

## Software for PicPort® grabbers and PentiCam

- tools and drivers for extended grabber and camera control
- powerful C/C++ libraries for real-time image processing
- easy-to-use ActiveX tools for machine vision
- configurable software for specific applications





# Products

*Leutron Vision provides a powerful toolkit for grabber and camera control. The toolkit is common for all the PicPort® frame grabbers and for the PentiCam system.*

*We also support other well-known third party vendors of image processing software by providing comprehensive hardware drivers to our products.*

**LV-SDS**, the primary software interface to PicPort® frame grabbers. In addition to the device drivers and low level libraries to control the hardware, LV-SDS also contains higher level tools to assist in the application development.

**HALCON**, a unique set of software tools for building high performance flexible vision systems. Its huge image-processing library may be accessed from C, C++, COM (Visual Basic) or from an integrated CAVE (Computer Aided Vision Engineering) tool.

**ActivVisionTools**, a Rapid Application Development (RAD) tool based on the HALCON library. It offers

the performance and robustness of the HALCON's features within straightforward and effective visual programming environment.

**VisionBlox™**, a feature full set of OCX based components designed for developing machine vision applications quickly in a visual programming environment (e.g. Visual Basic). It can save up to 70% of application development time.

**NeuroCheck®**, an interactive general purpose image processing system for industrial quality control. It offers powerful vision tools within an intuitive development interface, without the need for specialist programming.

## LV-SDS: Leutron Vision Software Development Suite

This easy to use software development environment allows users to focus on their applications without detailed knowledge of the hardware. The LV-SDS offers special tools and libraries for each application.

### Machine Vision

**Daisy SDK** – object oriented C++ library providing an essential interface between hardware and the user application.

**DRAL** – Daisy Real-time Application Library allows

the user to setup complex real-time image sequencing and processing applications on the host PC.

### Image Acquisition

**Orchid library** – high level library for developing interactive applications with a few lines of code in visual tools such as MS Visual Basic, Borland Delphi, Borland C++ Builder, etc.

**TWAIN Driver** – provides an easy interface to third party image processing or desktop publishing software packages.

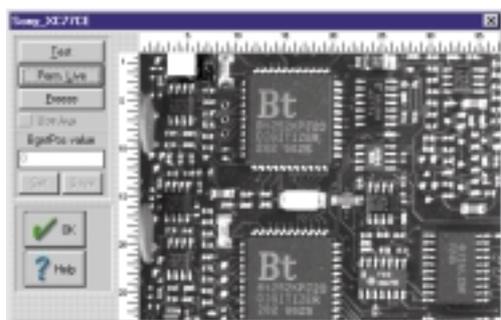
**Video for Windows Driver** for use primarily in multimedia applications.

Other multimedia drivers, i.e. MCI, are available on request.

### Additional Tools

**Interactive Camera Editor** – simple setup of standard and nonstandard cameras.

**Sample Applications** – Several ready-to-use applications are provided for quick installation. All the samples come with full source code.



## Daisy Library

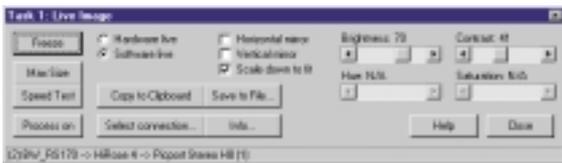
The Daisy library permits full utilization of the PicPort® frame grabbers' functionality whilst the Orchid library and Video for Windows driver simplify the programming, but use only basic frame grabber functions. Daisy is a C++ object oriented library, supplied as a set of DLLs in a 32-bit version for Windows NT4/2000 and for Windows 95/98/Me. The primary Daisy DLL is available in versions for MS Visual C++ and for Borland C++. Moreover, the Daisy library is also available in version for Linux systems.

Actual hardware is represented by Daisy classes. The most important of these being *LvGrabberNode* and *LvCameraNode*. The developer typically creates instances of these classes in the application for each grabber and camera in the system then logically connects cameras to grabbers and activates them for selected targets.

A brief list and description of the main Daisy functions with the PicPort® is as follows.

### Color image adjustment

The image brightness, contrast, hue and saturation can be adjusted in real time by the PicPort®.



### Input LUT

Input Look Up Table allowing various adjustments in a monochrome image (e.g. real-time binarization).

### Scale and mirror modes

The PicPort® frame grabbers provide interpolative or pixel skipping downscaling and horizontal/vertical mirroring.

### Lock Mask

For real time full color overlay with a Windows Device Independent Bitmap (DIB).

### Color format

A subset of Windows supported color formats (8-bit, 15-bit, 16-bit, 24-bit, and 32-bit).

### DIB/array mode

In the DIB mode the live image in the CPU memory can be directly accessed by Windows API functions, i.e. *SetDIBitsToDevice()*, *StretchDIBits()*, etc. In the array mode the image data is accessible in form of common 2D array.

### Source ROI (Region Of Interest)

Selects a rectangle from the input.

### Target ROI

Represents a channel on PicPort® (High Performance Scaler HPS or Binary Ratio Scaler BRS) with its scaling, mirroring and locking capabilities.

### Output to VGA/CPU memory

The target ROI can be mapped either to the VGA memory or to the system memory or both if required.

### Camera/grabber synchronization

The card can behave as slave or master, grabbing synchronously or in an asynchronous mode (with triggering).

### Opto-couplers

The opto-couplers can be read, set or cleared in order to control or communicate with other external devices.

### Connector management

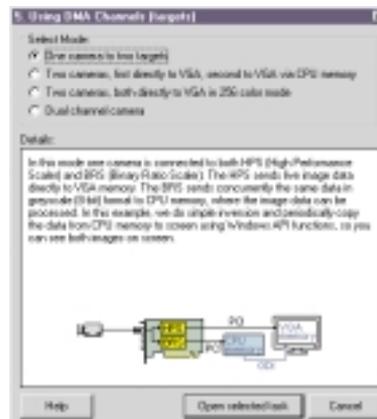
The user application can freely switch between all available connectors of the boards.

### Image grab

Activates/deactivates desired camera node, puts it to the live/freeze mode.

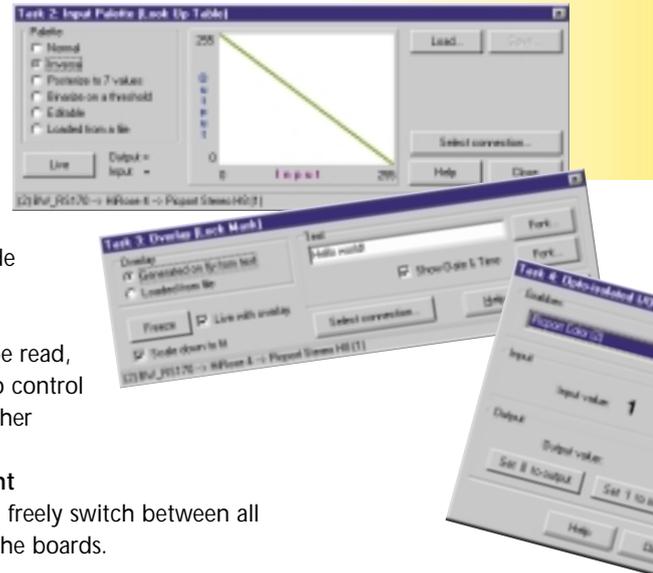
### Application synchronization

In 32-bit environment, Daisy is able to use the Win32 synchronization objects to signal various events, like start of odd/even field, vertical sync, status change in general port i/o, interrupts generated by PicPort's onboard real time sequencer; this enables the user to fully utilize the advantages of Windows multithreading application architecture.



### Other functions

A more comprehensive list of features can be found on our web site [www.leutron.com](http://www.leutron.com).



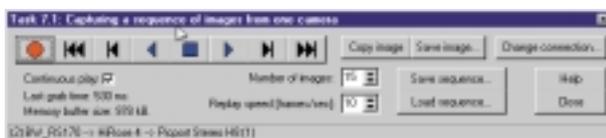


## DRAL

All boards utilize an onboard controller to guarantee performance of real time critical tasks independent of host processor or operating system. The controller functions are accessed using the Daisy Real Time Application Libraries (DRALs) to handle specific tasks, not covered with the standard Daisy programming (such as complex image sequence acquisitions with coupled I/O handling of an external device).

### Image Sequencer DRAL

The Image Sequencer DRAL was developed to allow acquisition of image sequences into the selected target



buffer. Applications can acquire series of images from either one or more cameras (from single or multiple synchronized frame grabbers) simultaneously or consecutively. Single or continuous frame acquisition modes may be selected while the number of images is limited only by the CPU memory size. All target buffers, image resolutions, color formats, scale and DIB modes are supported.

The Image Sequencer DRAL utilizes PicPort onboard opto-isolated inputs and outputs allowing synchronization with external devices. Thus frame or sequence acquisition may be triggered from «outside» and, on the other hand, devices like a flash may be controlled from the application.

### Image Preprocessing DRAL

The Image Preprocessing DRAL is a support module that allows the application to perform some simple manipulations on the acquired images. Its functionality includes noise reduction, Bayer array decoder, white balancing, etc. Processing may be performed only on selected image areas and the resulting output may be sent to a specific window on user's desktop.

DRALs are continuously being developed – please visit our website for the latest news.

## Orchid Library

Orchid is a library implementing a higher level interface between the Daisy library and the application. It covers the most used functionality provided by Daisy,



with stress put on the simplicity of usage. Simple, but functional application using PicPort® may not need more than a few lines of code (typically it is enough to set the grabber, camera and connector names plus the display window handle and then the Live method can already be called to display live image on screen).

Orchid covers both the standard PicPort® acquisition mode and the real-time modes (based on DRAL modules).

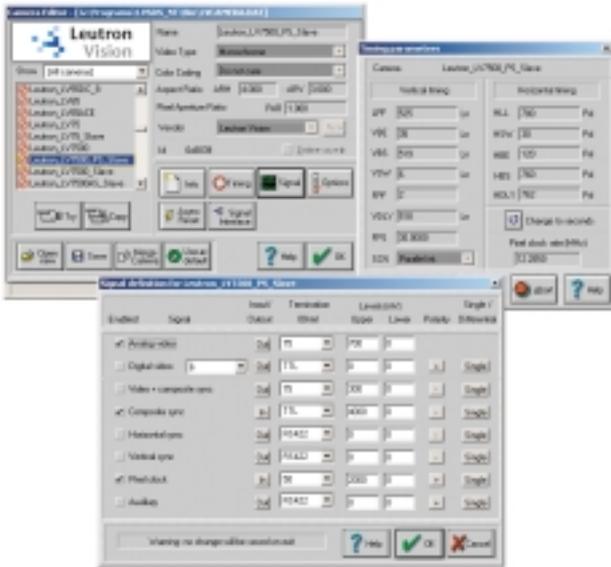
Thus it can be used not only for development of interactive user programs, but also for machine vision applications. Besides providing the Daisy functionality with strongly simplified interface, Orchid adds some more features:

- dialogs enabling to set various parameters comfortably
- displays live image in a supplied window, either in hardware or in software live mode
- saves images to BMP and JPEG files
- creates AVI files and saves images to it (without sound)
- copies images to Clipboard
- saves configuration to Windows registry or to INI files

Orchid is language independent and is available as a DLL and as an ActiveX control. It can be used in common visual tools as MS Visual Basic, Borland Delphi and C++ Builder, as well as in traditional MS Visual C++ and Borland C++. Namely the ActiveX version of Orchid enables rapid application development, just by placing the control in the application form and setting its properties and calling its methods.

## Camera Editor

The Camera Editor contains a database of the properties of many popular cameras. In addition, new cameras can be added by merely copying a similar camera



and modifying the values (within the hardware constraints of the frame grabber) and saving the modified camera file for future use.

The Camera Editor retains following information about the cameras:

**Basic information:** video type (mono, RGB, composite YC, separate YC), color coding (PAL, NTSC), aspect ratio, pixel aperture ratio.

**Timing parameters:** scanning mode (interlaced, non-interlaced, parallel), number of frames per second, fields per frame, lines per frame, line length, horizontal/vertical blank start/end, h/v sync width, h/v delay between camera and grabber.

**Signal definition:** termination, upper/lower level, polarity, input or output and single-ended or differential transmission for image and synchronizing signals (analog or digital video, video + composite sync, H/V/C sync, pixel clock, auxiliary signal).

**Asynchronous reset settings:** shutter speed (min, max, default, fixed, programmable), trigger delay, trigger type (one or two pulses on one or two pins, pin numbers, polarity), video readout timing, trigger relation to camera H/V sync.

**Signal interface:** camera signal (video, sync, trigger) interface descriptions for individual PicPort® frame grabbers.

**Other options:** various camera specific adjustments.

## Twain Driver

Twain defines a standard software protocol and application programming interface (API) for communication between software applications and image acquisition devices. The Daisy library supports the Twain interface by providing a general purpose driver that can be used to acquire images from any application supporting Twain (including Microsoft Office, CorelDRAW family and many other ones).

## Video for Windows Driver

The Leutron Video for Windows driver provides image capture functionality and can be used alone or in conjunction with other Video for Windows components, i.e. audio/video compressors and audio capture devices to manipulate complete multimedia streams. It is available for Windows NT 4.0 and Windows 2000 only.

## MCI Driver (available on request)

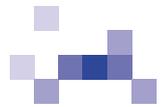
The Windows Media Control Interface (MCI) provides an interface for controlling multimedia devices. Functionality of Leutron MCI driver is accessed by means of standard Windows MCI calls, typically by sending a command string by the `mciSendString()` function.

## PicPort® Demo Program

PicPort® Demo program is supplied to guide the novice PicPort®/LV-SDS users through the complete functionality range of the products. It introduces most



of the API features via an intuitive user interface and together with an extensive set of sample programs, it enables the user or developer to start working quickly.



## HALCON Principles

HALCON is a unique machine vision tool enabling developers to build high performance flexible systems.



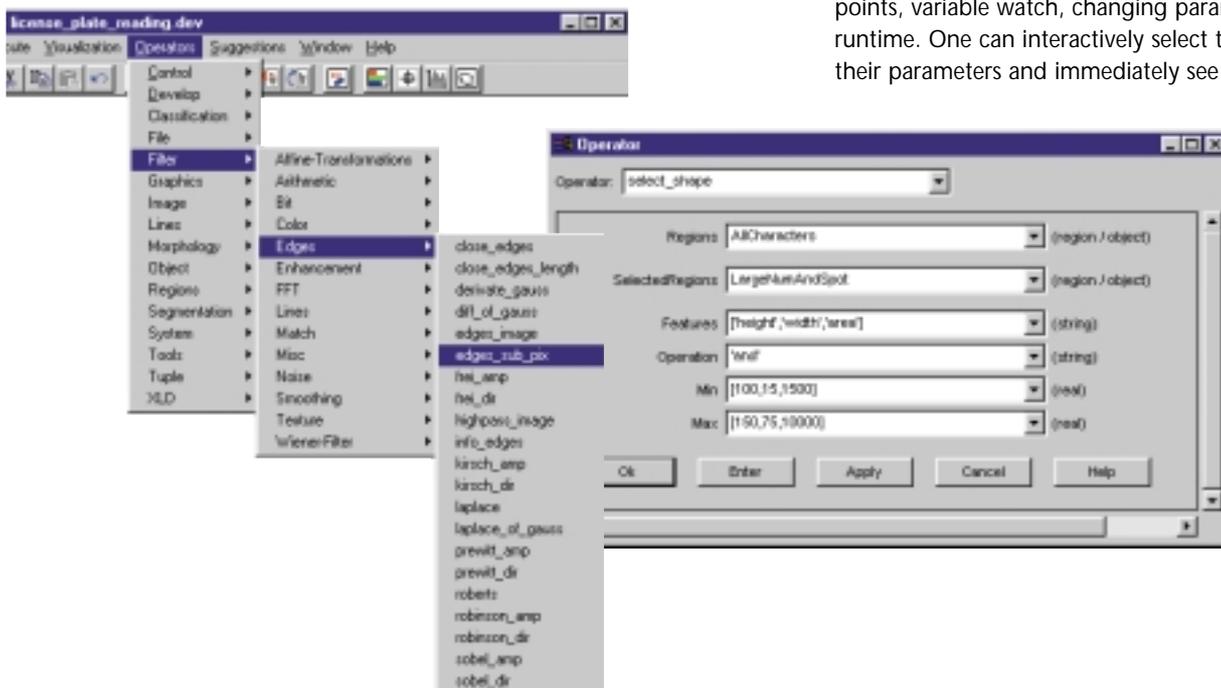
It is based on a huge image processing library with more than 950 operators for low, medium, and high level image processing - including object analysis, OCR & OCV, bar code reading, shape based pattern matching or color processing. Many of the operators work with sub-pixel accuracy (up to 1/50 pixel) and all of them are optimized for the highest performance. The HALCON is suitable for many kinds of applications from industrial inspection to remote sensing or medical image analysis. Image sequence processing (e.g. for surveillance tasks) is also available.

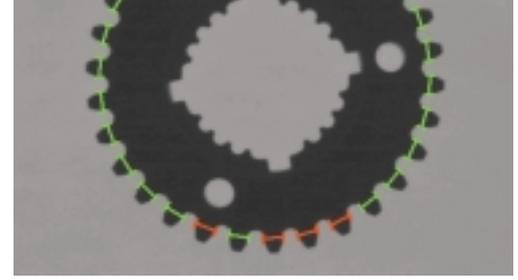
HALCON can be used in two modes. In contrast to Standard HALCON, optimized for single-processor computers, the Parallel HALCON actively exploits the power of multiprocessor computers. If more than one processor is detected, it automatically parallelizes HALCON operators without the need of rewriting a single line of code.

With HALCON, developers are not restricted to one particular programming language. HALCON library may be accessed from C, C++ or ActiveX (e.g. with Visual Basic).

In addition, users can take advantage of HDevelop, a CAVE (Computer Aided Vision Engineering) tool for rapid prototyping. This integrated part of HALCON offers a highly interactive programming environment to easily design image analysis programs quickly, with code export to C++ or Visual Basic. HDevelop provides an extensive debugging support: stepping, break-points, variable watch, changing parameters during runtime. One can interactively select the operators and their parameters and immediately see the results - in

both, numeric and pictorial forms. HALCON is available under various operating systems including Windows NT4/2000 and Linux.



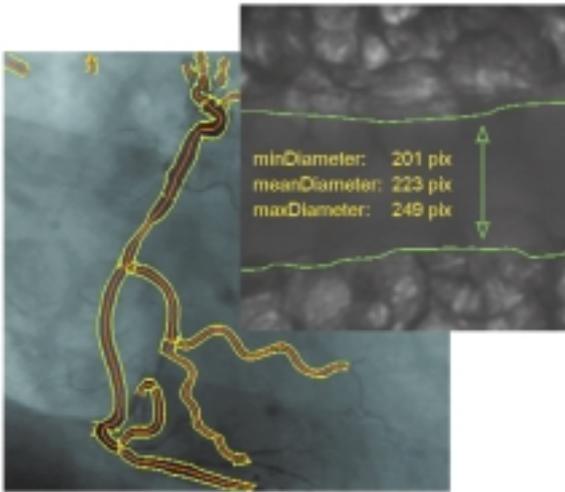


## HALCON Functions Overview

### Image Acquisition

HALCON interfaces to the complete family of PicPort® frame grabbers from Leutron Vision as well as to the PentiCam system.

Accepted input image file formats are Tiff, BMP, GIF, JPEG, PNM, PCX, XWD, Sun-Raster, binary.



### Filtering

Image enhancement (contrast enhancement, illumination correction, scaling, histogram adaption, interlace error correction), smoothing filters, edge detection and line/point extraction (some with sub-pixel accuracy), texture (Law's filters, deviation, entropy), affine transformations with different interpolation methods, various arithmetic and logical bit operations, color transformations, Fourier convolutions, Hough transformation (lines, circles), image sequence analysis (background estimation, optical flow), and other miscellaneous convolutions.

### Pattern Matching

Gray value matching with arbitrary size, shape and rotation. Best match, all matches, multi grid match. Shape based pattern matching with objects placed in any orientation and any rotation. Robust against occlusion, clutter and arbitrary illumination changes.

### Segmentation

Threshold (range, local, automatic, color, hysteresis), n-dimensional classification, region growing (gradient, average value, color, texture), edges (1st and 2nd derivatives), miscellaneous.

### Feature Extraction

Gray values (e.g. min/max, average, deviation, histogram, entropy, moments), regions (area, center, compactness, number of holes, eccentricity, etc.),

region processing (connected components, skeleton, junctions, set operations, filling holes, region generation), region matching, contour/polygons/line processing.

### Morphology

Set of gray value or binary based morphological operators.

### Classification

Clustering with hyper cubes for non-normal distributed data sets.

### OCR, OCV, Bar Codes

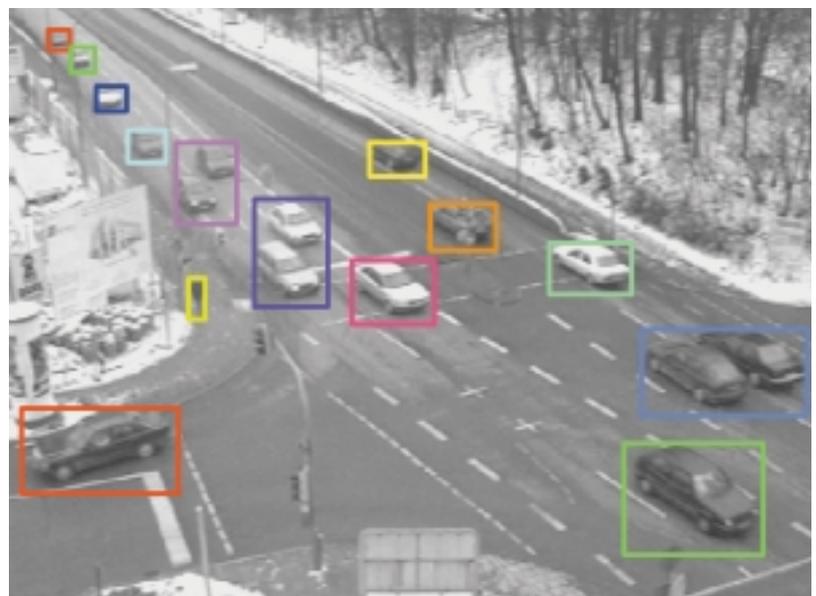
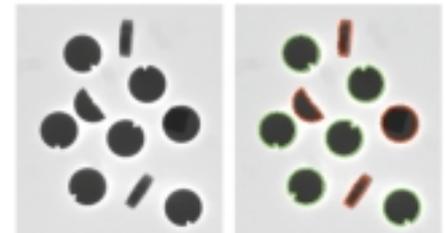
Character based recognition, specialized segmentation, clustering of characters, rotation elimination, trainable fonts, selectable features. Reading multiple 1D or 2D bar codes.

### Tools

Kalman filters (prediction of parameters or objects in an image sequence), camera calibration, geometry (distance and angle of lines, segments, points, regions, affine transformations), combining multiple images shape from shading, photogrammetric stereo.

### Custom operators

User-specific operators may be easily integrated into the HALCON environment.





# ActivVisionTools

## Activ VisionTools Principles

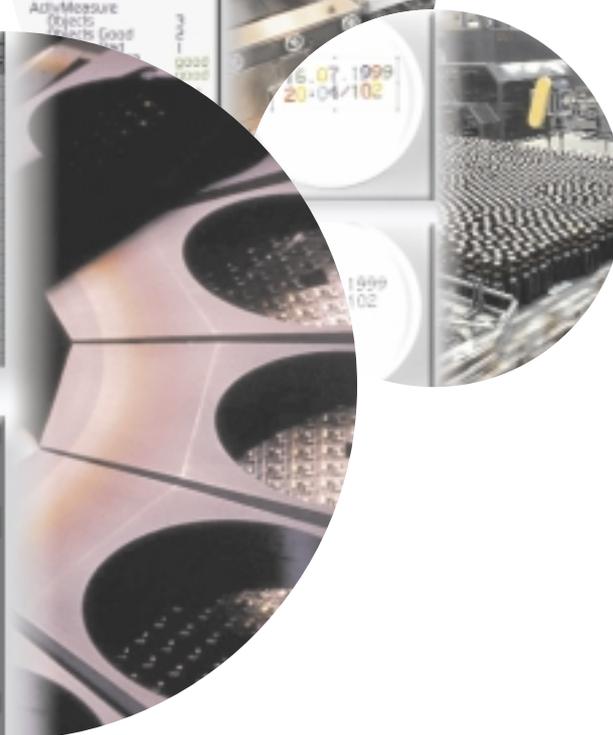
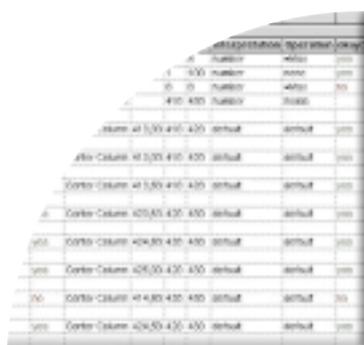
ActivVisionTools enable the user to develop powerful machine vision applications quickly and comfortably without writing a single line of code. They are based on the well-established HALCON library (also described in this brochure) and thus inherit its speed, robustness, and accuracy. However, the tools hide the complexity of image processing from the user; instead, they present solutions for standard tasks such as measuring objects, reading 1D and 2D bar codes, blob analysis, or OCR/OCV.

ActivVisionTools are integrated into the framework of Microsoft VisualBasic. Depending on the task, the user selects the appropriate tools and places them via drag & drop onto the Microsoft VisualBasic form. The communication between the tools is set up and configured automatically by the tools themselves. Connecting to a frame grabber involves just selecting the grabber and appropriate grabbing mode, no programming is needed.

To speed up image processing, the user can assign regions of interest (ROIs) to the tools. One or more ROIs with different shapes (rectangle, polygon, circle, ellipse, doughnut, line, arc) are positioned with the mouse in the image. Moreover, the ROIs may be automatically aligned to moving parts. All the tools may be quickly adapted to the relevant machine vision task via fully interactive graphical user interfaces.

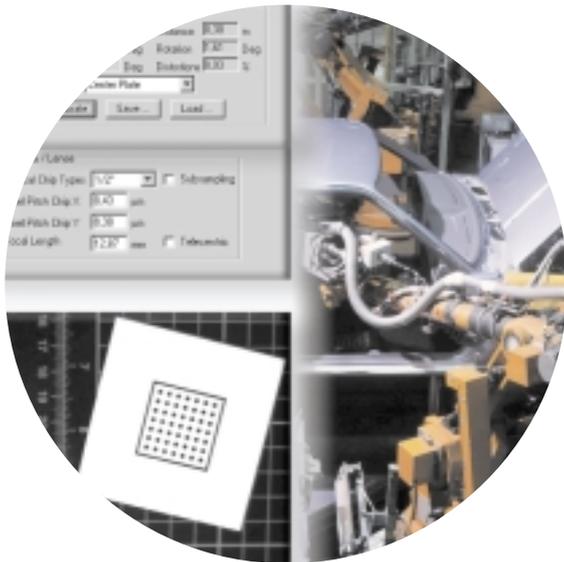
The application may be executed already in design mode. Thus, the user can immediately check if the chosen tool parameters lead to the desired result. The results (e.g. extracted edges) are overlaid on the live image. All results can be sent to various output channels, e.g., written to a file or transmitted via a serial interface.

ActivVisionTools also offer flexibility and extensibility. Besides continuously growing ActivVisionTools family, the users themselves can easily integrate their own VisualBasic/ActiveX components, or use the HALCON library to develop and integrate image processing components for special tasks.



## ActivVisionTools Functions Overview

The following text describes briefly the individual members of continuously growing family of the ActivVisionTools.



### ActivColor

Performs classification of the image pixels according to their color.

### ActivBlobFinder

Robust blob extraction using absolute or dynamic thresholding.

### ActivFeatureCalc

Calculation of more than 50 shape and gray value features (histogram, moments, region area, center, eccentricity, etc.).

### ActivOCR, ActivOCV

Robust recognition and verification even of difficult fonts. Any position, any orientation, varying illumination conditions.

### ActivGeoCalib

Geometric camera calibration for measurements in 3D world coordinates.

### ActivView

An integral part of every ActivVisionTools application. ActivView allows to select the frame grabber and specify the desired mode (e.g. continuous, triggered, progressive scan). All members of Leutron Vision family of PicPort® frame grabbers as well as the PentiCam system are supported.

Besides displaying the image and sending it to the other tools, ActivView also displays their results overlaid on the image, allowing even closer inspection and zooming.

Finally, ActivView provides management of regions of interest (ROIs) for the other tools.

### ActivMeasure

Enables to measure objects with sub-pixel accuracy in real-time. The tool may be adapted quickly, e.g., by choosing between different edge types. After being assigned one or more ROIs in form of lines or arcs, ActivMeasure extracts different types of edges with sub-pixel accuracy and measures the distances between the edges or edge groups.

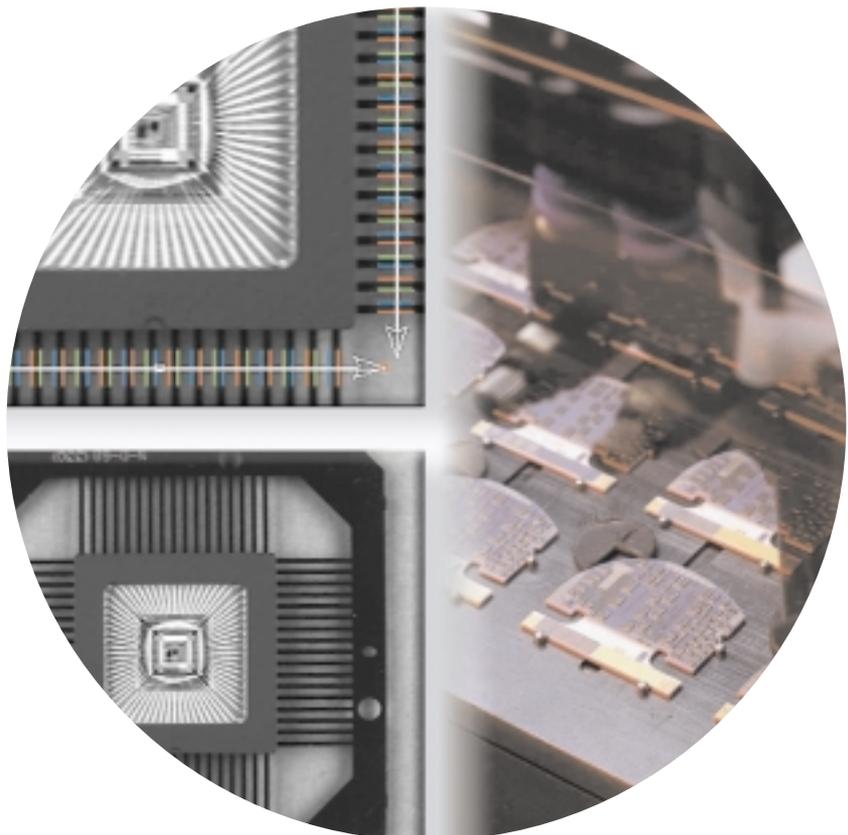
### ActivBarcode

Extracts and decodes various common bar codes.

Multiple bar codes per ROI can appear in any position and orientation. They are extracted robustly even from complex backgrounds or in case of varying illumination.

### ActivDataMatrix

A relative of ActivBarcode, responsible for extraction and decoding of 2D bar codes (DataMatrix).





# VisionBlox™

## VisionBlox™ Principles

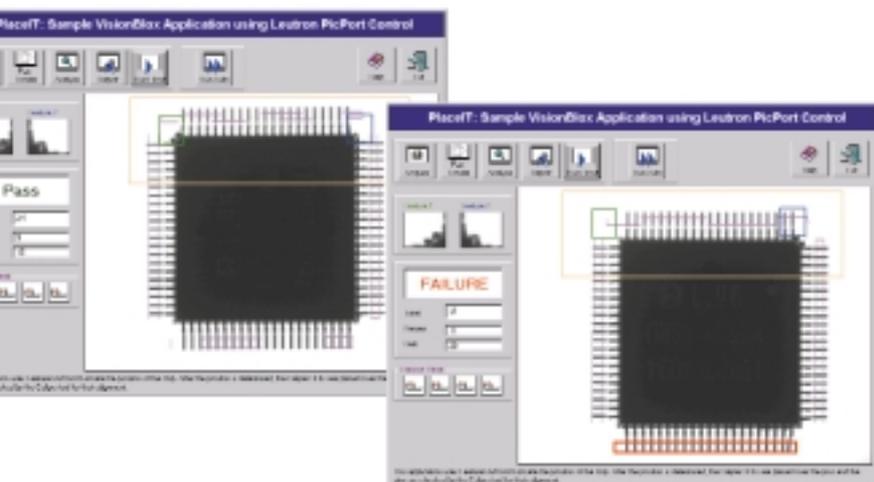
VisionBlox™ is a fast and cost-effective way for end-users to build powerful and custom machine vision applications and comprises of a set of software tools built upon the OCX technology.

## VisionBlox™ Functions Overview

VisionBlox™ is a set of software tools that are added onto the toolbar of Microsoft's Visual Basic or Visual C++ rapid application development environments.

### Image Capture

VisionBlox™ can capture images from the complete range of PicPort® image acquisition boards.



### Regions of Interest

All processing and analysis is performed within one or multiple ROIs. The ROIs can be a single point or as large as the whole image with its position and size specified graphically or through code. ROIs can be rectangular, square, oval, circular, doughnut, or squashed doughnut shapes and can be interactively moved, rotated, resized, or mutated. ROIs can be automatically placed relative to other object locations on newly acquired images.

### Polar Unwrap Tool

Used to convert circular image information into a linear format.

### Image Handling

Image handling is performed by means of Editable Image control providing an area for image display and image processing. The control can display stored bitmap or PCX images as well as grabbed or live camera images.

### Image Processing

Image Arithmetic (add, subtract, multiply, and divide

image/value), Boolean Operations (AND, OR, equivalence), Morphology (four predefined gray scale or binary operations with user defined structuring elements: dilate, erode, open, close), Enhancement Filters (band restore, edge enhance, Gaussian, Sobel angle, Laplacian, max, min, negate, Sobel magnitude, inverse transpose).

### Image Analysis

Image Analysis area is covered by several sets of functions: Feature find (search), Blob, Caliper, edge, Read (OCV), Template:, Color meter, Color filter, Point.

### Camera

Monochrome or color, analog or digital, area scan or line scan cameras are supported. The camera related functions include: Calibration, Device coordinates, Logical coordinates, Physical coordinates, Object coordinates.

### Light Meter

Pixel value distribution information: maximum, minimum, mean, median, total, standard deviation.

### I/O

Supports input and output functions via DLL exchange.

### Motion

Controls for user interface, different stage types, and different drive methods. Graphical User Interface control for x, y, z, roll, pitch, and yaw includes movement status, jog increments, current position, and x, y, φ alignment algorithms. Multi-Axis Stage control is intended for moving up to six independent axes. Optimized Control family of motion cards via RS232 or RS485 connection. It can perform half-step, micro-step, or servo motion.

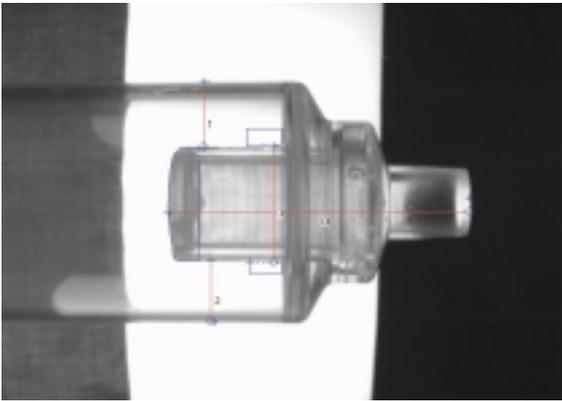


### Custom tools

VisionBlox™ supplies a Vision Tool Integration Kit enabling to add user's custom tools to VisionBlox™ in a matter of minutes. Please contact Leutron Vision for information about third party tools currently available.

## NeuroCheck® Principles

NeuroCheck® is a general-purpose image processing system for industrial quality control. Using NeuroCheck®, you can check completeness of assembly groups, surface quality and measurement of work pieces, correctness of printed labels and precise positioning. It encompasses a 1000+ set of functions from different areas, including e.g. sophisticated pattern matching, OCR with neural networks based training, bar code & data matrix code reading, sub-pixel accuracy gauging, color matching or specialized measuring.



The most notable advantage of NeuroCheck® is its developer environment. Application development with NeuroCheck® does not involve any programming. Instead it offers rapid visual point & click development where the user interactively selects and configures routines for the control flow and immediately checks the results. Using extensive wizards, the user can easily design screen layouts, configure automatic logging (including images) and signal error states with consequential actions, including the control of external devices.

Thanks to integration of development and runtime system, the application may be reconfigured on the fly (even directly during automatic inspection). Data exchange via OLE and standard file formats allows remote control of NeuroCheck® from database and spreadsheet programs for easy result evaluation and documentation.

A flexible password system allows an arbitrary number of user levels with individual access rights.

With NeuroCheck®, digital image processing has become a versatile, user-friendly, and cost-effective instrument of quality control, with the ability to be seamlessly integrated into modern quality management concepts (ISO 9000).

## NeuroCheck® Functions Overview

### Image Acquisition

NeuroCheck® interfaces to the complete family of PicPort® frame grabbers' family from Leutron Vision as well as to the PentiCam system.

### Position Adjustment

Computing current position of reference objects in the image (x and y offset, rotation angle, pivot point). Adjusting positions of search regions according to the reference objects.

### Image Preprocessing

Rotating image, copying image, enhancing image, shading corrections, look-up tables, combining images (addition, average, subtraction, max/min), filtering image (appr. 50 filters with editable kernels), unrolling ROIs (transforming arbitrary shaped image into rectangular one), smoothing ROIs (special two-stage filtering for improved edge detection), filling objects or background with uniform gray.

### Image Analysis

Defining ROIs (rectangular, polygonal, circular), determining threshold (for optimal segmentation), creating ROIs by thresholding (i.e. blob & edge extraction with sub-pixel precision), copying ROIs, combining ROIs, their counting, sorting or classifying, validating and filtering, re-sampling.

### Feature Computing

Computing many kinds of object features like center of gravity, dimensions, H/W ratio, perimeter, area, gray levels, contrast, gradient, curvature, and many more.

### OCR, OCV, Bar Codes

Sophisticated OCR & OCV algorithms for recognition of arbitrarily shaped character sequences. Training of arbitrary fonts. Reading all standard 1D or 2D bar codes, nonstandard codes, contrast levels below 10%. Print quality inspection.

### Pattern Matching

Searches objects based on similarity using correlation. Templates can be created interactively, optimized to the current patterns, and accelerated using pyramidal algorithms with adjustable step size. Searching for arbitrarily rotated patterns is supported.

### Gauging

#### Color Analysis

Color matching, adaptive color space transformation for distinguishing arbitrary colors.

#### Tools

Delay execution, reading digital input, setting digital output, pixel calibration (conversion to metric units).

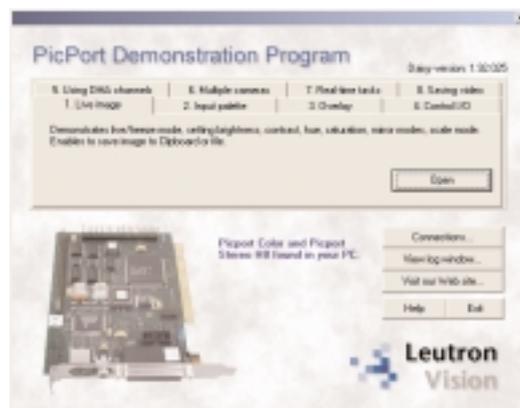
#### Custom Operators

Custom built algorithms can be easily integrated into the NeuroCheck® system.



# Customer's Support

The «Download» and «Support» areas on the Leutron web server ([www.leutron.com](http://www.leutron.com)) provide comprehensive documentation, including user manuals with the library references, for all Leutron's software products. A compact set of demo programs, all with their source codes, should briefly introduce the software capabilities and help the developer to quickly start building his application by using the framework (or just fragments) of one of the sample applications. The latest camera definition files for LV-SDS Daisy, patches and other useful information are also available at [www.leutron.com](http://www.leutron.com).



## Ordering Information

|                  | Ordering number | Product description   |
|------------------|-----------------|---|
| LV-SDS           | 16028           | Leutron Vision Software Development Suite: Daisy, Camera Editor, Orchid, Twain driver, Video for Windows driver, further multimedia drivers on request, documentation and sample programs including the source code |
| HALCON           | n/a             | HALCON software with interface to Leutron's PicPort® frame grabbers, available from 3rd party vendor (contact Leutron Vision for details)   |
| ActivVisionTools | n/a             | ActivVisionTools software with interface to Leutron's PicPort® frame grabbers, available from 3rd party vendor (contact Leutron Vision for details)   |
| VisionBlox™      | n/a             | VisionBlox™ Full Developers Suite, PicPort® OCX for VisionBlox™, available from 3rd party vendor (contact Leutron Vision for details)   |
| NeuroCheck®      | n/a             | NeuroCheck® software with interface to Leutron's PicPort® frame grabbers, available from 3rd party vendor (contact Leutron Vision for details)  |

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