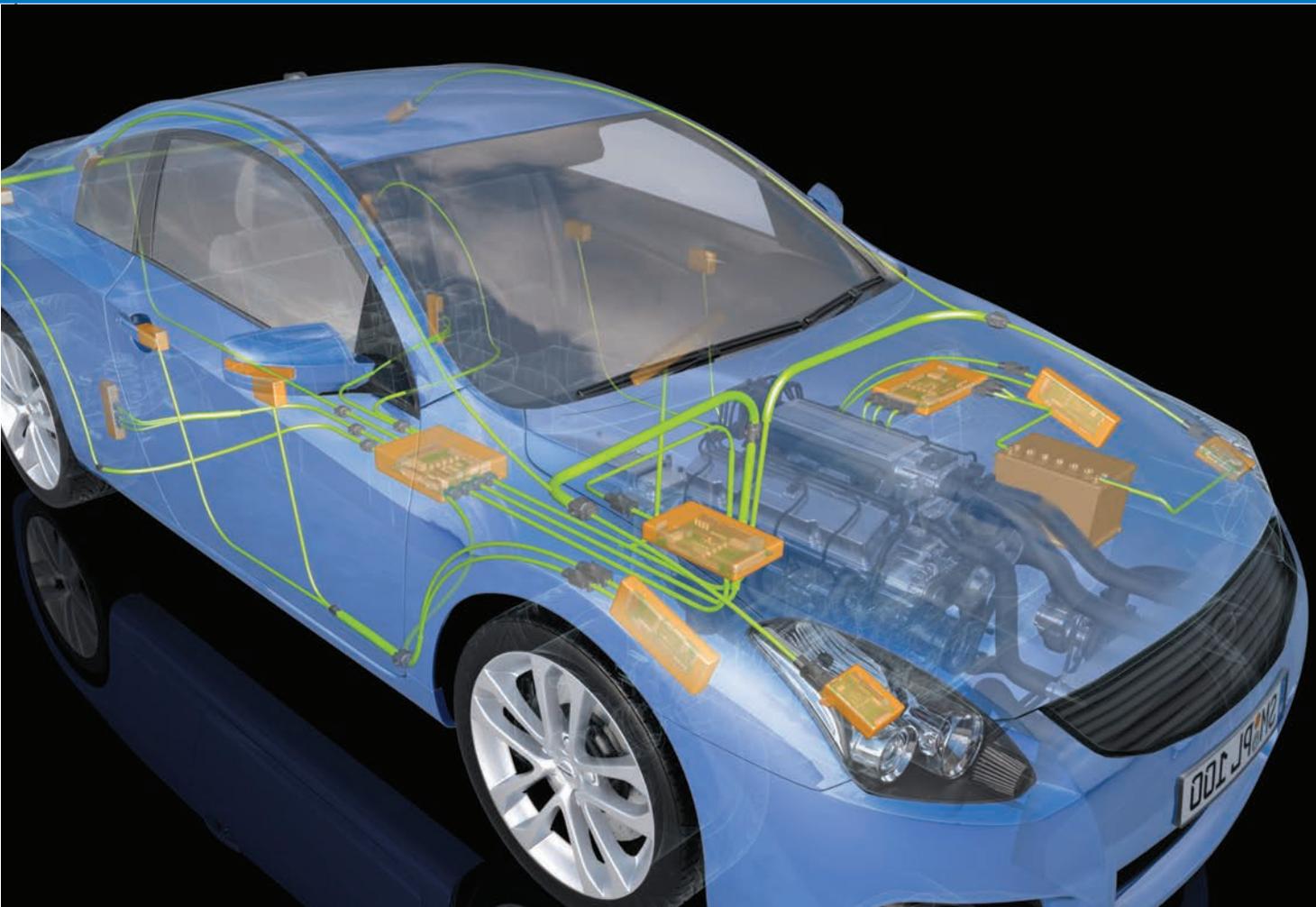# ZUKEN®

# E³
## series®

# Transportation Edition
# Automotive

**Electrical design and documentation**
**for the automotive market**

# Introduction

As automotive manufacturers wrestle for supremacy, each new vehicle design contains increasing complexity. To keep up with this tempo, automotive designers require increasingly sophisticated tools that integrate into their design processes and streamline cooperation between different design disciplines to create modern vehicles.

With a platform-driven design approach and the constant need to shave production costs, existing tools struggle to offer a truly integrated solution. Zuken's E$^3$.series is used for documenting and detailing electrical and fluid automotive projects. Its flexibility supports the entire design process, from definition and design, through manufacturing and maintenance. Its unique object-oriented architecture ensures that all stages are fully synchronized.

With an intelligent parts library and online design rule checks, E$^3$.series also assists the designer by preventing errors and speeding up the overall design process.

E$^3$.series has been chosen and successfully adopted by many large automotive manufacturers worldwide who appreciate its design process flexibility and ability to integrate with the supply chain.

## Common challenges

- Integrating global workforces
- Managing complex options
- Supply chain integration
- Multiple design iterations
- Managing legacy systems
- Creating full digital mockups
- Producing service documentation

| DEFINE | DESIGN | MANUFACTURE | MAINTAIN |
| --- | --- | --- | --- |
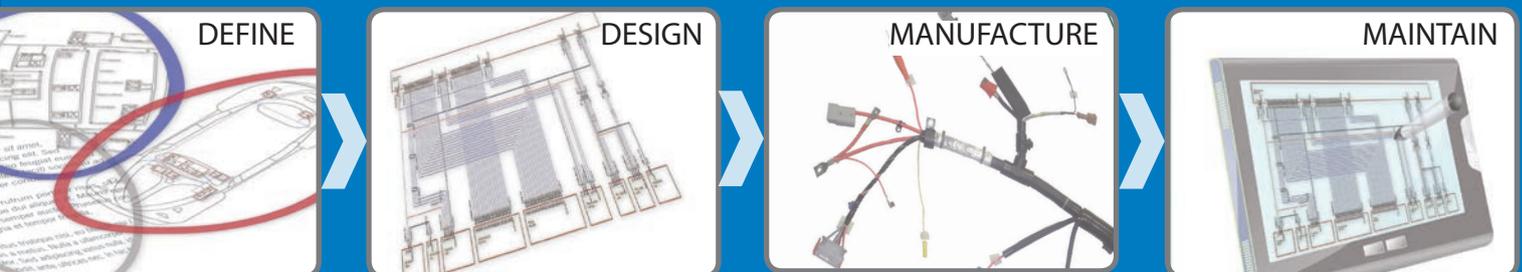
" Since 2003, electrical systems in Mercedes-Benz cars have been developed using Zuken's E$^3$.series. Our continued relationship with customers like Mercedes-Benz is validation of our dedication to keeping E$^3$.series at the forefront of electrical design. "

# Define

## Part management

In an industry driven by regulations, it is imperative that parts used within the design are controlled and managed. $E^3$.series comes with its own parts library, has its own data management system and has links to all major PLM systems.

## Electrically aware parts library

Intelligent parts libraries help drive the design with automatic part selection and real-time design rule checks to prevent errors.

## Centralized parts library

Centralizing parts libraries enables customers to control which parts are used in designs, avoid duplication, and ensure consistency. With the library stored in Oracle or Microsoft SQL and using standard replication tools, companies with multiple sites ensure parts libraries are consistent between locations.

## Functional designs

Using $E^3$.Functional Design, systems engineers create functional blocks at an architectural level. These blocks can represent equipment or locations, ports can be freely defined on the blocks and connections can be made between them; as the design progresses, the content and behavior of the blocks is developed. $E^3$.Functional Design also allows designers to create a physical and logical representation of their designs while maintaining an intelligent link between the two. Later in the process, functional blocks can be referenced in $E^3$.topology to assist in harness creation.

# Design

## Intelligent block designs

To cater to increased use of ECUs in the automotive industry, $E^3$.series provides special block functionality. Blocks can either be predefined or created dynamically on the fly. They represent components, black boxes such as ECUs, or with the use of hierarchy, entire systems. For ECUs or PCBs (supplied externally or developed in-house) blocks can be dynamically controlled by PCB applications such as CR-5000, where changes to signal and connector information will automatically update on the block.

## Systems engineering

A key factor in automotive design is the link between systems engineering and electrical engineering. Being able to link concepts and design information with the actual vehicle design greatly improves productivity and helps reduce lead times.

## Scalable solution

For companies looking to combine upfront planning with schematic and initial harness layouts, $E^3$.series offers a scalable solution.

For smaller projects, $E^3$.series is available in a standalone, single-user version; but when project scale or complexity increases, $E^3$.enterprise offers multi-user access to the same projects. This allows multiple engineers to work simultaneously in the same design. Changes are immediately seen by all users while maintaining design integrity, such as unique device naming. $E^3$.enterprise also comes with access control and lifecycle options.

## Simulation

The increasing complexity of vehicle design and excessive cost of recalls mean an intensified effort is needed to get things right during the design phase. $E^3$.series supports this process through its links to MCAD for full digital mockups, and with direct links between $E^3$.series schematics and Synopsys Saber.
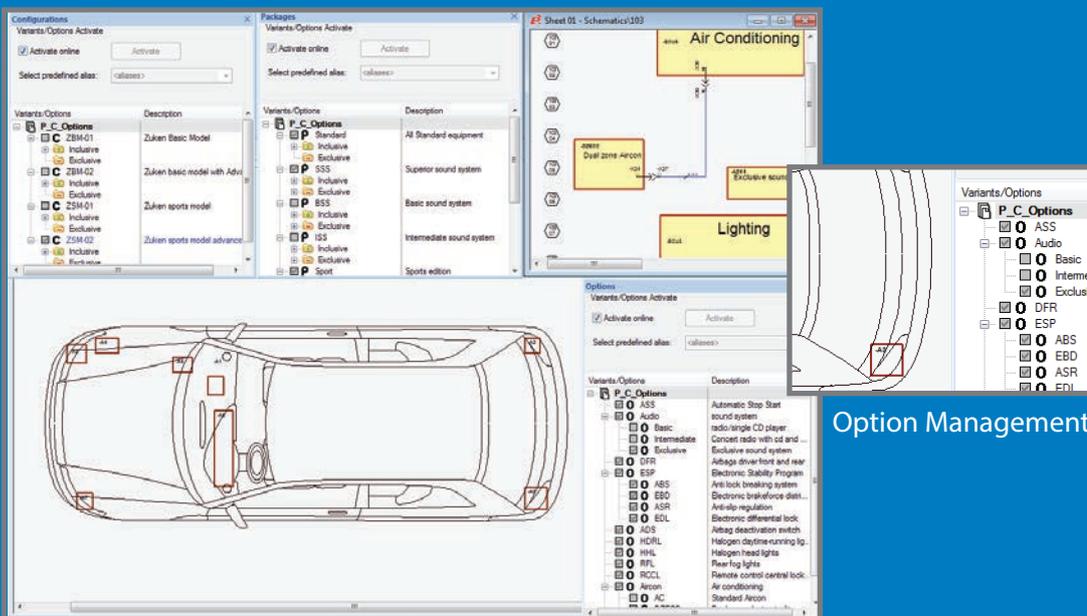


Option Management

# Design

## Option management

System engineers spend much of their time developing platforms, optimizing systems and defining harnesses; effort that goes towards saving costs on production runs. The system structure can be defined in E$^3$.series projects using configuration, packaging and option tools. At the same time, electrical engineers can create vehicle schematics while system engineers optimize the platforms for manufacturing. Drag and drop technology allows, new configurations to easily be defined and tested.
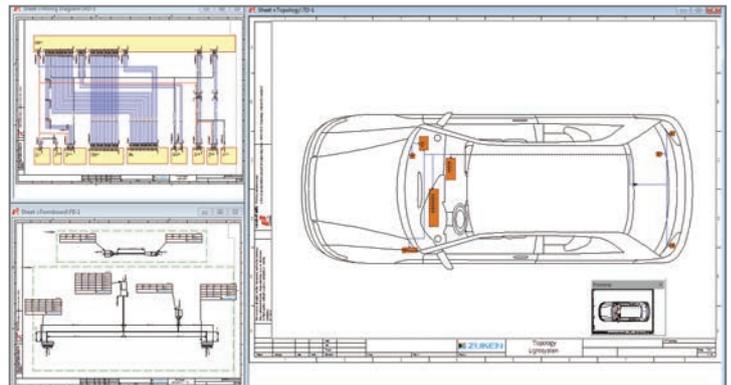
## Topology design

E$^3$.topology takes designs from the logical world into the physical. Topology sheets created at any scale can be added to the overall E$^3$.series project. Sheets can represent the chassis, and installation spaces such as the dashboard or light clusters are added to the sheets. The connections between these installation spaces represent harness routes. Alternate views of logical devices held in the same project are simply placed into the relevant installation spaces.

As this process continues, signal logic and wiring information from the schematic is automatically shown in the topology view and the harnesses start to be automatically defined. Inline devices are easily added and alternate harness configurations can be tested quickly. Special reports detail the harnesses, including cost and weight estimates.

## MCAD routing

E$^3$.3D Routing Bridge enables companies to integrate their electrical harness designs with all major MCAD vendors. Electrical harness details such as connectors, terminals, splices and netlists are transferred to the MCAD system, where harness engineers route the cables in the mechanical space. The length and structure of the harness is transferred back into E$^3$.series where the final details are added for manufacturing..
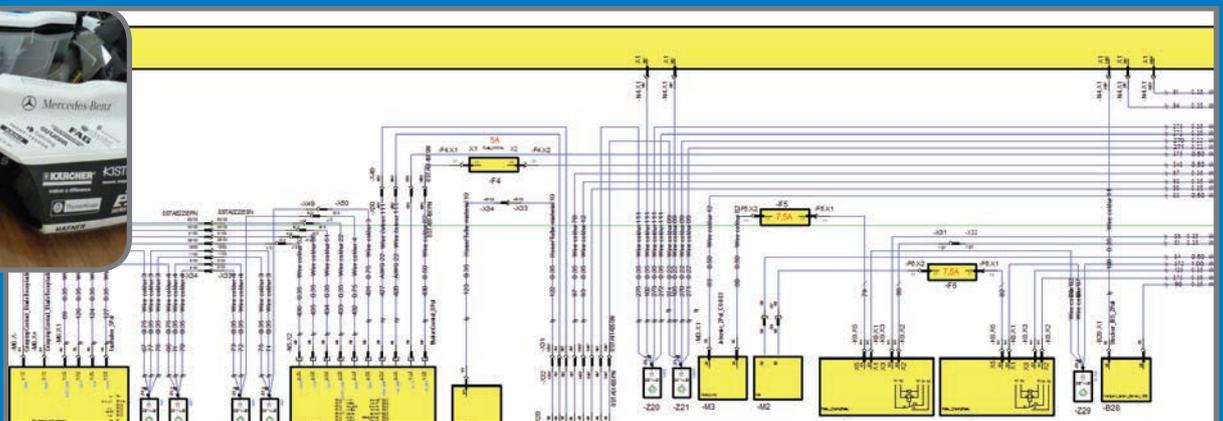
Topology design for concept and physical planning

## Bridging the gap between electrical and mechanical engineering

MCAD tools supported in E$^3$.series:

- CATIA
- Siemens NX
- SolidWorks
- PTC
- SolidEdge
- Inventor

" Zuken are proud sponsors of Formula Student team, Rennstall Esslingen, the winners of the Formula Student Event in Spain 2012. Their car was designed using E$^3$.series. "

# Manufacture

### Harness creation

Whether carrying out build-to-print or working with your supply chain, E$^3$.series will assist with your harness creation. Alternate views of connectors and splices are laid out on either a 1:1 scaled formboard sheet or on a cable layout sheet, and changes to either the schematic or formboard design are immediately reflected across the entire project. Automatic part selection at the design phase ensures accurate details are passed to manufacturing, placing the focus on the design, and not on the tools.

### Open architecture

E$^3$.series has an open architecture; data can be extracted in any format using the Application Programming Interface (API). This flexibility enables our automotive customers to fully-integrate E$^3$.series into their development processes and is a key factor to its success.

### Review and markup

To assist in the prototyping and manufacturing phases, E$^3$.viewers and E$^3$.redliner allow installation and production teams to reference native E$^3$.series documents. E$^3$.redliner is an intelligent markup tool which uses special view-only documents for its annotations. Field changes are loaded back into the native E$^3$.series document and an intelligent search feature helps designers navigate to each recommended change.

### Driving change

E$^3$.Revision Management allows companies to track all changes that occur through all phases of the product lifecycle. Complete projects and sub-projects are passed through release or pre-release stages and locked down to prevent modification. E$^3$.Revision Management documents all graphical and textual changes and keeps a history of each revision, and the resulting data can be incorporated into the engineering change process.

## View and markup

- Create read-only view files
- View and print native E$^3$.series files
- Markup field changes in E$^3$.rediner
- Back annotate changes to E$^3$.series

## Change management

- Compare changes between versions
- Track graphical changes to schematics
- Track textual changes
- Automatic creation of change documentation
- Compare whole project
- Compare sub-sections of project
- Compare any versions
- SAP interface
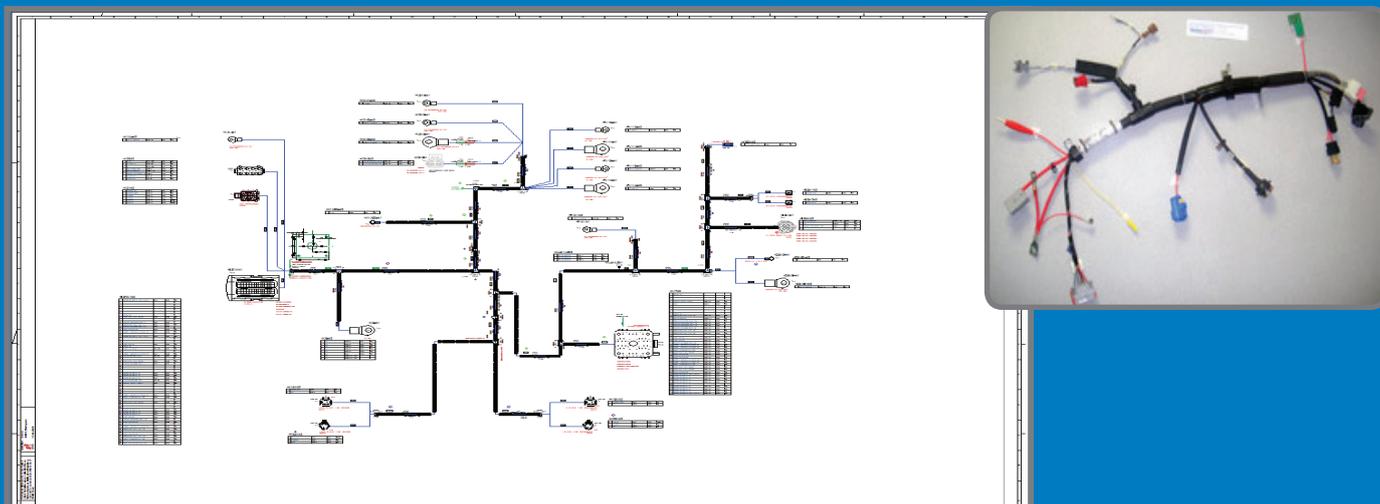


1:1 scale harness documentation

www.zuken.com

# Maintain

### Service documentation

The final phase of most automotive projects is creating the service documentation – detailed schematic and wiring diagrams supplied to the service outlets. This work is usually undertaken by the supply chain and requires a complete redraw of the wiring diagrams. Using the design data from E$^3$.series, it is possible to automate the creation of the service documentation.

E$^3$.Wiring Diagram Generator can automate wiring diagrams from the data in the associated E$^3$.series schematic, or via a CSV file. Additionally, reports can be defined to extract design data for service manuals.

# E$^3$.series Industry Editions

Specially configured electrical design suites to meet the needs of key industries. The industry editions evolved through working with key customers in each of these sectors and contain functionality core to these industries.

## E³.series Industry Editions:

- Machinery
- Mil/Aero
- Power
- Railway
- Systems
- Transportation
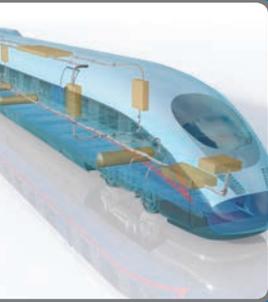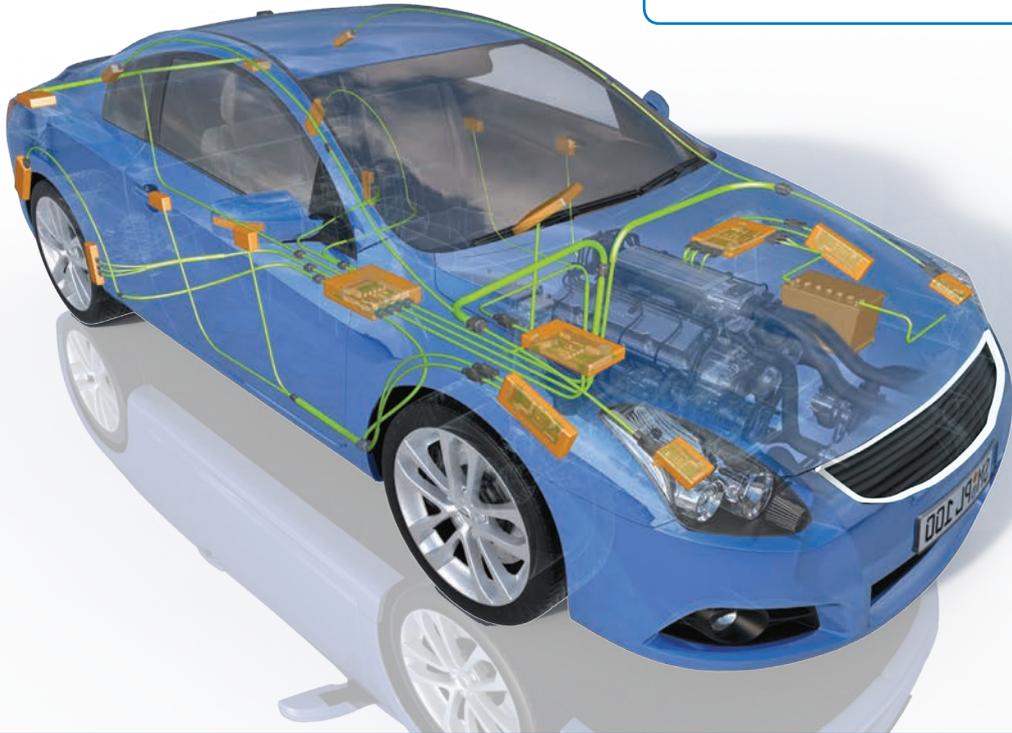
# E$^3$.series Transportation Edition

### E$^3$.cable
Electrical design and documentation of schematic and cable layouts.

### E$^3$.Extended Connector Handling
Standard connector representations for the automotive industry, showing continuation lines, backshell connections and block graphics.

### PDF Output
Produces intelligent, multi-sheet pdf design outputs, with full project structure and built-in hyperlinks.

### E$^3$.step AP212/KBL Output
Part of the Vehicle Electric Container (VEC) standard, STEP AP212/KBL defines the exchange format of a vehicle wire harness between OEMs and their suppliers.

## Options

### E$^3$.EDM
Zuken proprietary library and data management system for managing native E$^3$.series library and project data and documentation.

### E$^3$.enterpise
The multi-user option for E$^3$.series. Allows multiple users to access the same project simultaneously, with built-in access control and workflow capabilities.

### E$^3$.formboard
For creating build-to-print detailed 1:1 harness designs; linked dynamically to E$^3$.schematic drawings.

### E$^3$.Functional Design
For creating system functions and their effects. Links logical schematic designs into functional diagrams and enables basic harness structuring.

### E$^3$.HarnessAnalyzer
Enables OEMs to collaborate with their suppliers effectively. View and analyze harness drawings in the standard HCV container data format.

### E$^3$.3D Routing Bridge
Transfers wire, cable and cable harness information to 3D MCAD systems. After routing, individual wire length data is transferred back to E$^3$.series.

### E$^3$.Revision Management
Document all physical and graphical changes between design iterations. Automatically produce engineering change order documentation.

### E$^3$.redliner
Markup documents in a protected read-only copy of the design. Playback and jump to all recommended changes in the master design.

### E$^3$.Saber Frameway
A dynamic, bidirectional link from E$^3$.series to Saber, an industry- standard simulation environment.

### E$^3$.step AP212/ELOG
A more detailed xml format describing the electrical logic of a circuit; not limited to harness information.

### E$^3$.topology
From conception to detailed wiring plans, E$^3$.topology enables early evaluation of system harnesses including their length, weight and cost. This enables tradeoff analysis of harnesses and sub-harnesses to optimize manufacturing, performance and cost.

### E$^3$.view
Free-of-charge viewer for all E$^3$.series projects (.e3s) and special viewer files (.e3v).

### E$^3$.Wiring Diagram Generator
Automatic wiring diagram generation with configurable front end for producing service and field documentation.

"Since we started using E³.series almost two years ago, we have reduced our design cycle by almost 40% when compared with our previous practice of wire harness design using non-automated tools."

M. Amardeepkumar, R&D Manager, TVS Motors

zuken.com/e3-transportation

**ZUKEN** ®

## About Zuken

**The Challenge.**
More quality, more functionality, in less time, with less cost; it's a common story in today's market place.

The increased competition and requirement to operate on a global scale make these end-user demands ever more challenging to meet. So companies need to be innovative and dynamic to stay one step ahead of the game – this is where Zuken can help.

**What we do.**
Zuken is a global provider of leading-edge software and consulting services for electrical and electronic design and manufacturing. Founded in 1976, Zuken has the longest track record of technological innovation and financial stability in the EDA and ECAD software industry.

The company's extensive experience, technological expertise and agility, combine to create world-class software solutions. Zuken's transparent working practices and integrity in all aspects of business produce long-lasting and successful customer partnerships that make Zuken a reliable long-term business partner.

**Security of Solid Foundations.**
Zuken is focused on being a long-term innovation and growth partner. The security of choosing Zuken is further reinforced by the company's people – the foundation of Zuken's success. Coming from a wide range of industry sectors, specializing in many different disciplines and advanced technologies, Zuken's people relate to and understand each company's unique requirements.

For more information about the company and its products, visit **www.zuken.com.**

# The Partner for Success

## Locations

**NORTH AMERICA**
**United States**
Zuken USA Inc.
Westford, MA
Tel: +1 978 692 4900

Zuken SOZO Center
(Zuken Inc., US branch)
Milpitas, California, USA
Tel: +1  95035 7457

**ASIA**
**Japan**
Zuken (Headquarters)
Yokohama, Japan
Tel: +81 45 942 1511

**China**
Zuken Inc. (Beijing Rep. Office)
Beijing, China
Tel: +86 10-8447 5076

**South Korea**
Zuken Korea Inc.
Seoul, South Korea
Tel: +82 2 564 8031

**Singapore**
Zuken Singapore Pte. Ltd.
Gateway East, Singapore
Tel: +65 6392 5855

**Taiwan**
Zuken Taiwan Inc.
Taipei, Taiwan
Tel: +886 2 2562 7227

**EUROPE**
**Germany**
Zuken GmbH
(European Headquarters)
Hallbergmoos, Germany
Tel: +49 89 607696 00

Zuken E3 GmbH
Ulm, Germany
Tel: +49 7305 9309 0

Zuken E3 GmbH
(Global Automotive and Transportation Competence Center)
Erlangen, Germany
Tel: +49 (0) 89 607696 00

Zuken E3 GmbH
Hannover, Germany
Tel: +49 511 8595 94 89

**Switzerland**
Zuken E3 GmbH
(Sales Office Switzerland)
Mägenwil, Switzerland
Tel: +41 56 4370890

**United Kingdom**
Zuken UK Ltd.
Bristol, UK
Tel: +44 1454 207801

**France**
Zuken S.A.
Courtaboeuf Cédex, France
Tel: +33 1 69 29 48 00

**Italy**
Zuken S.r.l.
Milan, Italy
Tel +39 02 575921

**Netherlands**
Zuken GmbH
(Sales Office Benelux)
Herkenbosch, The Netherlands
Tel: +31 475 520998

**Poland**
Zuken E3 GmbH
Sp.z o.o. Oddział w Polsce
Kraków, Poland

Find out more about our Transportation Edition

**zuken.com/e3-transportation**