

PSI Research Center Infrastructure

Phenotyping platform for small and mid-size scale plants

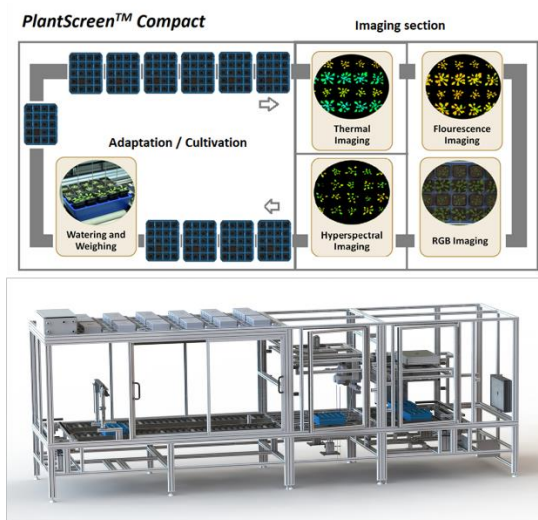
Installation name:	PSI RC 1. Small
Installation place:	PSI Research Center, Drásov, Czech Republic
Installation category:	platform under controlled environment
Environmental manipulation:	air temperature, humidity, light quantity, light quality
Trait measurements:	agronomic, chlorophyll fluorescence, growth, photosynthesis, plant structure/architecture, plant water status, plant biochemical status
References:	AWLIA M., NIGRO A., FAJKUS J., ET AL. (2016): High-throughput non-destructive phenotyping of traits contributing to salinity tolerance in Arabidopsis thaliana. Submitted Frontiers in Plant Sciences. DOI: 10.3389/fpls.2016.01414
Contact information:	panzarova@psi.cz http://plantphenotyping.com/about-us/#psi-research-center

Technical specifications

Max plant size:	40 cm
Max throughput:	320 – 960 plants
Temperature range :	18-30°C
Humidity range:	40 – 80% Rh
Max light intensity	500 $\mu\text{mole/m}^2\text{s}$ PAR
Imaging units:	top and side RGB, kinetic chlorophyll fluorescence, thermal camera, VNIR hyperspectral camera
Others sensors:	watering and weighing unit, dark/light adaptation chamber, environmental sensors

General description

PlantScreen™ Compact System for small and mid-size scale plants up to 40 cm with throughput of 320 plants in one run is installed in controlled environment (FytoScope FS_WI, PSI, Drásov, Czech Republic). The platform is equipped with four robotic-assisted imaging units for high-resolution thermal imaging, Red Green Blue (RGB) imaging, kinetic chlorophyll fluorescence imaging and VNIR hyperspectral imaging. In addition adaptation chamber for plant light/dark adaptation and/or cultivation is implemented with illumination 0 – 500 $\mu\text{mole/m}^2\text{s}$ PAR. A weighing/watering unit for precise water management is included. Plants set in trays are transported from adaptation chamber to the individual imaging units and watering/weighing unit by conveyor belts. The plant carrier tray system is designed to contain either two single pots, twenty individual pots or 6 multi-well plates. The system is located in a climate-controlled chamber with a temperature range of 18 to 30°C and a relative humidity range of 40 -80 %. Additionally, plants can be also cultivated in FytoScope Walk-In (PSI, Czech Republic) growing chamber situated next doors (about 1 440 plants) and regularly transferred into the phenotyping platform to increase the throughput and modularity of the system. The multi-sensor setup allows to determine large number of plant traits describing the growth and developmental dynamics, plant architecture and color, photosynthetic performance of the plants, plant water relations and leaf temperature and plant biochemical status. The data management pipeline Plant Data Analyser (PSI, Drásov, Czech Republic) is used for automated data handling including pre-processing, segmentation, feature extraction and post-processing, all raw and result data being stored in SQL database.



Imaging sensors

Visible RGB imaging unit

One top and two side cameras

Resolution (MPix): 5

Resolution (H x W): 2560 x 1920 pixels

Output: 12 bit

Image frequency: 14.1 fps

Thermal imaging unit

Top view camera with homogenous light illumination source

Resolution (H x W): 640 x 450 pixels

Spectral range: 7.5 μm to 13 μm

Output: 16 bit

Thermal sensitivity: < 0.05 $^{\circ}\text{C}$ at 30 $^{\circ}\text{C}$

Image frequency: 50 Hz

Chlorophyll fluorescence imaging unit

Top view camera with light panel supplementing saturating light up to 6000 $\mu\text{mol m}^{-2}\text{s}$, actinic light up to 2000 $\mu\text{mol m}^{-2}\text{s}$ and pulse-modulated short duration flashes.

Resolution (H x W): 720 x 560 pixels

Output: 12 bit

Frame rate: 50 fps

VNIR hyperspectral imaging unit

Top view camera with illumination source

Spectral range: 350 - 900 nm

Wavelength resolution, FWHM: 0.8 nm

Spatial resolution: 1000 pixels (max 1000 pixels)

Spectral resolution: 1920 pixels (max 1920 pixels)

Image frequency: 45 fps



PSI (Photon Systems Instruments), spol. s r.o.

Drasov 470, 664 24, Czech Republic

+420 511 440 012

info@psi.cz

VAT: CZ60646594