

The portable 2-channel spectral sensor system is specifically designed for the measurement of diffuse reflection/emission characteristics of plants and soil. The sunlight is used as natural light source. The system is available for various spectral ranges from 350 to 2.150nm. HandySpec Field is used by several well known scientific

institutes for years and shows superior performance within this demanding environment. tec5 is also known as partner of Yara GmbH & Co.KG in Dülmen for the development and production of the Yara N-Sensor, the tractor based system for the site-specific N-fertilization.



Fig. 1: HandySpec<sup>NIR</sup>

#### Application area:

- ü Remote sensing
- ü Plant production / Ecology

#### Advantages:

- ü Internal compensation of sunlight variations
- ü Robust, portable instrument design
- ü Modern detector array technology
- ü Online correction of dark current
- ü High dynamic range
- ü Specially adapted, user-friendly software

#### Spectral Sensor

The HandySpec Field is based upon the high-quality spectrometer modules from Carl Zeiss. Their main features are high signal-to-noise ratio, outstanding wavelength accuracy and long-term stability. No recalibration is necessary.

#### Illumination

The sunlight is used as light source for generating the diffuse reflection of plants. Because the intensity and spectral emission of the sunlight varies a lot the system is designed as a 2 channel device. As a key functionality the reference channel permanently compensates for these variations (simultaneously - VIS system or sequentially - NIR system).

#### System Design

The portable system consists of a measuring unit and a sensor head, which is connected to the main unit by flexible optical fibers. The main unit comprises the two spectrometer modules, the operating electronics and an exchangeable battery pack. The sensor head contains two input windows with the receiving optics and the shutter module (if applicable); one port picks up the reflected light from the ground whereas the other one automatically records the sun irradiance. The reference channel is equipped with a cosine diffusor. The measurement itself is controlled by one push button only located on top of the sensor head.



Fig. 2: HandySpec<sup>VIS</sup>

#### Dynamic Range

Because of the wide dynamic range (15 or 16 bit; 32.000 or 65.000 counts) a readjustment of the integration time is only necessary under extreme illumination conditions.

## Designs



Fig. 3: HandySpec<sup>VIS\_CT</sup>

HandySpec<sup>Field</sup> is available in three different basic versions: The backpack version (fig.1) is designed for the VIS- and NIR-region and offers high carrying comfort even in pathless areas. The shouldered model (fig.2) is the small and compact version for the VIS/NIR area up to 1100nm and features a low weight. The third type shown in fig.3 is the HandySpec<sup>VIS\_CT</sup>.

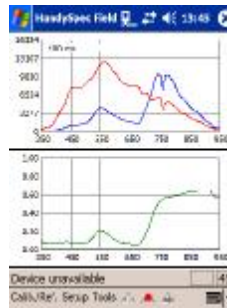
It is carried in front of the body by means of a belt. The elevated measurement head mounting accomplishes a bigger measurement spot. The angle between measurement channel and reference channel is 120 degrees.

### White Standard Adapter



The spectral calibration of the two measurement channels is performed by means of the White Standard adapter. The White Standard, made of teflon material, can be connected to the sensor head easily and reproducibly using the bayonet lock of the adapter.

## Software



The HandySpec Field system is provided with an easy-to-use application software based on Win CE, especially designed for portable use. The user interface consists of displays and menu options for setting parameters, data display and storage. The measurement- (or integration-) time is automatically adjusted to the given light conditions (typ. 0.1-1s). Alternatively various other software modules are available for operating the system under Windows XP.

### Operating Unit

A small PDA is used to operate the instrument. It offers the user interface for parameterizing and visualisation as well as for data storage. The saved data can be transmitted to a standard Windows-based PCs using common synchronising mechanisms (USB cable + sync. software). Alternatively, the spectrometer system can be operated by every customary laptop. The connection to the spectrometer-system is done via USB interface for all types.

### Technical Data

Spectral range [nm]	Pixel dispersion [nm]
360 – 900	3.3
400 – 1100	3.3
400 – 1690	3.3 bzw. 1.5
400 – 2150	3.3 bzw. 5
960 – 1690	1.5
1000 – 2150	5

### Power Supply Unit:

Interchangeable, rechargeable battery pack 4Ah (allows ca. 8 hours of operation) or 12V DC power supply voltage.



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