

iCONNECT™

ME
MICRO-EPSILON
SOFTWARE DIVISION



Visual Programming

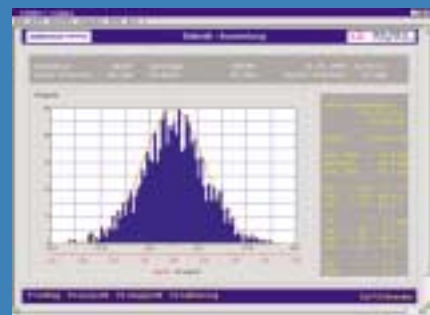
- | | |
|-----------------------|------------------------|
| Data Acquisition | Process Visualization |
| Measurement & Control | Research & Development |
| Automation | Documentation |
| Quality Control | Education |



Setup



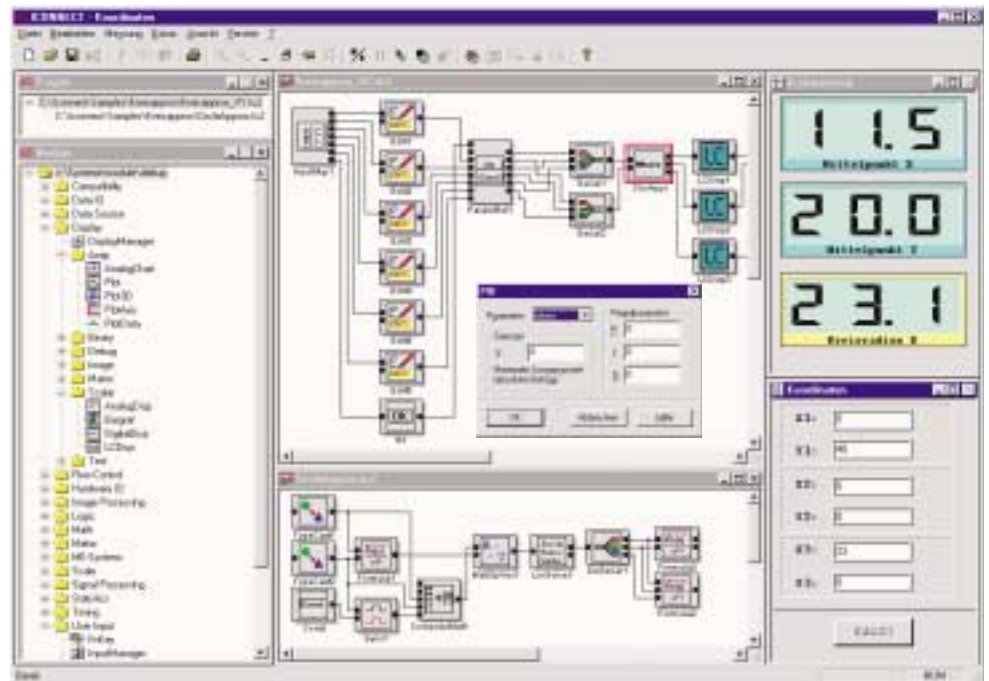
Measurement



Analysis

Visual Programming

For many years, ICONNECT has provided a useful means for the generation of applications for measurement and control. This powerful and yet easy to use software offers a graphical approach to the design of Windows® programs using data flow diagrams. This graphical representation is translated into ready-to-run programs at the press of a button. The patented algorithm used is able to directly control a large range of hardware devices. Many display and control elements are provided, which may be combined with powerful data acquisition and analysis functions without the need for programming skills.



Comfortable development and runtime environment

Flexible and Robust Designs

Upgrading hardware components or changing user-interface elements is as simple as changing a few program blocks or connections. A highly encapsulated, modular design facilitates such design changes without major re-testing implications.

Simple Solutions

It takes only a few minutes to build a first application using the ICONNECT StarterKit. The comfortable drag & drop technique allows rapid prototyping. A graphical debugging tool animates the calling sequence of software modules, thus allowing errors to be quickly located. ICONNECT executes parallel data flow diagrams in a multithreaded fashion and automatically arranges synchronisation. Independent program fragments and display elements can be configured to execute with different thread priorities using a simple set-up dialog.

Digital Filters

Vibration Analysis

Optimization

Controller Design

Logical Functions

Measurement Device Control

Regression Analysis

Curve Fitting

Linear Algebra

Pattern Recognition

Cluster Analysis

Numerical Methods

Neural Nets

Fuzzy Logic

Differential Equations

Interpolation

Approximation

Image Analysis

... and Industry



Data Acquisition and Traverse Control of a Foil Thickness Measurement Device

Savings in Time and Development Costs

Visual programming in combination with an extensive library of reusable modules saves development time, human resources and development costs. ICONNECT works as a rapid prototyping tool - you can deliver error-free products within a fraction of your previous time-to-market requirements. PC-based components, based on well-established standards, reduce hardware cost in the short-term and guarantee low-cost upgrade possibilities in the long-term.

Return on Investment

ICONNECT is supported by continuous development and is updated for compatibility with each new version of Windows. Each application can easily be connected to a company network to share and exchange data. A simple scripting language enlarges ICONNECT's functionality. Any kind of user-specific modules can be implemented once in Visual C++ and used in the system, again and again. Your specialised know-how is therefore secured.

Complex Systems

ICONNECT can also control complex and real-time processes for data acquisition and analysis, such as image processing, and offers on-the-fly visualisation as well as archival of measurements. The user-interface is in the familiar and ergonomic Windows style and includes menus, function keys and a windowed display. Password protection secures your system. The wide range of supported hardware components make it easy to adapt ICONNECT to new or existing systems in the laboratory or production environment. Data exchange with other products, and SQL access to company databases, simplify the integration process.

Automation

Process Control

Test Systems

Machine Diagnostics

Quality Control

Sensor- / Actuator- Coupling

Drive Control

Real-time Programming

Data Management

Image Processing

Documentation

Internet / Intranet

Remote Control

Measurement and Control

Calculation of heat diffusion coefficients of concrete

Inspection of foil extrusion (profile of inner diameter measured by a capacitive sensor in combination with an incremental displacement sensor)

Planarity measurement of display glasses for notebooks

Measurement of the coaxiality of bearings for compressors of a refrigerator

Research and Analysis

Analysis of multi sensor data of tools wear for precision turning

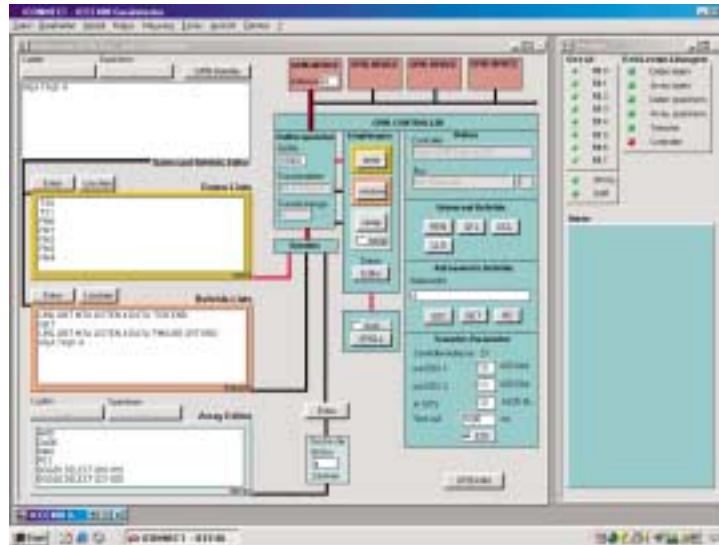
Comparison of control algorithms for an inverted pendulum with neural networks and fuzzy methods

Image analysis of a Shack-Hartmann-Sensor for wave front reconstruction

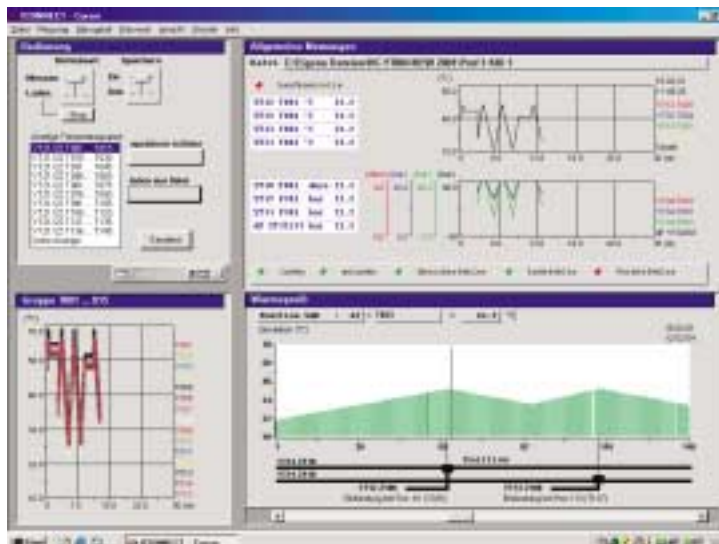
Process Control and Automation

Optical Recognition of spare wheels before mounting (Adam Opel AG)

Capacitive foil thickness measurement for extrusion machines including traverse control and regulation + display of the thickness profile



Universal IEEE-488-Device Test Environment



Thermal leak test of valves (Nuclear Power Plant Isar I)

Many Application Domains

Systems built with ICONNECT have been integrated into a wide range of technical applications, e.g. within the automotive industry, general engineering and in paper and foil production. These applications range from automatic quality inspection to process control and research.

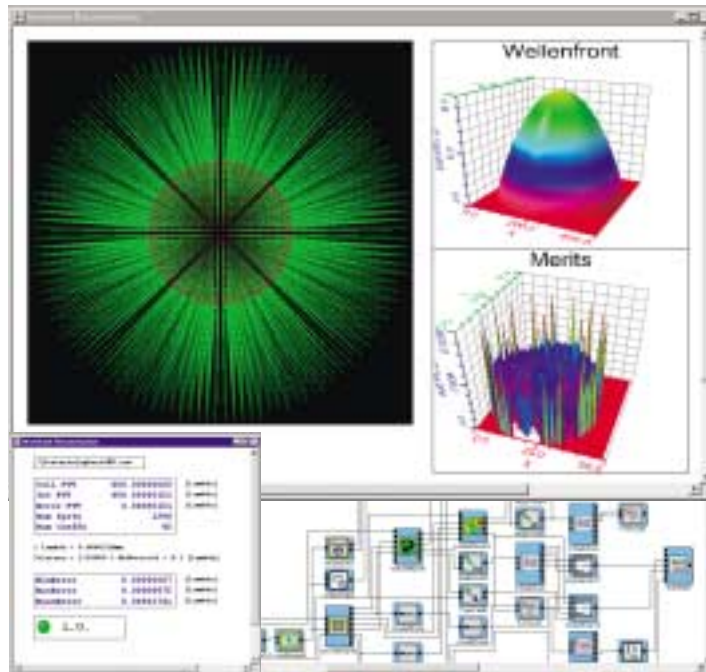
Measurement and Control

PC DAQ-Boards of various manufacturers can be combined in ICONNECT. IEEE488 devices and measuring units using serial RS232c- or USB- interfaces are as easily adapted as sensors with field-bus interfaces. The integration of PLCs via Siemens Profibus DP is an ideal basis for building large scale control applications.

... of ICONNECT



Long term data acquisition for a burn in system



Wave front reconstruction with Shack-Hartmann-Sensor (FORWISS Passau)



Foil extrusion machine control (META Ltd.)

Customer Applications

Paper thickness measurement, foil extrusion machines (META Ltd. / Greece)

Neutron flow measurement of nuclear fuel elements, leak test of valves (Nuclear Power Plant Isar 1)

Real-time control of a motor test environment for the material strength test of rods with torque, pressure, temperature and revolution sensors (Audi AG)

Acquisition and analysis of mining weather data (methanol, pressure, temperature) (Mahaczek)

Hidden Barcode Reader (Translucent-Technologies Inc.)

Expansion of carpet tiles due to humidity and temperature changes (DLW)

Research and Analysis

Comprehensive analysis tools - including mathematical functions for linear and non-linear optimisation, matrix operations and statistical functions - scale neatly from everyday to highly specialised tasks. ICONNECT includes tools for digital filtering, Fourier transform, Joint-Time-Frequency-Analysis and many other techniques.

Process Control and Automation

In many industrial automation applications, real-time performance is critical. ICONNECT is well-suited for time-critical tasks and for use within systems that must scale involving, for instance, industrial PCs. Its optimised adaptation to multi-processor motherboards mean that ICONNECT is the best solution for applications handling large amounts of data, e.g. in multi-channel image processing.

Application Design ...

Build Data Flow Diagrams in a Very Intuitive Way

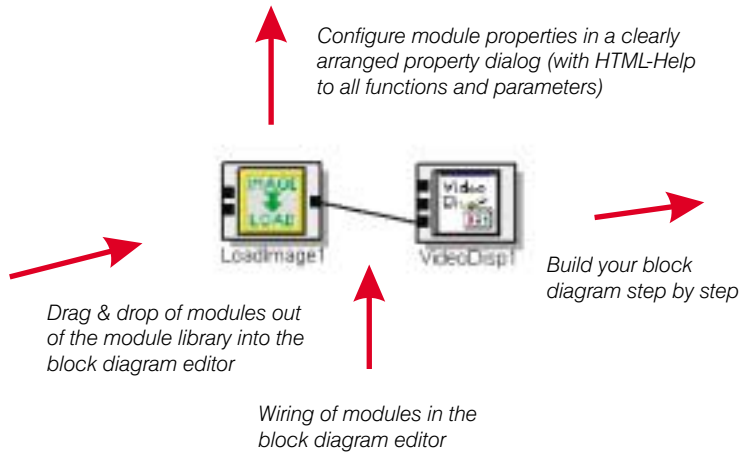
ICONNECT offers a comfortable and intuitive development environment for your application design. A typical development process is shown in the following images:



ICONNECT Module Library



Configure module properties in a clearly arranged property dialog (with HTML-Help to all functions and parameters)



Modularity and Hierarchy

With growing requirements, a hierarchical structuring of the block diagram using macros offers an easily readable and maintainable representation. Parallel structures can be easily implemented as independent data flow graphs. In this case data flow is executed in parallel on multiprocessor or multithreaded on single processor boards.

Performance Optimization with Profiling Tool

ICONNECT data flow diagrams consist of compiled C++ - modules. This guarantees an extremely high execution speed. In-place optimizations may be carried out with the aid of statistical analyse of module execution times. A performance timer with a resolution of 1 μ s can be used for precise analysis. All results can be displayed graphically or textually.



Automatic Documentation

To save a complete project documentation is just a few keys away. The output consists of a listing of all used modules and versions, module priorities and parameters and the complete wiring list with wire parameters.

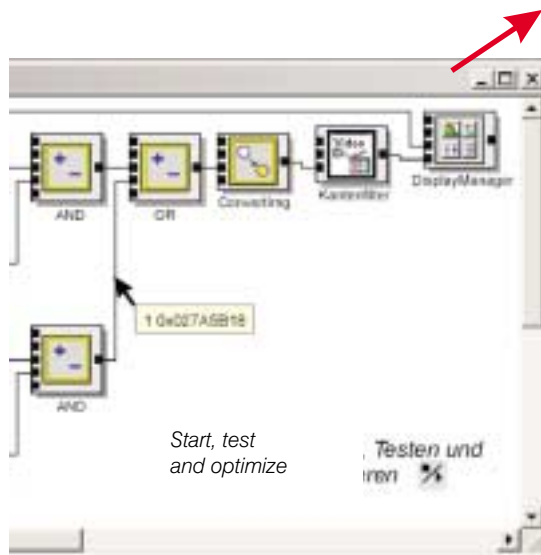
... in ICONNECT

Interactive Design of Windows conformant User Interfaces

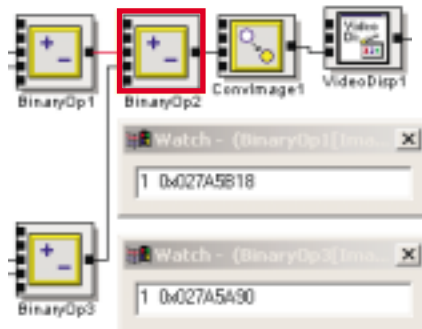
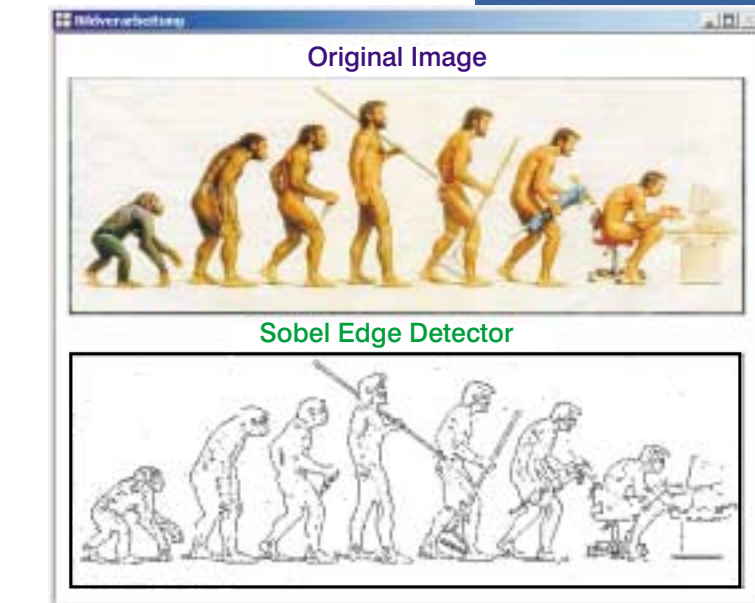
All ICONNECT user interfaces have the familiar Windows look & feel. An intuitive menu module provides programmable, dynamic menu bars, which can be combined with freely definable function keys. Using the Windows MDI-style (Multiple Document Interface) display windows with different screen and print layouts can be arranged. Your measurement journal is printed in full printer resolution and colors. Input elements are arranged in modal or modeless dialogs, where a html-help can be added.

Input dialogs are generated using the InputManager module.

The DisplayManager is an editor for display and print layouts.



Interactive debugging of semantic errors with graphical debugger



Graphical Debugger

A graphical debugger helps you track down semantic errors. The data flow can be interrupted by setting a breakpoint at the desired module. In single step mode, data flow is visualized as an interactive tool tip (place the mouse pointer over a wire) or with the help of watch windows that can be opened by a double click on the wire you wish to inspect.

Dynamic Scheduler

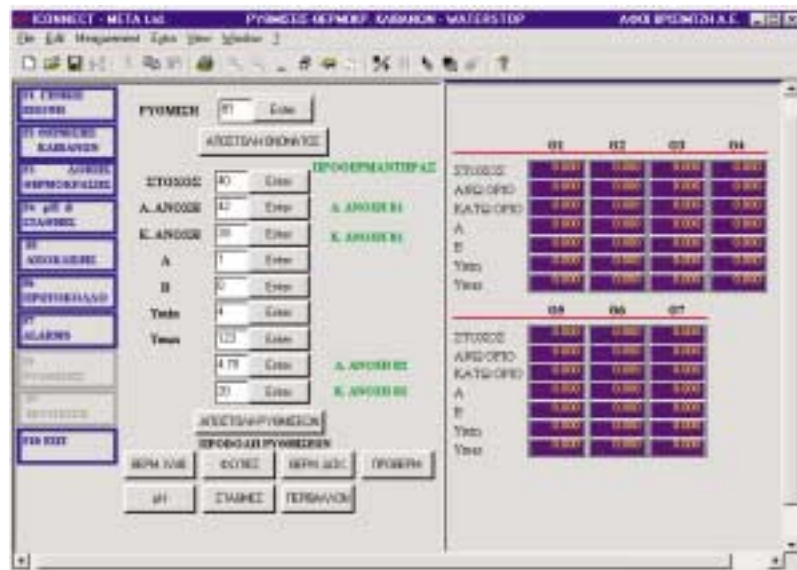
The optimal calling sequence for modules in an ICONNECT system is determined dynamically. This technique leads to an optimal processing performance. Individual process priorities for user input and display elements guarantee a real-time performance that is necessary for control purposes.

Object-Oriented Design
Analysis of Design Errors
Comprehensive Module Library
Flexible Graphical I/O
Adjustable Fault Tolerance
Manufacturer Independent
Hardware Interface
Hierarchical and Parallel Data
Flow Diagrams
Distributed Applications
Intelligent Display Scaling
Dynamic Parameterization
User Management
Cyclic Structures
Error Log Files

Module Library...

Dialogs and Displays

Solutions developed with ICONNECT are operated like other familiar Windows programs via menus, function keys, toolbars, modal or modeless dialogs and so on. All user input elements look like common Windows dialog elements and are edited with mouse or keyboard. The display of measurement data, web sites, 3D graphics, images, text, timing diagrams, colour coded images, vector graphics or debug output is done in overlapping or fixed windows. Display windows are controlled by the DisplayManager module. A print input port is responsible for an automatic, high resolution print of the DisplayManager content.



SQL Parameter Database for a Drying System (META Ltd.)

Measurement Units, Sensors and Actuators

ICONNECT manages a large number of existing PC-DAQ-Cards from various manufacturers using a multi function driver concept. All cards can be mixed and run with different sampling rates simultaneously. In addition to A/D and D/A converter boards, counter, trigger and gate inputs or digital I/O ports are supported. USB devices, IEEE-, RS232c- and CAN- or Profibus systems can be integrated as easily as sensors with Ethernet interface, incremental or optical sensors. Complex protocols for motor controllers can be implemented using an easy-to-learn scripting language. Analogue or digital cameras can be integrated using frame grabber boards from various manufacturers.

Control Applications

Real-time control tasks with cycle times below 100 ms and low jitter could not be realised with Windows-based systems until now, due to unknown latency times. Therefore high speed regulation or control tasks were implemented on expensive hardware with real-time characteristics. ICONNECT makes use of Windows multithreading in an intricate way to avoid latency time problems. Regulation cycles of less than 10 ms can be achieved with this technique. This is sufficient to balance an inverted pendulum without problems, even if another application is launched, or another program is storing large amounts of data to a hard drive.

Data Acquisition

A/D-, Digital I/O-, Counter-Boards (Adlink, National Instruments, Computer Boards, Data-Translation, BMC, ...)

USB Devices

Optical Sensors

Incremental Distance and Angle Sensors

Frame Grabbers (WinTV, IDS, ...)

Multi Meters, Servo Motors

Profibus DP, CAN, IEEE 488

Statistics

Auto- und Cross-Correlation

Mean, Variance, Curtosis, ...

Histogram und Sort

Regression Analysis
linear, polynomial, exponential or logarithmical

Process Statistics, Capability Index, Gauge Capability

Control

2 point, 3 point, PID-Controller

Fuzzy Controller

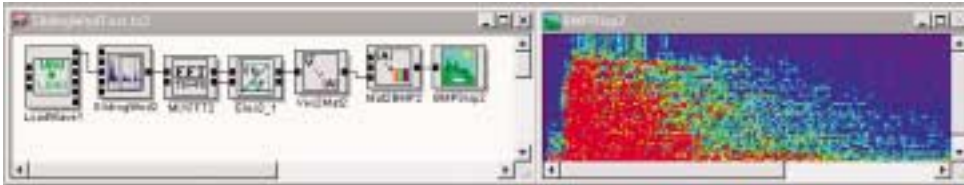
TDNN Controller (Time-Delay Neural Network) including Multilayer Perceptron

... in ICONNECT

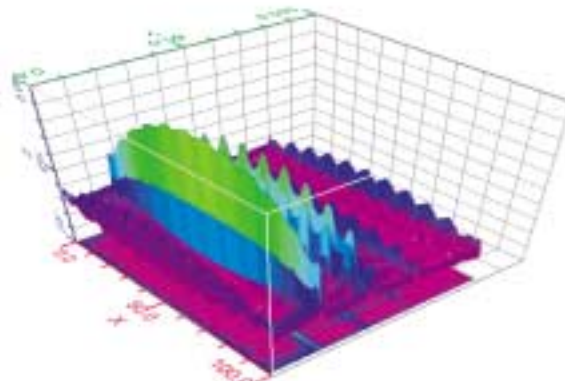


Data Analysis

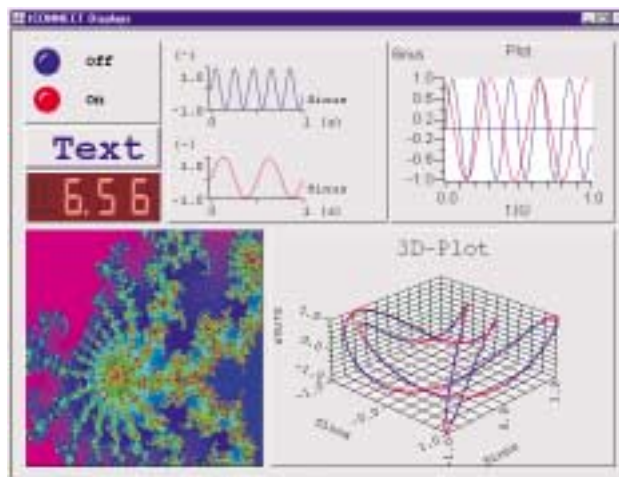
ICONNECT offers a comprehensive collection of powerful online signal processing functions, mathematical functions, optimization, interpolation and approximation routines as well as vector and matrix algebra.



Short-time spectrum with sliding window



3D surface display of a JTFA



Some online displays of ICONNECT

Statistical Functions

The functions of the ICONNECT statistics library facilitate descriptive statistics, regression analysis and process capability inspection in quality control. All functions can be used online during a running application and produce results dynamically from the beginning of a measurement using a sliding calculation technique. The evaluation of auto- and cross-correlation functions in the frequency domain benefits from a fast mixed-radix FFT with arbitrary block size (without "power of two" restrictions).

Data Analysis

Discrete transformations: DFT, Radix2 FFT, Mixed-Radix FFT, Goertzel, Fast-Hartley

Fixed and adjustable window functions

Short time spectrum in sliding, overlapping windows

Automatic search of dominant frequency parts

JTFA (Joint Time-Frequency-Analysis): Born-Jordan-Cohen, Correlogram, Choi-Williams, Page, Periodogram, Rihaczek, Wigner-Ville

Fourier smoothing filters and noise reduction

Statistical smoothing filters

Digital IIR filters (LP/HP/BP/..., Butterworth, Bessel or Chebyshev characteristics)

Signal reconstruction with LMS- (Least Mean Square) denoising

Hilbert, Gabor and universal least mean square filters

Fast polynomial approximation in sliding windows, rising edge limiting filters

Convolution and deconvolution with universal convolution core

Numerical integration and differentiation on smoothed signals

Image Processing

Camera Calibration

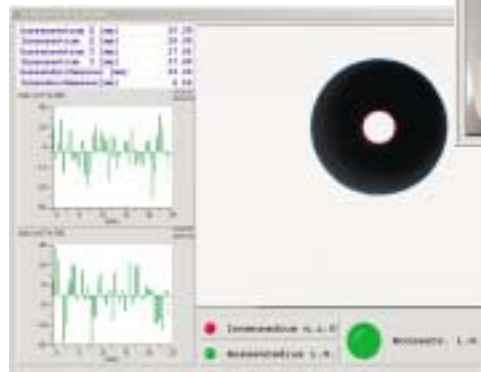
ICONNECT offers an automated calibration procedure for the exact modelling and computation of camera and lens parameters needed for any application of image processing in a technical measuring setup. This novel coordinate transformation for perspective equalization supplies a virtual orthogonal view of the inspection target. The underlying computation is achieved in real-time for video frame rates! Based on the results of the calibration, any image processing function with sub pixel accuracy taken from the extensive module library of ICONNECT may be applied.



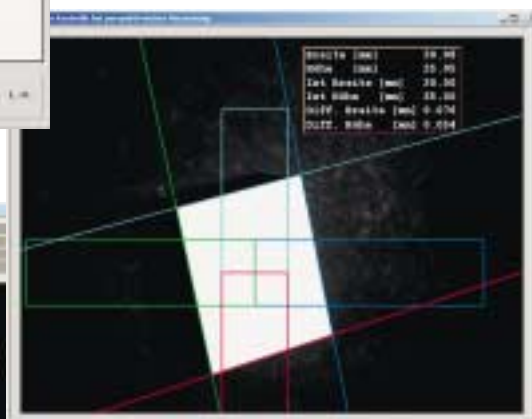
Correction of optical and perspective distortions (wide angle objective)



Distance and angle (caliper rule)



Diameter and concentricity (shim)



Measurement of height and width under perspective distortions (parallel reference gauge)



Area and region analysis (coin inspection)

Image Filtering

Smoothing, edge, point, arbitrary discrete convolution filters

Image Transformation

rotation, mirror, crop, sub sample, color-, gray value-, binary images

Image Operators

arithmetic, logical, mask

Morphology

Dilatation, erosion, arbitrary combinations / structuring elements

Segmentation

Threshold, interval selection, multi-level fitting

Feature Extraction

Point, corner, edge, region, histogram, statistics, orientation, gray value profile

Geometric Fitting

Center of gravity, lines, circles, computation of position, orientation, distances and angles

Blob Analysis

Connected components, shape analysis

Detection of Edges with Sub-pixel Accuracy

min, max, edges, position, statistics

Open Systems

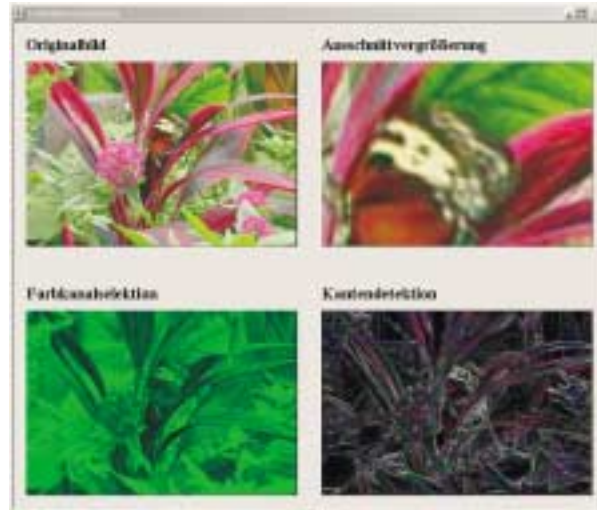


Data Exchange

ICONNECT can accept a wide range of different file formats. For example, digital video can be played synchronously with measurement data. Online image sequences can be processed with all image processing functions.



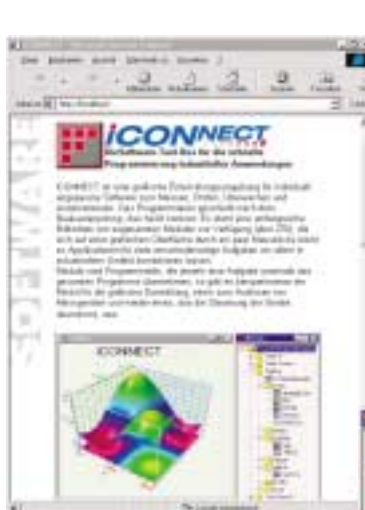
Video capture compatibility



Color image processing and animations

Open Connectivity and Internet

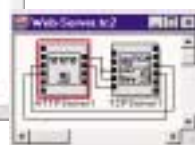
With ICONNECT's TCP/IP client and server functionality arbitrary data can be transmitted via networks. Distributed applications may also be simply created. OPC (OLE for process control), ODBC (database access), Telnet (DOS shell) or TFTP (trivial file transfer protocol) is supported, too. Wiring two modules makes ICONNECT a complete web server. One module is sufficient to generate a web browser, which may for example display help pages. Alarms may be sent via E-mail or SPS (short message service) directly to a service engineer. Using an arbitrary internet browser the system state of the application can be diagnosed without additional tools (remote maintenance).



Remote control or maintenance using Internet Explorer



Web Browser Integration in ICONNECT



Web Server consisting of two ICONNECT modules

Input / Output Protocols

- Binary or ASCII format (with timing information)
- Excel compatible tables
- Image formats (JPEG, PPM, PGM, BMP, WMF, EMF, ...)
- Animation formats (AVI, QT, MOV, MPG, ...)
- Data base protocols (ACCESS, MS-SQL-Server, Oracle, ...)
- Windows registry entries
- Event protocol, NT messages

Basic Training

- Concepts of visual data flow programming
- Hierarchical data model
- Modul library
- Scripting in ICONNECT (Formula, GAL, Interpret)
- Training period: 1 day

Module Programmers Training

- Data types and validation
- Sequencer (Scheduling)
- Module communication
- Serialization (Persistency)
- Dialog elements and Views
- Image Processing Modules
- Training period: 1 day

**First steps to
visual programming:**

ICONNECT starterKIT



ICONNECT starterKIT is an inexpensive tool for data acquisition, data processing and visualization including dataGATE ADC10.6, a 10 bit A/D converter. DataGATE is a flexible measurement hardware with drivers for use on the PC COM port. It consists of six single ended inputs with different input voltage ranges and an overall sampling rate of up to 6 kHz. In combination with the ICONNECT demo software evaluation setups like an internet thermometer or a small weather station can be built up rapidly. Besides a Windows PC only few external components are necessary. In the starterKIT some hints for experiments and component supply sources are included. All evaluation setups can be saved and used for an unlimited period. An extensive online documentation relieves initial requirements for PC measurement, control or automation applications.

ICONNECT Demo

A free of charge demo version on CD is available at MICRO-EPSILON or for download at:

<http://iconnect.micro-epsilon.de>

Here you can find new modules, driver updates and news.

ICONNECT Development System	Our recommendation...	Light	Developer	Expert	Runtime	Demo
Your requirements...						
Hardware Access (PC cards, field bus systems, ...)		✓	✓	✓	✓	✓
Scripting (C-Interpret, PERL-Interpret)		✓	✓	✓	✓	✓
High resolution print		✓	✓	✓	✓	✓
Network communication		✓	✓	✓	✓	✓
Unlimited number of simultaneously running modules		<150	✓	✓	✓	<50
Data flow diagram editing		✓	✓	✓	-	✓
User administration		✓	✓	✓	✓	-
Printed manual		✓	✓	✓	-	-
Training (2 days) + servicing contract		✓ ¹⁾	✓ ¹⁾	✓	✓ ¹⁾	✓ ¹⁾
Development of user specific modules		-	-	✓	-	-

1) requiring fee

System requirements

Windows 2000 / NT / ME / 9x
64 MB RAM (128 MB for image processing applications)
Pentium II, at least 233 Mhz.

Micro-Epsilon Messtechnik GmbH & Co. KG

Software Division

Griessbacher Strasse 18a · 94496 Ortenburg

Phone: +49 8542 9199-0 · Fax: +49 8542 168-90

e-mail: iconnect@micro-epsilon.de

<http://iconnect.micro-epsilon.de>

Certified acc. to DIN EN ISO 9001

