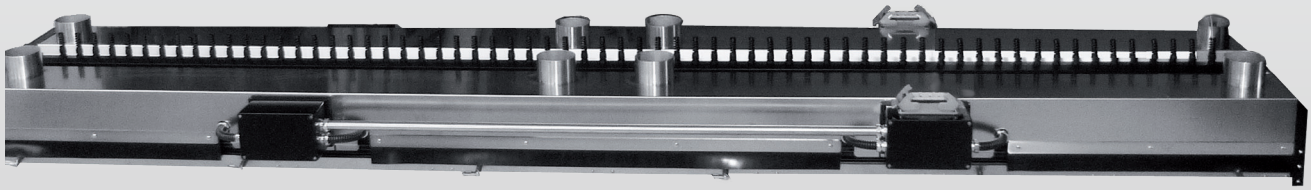
Analytical
Process
technology

MULTIPLEXED NIR SPECTROMETER



KUSTA1.9MPL-24V

LLA Instruments GmbH & Co. KG

KUSTA1.9MPL-24V

Purpose

The multiplexed NIR spectrometer KUSTA1.9MPL-24V is ideally suited for recycling applications. The spectrometer can be connected to probe lines (64 measurement tracks) via fiber cables. In this case, a spacially resolved record of the classified material is generated. The spatial resolution is suitable for the detection of particles larger than 30 mm. Due to the high spectral resolution, even small spectral differences can be detected; therefore a separation of similar plastics e.g. ABS and PS becomes possible. The high scan rate of up to 70 Hz enables an identification and detection of material streams at conveyor belt speeds of up to 3 m/s (figure 2).

Setup

The light, which is reflected from the objects, is collected by the fiber optics of the probe line and subsequently projected - one track after another - by a rotating mirror to the spectrometer/sensor. For each track, a complete NIR spectrum is recorded and classified. By recomposing the classification results of all tracks the identification of the complete material stream is obtained. The multiplexed NIR spectrometer is offered in combination with a probe line PMAmpl for line scan detection of material streams on a conveyor belt in the recycling plant. The scope of delivery includes next to the NIR spectrometer an industrial PC as well as comprehensive control and analysis software (figure 1). An RGB color sensor is included as standard.

Key characteristics

- **Praxis proven technology, hundreds of installations worldwide**
- **High resolution multiplexed NIR spectrometer with fibre optic for non-contact detection**
- **Spectrograph with cooled InGaAs linear sensor**
- **Comprehensive tools for setup and service**
- **Industrial PC incl. Windows® 7 Embedded OS**
- **Analysis routines for standard sorting applications in recycling included**

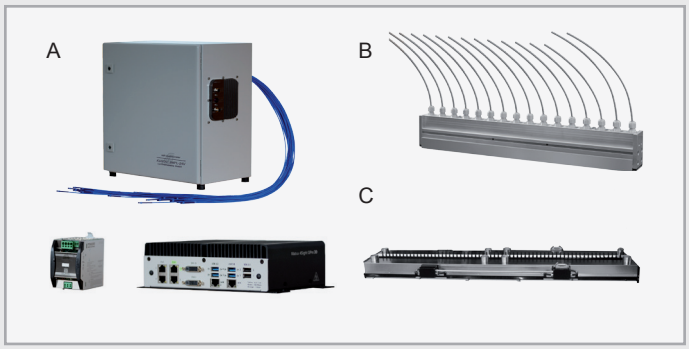


figure 1: Setup: A - multiplexed NIR spectrometer, B - optic line OL incl. optical fibers, C - process probe line PMAmpl

Applications for recycling

LLA devices are utilised for a wide range of applications. The sorting task can be changed by simply selecting a different identification routine in the device software. Several ready-to-use applications are available for recycling.

- **Household waste (idHwaste)**
  Identification of: PET, PE, PP, PS, PVC, PA, PE-bottles, PE-foil, paper, cardboard, wood, liquid packing board (TETRA), textiles, PET-bottles with PE-, PP- or PVC-label, HD-PE, LD-PE , PET and PET-G (figure 2, figure 3)
- **Waste paper (idPaper)**
  Identification of: Office paper, magazines, newspapers, catalogues, cardboard, folded box, liquid packaging board (TETRA), PET, PE, PP, PS and PVC
- **Electronic waste / WEEE (idEwaste)**
  Identification of: ABS, PS, PA, PBT, PC, PE, PP, PET, PVC, PMMA, PUR, POM, PC+ABS, PPE+SB, PVC+ABS, ABS+TBBPA, ABS+TBBPAep, PS+TBBPA, PS+TBBPEep, paper, cardboard and wood (figure 3)
- **Extraneous material in C&D (idDebris)**
  Identification of: Plastics, wood, paper, card boards, gypsum and gas concrete in mixed debris

Applications for recycling

- **Fractioned RC-construction material in C&D (idCM)**
  Identification of: Gypsum, concrete/lightweight concrete, sand-lime brick, gas concrete, brick and extraneous materials (wood, paper/card boards, plastics) (figure 3)

- **Printed circuit boards (idPCB)**
  Identification of: ABS, PS, PA, PBT, PC, PE, PP, PET, PVC, PMMA, PUR, POM, PPE+SB, printed circuit boards, epoxy resin drenched printed circuit boards, silicone foils, melamine formaldehyde resins (MF), liquid crystal display (LCD), paper, cardboard and wood (figure 3)

figure 2: Multiplexed NIR spectrometer for waste sorting

figure 3: Applications for recycling by NIR technology

Analytical and control software

The KUSTA1.9MPL-24V spectrometer is delivered including a comprehensive set of software. The control software KustaMPLe (figure 4) permits adjusting of spectrometer parameters and monitoring of spectrometer status. In addition to the spectrometer control options, several standardised interfaces are implemented in KustaMPLe for data transfer to an external process control device. Important device parameters are password protected and therefore changeable by authorised service personnel only. In addition, the application routine can be changed in service mode, enabling an easy adaption of the multiplexed NIR spectrometer to different sorting tasks. Additionally, LLA offers chemometric software for application development (KustaSpec) and software (Kusta Online Belt) for visualisation of material streams in real time (figure 5).

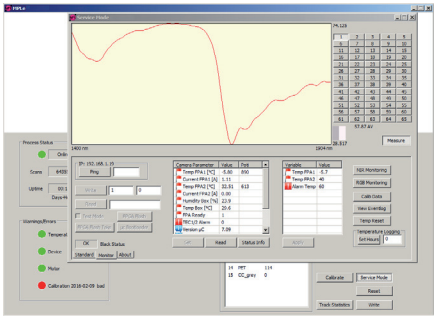


figure 4: Device control software KustaMPLe

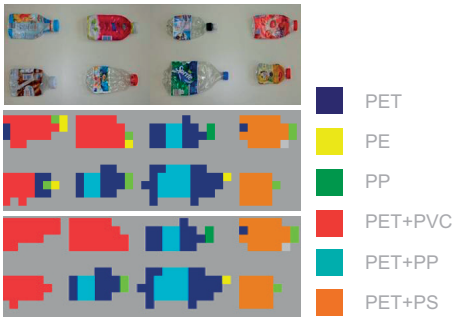


figure 5: Visualisation software Kusta Online Belt

Technical data

NIR spectrometer	KUSTA1.9MPL-24V
Method	Non-contact and non-destructive testing (NDT) method based on NIR spectroscopy; detection of absolute remission as a function of the wavelength
Wavelength range	1.36 µm – 1.94 µm
Spectral resolution	< 8 nm
Dispersion per pixel	4 nm
Scan rate	30 Hz – 70 Hz
Number of measurement tracks	Max. 64
16bit RGB sensor	Integrated
Operating voltage optical unit	24V DC, max. 3.6A (without industrial-PC and control cabinet heating)
Operating voltage industrial PC	24V DC, max. 4.8 A
Operating voltage control cabinet heating	24V DC, 7A, 150W
Voltage supply 24V power supply	90…265 V AC, 50-60 Hz, fuse 20 A (T); Input: 100 V ... 240 V AC, Output: 24V DC / 20A
Environmental operating temperature	+5 °C to +55 °C
Environmental operating Humidity	In process: 5 % – 95 % 20 % – 95 % rel.
Weight	31 kg
Dimensions (LxWxH)	500 mm x 500 mm x 300 mm

Process probes	
Probe lines	PMAmpl (Remission)

Setup	
Base device	Optic module containing the spectrometer, optical multiplexer and control electronics in a housing of protection class IP65, external: industrial PC, 24V power adapter
PC configuration	Operating system Windows® 7 Embedded, 1,7 GHz, 8 GByte RAM, Solid State Disk 80 GByte, connectivity: DVI, COM, USB, Ethernet
Software	Control software KustaMPL, customer specific analysis routines, Optional: spectrometric development environment KustaSpec
Operation	Process mode: the process unit interacts via Ethernet interface with the industrial PC, which evaluates the spectra. Controling the system with a TFT display, mouse and keyboard for service purposes is possible but is not included in the scope of delivery.

PP-MG-KUSTAx.xMPL-1801
Product photos by: Meyerfoto

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