Service life testing:
different machine components simple and reliable connected

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TECHNIEKHUYS
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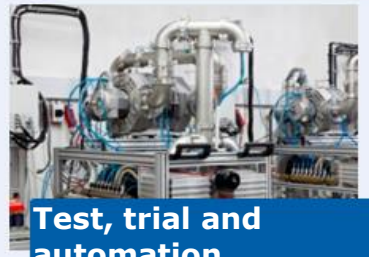
PLOT CONFERENTIE
TOMORROW'S RELIABILITY

Data acquisition and data logger



Test, trial and automation

Monitoring and environ-mental technology

Vibration measurement

Intelligent measurement technology

We at Delphin supply our global customers with intelligent, universal **data acquisition hardware** and intuitive **measurement software**. This enables our customers to reliably and efficiently carry out their measurement and monitoring requirements.

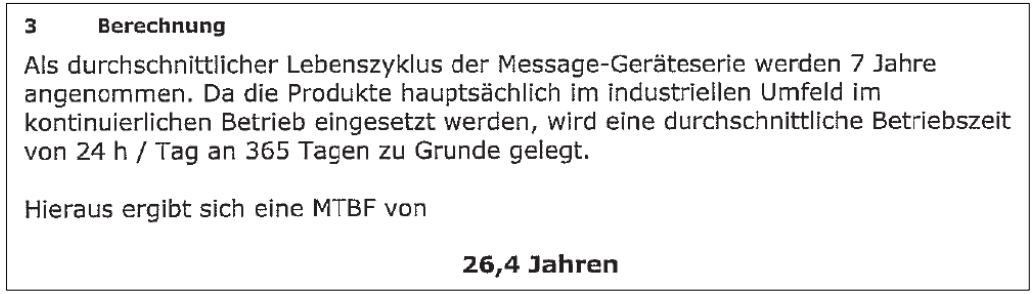
Agenda.

- Definition / MTBF certificate
- Importance of the reliability
- Activities
- Usual requirements
- Real application example
- Further typical applications

Definition.

What is reliability?

- In the area of manufacturing: The probability of failure-free performance over an item's useful life, or a specified timeframe, under specified environmental and duty-cycle conditions. Often expressed as mean time between failures (MTBF) or reliability coefficient. Also called quality over time. Source: http://www.businessdictionary.com/definition/reliability.html
- MTBF is the measure of the reliability of devices and systems.
- MTBF is the time in hours that the manufacturer specifies as the average time before a fault occurs on a device for the first time. A definition is given in DIN 40041 and 40042.



3 Berechnung

Als durchschnittlicher Lebenszyklus der Message-Geräteserie werden 7 Jahre angenommen. Da die Produkte hauptsächlich im industriellen Umfeld im kontinuierlichen Betrieb eingesetzt werden, wird eine durchschnittliche Betriebszeit von 24 h / Tag an 365 Tagen zu Grunde gelegt.

Hieraus ergibt sich eine MTBF von

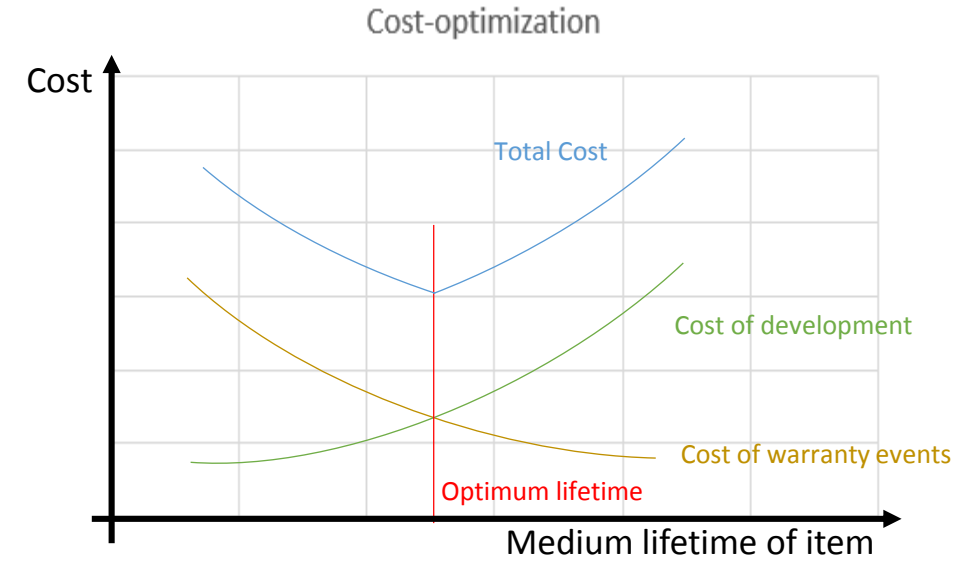
26,4 Jahren

Clipping from a MTBF certificate for one Delphin product.

Importance.

Why is reliability important? Aims for manufacturers.

- Reduce early and spontaneous failures
- Optimize fault during and after the warranty period
- Avoid recalling of products
- Planned obsolescence
- Cost optimisation
- Quality assurance



Activities.

What can be done?

- Simulation of product reliability on test stands.
- Simulation inside climate chambers or shaker stands for acceleration of the aging process.
- Lifetime testing under statical and dynamical testing conditions.

Test stand with shaker and climate chamber

Activities.

What can be done?

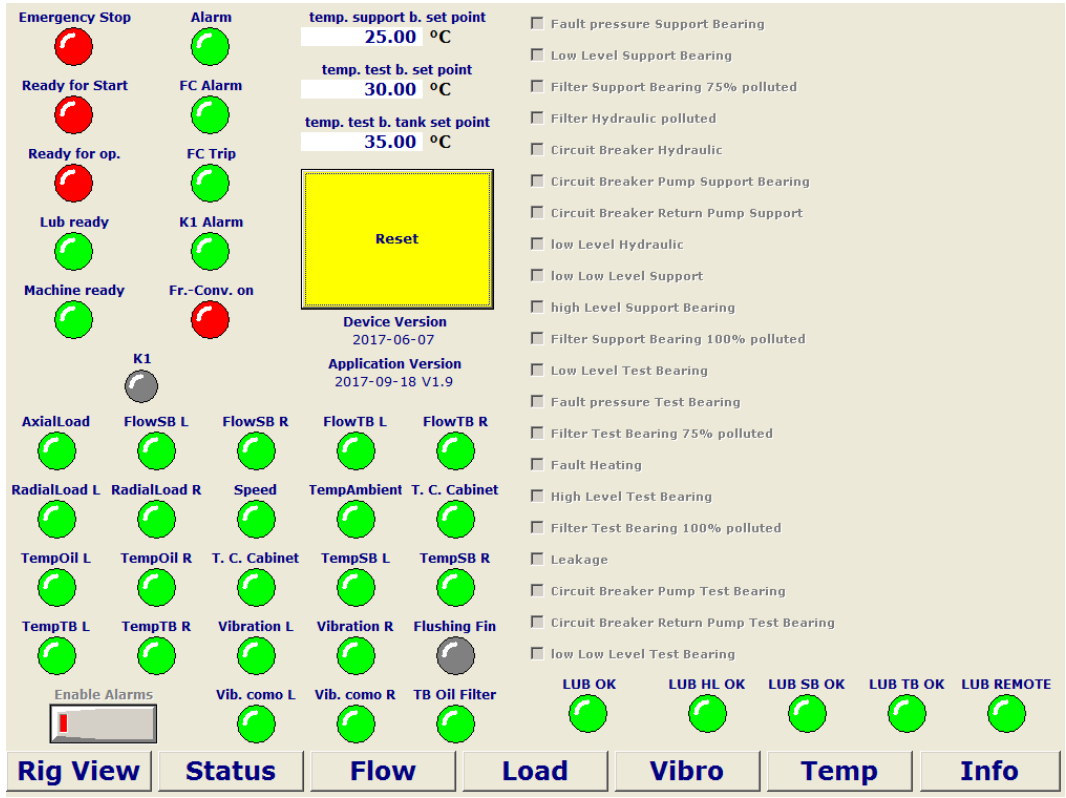
- Mixture of different testing procedures independent/dependent of different products.
- Continuous, self-sufficient and automated testing of the products with high flexibility
- Implementation of lifetime testing procedure
- Optimisation of the existing lifetime testing procedure

Control cabinet with visualisation

Usual requirements.

High requirements need an reliable system. Why?

- Resistance against permanently changed environment conditions.
- Acquisition, analysis and documentation of multiple parameters (temperature, pressure, current, moisture, flow, vibration, etc.).
- Synchronized control of test stands with easily programmable software with stand alone interface:
  - Simultaneous adjustment, acquisition and archiving of temperature, vibration force and frequency in order to be able to act on the test specimen with different load factors.
  - Estimation of the relations between the measurement parameters.



Possible interface of observed processes and parameters

Real application example.

High requirements need an reliable system. Why?

- Remote control and observations of the experiments inside the test stands.
- Distributed test stands with data collection inside one central server.
- Individual, user defined interfaces and settings on separate working places can proceed different datasets, which can be used by multiple users and for diverse analysis.

Test stand for product testing

Real application example.

The initial situation

- Acquisition and recording only of the bearing temperatures during the test simulation.
- Only manual controlling of the lubrication flow and the loads.
- One central control unit for several test stands.
- No centralized database for the measurement results.

Real application example.

The requirements

Endurance testing equipment for the complete refurbishment of the life test rigs for roller bearings. Full solution for several test stands is required.

- Acquisition and recording of the bearing temperatures and of bearing vibration parameters during the test simulation.
- Monitoring and controlling of the lubrication flow and the loads.

  → full automation mode
- Independent operation on the test stands.
- Centralized database for all measurement results.

  → Comparison and further analysis of the results

Real application example.

The realization steps

Step 1: Pre-Engineering

→ The most important step to clarify the specs with the customer

- Clarification of the requirement specification
- Determination of the scope of delivery
- Setting the project schedule

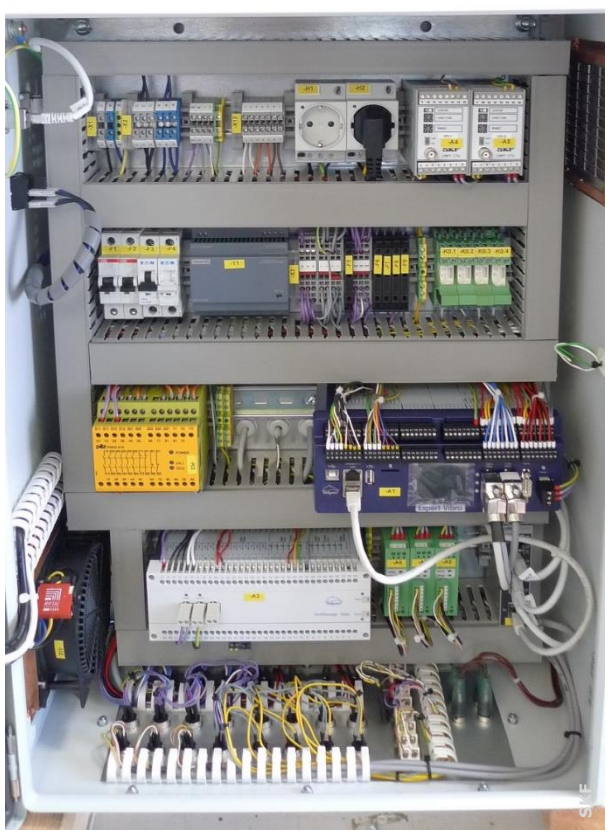
The Requirements Specification is absolutely necessary for such complex projects!

Real application example.

The realization steps

Step 2: Development of the test stand prototype

- Selection of the fitting hardware and optimum I/O structure.
- Setting the periphery and the sensors together with customer.
- Production and wiring of the test stand control cabinets.



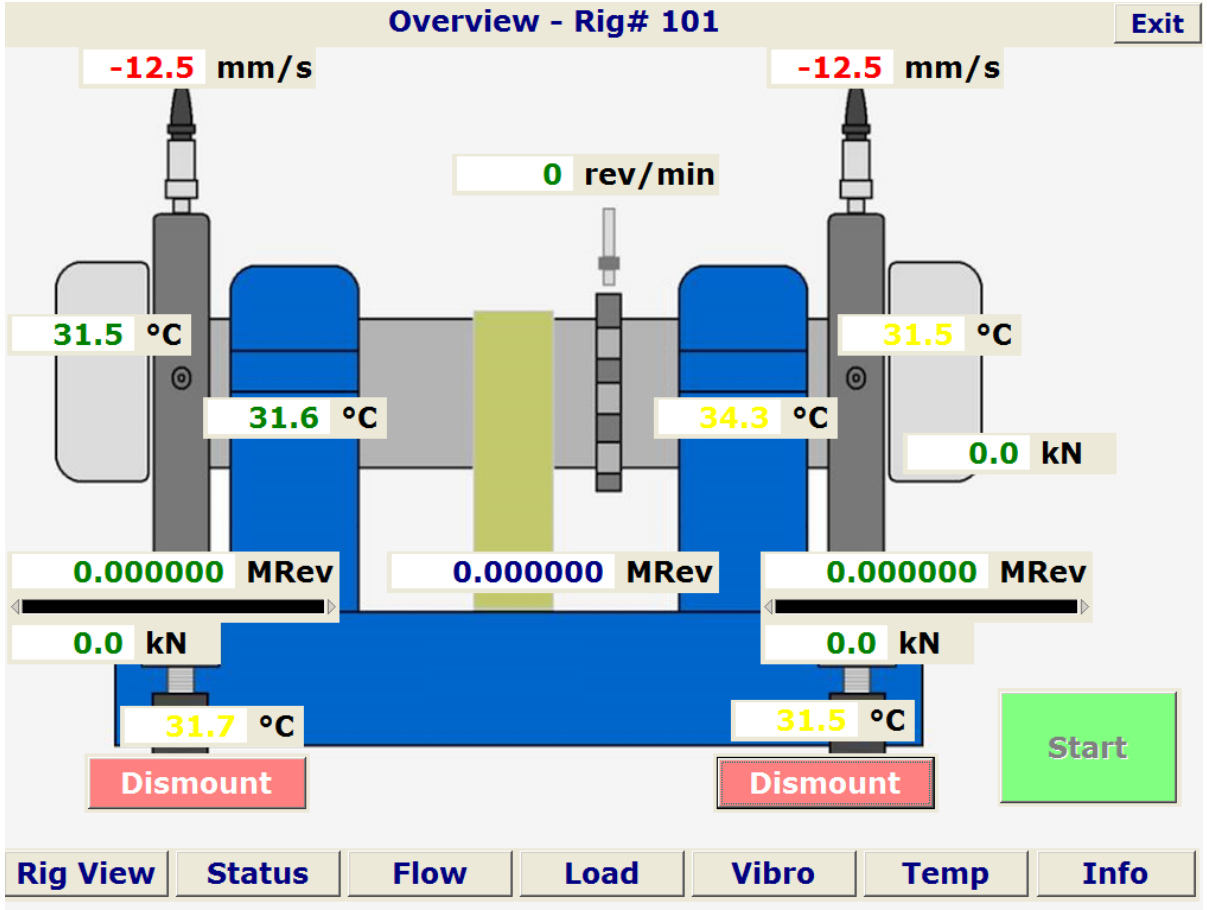
Control cabinets

Real application example.

The realization steps

Step 3: Application development

- Developing an user-friendly visualization and user interface.
- Developing the different testing modes.
- Developing the needed driver to adapt the periphery systems.

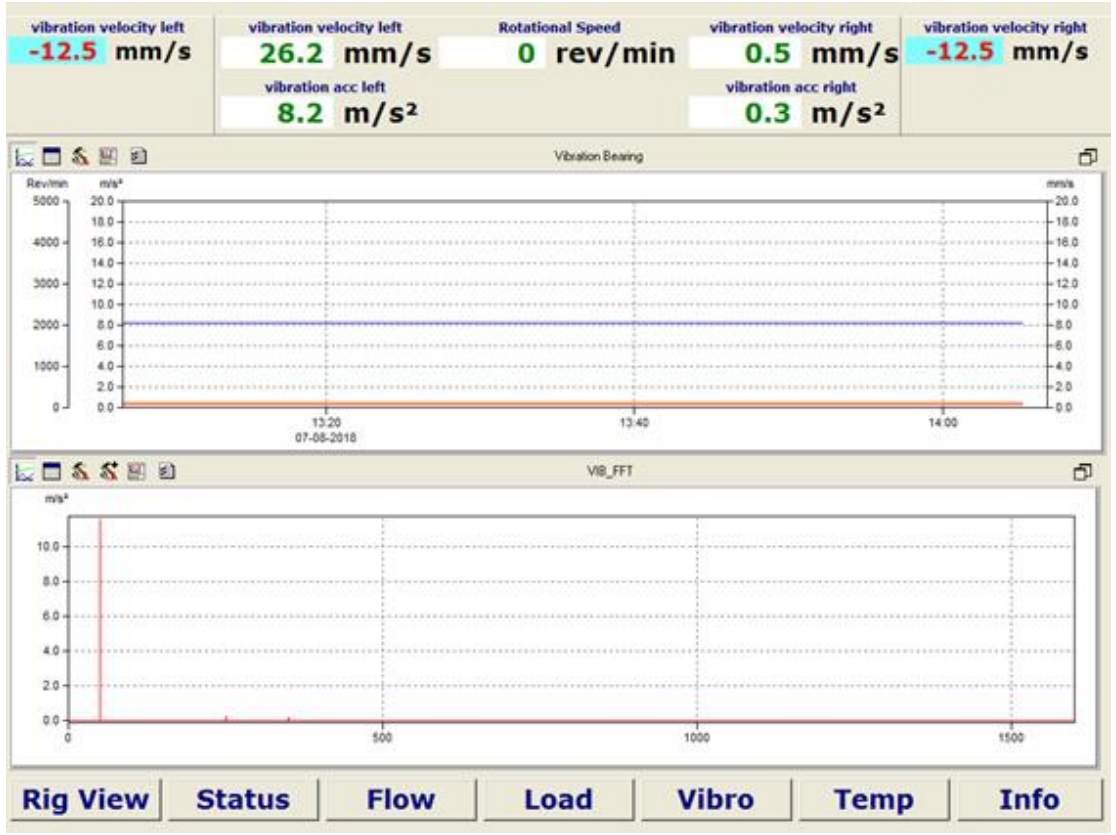


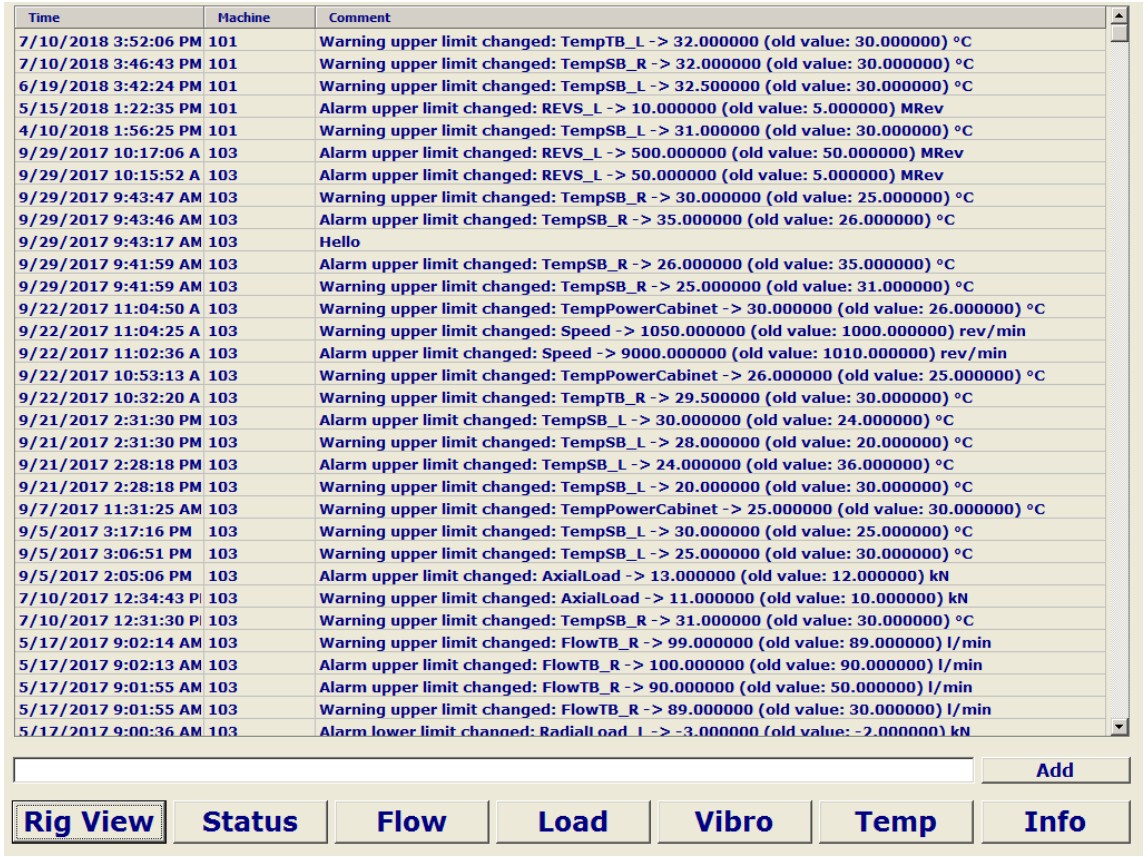
Visualisation

Real application example.

The realization steps

Step 3: Application development





Time	Machine	Comment
7/10/2018 3:52:06 PM	101	Warning upper limit changed: TempTB_L -> 32.000000 (old value: 30.000000) °C
7/10/2018 3:46:43 PM	101	Warning upper limit changed: TempSB_R -> 32.000000 (old value: 30.000000) °C
6/19/2018 3:42:24 PM	101	Warning upper limit changed: TempSB_L -> 32.500000 (old value: 30.000000) °C
5/15/2018 1:22:35 PM	101	Alarm upper limit changed: REVS_L -> 10.000000 (old value: 5.000000) MRev
4/10/2018 1:56:25 PM	101	Warning upper limit changed: TempSB_L -> 31.000000 (old value: 30.000000) °C
9/29/2017 10:17:06 A	103	Alarm upper limit changed: REVS_L -> 500.000000 (old value: 50.000000) MRev
9/29/2017 10:15:52 A	103	Alarm upper limit changed: REVS_L -> 50.000000 (old value: 5.000000) MRev
9/29/2017 9:43:47 AM	103	Warning upper limit changed: TempSB_R -> 30.000000 (old value: 25.000000) °C
9/29/2017 9:43:46 AM	103	Alarm upper limit changed: TempSB_R -> 35.000000 (old value: 26.000000) °C
9/29/2017 9:43:17 AM	103	Hello
9/29/2017 9:41:59 AM	103	Alarm upper limit changed: TempSB_R -> 26.000000 (old value: 35.000000) °C
9/29/2017 9:41:59 AM	103	Warning upper limit changed: TempSB_R -> 25.000000 (old value: 31.000000) °C
9/22/2017 11:04:50 A	103	Warning upper limit changed: TempPowerCabinet -> 30.000000 (old value: 26.000000) °C
9/22/2017 11:04:25 A	103	Warning upper limit changed: Speed -> 1050.000000 (old value: 1000.000000) rev/min
9/22/2017 11:02:36 A	103	Alarm upper limit changed: Speed -> 9000.000000 (old value: 1010.000000) rev/min
9/22/2017 10:53:13 A	103	Warning upper limit changed: TempPowerCabinet -> 26.000000 (old value: 25.000000) °C
9/22/2017 10:32:20 A	103	Warning upper limit changed: TempTB_R -> 29.500000 (old value: 30.000000) °C
9/21/2017 2:31:30 PM	103	Alarm upper limit changed: TempSB_L -> 30.000000 (old value: 24.000000) °C
9/21/2017 2:31:30 PM	103	Warning upper limit changed: TempSB_L -> 28.000000 (old value: 20.000000) °C
9/21/2017 2:28:18 PM	103	Alarm upper limit changed: TempSB_L -> 24.000000 (old value: 36.000000) °C
9/21/2017 2:28:18 PM	103	Warning upper limit changed: TempSB_L -> 20.000000 (old value: 30.000000) °C
9/7/2017 11:31:25 AM	103	Warning upper limit changed: TempPowerCabinet -> 25.000000 (old value: 30.000000) °C
9/5/2017 3:17:16 PM	103	Warning upper limit changed: TempSB_L -> 30.000000 (old value: 25.000000) °C
9/5/2017 3:06:51 PM	103	Warning upper limit changed: TempSB_L -> 25.000000 (old value: 30.000000) °C
9/5/2017 2:05:06 PM	103	Alarm upper limit changed: AxialLoad -> 13.000000 (old value: 12.000000) kN
7/10/2017 12:34:43 PI	103	Warning upper limit changed: AxialLoad -> 11.000000 (old value: 10.000000) kN
7/10/2017 12:31:30 PI	103	Warning upper limit changed: TempSB_R -> 31.000000 (old value: 30.000000) °C
5/17/2017 9:02:14 AM	103	Warning upper limit changed: FlowTB_R -> 99.000000 (old value: 89.000000) l/min
5/17/2017 9:02:13 AM	103	Alarm upper limit changed: FlowTB_R -> 100.000000 (old value: 90.000000) l/min
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5/17/2017 9:00:36 AM	103	Alarm lower limit changed: RadialLoad_L -> -3.000000 (old value: -2.000000) kN

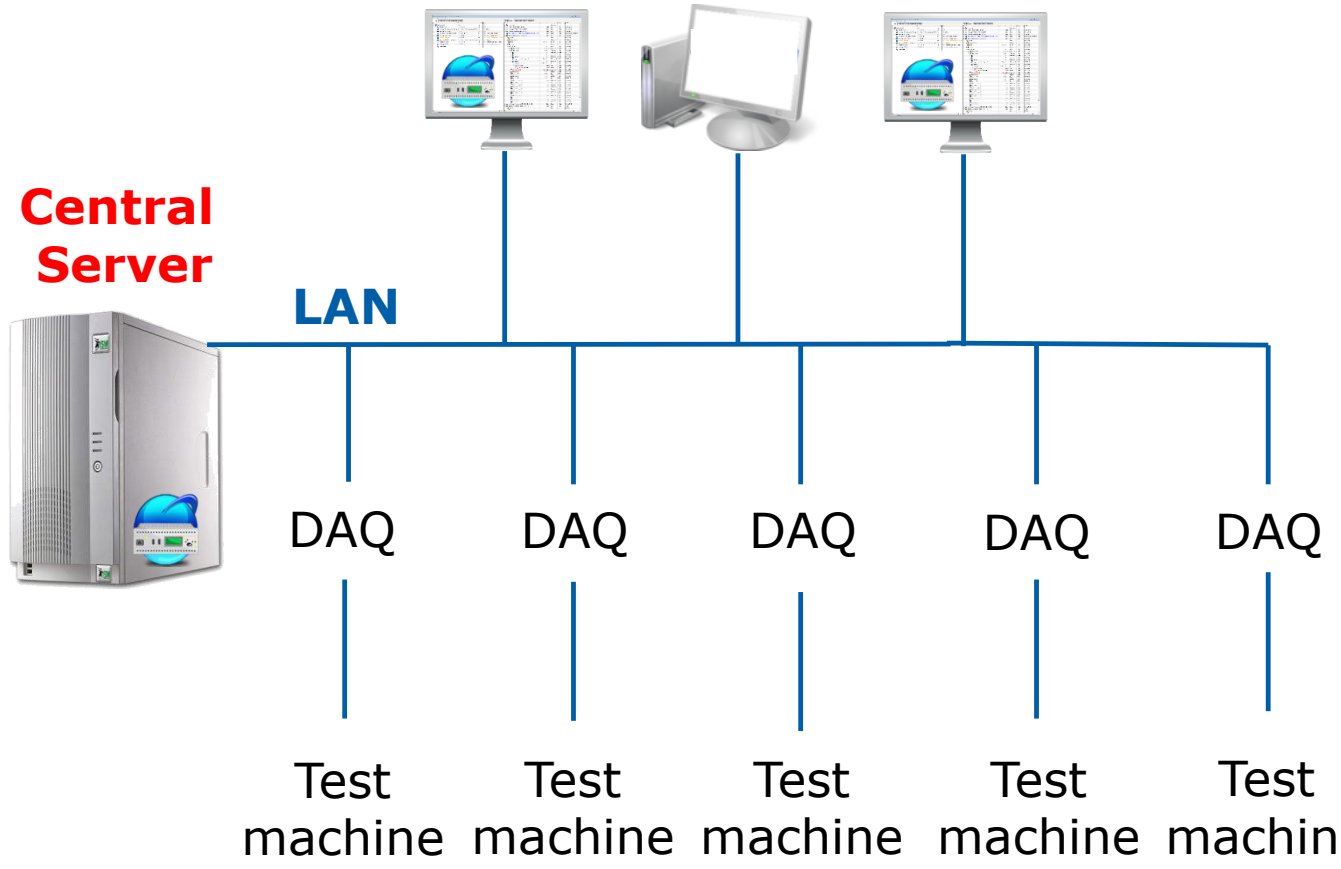
Online trend and selected events

Real application example.

The realization steps

Step 4: Development of infrastructure und server solution

- The test stands are grouped and can work together or independent.
- One central server for the database structure and shared test conditions communicates with all test stands.

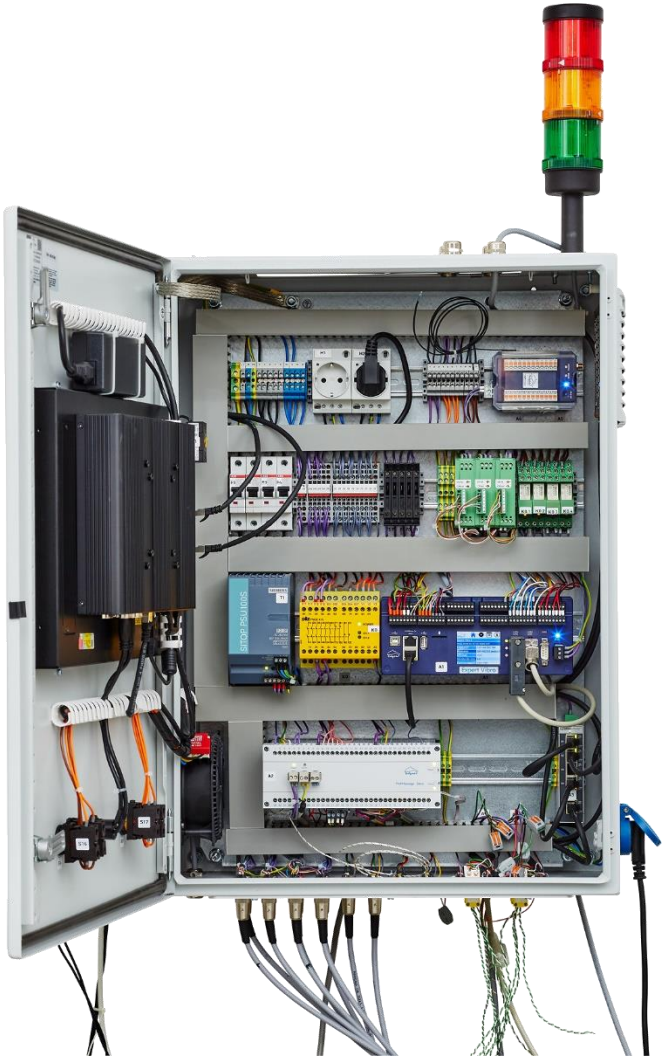


Real application example.

The realization steps

Step 5: Commissioning on site

- Intensive training for the operators.
- Testing phase to gather experiences.
- Optimization of the standardized test stand.



Control cabinet

Real application example.

The result

Test stands for vibration measurements of bearings

Real application example.

Customer benefits

- The complete solution with data acquisition and control system, monitoring and analysis with one central system provided by one supplier.

- Connection to different periphery systems:
  - frequency converter,
  - lubrication system,
  - special measuring equipment …

- Centralization of all important data in one central database with a user-friendly IT infrastructure and traceable values.

- Several test stands can work independently from each other with one central server / PC or with separate PCs for the operator.

Real application example.

Customer benefits

- Automatically restart after voltage breakdown, all measurement data and configuration securly stored inside a measurement unit.
- The operator doesn’t need programming skills.
- The system is customized for him and easy to handle.
- Perfect constellation for further test stands and “rollout” (copy & paste).
- From pre-engineering till commissioning, training and service in one.

Conclusion of the example

What is an endurance test?

A test simulation for a product under real conditions like it is used in practice.

Why are they needed?

The endurance test stands are needed to define the life time cycle of a product.

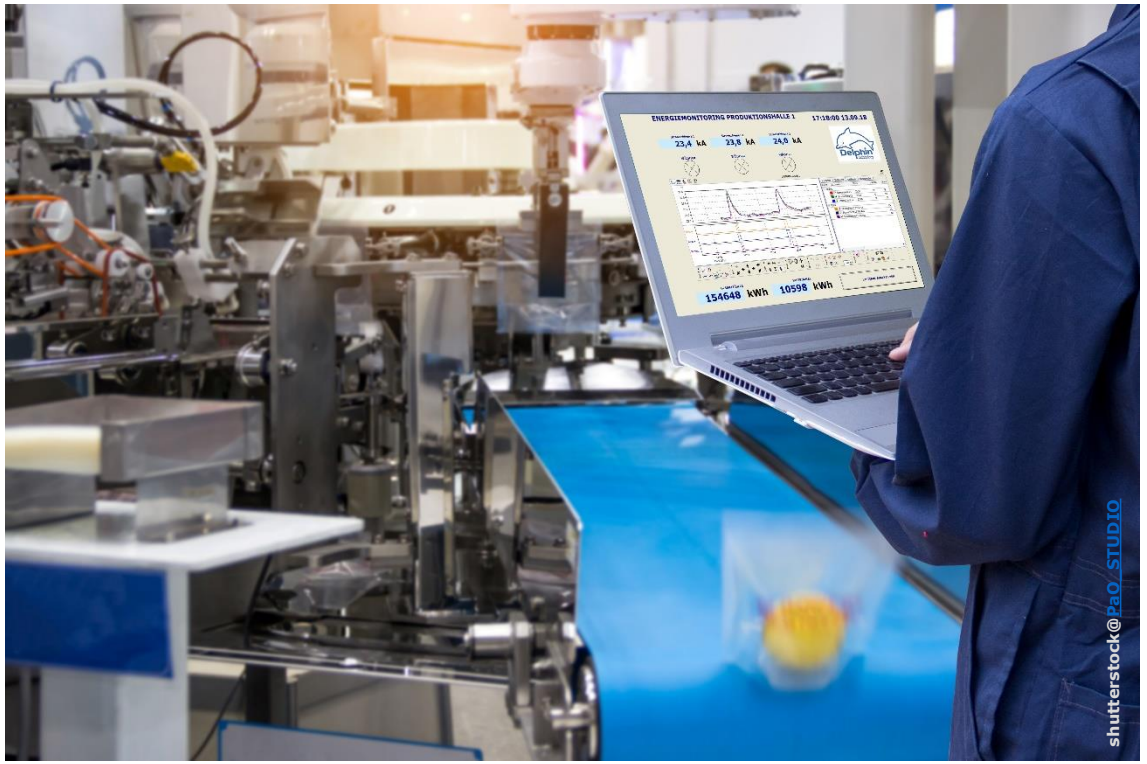
What is the main target of the customer?

The maximization of the product quality and performance as well as the data acquisition for the further product development.

Typical applications.

Further typical applications for reliability

- Test stands for long-term testing
- Standards-compatible testing
- Environmental simulation in climate chambers
  - Provision of setpoint profiles in climate chambers
- Reliability testing of relays
- Reliability testing of oven doors
- Automated testing on heating systems
- Experiments in chemical and pharmaceutical laboratories



Test stands for pumps

Typical applications.

Further typical applications for reliability

- Quality assurance of controllers and switches in household appliances
- Environmental and endurance testing on vehicle components
- Environmental simulation for vehicle cooling systems
- Endurance testing of oven doors
- Service life testing for window winders
- Hob and hot plate testing
- Service life testing for fan motors

Test stands

Contactgegevens

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