

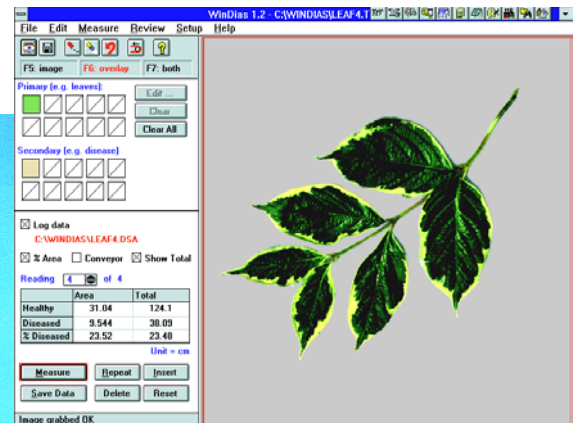
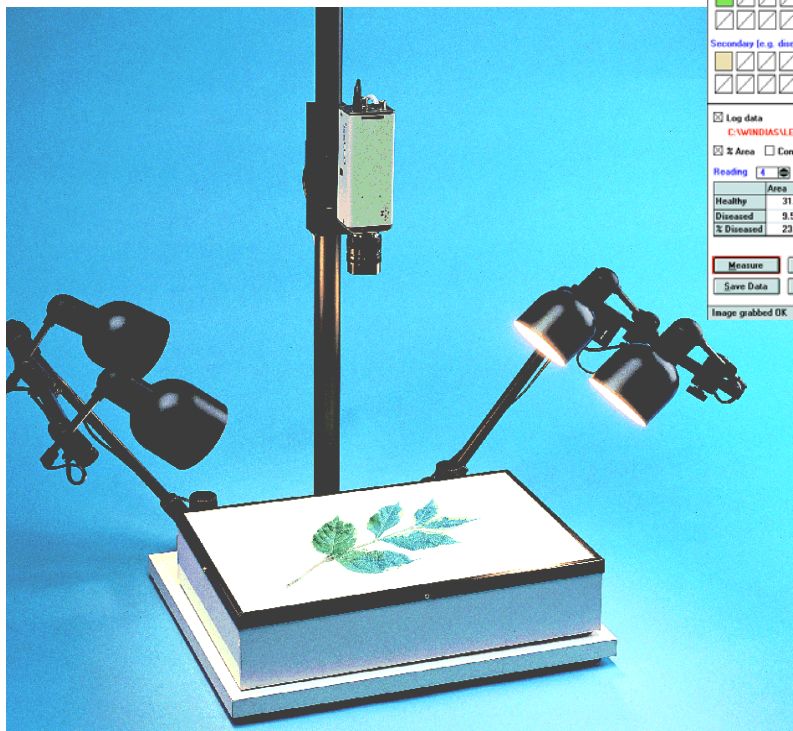
WinDIAS

Delta-T Devices Ltd

Colour Image Analysis System

- **Rapid, inexpensive, true colour image analysis**
- **Advanced Leaf Area Meter features**
- **Automated measurement of diseased and healthy leaf areas**
- **Simple, powerful colour picking**
- **Conveyor accessory for rapid processing of leaves**

WinDIAS provides high speed measurement and analysis of leaf area and leaf features, making it the ideal tool for plant pathology applications



What it does

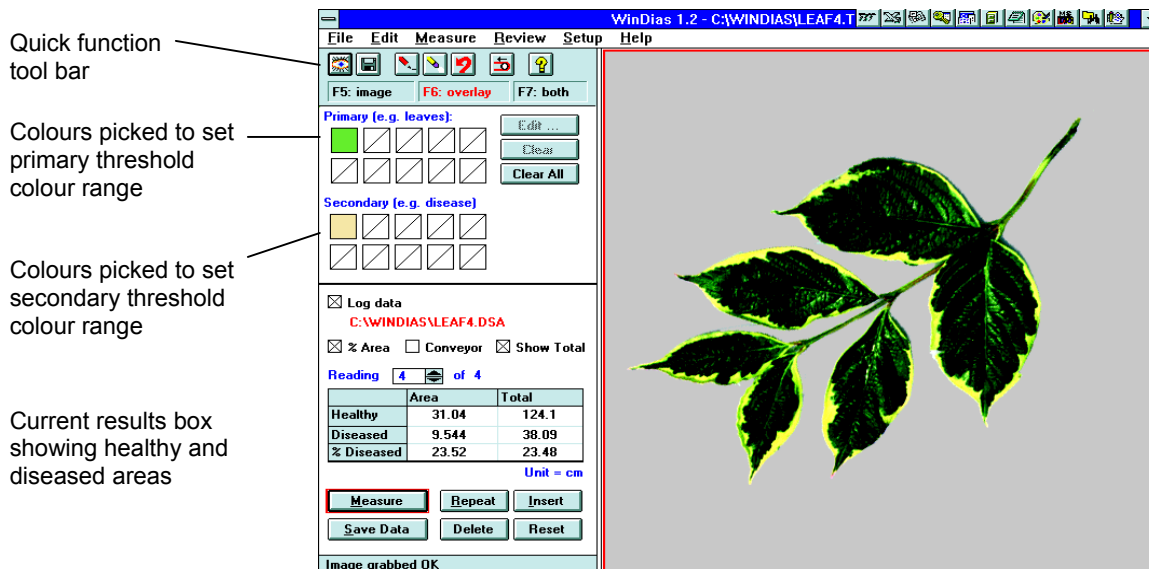
The WinDIAS system uses a PC with an image grabber card to offer fast image analysis for a wide range of applications. It provides a full set of measurement statistics, and can process up to 800 leaves per hour with the conveyor option.

For reporting and further analysis, all results and images from WinDIAS are easily exchanged with other Windows applications.

WinDIAS is especially suited to applications that need high colour discrimination, for example in plant pathology; it can also count objects in an image.

The WinDIAS components include a high resolution colour CCD video camera and a powerful image grabber card; a lightbox and overhead lighting unit ensure good contrast and colour rendition. The WinDIAS card and software are supplied pre-installed in a PC.

Point and click colour selection



Rapid thresholding: Two thresholds can be set, each based on a different user-defined range of colours. The primary threshold is used for the main zones of interest in the image, e.g. healthy areas. The secondary threshold is used for other zones, e.g. diseased areas. Thresholds are set by a simple point and click with the mouse in a region of interest. The areas included are immediately visible as a grey (primary) and light blue (secondary) overlay on the image. WinDIAS grabs a 512 x 512 pixel image, and can distinguish 16.7 million colours.

WinDIAS features

Editing: Using the mouse, images can be edited on-screen to retouch boundaries, separate objects that overlap, remove undesirable "noise" and holes, add or erase lines, rectangles and polygons, and fill bounded areas in any user-specified colour.

Measurement: WinDIAS analyses the thresholded regions to measure the following parameters: area, perimeter, length, width, circularity, elongation and shape factor.

Calibration is carried out against a ruler. Where projected area has to be used to estimate the surface area (of pine needles for example) a correction factor can be applied.

Object count: Seeds, needles, or other small objects can be quickly counted by WinDIAS. Colour thresholding enables easy discrimination of different types of object, or disease spots. Dust and debris can be excluded by defining a minimum object area.

Exchange of data and images: WinDIAS stores and uses images in 24-bit colour TIF format. Results can be transferred to other Windows applications, such as Excel, stored on file, and printed out in formatted reports.

WinDIAS accepts images from many sources, such as CCD video cameras, video recorders, and images stored on computer media.

Zoom An optional zoom lens kit permits fields of view down to 5 mm across, without the need for a microscope.

Ideal for Plant Pathology

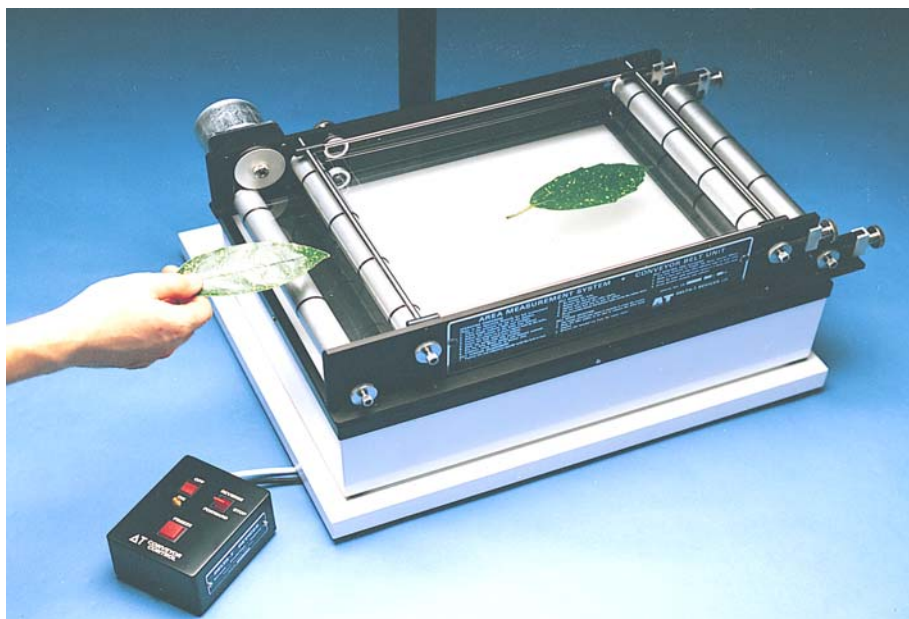
Diseased and healthy leaf area Rapid measurement of a wide variety of leaf types is a key requirement in plant pathology. WinDIAS automates these measurements after a simple setup procedure.

By pointing and clicking with the mouse on the image, up to 10 examples of colours from healthy leaf regions can be tagged, and up to 10 examples from diseased regions.

These defined bands allow for the natural colour variation among samples of healthy leaves, permitting WinDIAS to distinguish them from the colours present in the diseased areas - as, for example, in a mosaic virus infection.

The regions whose colours lie within the primary and secondary colour ranges show immediately as an overlay on the video image, quickly indicating if the required areas have been detected. WinDIAS can then calculate areas, make other measurements, and count the number of spots, within these regions.

Once set up, WinDIAS rapidly analyses further samples in the same way, even at conveyor belt speeds.



Conveyor Belt Unit The Conveyor Belt Unit works with WinDIAS to offer a rapid and convenient method of handling large batches of leaves. Twin transparent belts carry the leaves past the camera. A lightbox provides background illumination, and for optimal colour discrimination top lighting is also necessary.

Measurement of Long Leaves

With the addition of the Conveyor Belt Unit WinDIAS can measure leaves which are too long to fit in the field of view of the video camera. WinDIAS software repeatedly samples the leaf image as it moves past the camera at constant speed. Stored data sets include total area, and the percentages of healthy and diseased leaf area. Typically, a leaf 30cm long by 2cm wide can be measured in 4 seconds. Calibration is straightforward, using a reference leaf target of known area. In Long Leaf Mode, accuracy is typically better than $\pm 5\%$ (see specs on back page).

WinDIAS applications

Agronomy and plant physiology

WinDIAS provides a flexible resource with countless laboratory applications - from simple leaf area measurement to the analysis of complex distributions of colour. The addition of the Conveyor Belt accessory opens up further applications:

- Rapid throughput of large numbers of leaves
- Measurement of intact long leaves e.g. maize, sorghum, sugar cane and miscanthus

Crop protection

WinDIAS is optimised for the rapid analysis of area by colour difference, creating many applications in plant pathology and plant protection.

Examples include:

- Necrosis caused by pathogenic fungi and bacteria
- Leaf tip burn and leaf spotting
- Nutrient deficiency symptoms
- Viral infection and leaf senescence
- Original area of damaged or missing leaf tissue

Forestry

All of the applications described above are relevant to the study of broadleaf tree species. It is also possible to use WinDIAS with conifers; the surface area of pine needles can be estimated by multiplying the projected area by a conversion factor. Factors for Corsican Pine (*Pinus nigra var maritima*) and Scots Pine (*Pinus sylvestris*) are included in the User Manual. Generalised conversion factors and other references are also included.



WinDIAS Specifications

WinDIAS System Performance

(Specs apply to a WinDIAS system using standard components supplied by Delta-T Devices)

Accuracy - area measurement:

Typically $\pm 4\%$ of object area, for objects of simple shape occupying at least 3% of the picture area and placed within the central region of the screen (i.e. a circle of diameter 90% of the image height). Objects that are extremely narrow or indented will not meet this accuracy specification.

Accuracy - diseased/healthy area:

accuracy is affected by the colour contrast between diseased and healthy areas.

Accuracy - in long leaf mode with Conveyor Belt Unit:

Typically better than $\pm 5\%$ (based on single colour and two colour, well-contrasted long test targets of uniform widths under well controlled lighting conditions).

Resolution:

Thinnest width single line detectable: 1/512th of width of field of view. Smallest object area detectable: 1 pixel in 262,144 (-0.01 mm^2 in a viewed area of 2621 mm^2)

Maximum sample dimensions:

400 x 370 mm if object(s) placed on lightbox,
250 x 290 mm if Conveyor Belt Unit used.

Calibration:

Against an object of known length - e.g. a ruler.

Conveyor Belt Unit

Belt speeds

60/100/140/190mm/s for 50Hz models (20% faster at 60Hz), with forward, reverse, freeze and stop controls.

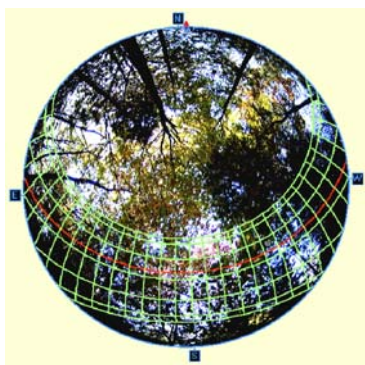
Throughput

Up to 800 leaves per hour

LAI - Leaf

Area Index

There are more ways of getting to LAI than just measuring individual leaves. We also offer SunScan and HemiView - two innovative techniques for estimating LAI non-destructively.



Computers

WinDIAS is supplied complete with a PC in which the grabber card and software have been pre-installed.

Customers who purchase directly from Delta-T will be supplied with a standard UK PC running Windows 98, set up in English language mode (for compatibility reasons we cannot install later Operating Systems).

Customers who purchase their system from a local Delta-T distributor may be offered a PC with hardware and software suited to the local language, but this service will vary from country to country. However, for compatibility reasons, in all cases the PC will have Windows 98 as its operating system. Please contact your distributor for further details.

Ordering Information

220V Systems

Basic Colour Image Analysis System type

W-B230-PCM, 230V/50Hz. Includes WDIGC-2 Colour Grabber Card, WDIGS-2 Software, Colour CCD Camera, Precision Lens, Camera Stand, Lightbox, Overhead Lights (with spare bulbs) & acrylic sheets. Supplied with PC (Windows 98) and 17" monitor

Complete Colour Image Analysis System type

W-C230-PCM, 230V/50Hz. Contents as listed for above Basic system, plus WCRC colour chart and Conveyor Belt Unit

110V Systems

Due to mains frequency issues, WinDIAS and PC systems for supply to 110V regions do not include a monitor.

Customers will need to obtain a monitor locally. Any reputable model from Compaq, IBM, Sony, Taxan etc that is compatible with Windows 98 should be suitable. 17" screen recommended. In the event of difficulty obtaining a suitable monitor please contact us.

Customers obtaining 110V systems from their local Delta-T distributor may be offered a system complete with monitor.

Basic Colour Image Analysis System type

W-B110-PC, includes 110V/60Hz versions of the items listed for Basic 220V system above
(NB no monitor included. See 110V notes above).

Complete Colour Image Analysis System type

W-C110-PC, includes 110V/60Hz versions of the items listed for Complete 220V system above
(NB no monitor included. See 110V notes above).

Zoom lens kit, spare parts and individual items

Please enquire

Root Length For root length measurement, we offer Delta-T SCAN. Please request separate data sheet.



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