

# 对于进取的热情：4 年的历程，并在延续



**Rexroth**  
Bosch Group The Drive & Control Company

**BorgWarner**

**BOSCH**  
Invented for life

**Continental**  
The Future in Motion

**ebmpapst**

**ABB**



**mangelberger**  
Corporate Technology

**SEW**  
EURODRIVE



2013



2014



2015



2016

# PASSION FOR IMPROVEMENT: 4 YEARS AND COUNTING



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2013



2014



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2016

# 名人堂：ROI德国工业4.0奖获奖企业

2013

MASCHINENFABRIK REINHAUSEN  
水平 & 垂直整合 *Horizontal & vertical integration*



2014

BOSCH REXROTH   
工业4.0 装配系统  
*i4.0 assembly system*

BORG WARNER   
班次计划app应用  
*Shift planning app*

2015

BOSCH   
实时数据  
*Real-time data*

CONTINENTAL   
协作机器人  
*Collaborative robots*

EBM PAPST   
垂直整合  
*Vertical integration*

2016

ABB   
智能自动化  
*Intelligent automation*

KLINGELNBERG   
设计 & 产品整合  
*Integration design & production*

MANGELBERGER   
中小型企业物联网  
*IoT@SME*

SEW   
精益工业4.0  
*Lean industry 4.0*

2017

ROBERT BOSCH   
IT 集成 & 大数据  
*IT integration & big data*

WS KUNSTSTOFFTECHNIK   
数据眼镜 & 协作机器人  
*Data glasses & CoBots*

SIEMENS   
研发与生产集成  
*Integration of R&D & production*

JOHN DEERE   
农业4.0  
*Farming 4.0*

2018

您想成为其中一员吗 **COULD BE YOUR COMPANY HERE**

# HALL OF FAME: WINNERS OF THE ROI INDUSTRY 4.0 AWARDS GERMANY

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# 2013年获奖企业



## 绩效改善

产品成本: -22%

装配交付期: -60%

客户抱怨率: -50%

不良率: 12dmp

条码整合: 99,8%

## 概念实施

- 自主开发数据交换平台
- 完成垂直及水平整合
- 设备及工具数字化管理
- 实时数据系统
- 不同NC控制及平台的直接访问
- 工位相关数据的整合, 如: 设备设置, 作业指导等
- 无纸化生产
- 实时生产计划的自动优化

# 2013 AWARDS WINNER



## IMPROVEMENTS

Production costs -22%

Throughput time assembly -60%

Customer complaint rate -50%

Error rate 12dmp

Barcode integration 99,8%

## CONCEPT

- Self-developed data exchange platform
- Complete vertical and horizontal integration
- Digital twin of all machines and tools
- All data available in real-time
- Direct access to different NC-controls and platforms
- Combination of all relevant data per workplace, e.g. set-up, work instruction, etc
- Paperless production
- Automatic routing optimizer in real-time

# 2014年获奖企业



## 绩效改善

设置时间: - 80%

库存: -50%

交付期: -8%

产量: +11-20%

## 概念实施

- 6个产品族200种产品的柔性装配线的实施
- 通过ERP, MES的垂直整合及产品架构缩短来料订单时间
- 建立产品与工位及员工的交互
- 实时云数据记录及大数据分析
- 实时生产状态可视化

# 2014 AWARDS WINNER



## IMPROVEMENTS

Setup times - 80%

Inventory -50%

Lead time -8%

Output +11-20%

## CONCEPT

- Flexible assembly line for 6 product families with 200 variants
- Shortened incoming order process through a product configurator and vertical integration of ERP and MES
- Linking of products as well as workstations and employees
- Recording of data in real-time in a cloud as well as big data analytics
- Visualization with activeCockpit



# 2014年获奖企业



## 绩效改善

目标导向的员工柔性化发展及控制

透明化工作任务及工作强度分配

对非生产时间的预防来改善生产计划强度

## 概念实施

- 通过基于过程工艺的APP应用以调度员工工作任务
- 智能手机APP的终端记录
- 基于需求的员工规划及调度

# 2014 AWARDS WINNER



## IMPROVEMENTS

Controlled, target-oriented deployment of flexibility instruments in human resources

Transparent work distribution and load

Preventing non-productive time

Reduction of planning effort

## CONCEPT

- Active involvement of employees in personnel deployment using Doodle app based on defined process sequences
- Smartphone App and same functionality at the time recording terminal
- Systematic selection of employees to be contacted based on request list and defined priority rules

# 2015年获奖企业



## 绩效改善

设备利用率: +5%

节拍: +40%

库存: -10%

能源消耗: -15%

追溯: 100%

生产成本: -18%

## 概念实施

- 超过5000台作业设备的垂直、水平网络及软件的标准化
- 过程状态及质量数据的实时监控
- 能源消耗及智能网络系统的实时监控
- 结合标准化会议沟通系统及流程的数字化车间管理
- 基于RFID的可视化及部分自动化物流
- 线旁辅助操作系统协助设备设置及调整（终端机，移动终端）
- 通过独立系统的整合，智能设备的应用来改善新业务模式下的产品开发

# 2015 AWARDS WINNER



## IMPROVEMENTS

OEE +5%

Cycle time +40%

Inventory -10%

Energy consumption -15%

Traceability 100%

Production costs -18%

## CONCEPT

- Vertical and horizontal networking and software standardization of more than 5.000 manufacturing equipment
- Real-time monitoring of performance und quality process parameters
- Real-time monitoring of energy consumption
- Staff support for the machine operation by a point-of-use operator support system
- Use of field data by smart products to improve product development and as a basis for new business models and ability to Internet-based product update

# 2015年获奖企业



## 绩效改善

人工成本的节约

产品交付期的缩减

供应链能力的提高

内部供应链透明化的提高

柔性的提高

资源效率的提高

## 概念实施

- 明确的工业4.0策略
- 使用协作机器人及无人运输系统
- 作为作业辅助的智能眼镜的使用
- 能源消耗的监控及可视化和仓库照明的条件监测
- 基于IT模拟的垂直生产计划协作系统
- 使用语音定向检验以减少生产前置期及物流成本
- 水平整合的作业设备实现物流的自动补货
- 使用3D打印进行产品装配测试

# 2015 AWARDS WINNER



## IMPROVEMENTS

Reduction of personnel cost

Reduction of lead times

Increase of supply capacity

Increase of transparency over the entire internal supply chain

Increasing of flexibility

Increase of resource efficiency

## CONCEPT

- Use of collaborative robots, driverless transport systems, and smart glasses
- Measurement and visualization of energy consumption and the use of condition monitoring in the high-bay warehouse
- Voice-directed outgoing inspection to reduce throughput time and logistics costs
- Use of 3D printing for the planning of new assembly processes

# 2015年获奖企业

**ebmpapst**

## 绩效改善

一次通过率的提升

自动设置

设备产能的提高

建立过程数据的中央数据库  
(以改善未来的产品及质量)

## 概念实施

- 可持续的，柔性的，可展开的基于SAP ME / MII 的MES设备管理系统的实施
- 过程控制（装配流程控制及包含动态工艺路线调整的质量门控制）
- 自动过程保障（零部件匹配，变化状态监控，工具、材料、包装的自动准备）
- 自动准备过程（资源程序的选取）
- 包含过程数据，产品数据及检测数据的产品生命周期追溯系统
- 标准化使用界面（作业，设备，移动设备）

# 2015 AWARDS WINNER



## IMPROVEMENTS

Increase of first-pass yield

Automate make-ready processes

Improving equipment productivity

Creation of a central database for process data (as a basis for further product and quality improvement)

## CONCEPT

- Sustainable, flexible and rollout capable MES architecture based on SAP ME / MII with standardized machine interface
- Automated process assurance (matching of components, monitoring of change statuses, make-ready process tools and materials, packaging)
- Traceability of the entire production cycle of a product including process data, product data and test data
- Standardized user interfaces (work, machine, mobile)



# 2016年获奖企业



## 绩效改善

产品线柔性程度可生产600种产品

减少换型时间

降低能源消耗

交付期时间减少

质量提升

- % 数据指标保密 -

## 概念实施

- 高度柔性自动化装配线的引入
- 所有生产及测试数据的实时监控（每种型号300项参数）
- 自动换型（如：焊接、激光切割、测试工位）
- 所有产品通过条码的数据追溯：在线反馈/参数调整
- 参数状态的线旁可视化

# 2016 AWARDS WINNER



## IMPROVEMENTS

Line with flexibility to produce 600 types

Reduced changeover times

Reduced energy consumption

Reduced lead times

Increased quality

- % figures trade secret -

## CONCEPT

- Introduction of a highly flexible automated assembly line
- Real-time availability of all production and test data (300 parameter per type)
- Automatic changeover (e.g. welding, laser, test stations)
- Full traceability with data matrix code per product & digital twin: Online feedback / adjustment of parameter
- Lineside visualization of all performance parameter

# 2016年获奖企业



## 绩效改善

生产成本降低15%

一次通过率由0%提高到接近100%

交付期时间减少

## 概念实施

- 生产各工序的数字化模拟以进行设备设置及工具参数设置
- 完成CAD，计算，模拟，制造，质量控制的垂直整合
- 数字化存贮各生产工序的质量门及反馈数据
- 完成生产各阶段的产品追溯

# 2016 AWARDS WINNER



## IMPROVEMENTS

Reduction of production costs by 15%

Increase of first-pass yield from 0% to near 100%

Reduced and more reliable lead time

## CONCEPT

- Digital twin with simulation of each production step and appropriate adjustment of machine / tool parameter
- Complete vertical integration from CAD, calculation, simulation, manufacturing and quality control
- Quality gate after each production step and feed back of reference data into digital twin
- Complete traceability of all production steps

# 2016年获奖企业

mangelberger  
Corporate Technology

## 绩效改善

实现批量化自动装配控制柜

减少交付期

提高员工生产率

为客户提供数字化服务以开展  
新业务模式

## 概念实施

- CAD系统，MES，产品文件及追溯的整合
- 能源管理系统的云数据融合（实时数据收集、分析及对标）
- 算法的自动优化（如：基于云数据分析的能源自主管理）

# 2016 AWARDS WINNER



## IMPROVEMENTS

Automatic assembly of control cabinets with lot size 1

Reduction of lead time

Increase of people productivity

Provision of digital services for clients to explore new business models

## CONCEPT

- Integration of CAD system with MES, product documentation, and traceability
- Integration of energy management systems into the cloud (collection of all runtime data, analysis, benchmarking)
- Self-optimization algorithms (e.g. cloud based dimming or active energy management)

# 2016年获奖企业



## 绩效改善

产量提升

质量风险降低70%

交期时间减少70%

提高应对客户需求波动的反应速度

经济可行性提高18-25%

## 概念实施

- 以精益为基础
- 装配及运输的智能自动化（包括协作机器人）
- 实现内部物流自动托盘运输自动化
- 实现控制系统&识别系统的过程引导

# 2016 AWARDS WINNER



## IMPROVEMENTS

Increase of production output

Reduction of error risk by 70%

Reduction of lead time by 70%

Increased speed to react to demand fluctuation

Increased economic feasibility by 18-25%

## CONCEPT

- Lean as foundation
- Intelligent automation with mobile assembly and handling assistants (including collaborative robots)
- Automated internal logistics with smart pallet mover
- Process guidance over identification & control systems