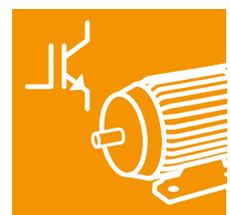


Training Systems for Energy-efficient Drives

The key to profitable and environmentally friendly production is the acquisition of practical, project-oriented skills



Qualification through quality

Training systems for energy-efficient drive technology

Environmentally friendly solutions ...

Rising energy prices due to dwindling fossil fuels and increased environmental awareness have led to a rethink in most countries forming part of the global economy. The need to reduce consumption of resources is indisputable. However, this can only be achieved by finding alternative, more reliable ways to not only generate energy, but also to use it much more efficiently. This is the only way to minimise environmental impact without harming the economy and thereby the prosperity of nations.



Energy-saving drives are in demand, and help keep industrial production costs viable.

In Germany, approximately half of electrical energy demand comes from industry. The main consumers are electric drive motors, which account for about 70 percent of industrial electricity consumption. Optimising such drives can help save costs and conserve resources.

Ways to maximise energy efficiency

During optimisation of an electrically operated industrial facility, consideration should always be paid to the entire drive system. This is because various parameters affect the energy efficiency of drives.

Energy efficiency can be increased in three different ways:

| 1. Intelligent use of electrical energy (60%) | 2. Improvement in efficiency (10%) | 3. Speed control and energy recovery (30%) |
|--|---|---|
| <ul style="list-style-type: none"> • Determination of exact energy requirements • Optimisation of movements • Use of geared motors or direct drives, depending on the application | <ul style="list-style-type: none"> • Use of energy saving motors | <ul style="list-style-type: none"> • Recovery of braking energy • Feeding recovered braking energy back into the system • Exchange of energy between multiple drives |

Energy efficiency – a key aspect, not least in the sphere of vocational training

As part of their professional training, young adults need to learn how machines can be used optimally to save costs and energy. Lucas-Nülle's modular, scalable teaching and training equipment helps impart this valuable knowledge. This equipment serves as an innovative, sustainable foundation for sound education in the field of drive technology. The following pages present three educational and training devices which implement the aforementioned energy-saving techniques.



Energy-efficient drive design

Training system

Many machines at industrial facilities are oversized in order to "be on the safe side". This means that they consume more electrical energy than is actually necessary. Such excess consumption necessarily raises costs. However, significant savings can be achieved through matching drives accurately to the maximum mechanical power required. The "Energy-efficient drive design" training equipment is perfect for learning how drives can be designed according to their maximum required mechanical performance.



The "Energy-efficient drive utilisation" training system consists of a three-phase asynchronous motor and servo machine test stand.

Training objectives

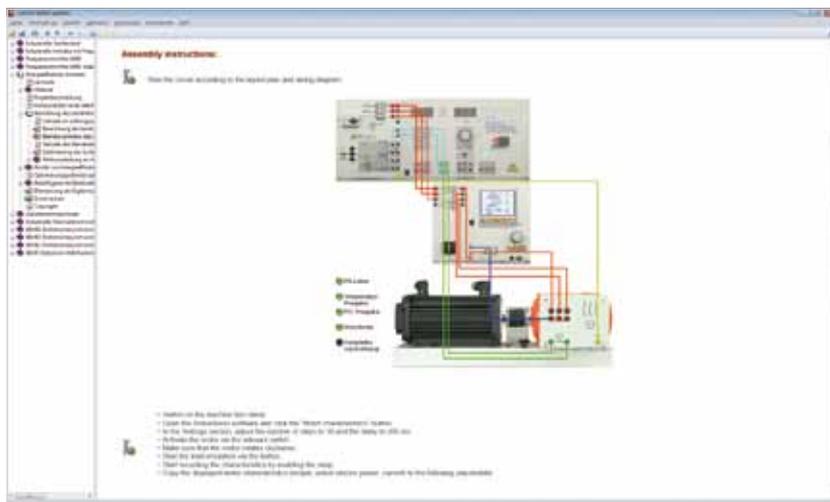
- Identifying losses in drive systems
- Using the characteristic of a motor to investigate its key parameters
- Optimising a system's efficiency by selecting the correct motor
- Indirect determination of motor utilisation



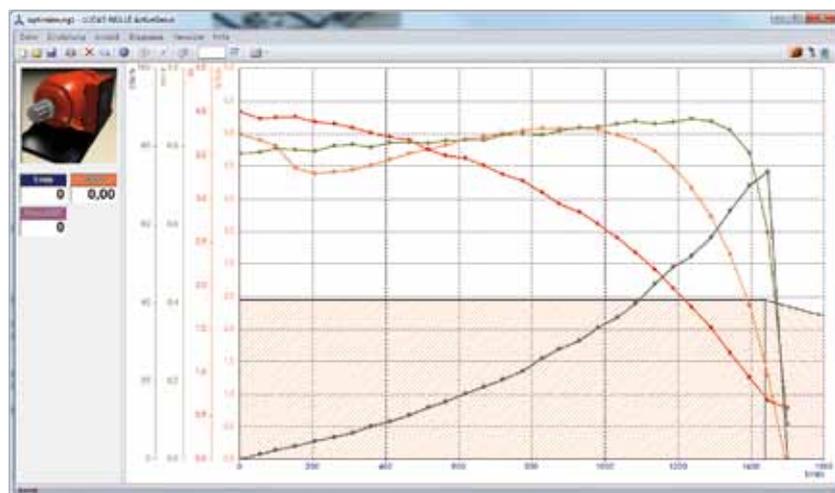
Interactive learning environment

Is the motor being properly utilised?

The course includes determining motor utilisation as part of a project. In matching the motor to the machine it is possible to learn how motor utilisation can easily be determined in practice. The "Energy-efficient drives" ILA course guides you step-by-step through the experiments (further details on Page 10 of the ILA course).



Project description for the "Energy-efficient drives" ILA course



Automatic recording of characteristics by ActiveServo software

Where is a motor's actual operating point?

Record a motor's characteristic and use the machine to determine the operating point during ongoing operation. You can also determine power consumption and efficiency in this process. The ActiveServo software records characteristics and emulates machines. Measured values can be copied to the ILA course via "drag & drop".

Use of energy-saving motors

Training system

Energy-efficient motors exhibit higher efficiency than is usual. The lower a motor's power losses, the higher its efficiency. Because electric motors already operate at quite high efficiency in general, room for enhancement in this respect is limited. In terms of power losses, however, those improvements that can be made have an immense effect. A standard motor with an efficiency of 85% suffers about 50% more energy loss than an energy-efficient motor with an efficiency of 90%. These and other correlations can be modelled with the "Use of energy-saving motors" training system.



The "Energy-saving motors" training system consists of a highly efficient motor and a servo machine test stand.

Training objectives

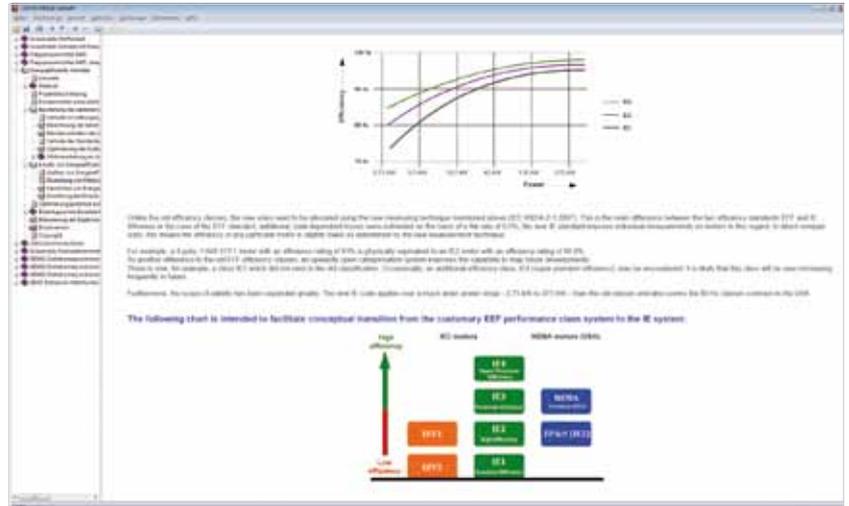
- Design and operation of energy-saving motors
- Energy efficiency classifications for motors
- Comparison between energy-efficient and standard motors
- Characteristic data for energy-saving motors
- Determination of potential savings



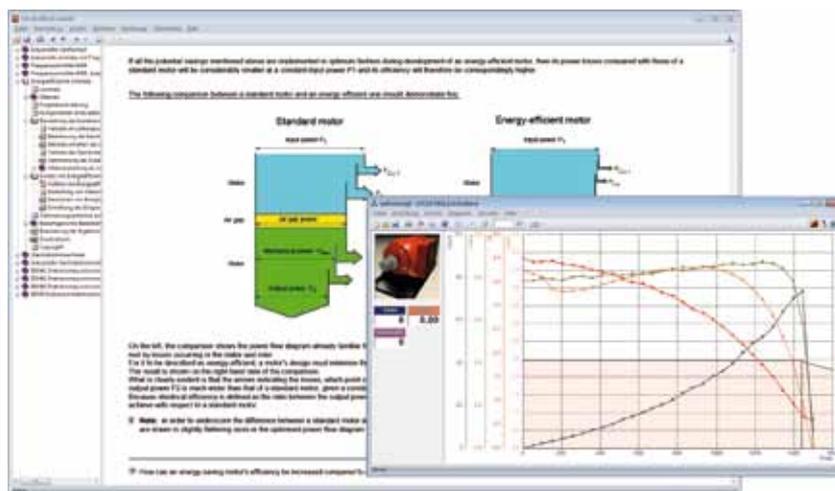
Interactive learning environment

Learn about the demands currently placed on motors.

Requirements concerning the energy efficiency of motors have recently undergone fundamental revisions. Besides the introduction of new efficiency classes, the contents of a motor's type plate have been re-specified. The ILA course brings you up to date (further details on Page 10 of the ILA course).



Comparison of efficiency classes in the ILA course titled "Energy-efficient drives".



Comparison between standard and energy-efficient motors with the help of characteristic recording in the ILA course titled "Energy-efficient drives".

What is the savings potential of energy-efficient motors?

Efficiency is increased primarily through a use of very high-grade materials. Learn about the different effects this can have and directly compare an energy-efficient motor to a standard motor in a real project. This ILA course provides the necessary background information and serves as a guide through the practical experiments (further details on Page 10 of the ILA course).

Energy-efficient drives with frequency converters

Training system

In the case of variable-speed drives, frequency converters play an especially important role in enabling energy-saving operation of a motor. The speed control used particularly in pumps, fans and compressors constantly matches the motor's power consumption to actual requirements when the load is below maximum. However, frequency converters not only match motor speed but are also of significance to energy recovery. They feed braking energy, otherwise wasted in conventional power systems, back into the grid. The "Use of frequency converters" training system vividly demonstrates how frequency converters operate as part of an entire system.



The "Energy-efficient drives with frequency converters" training system consists of a highly efficient motor, frequency converter and servo machine test stand.

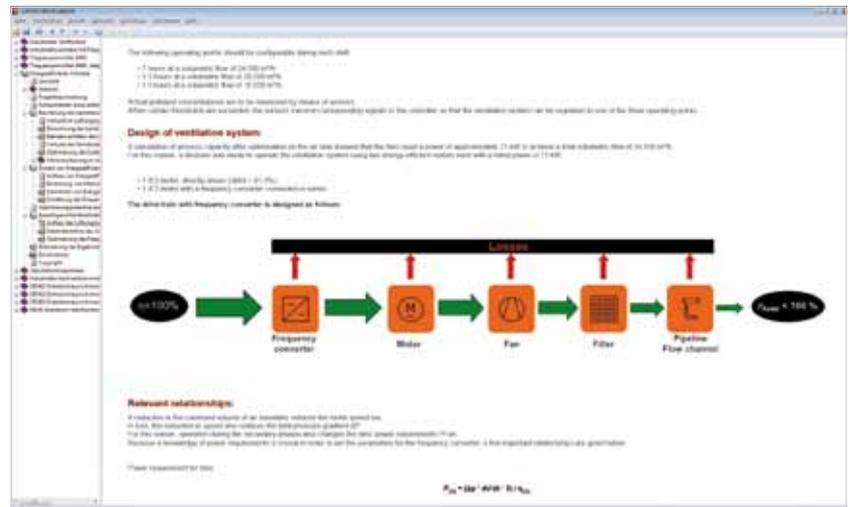
Training objectives

- Operation of variable-speed drives
- Investigating the influence of various parameters on operating characteristics
- Energy-efficient adaptation of operating points
- Creation of energy-efficient movement patterns
- Consideration of a system's overall efficiency

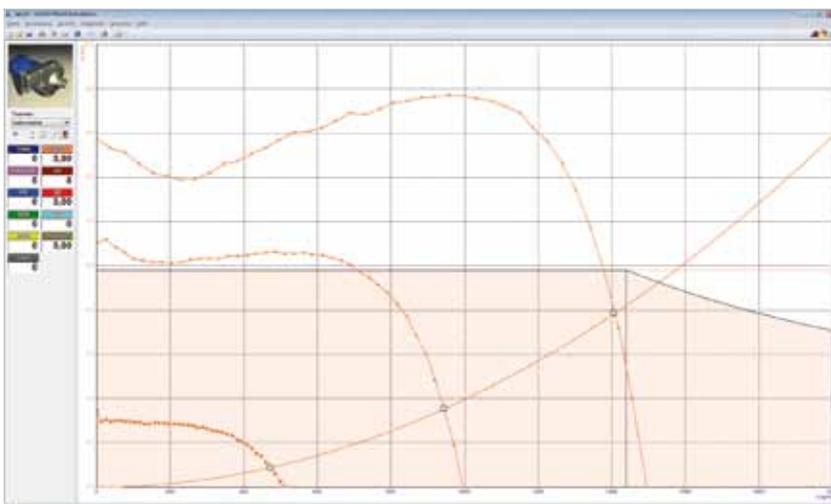
Interactive learning environment

When is use of frequency converters worthwhile?

To effectively utilise available energy, electric drives must account for the actual requirements of the applications. This is particularly evident in the case of pumps, compressors and fans where the output rates vary during the production process. This ILA course uses a practical example to demonstrate the savings that can be achieved through the use of frequency converters (further details on Page 10 of the ILA course).



Set-up for a drive system with a frequency converter forming part of the ILA course on energy-efficient drives



Various operating points are displayed by the ActiveServo software during use of a frequency converter.

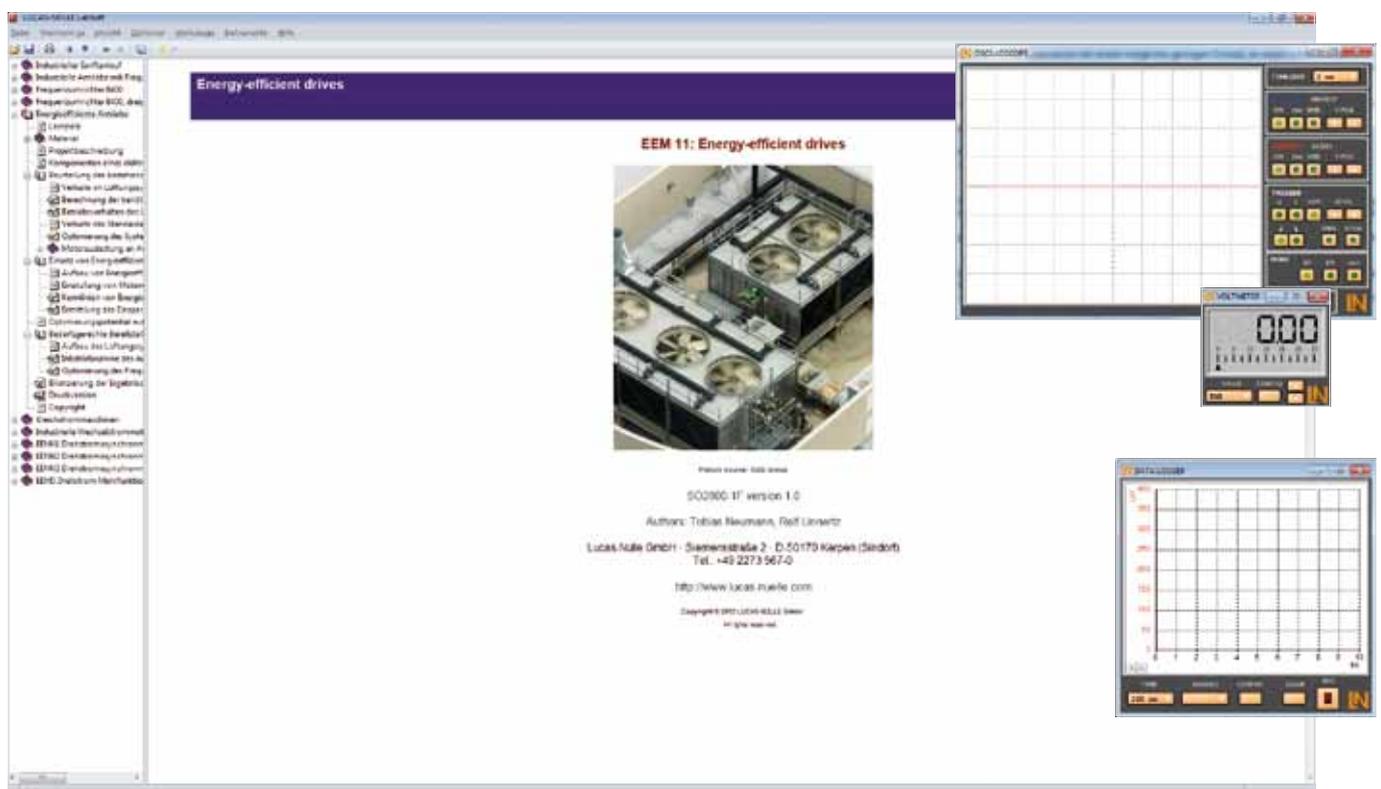
Where are the operating points in variable-speed mode?

Learn about the influence of speed on torque, power and efficiency. Use the ActiveServo software to determine the various operating points. Savings can be calculated directly from the demonstrative graphics.

Computer-aided learning environment

Interactive Lab Assistant (ILA) for energy-efficient drives

Interactive Lab Assistant (ILA) provides support for carrying out testing. It not only serves as a guide through the tests but also supplies valuable theoretical information, records readings and automatically creates the necessary laboratory reports in the background as printouts or PDF documents. In order to customise this guide, simply amend or supplement its contents using LabSoft Classroom Manager.



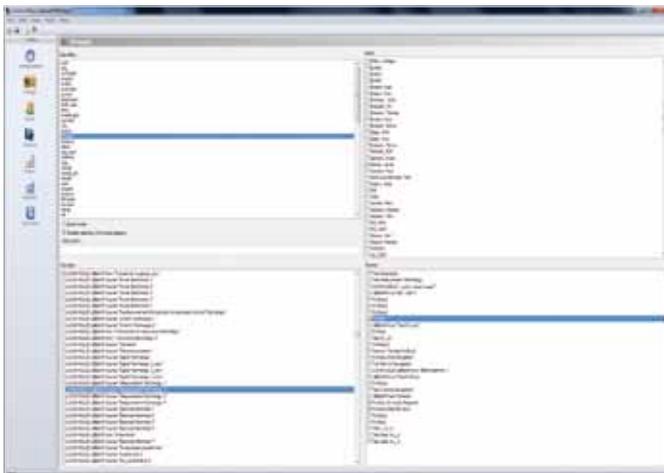
Interactive Lab Assistant (ILA) for energy-efficient drives

Benefits to you

- Imparting of theory using easily comprehensible animations
- Support for carrying out experiments
- Inactive display of experiment set-ups
- Access to real measurement and test devices, including extensive evaluation options
- Practical project exercises
- Integrated operating manuals
- Documentation of experiment results (preparation of experiment reports)
- Tests of knowledge including feedback for answers

LabSoft Classroom Manager

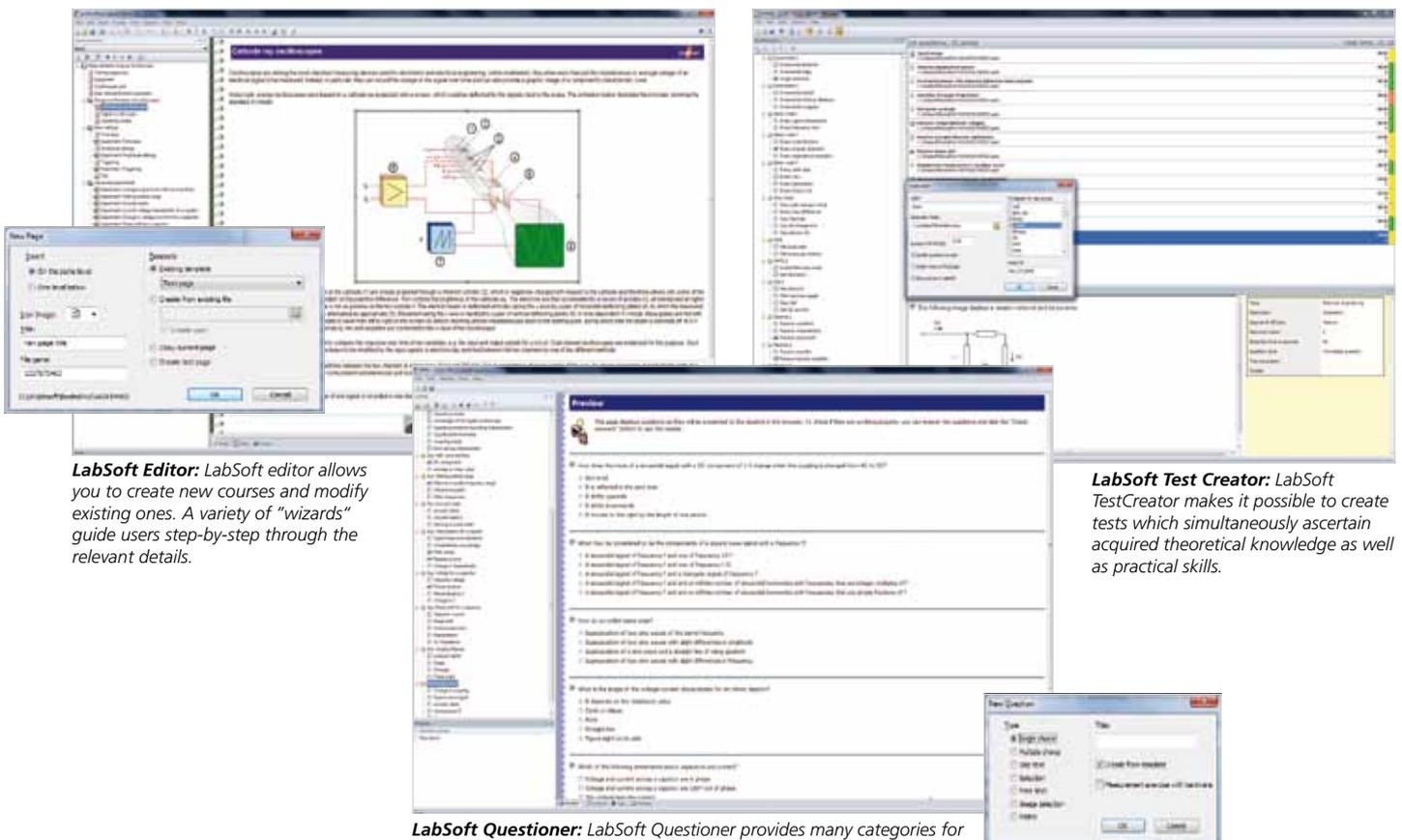
LabSoft Classroom Manager is extensive administration program allowing comfortable organisation and management of practical teaching and learning processes. Classroom Manager is suitable for all LabSoft-based learning programs such as ILA, UniTrain-I, InsTrain and CarTrain. It consists of the following program modules:



LabSoft Manager: Manage your LabSoft courses, students and their groups with LabSoft Manager. This makes the optimum educational content available for students at all times.



LabSoft Reporter: LabSoft Reporter can be used to view learning progress and test results. Numerous evaluations of results obtained individually or collectively during courses and tests make it easier to monitor student progress in targeted fashion.



LabSoft Editor: LabSoft editor allows you to create new courses and modify existing ones. A variety of "wizards" guide users step-by-step through the relevant details.

LabSoft Test Creator: LabSoft TestCreator makes it possible to create tests which simultaneously ascertain acquired theoretical knowledge as well as practical skills.

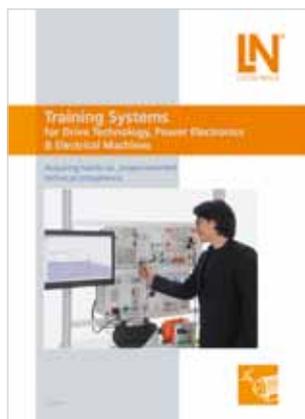
LabSoft Questioner: LabSoft Questioner provides many categories for creating questions, measuring exercises and test items. These can be added to courses and tests.

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*Further information is provided
in our catalogue on drive
technology.*