PolyPen RP 410

PolyPen RP 410 features a complete system for measurement of spectral reflectance of an internal light source (Xenon incandescent lamp 340 – 1,050 nm) from leaves and other types of samples.

PolyPen RP 410 incorporates formulas of commonly used reflectance indexes (e.g., NDVI, NDGI, PRI etc.) into its software and displays values of selected indexes for the measured sample. Measured data are instantly displayed in graphs or data sheets on the device screen display. They are also stored as full spectrum in the device memory for later re-collection or transfer onto a PC.

◥ APPLICATIONS

- Photosynthesis research and education
- Plant biology
- Plant screening & field studies
- Environmental monitoring
- Ecology
- Agriculture and horticulture

◥ VERSIONS

RP 410 UVIS
- Spectral response range: 380 to 780 nm

RP 410 NIR
- Spectral response range: 640 to 1,050 nm

◥ KEY FEATURES

- Complete system for measurement of spectral reflectance on leaves
- Automatic calculation of all commonly used reflectance indices
- Custom indices calculation possible
- Rugged and compact device for both lab and field applications
- Programmable via intuitive touch--screen use
- Integrated light source
- Leaf clip for non-destructive, *in-situ* measurements
- Comprehensive software for data processing
- USB communication for data transfer
- Handheld, lightweight and battery--powered with affordable price

◥ SOFTWARE

- Automatic calculation of all commonly used reflectance indices
- Calculation of custom indices possible
- Instant data graphs and data sheets
- Export to a PC via USB communication
- Data browsing and data averaging
- Visualization and data transfer routines to Microsoft Excel
- GPS mapping plug-in
- Future firmware updates

◤ LIST OF CALCULATED VEGETATION INDICES

- **Normalized Difference Vegetation Index (NDVI)**
  Reference: Rouse et al. (1974)
  Equation: $NDVI = (R_{NIR} - R_{RED}) / (R_{NIR} + R_{RED})$

- **Simple Ratio Index (SR)**
  Reference: Jordan (1969); Rouse et al. (1974)
  Equation: $SR = R_{NIR} / R_{RED}$

- **Modified Chlorophyll Absorption in Reflectance Index (MCARI1)**
  Reference: Haboudane et al. (2004)
  Equation: $MCARI1 = 1.2 \times [2.5 \times (R_{790} - R_{670}) - 1.3 \times (R_{790} - R_{550})]$

- **Optimized Soil-Adjusted Vegetation Index (OSAVI)**
  Reference: Rondeaux et al. (1996))
  Equation: $OSAVI = (1 + 0.16) \times (R_{790} v R_{670}) / (R_{790} - R_{670} + 0.16)$

- **Greenness Index (G)**
  Equation: $G = R_{554} / R_{677}$

- **Modified Chlorophyll Absorption in Reflectance Index (MCARI)**
  Reference: Daughtry et al. (2000)
  Equation: $MCARI = [(R_{700} - R_{670}) - 0.2 \times (R_{700} - R_{550})] \times (R_{700} / R_{670})$

- **Transformed CAR Index (TCARI)**
  Reference: Haboudane et al. (2002)
  Equation: $TSARI = 3 \times [(R_{700} - R_{670}) - 0.2 \times (R_{700} - R_{550}) \times (R_{700} / R_{670})]$

- **Triangular Vegetation Index (TVI)**
  Reference: Broge and Leblanc (2000)
  Equation: $TVI = 0.5 \times [120 \times (R_{750} - R_{550}) - 200 \times (R_{670} - R_{550})]$

- **Zarco-Tejada & Miller Index (ZMI)**
  Reference: Zarco-Tejada et al. (2001)
  Equation: $ZMI = R_{750} / R_{710}$

- **Simple Ratio Pigment Index (SRPI)**
  Reference: Peñuelas et al. (1995)
  Equation: $SRPI = R_{430} / R_{680}$

- **Normalized Phaeophytinization Index (NPQI)**
  Reference: Barnes et al. (1992)
  Equation: $NPQI = (R_{415} - R_{435}) / (R_{415} + R_{435})$

- **Photochemical Reflectance Index (PRI)**
  Reference: Gamon et al. (1992)
  Equation: $PRI = (R_{531} - R_{570}) / (R_{531} + R_{570})$

- **Normalized Pigment Chlorophyll Index (NPCI)**
  Reference: Peñuelas et al. (1994)
  Equation: $NPCI = (R_{680} - R_{430}) / (R_{680} + R_{430})$

- **Carter Indices**
  Reference: Carter (1994), Carter et al. (1996)
  Equation: $Ctr1 = R_{695} / R_{420}$; $Ctr2 = R_{695} / R_{760}$

- **Lichtenthaler Indices**
  Reference: Lichtenthaler et al. (1996)
  Equation: $Lic1 = (R_{790} - R_{680}) / (R_{790} + R_{680})$; $Lic2 = R_{440} / R_{690}$

- **Structure Intensive Pigment Index (SIPI)**
  Reference: Peñuelas et al. (1995)
  Equation: $SIPI = (R_{790} - R_{450}) / (R_{790} + R_{650})$

- **Gitelson and Merzlyak Indices**
  Reference: Gitelson & Merzlyak (1997)
  Equation: $GM1 = R_{750} / R_{550}$; $GM2 = R_{750} / R_{700}$

◤ POLYPEN MEASURES

- Absorbance – calculated data using the following formula
- $A = \log(I_0/I)$, where I_0 is reference light intensity and I is measured light intensity
- Transmittance – calculated data using the following formula
- $T = I / I_0$, where I_0 is reference light intensity and I is measured light intensity

◤ TECHNICAL SPECIFICATION

- **Light Source:** Xenon incandescent lamp 380 – 1,050 nm
- **Spectral Response Range:** 380 – 790 nm (UVIS), 640 nm – 1,050 nm (NIR)
- **Spectral Response Half Width:** 8 nm
- **Spectral Straylight:** -30 dB
- **Optical Aperture Diameter:** 5 mm
- **Scanning Speed:** About 100 ms
- **Touch Screen:** 240 × 320 pixel; 65,535 colors
- **Memory Capacity:** 32 Mbit (up to 4,000 measurements)
- **System Data:** 16 bit A/D conversion
- **Dynamic Range:** High gain: 1:4,300; Low gain: 1:13,000
- **Communication:** USB
- **Dimension / Weight:** 153 × 76 × 44 mm / 350 g
- **Case:** Splash-proof
- **Battery:** Li-ion; rechargeable via USB port of a PC