25A; power 30W
- Mains supply: 100...240Veff.; 50...60Hz; 550mA
- Secondary side 4-pole M8 fem. connector
- Cable length 1.5m

PS-24V-1,25A/30W-M8/4

PS-24V-1,25A/30W-M8/4 (power supply):
4-pole M8 fem. connector Binder Series 768/718

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



Connecting Cables

Connection of the SPECTRO-T-4-MOBILE-VISNIR mobile measurement system to USB

cab-4/USB-2m USB connecting cable (converter)

(included in the scope of delivery, incl. 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

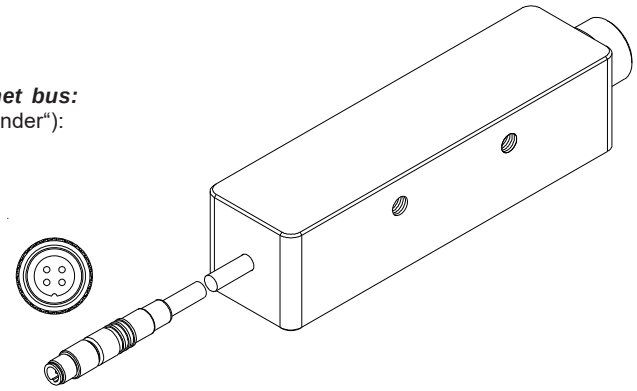
cab-4/USB-2m (USB converter):
4-pole connector Binder Series 707

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

Alternatively:

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 in 2m, 5m, 10m, 20m)



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

Calibration

Calibration of the SPECTRO-T-4-MOBILE-VISNIR mobile measurement system

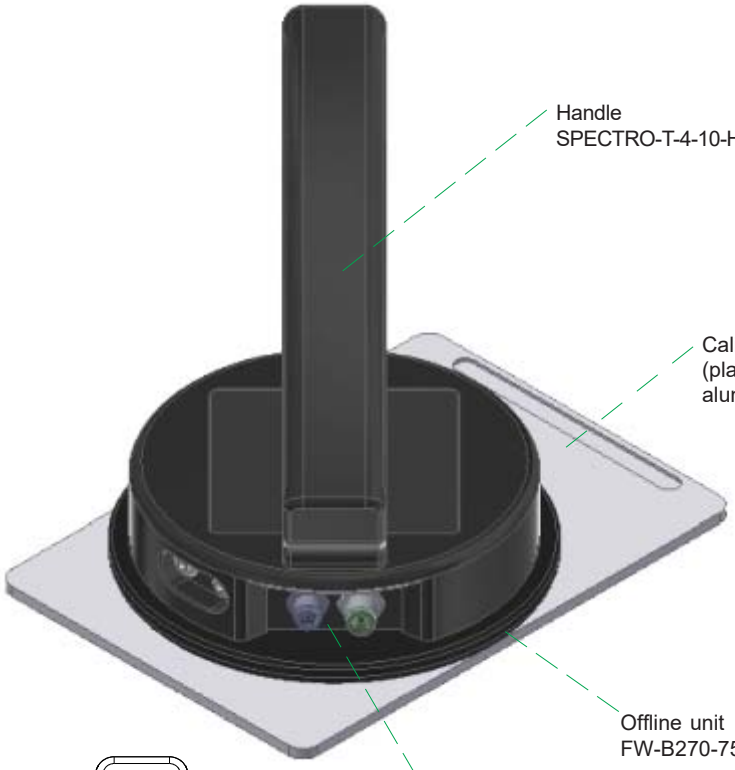
The following cards are required for white light calibration (included in the scope of delivery):

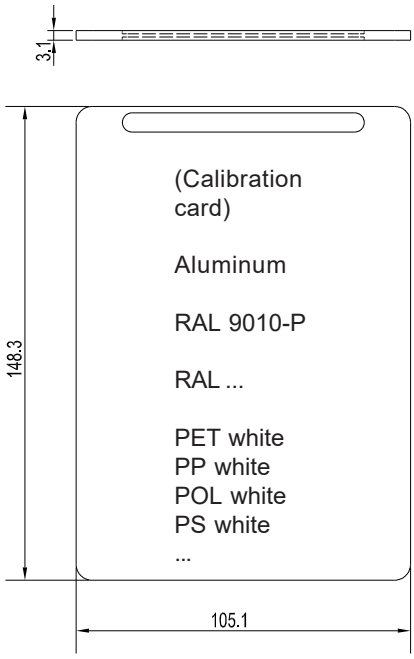
Color: RAL plastic color card „RAL 9010-P pure white“
NIR: Aluminum card in RAL format (148x105mm) colorless

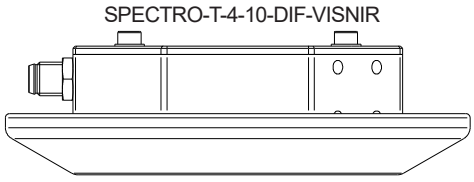
In addition, plastic color cards can be used that are similar in color or material to the recyclates to be inspected.

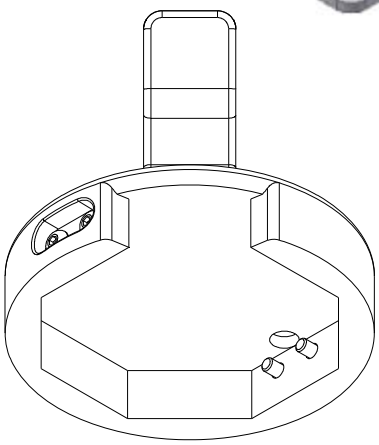
Calibration is performed using the SPECTRO-T-4-DOCAL-Scope Windows® software. In interactive mode, the CAL menu item requests the cards to be calibrated. The color and NIR values are entered into the calibration table together with the measured data. The SPECTRO-T-4-DOCAL-Scope software then determines the correction factors and transmits them to the sensor system.

Calibration arrangement:

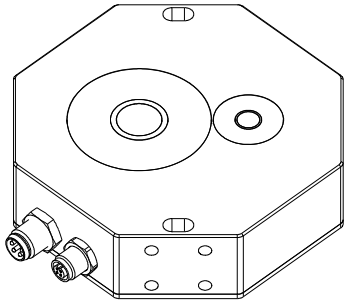




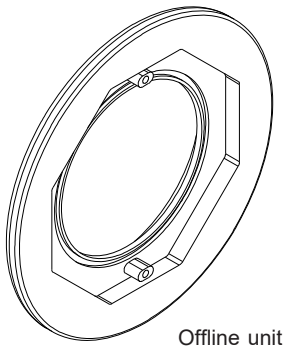




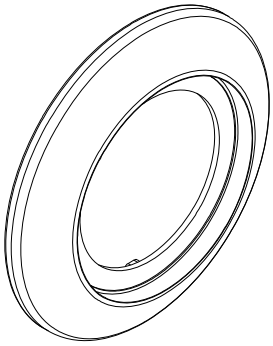
Handle
SPECTRO-T-4-10-HANDLE
View: Sensor mounting side



Color/NIR sensor
SPECTRO-T-4-10-DIF-VISNIR

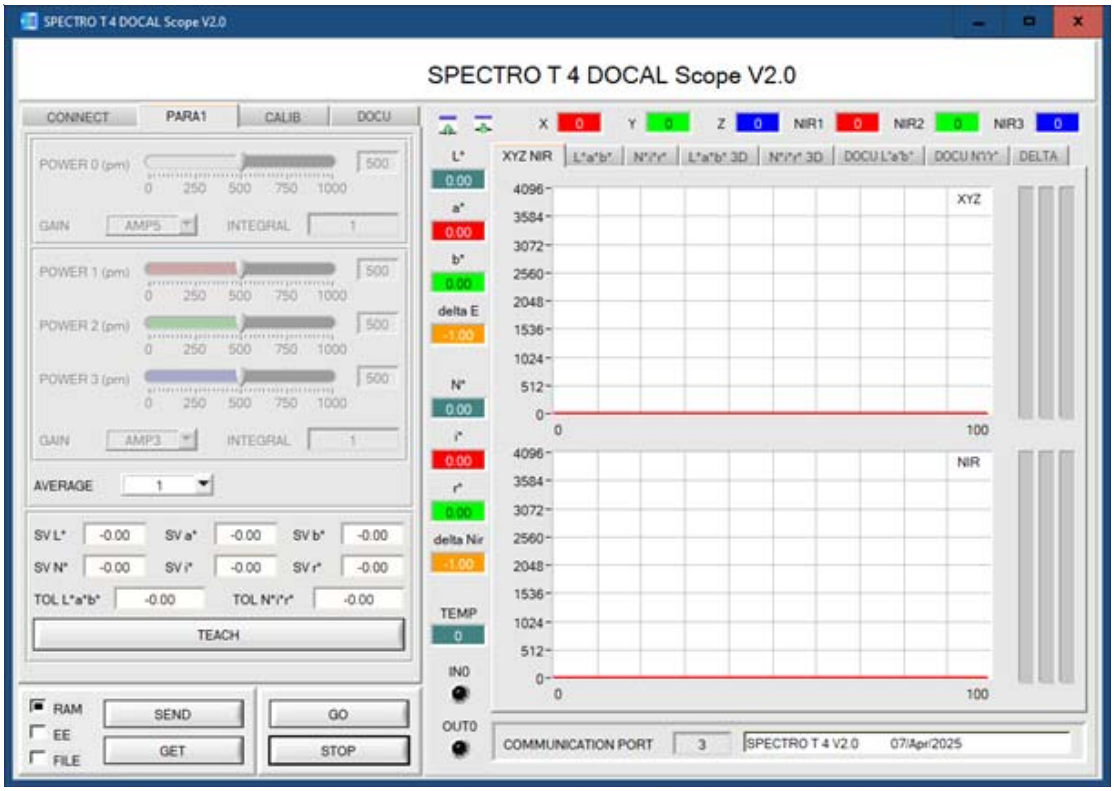


Offline unit
FW-B270-75-OFL
View:
Sensor mounting side



View:
Optics placement side

DOCAL Software

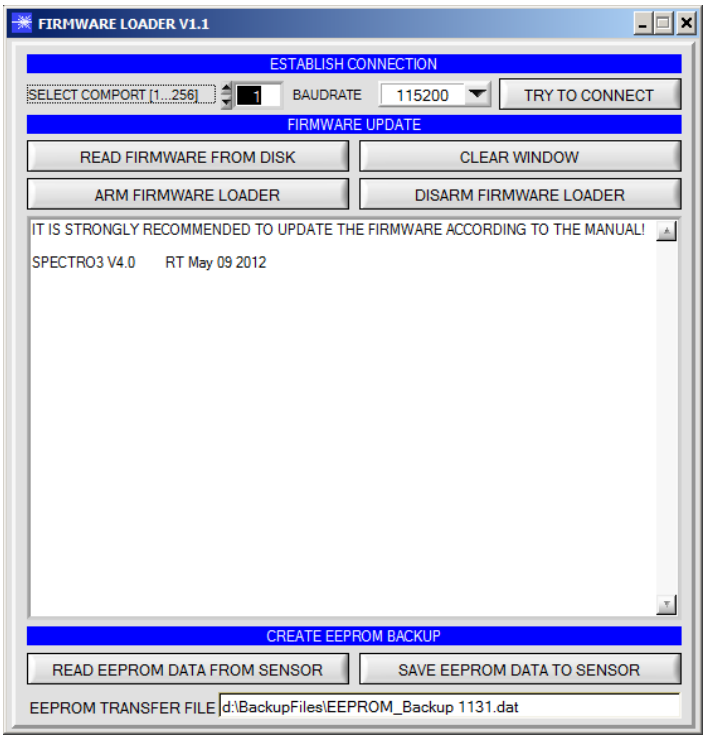


The SPECTRO-T-4-DOCAL-Scope software enables data to be recorded and also allows the measurement data to be viewed during recording.

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“:



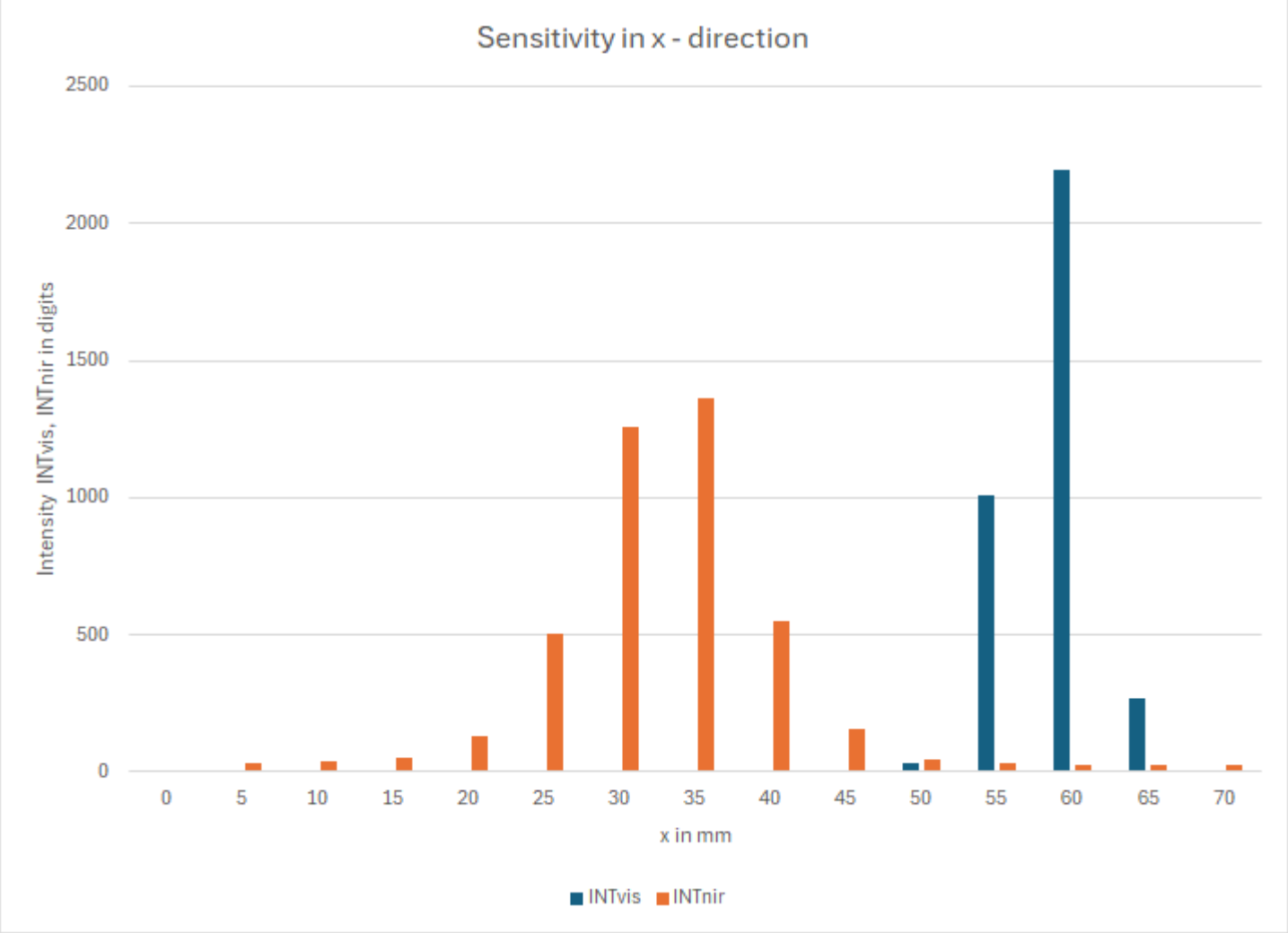
The software „Firmware Loader“ allows the user to perform an automatic firmware update. The update will be carried out through the RS232 interface.

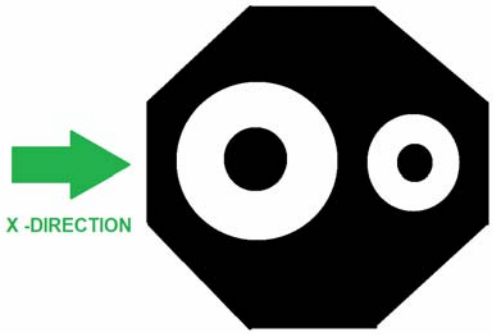
An initialisation file (xxx.ini) and a firmware file (xxx.elf.S) are required for performing a firmware update. These files can be obtained from your supplier. In some cases an additional firmware file for the program memory (xxx.elf.p.S) is also needed, and this file will be automatically provided together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



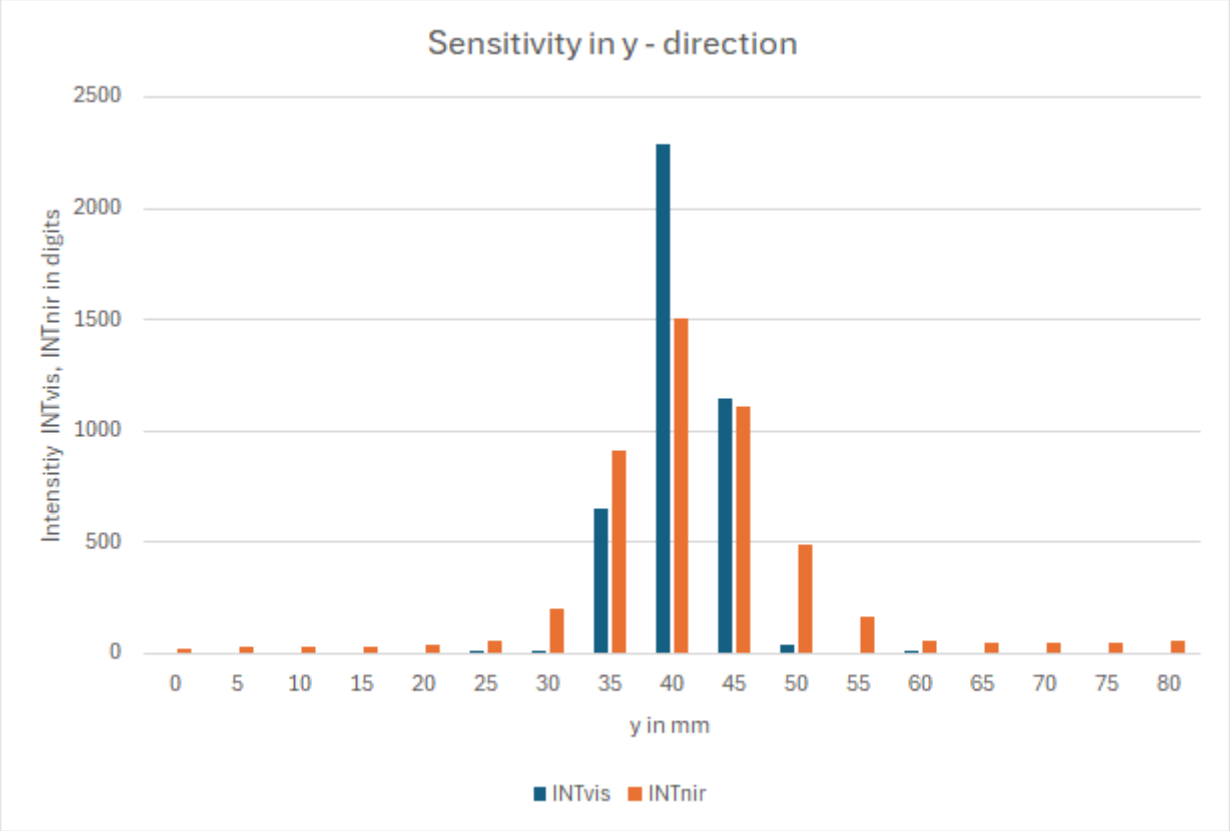


Half value width for INTnir: typ. 12 mm (of the detection range)
Half value width for INTvis: typ. 8 mm (of the detection range)

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)

Measurement Process

Measurement process of the SPECTRO-T-4-MOBILE-VISNIR mobile measurement system

The measuring head is placed directly on the granulate during measurement. After starting the measurement software, the sensor head is moved over the granulate; this increases measurement accuracy by reducing the dependence on the random pellet position.

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-MOBILE-VISNIR mobile measurement system.

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

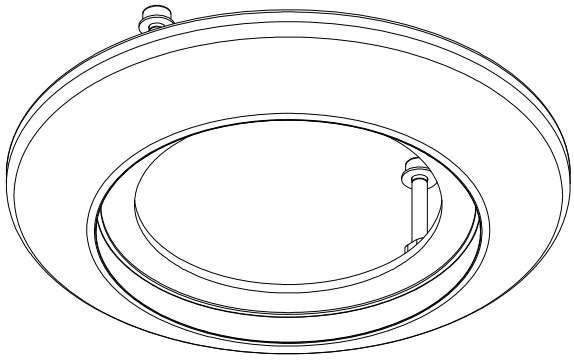
Aluminum card in RAL format (148x105mm) colorless

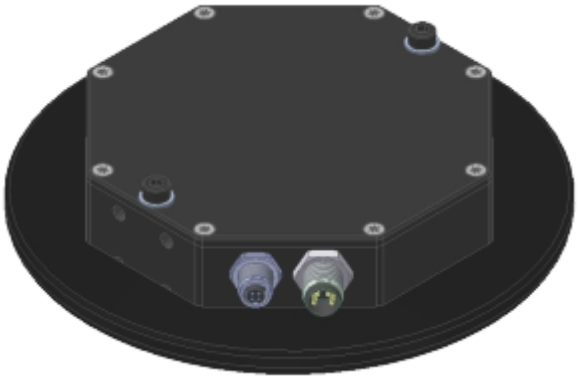
Offline Unit

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

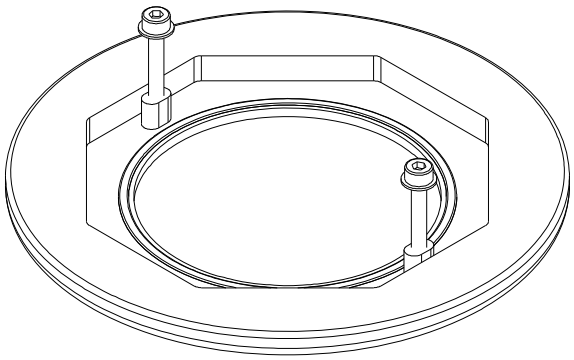
FW-B270-75-OFL (offline unit)

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

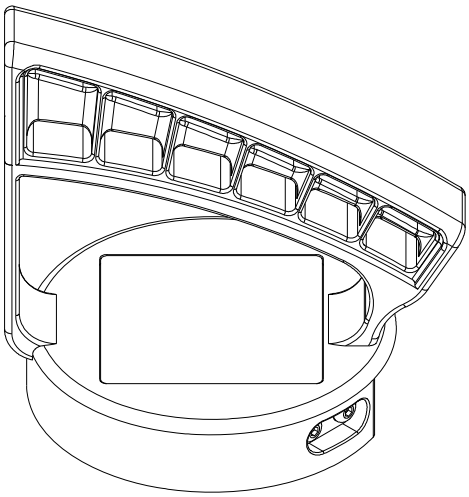


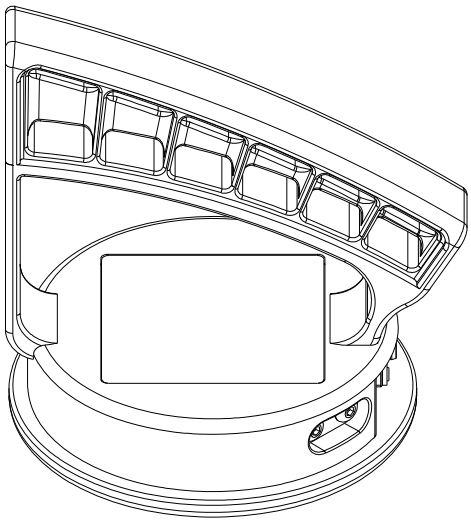
Handle

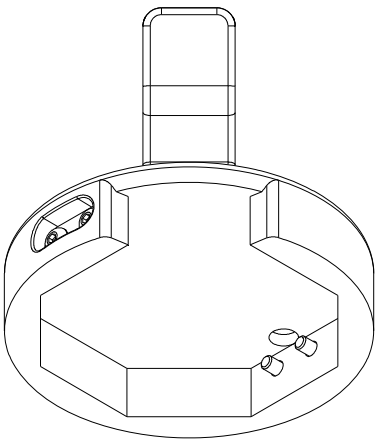
SPECTRO-T-4-10-HANDLE
(included in the scope of delivery)

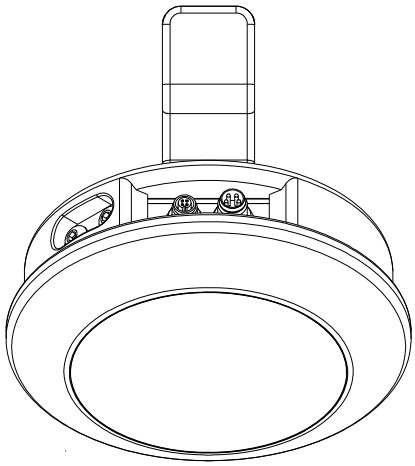
SPECTRO-T-4-10-HANDLE

SPECTRO-T-4-10-HANDLE
with SPECTRO-T-4-10-DIF-VISNIR





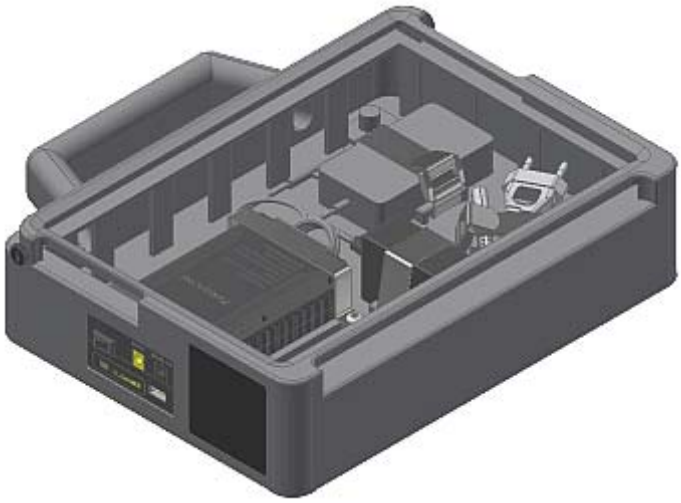




Accessories

TABUN-13“ (V1.1) (battery-powered tablet PC for power supply of SI sensors)
(please order separately)

TABUN-13“ (V1.1)
incl. Microsoft Surface Pro 11 (Windows® tablet PC)
incl. Microsoft Surface keyboard with Slim Pen 2
incl. Power supply (2-piece) for tablet PC Surface Pro 11
incl. Rechargeable lithium-ion battery TalentCell PB240A1
incl. Power supply for battery TalentCell PB240A1



The battery-powered **TABUN-13" (V1.1)** tablet PC can be connected to almost all Sensor Instruments sensors featuring an RS232 interface. Various cables, available separately as accessories, enable connection to the +24V battery integrated in the TABUN-13" (V1.1) housing.

The Microsoft Surface Pro 11 tablet PC can be connected to the RS232 socket of the respective sensor using the USB-C interface adapter cable cab-4/USBC-... (available separately). The sensor and TABUN-13“ (V1.1) thus form a self-sufficient, mobile unit.

The Windows® software versions from Sensor Instruments required for using the SI sensors can be preinstalled on the TABUN-13” (V1.1).

View:
Microsoft Surface Pro 11
(tablet PC)

View:
Microsoft Surface keyboard
with Slim Pen 2