BECKHOFF New Automation Technology

PC-based Control:
Cut Costs Using Comprehensive
Energy Data Management.

IPC

I/O

Automation

Energy and raw materials: discover your savings potential.

Cost pressures and efficiency optimisation: all manufacturing enterprises face these challenges every day. The PC-based control system from Beckhoff maximises savings potential in key areas, ensuring that these challenges are solved. The first covers raw materials savings through fast, high-precision control technology in the form of eXtreme Fast Control technology (XFC) – explained in detail at **www.beckhoff.com/XFC**.

Company

If you want to meaningfully lower the costs of energy, you have to look at the big picture: and create transparency with regard to consumption by offices, conference rooms, cafeterias, foyers, administration wings, basements and auxiliary buildings.

Production

If you want to lower the costs associated with energy and raw materials, you have to do so in all production areas at the same time: that begins with the determination of the peak load and usage of all production plants.
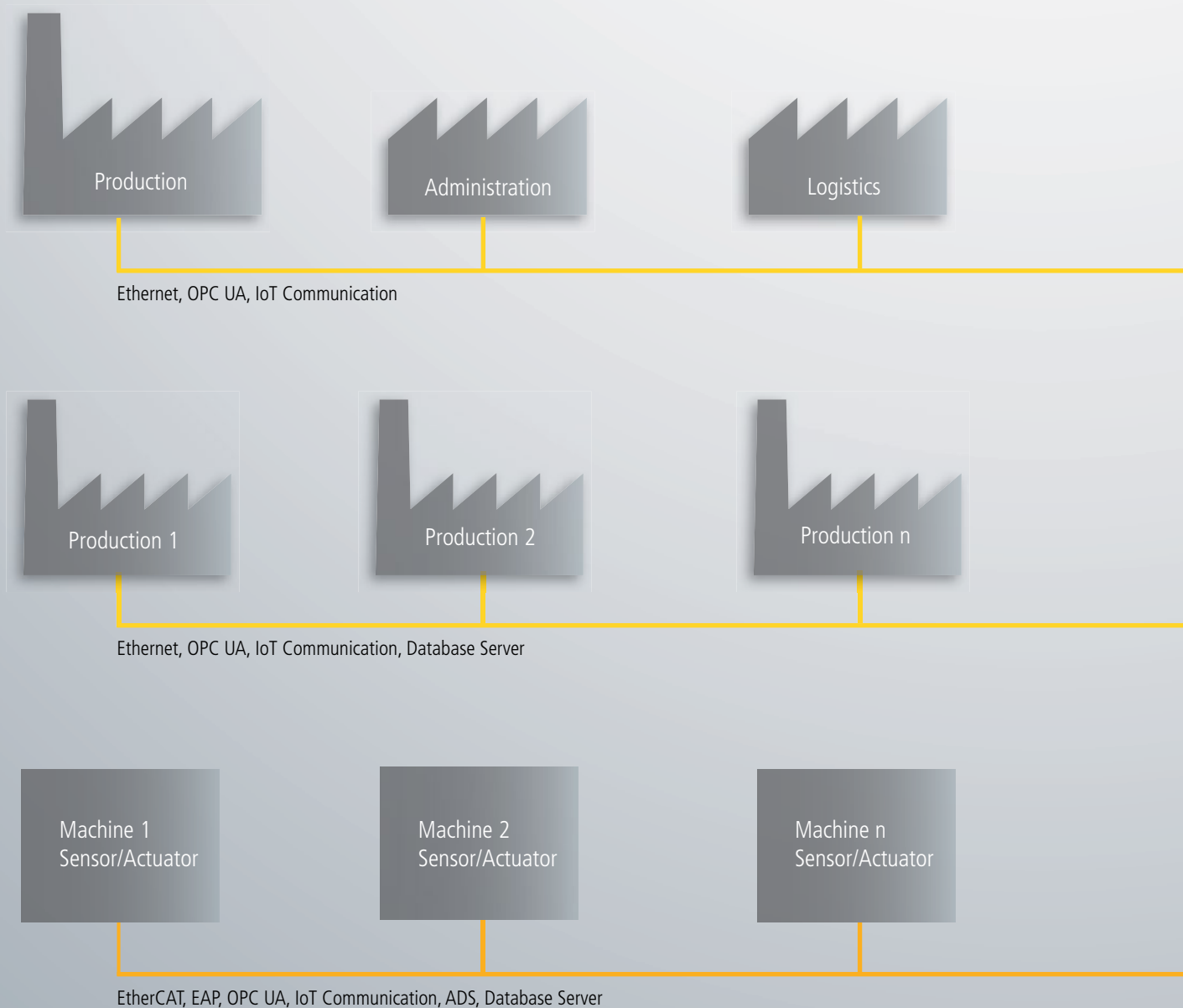
Machines and plants

If you want to lower the costs of energy and raw materials, you have to consciously think small: and measure the consumption of even the smallest actuator with the utmost precision.

The second key savings factor: robust energy management that covers the full spectrum of buildings, production facilities and machines with one universal platform. Massive cost savings are possible here – on one condition: complete, transparent acquisition and processing of all energy consumption data from the whole enterprise. This ensures that the best energy management decisions can be made to best drive down costs. Beckhoff establishes this transparency for energy data management technology that can be directly integrated into your PC-based automation controller. This way, machines can be analysed and classified in the simplest possible way, "energy hogs" can be dealt with and all relevant key metrics can be determined. As a result, your facility can also become a "Smart Factory" in terms of energy efficiency – while at the same time fulfilling demanding energy requirements and regulations from around the world, such as ISO 50001.
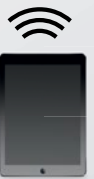
- Intelligent energy management significantly optimises efficiency.
- Beckhoff supports the transparent acquisition and processing of all energy consumption data.
- Direct integration in a standard PC-based controller
- Fulfils energy efficiency requirements such as ISO 50001

Universal and fully transparent: monitoring, measurement and analysis with PC-based control.
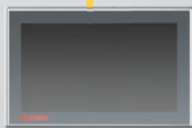
Production

Administration

Logistics

Ethernet, OPC UA, IoT Communication

Production 1

Production 2

Production n

Ethernet, OPC UA, IoT Communication, Database Server

Machine 1
Sensor/Actuator

Machine 2
Sensor/Actuator

Machine n
Sensor/Actuator

EtherCAT, EAP, OPC UA, IoT Communication, ADS, Database Server

Energy Management System

OPC UA

Data-base

Wearable Device

Company

The consumption of electricity, heat, water and gas is monitored at all company levels, analysed and then supplied to the higher level energy management system via OPC-UA.

| Current |
| Heat \| Gas |
| Water |

Data-base

Visualisation of the production data

Production

From the small business to the global enterprise with multi-site operations: Beckhoff monitors the energy consumption, detects air pressure leaks in the field, for example, and visually displays all production-related energy data.

| Current |
| Heat \| Gas |
| Wasser |
| Air pressure consumption |

Data-base

Machines and plants

Electricity, air pressure consumption, temperature and machine-specific data are monitored and recorded directly on-site in the field.

| Current |
| Air pressure consumption |
| Temperature |
| Condition Monitoring |

Beckhoff creates the foundation for highly efficient energy data management with PC-based control technology. It is essential to look at the picture as a whole: the measurement of all energy consumption in the enterprise is just as important as the high-precision acquisition of the data for each individual consumer. Therefore, Beckhoff offers the power to measure energy consumption precisely, right where it takes place – at any location within the company in each area, at each machine and directly at each

actuator. The energy consumption is measured via distributed I/O systems from Beckhoff. The raw data are transmitted to the controller via the fast, broad-band EtherCAT system. TwinCAT control software enables pre-processing of data, such as analyses, scope and HMI functions. All energy data are supplied to the higher-level energy management system via standardised interfaces such as OPC-UA.

- High-precision measurement of total resource consumption and of each individual consumer
- Energy consumption recording via Beckhoff I/O
- Data transmission via EtherCAT industrial Ethernet system
- Data pre-processing via TwinCAT software
- Transfer to higher level energy management systems via OPC-UA

System-integrated
energy data management:
the simple extension to your
PC-based controller.

Through a wide range of I/O Terminals with advanced functionality, Beckhoff integrates measurement technology directly into the standard I/O system. Modular measuring terminals are available for applications that range from the measurement of temperature, power, current and voltage up to complex mains monitoring or Condition Monitoring.

The signals are made available to the controller as raw data for processing. Now only one controller is required for automation and energy data management – TwinCAT automation software covers everything in one universal system: System Manager, engineering, runtime functions such as PLC, motion control and measurement modules such as condition monitoring

or scope. PC-based control significantly simplifies implementation and retrofitting requires little effort. At the same time, the Beckhoff principle of open control technology and the high signal variety in the I/O system guarantee maximum flexibility and compatibility with existing equipment and facilities.

Direct measurement
- EL3403 and KL3403 3-phase power measurement, 500 V AC
- EL3413 3-phase power measurement, 690 V AC
- EL3773 high-end power analysis

Indirect measurement (meter)
- KL6401 LON Bus Terminal
- KL6781 M-Bus master terminal
- EL6224, KL6224 IO-Link master terminals
- EL1xxx/KL1xxx digital input terminals (acquisition of pulse outputs)

Indirect measurement (meter)
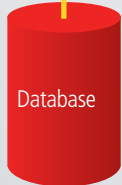- KL6401 LON Bus Terminal
- KL6781 M-Bus master terminal

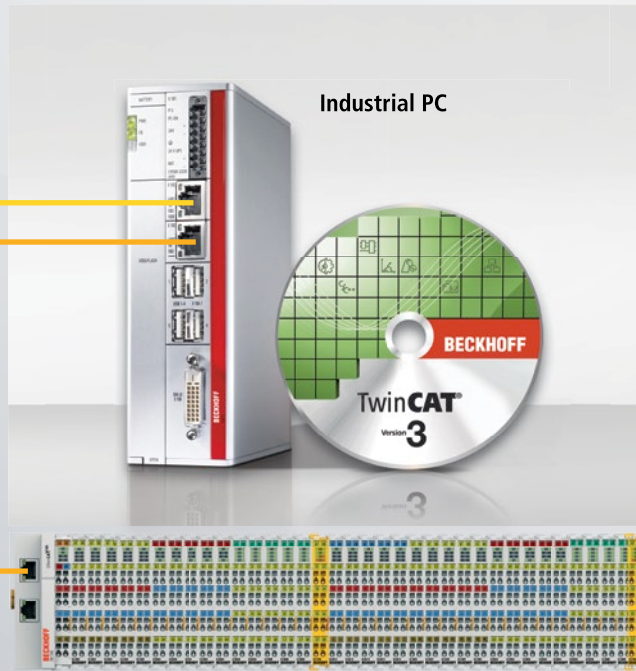| Current | Heat | Gas | Water |

We reserve the right to make technical changes.

Big Data

Energy Management System

TC Database Server, OPC UA

Database

Industrial PC

TwinCAT 3

BECKHOFF

Connectivity
TF6100 | TC3 OPC UA
TF6420 | TC3 Database Server
TF6421 | TC3 XML Server
TF6500 | TC3 IEC 60870-5-10x
TF670x | TC3 IoT Communication

Measurement technology
TF3600 | TC3 Condition Monitoring
TE1300 | TC3 Scope View

Direct measurement
- EP3744 pressure measurement box
- KM37xx and EM37xx pressure measurement terminals

Indirect measurement (analog)
- EL3xxx and KL3xxx analog input terminals
- EP3xxx analog input modules
- EL6224, KL6224 IO-Link master terminals

Direct measurement
- KL33xx, EL33xx and EP3314 thermocouple
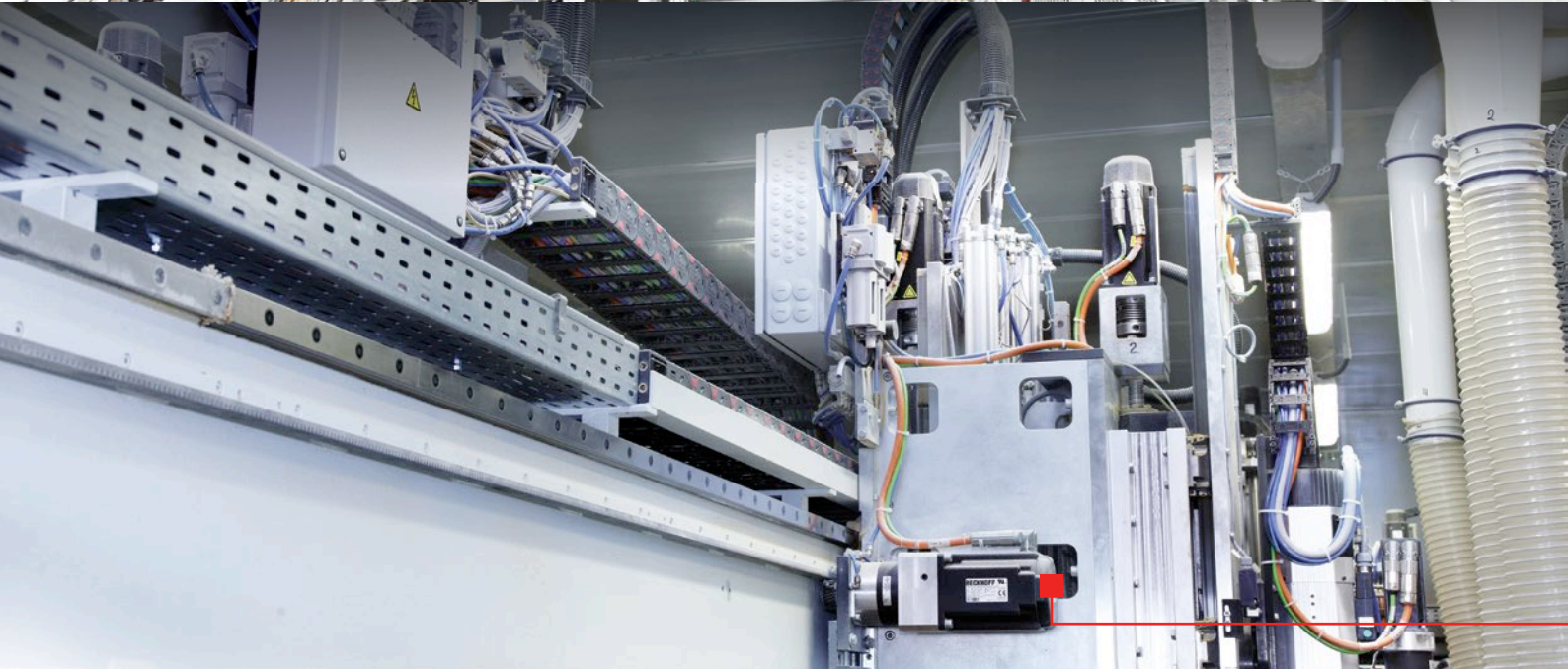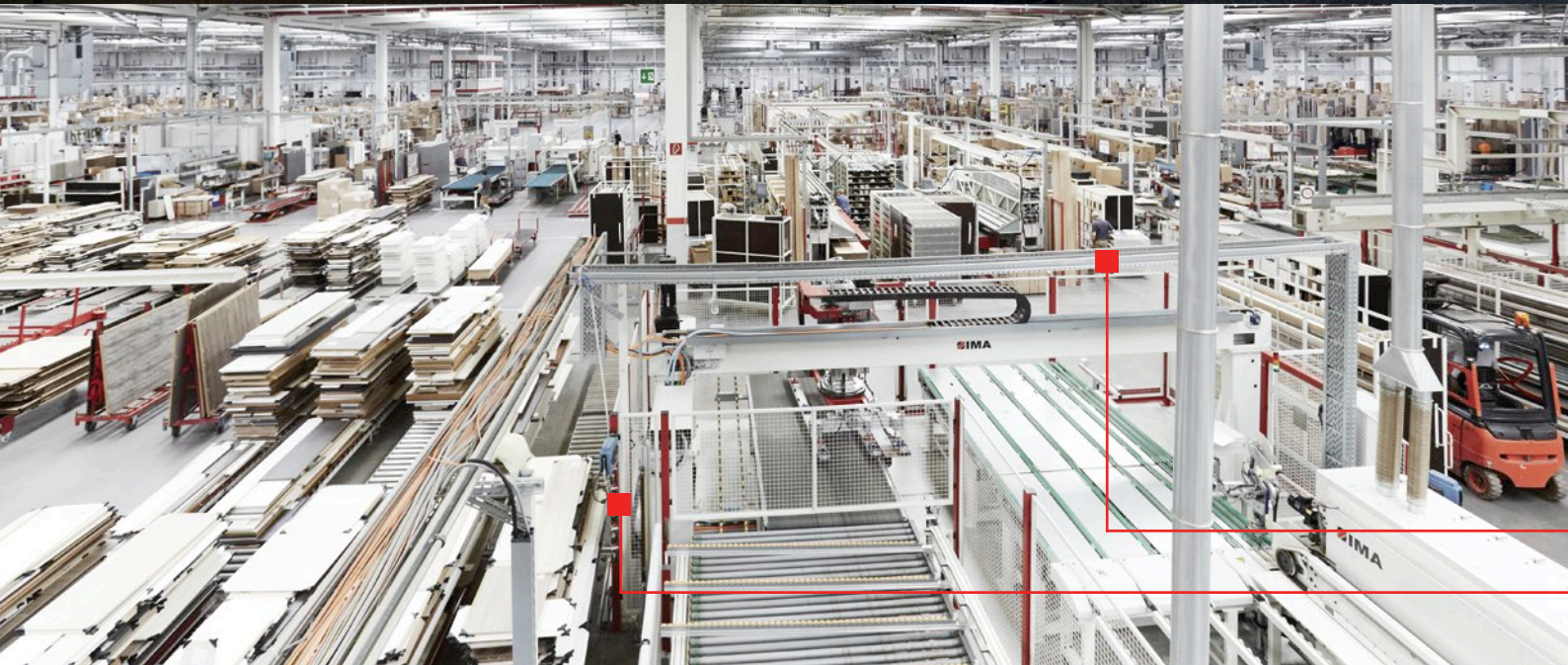- KL32xx, EL32xx and EP3204 resistance sensor RTD

Direct measurement
- EL3632 CMS terminal (IEPE)

| Air pressure consumption | Temperature | Condition Monitoring |

Solutions that maximise your energy cost savings.

## Administration

Energy data management in building automation:
- Embedded PC with TwinCAT 3
- Bus Terminals
  - current: KL3403 3-phase power measurement terminal
  - water: KL6781 M-Bus master terminal

Ethernet

KL6781   KL3403

3 x 230 V AC

Current   Current converter

Water meter

Lighting
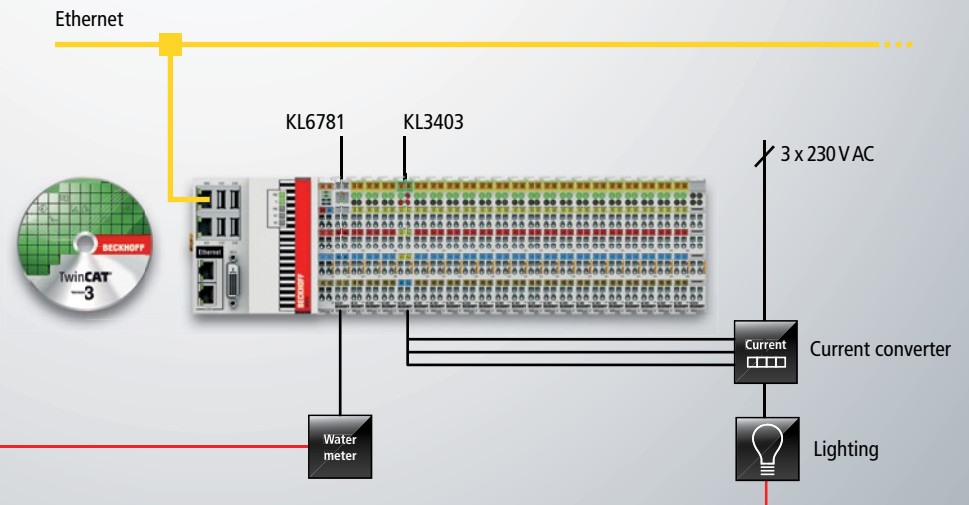
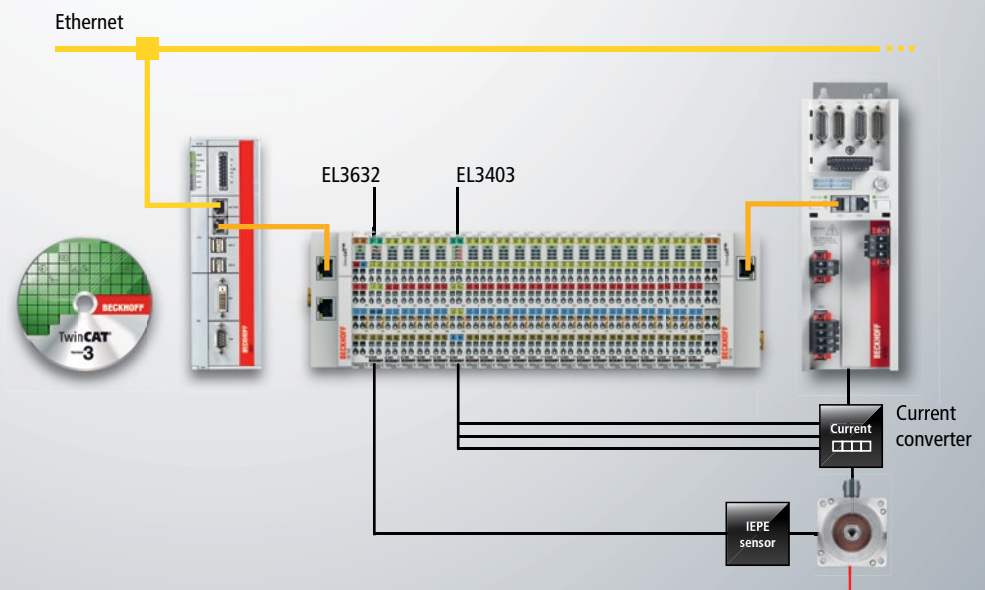## Production

Energy data management in production facilities:
- Industrial PC with TwinCAT 3
- Bus Terminals
  - gas: EL1004 digital input terminal
  - air pressure consumption: EL6224 IO-Link master terminal

Ethernet

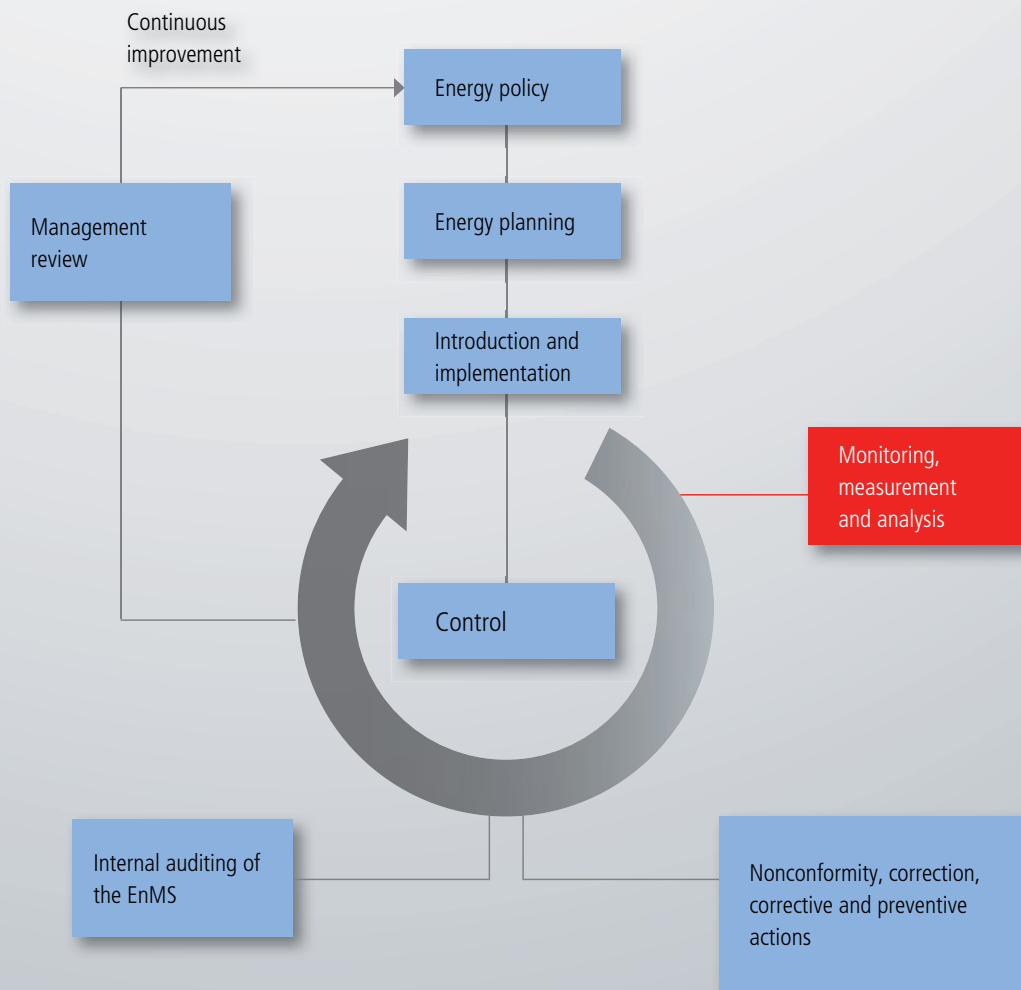EL1004   EL6224

Gas meter   Flow sensor
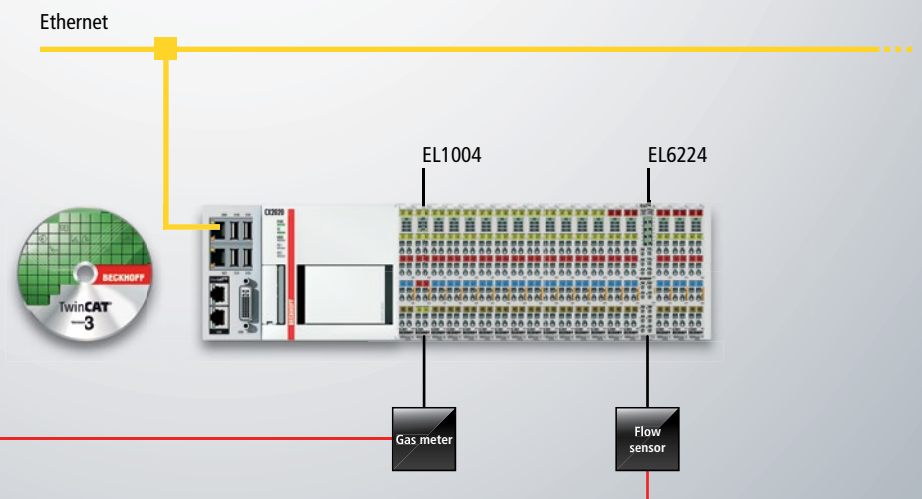
Machines and plants

Energy data management on the machine:
- Industrial PC with TwinCAT 3
- EtherCAT Terminals
  - EL3403 3-phase power measurement terminal
  - EL3632 condition monitoring terminal

Ethernet

EL3632   EL3403

Current   Current converter

IEPE sensor

Integrated energy data management enables the implementation of ISO 50001…

Continuous improvement

Energy policy

Management review

Energy planning

Introduction and implementation

Monitoring, measurement and analysis

Control

Internal auditing of the EnMS

Nonconformity, correction, corrective and preventive actions

Source: ISO 50001

An initial implementation as well as the constant, optimised compliance with ISO 50001 or certification according to EMAS (Eco-Management and Audit Schemes) is compulsory for tax breaks and refunds related to energy and environmental taxes in many countries. Continuous, highly precise energy data are required for these improvements. Beyond that, the Energy Efficiency Directive (EED) requires that all companies not falling under the definition of "small enterprises" implement an

energy audit as well as an energy or environmental management system. In this context, Beckhoff supplies the ideal automation toolkit to successfully implement reliable and continuous monitoring, analysis and evaluation of data around the world.
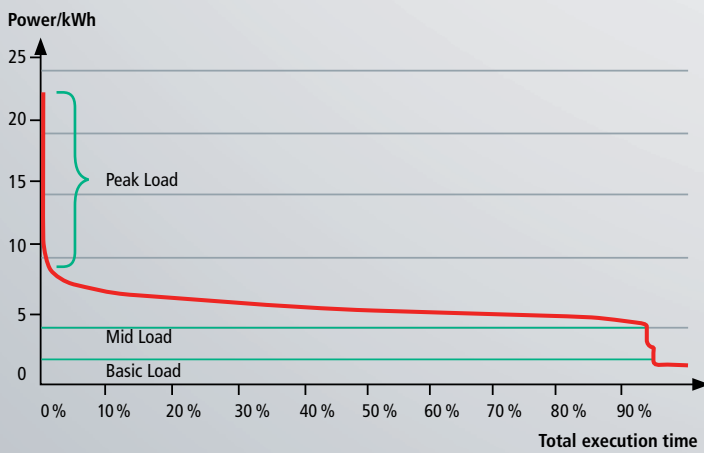
- Continuous energy management optimisation reduces tax burdens
- Potential for energy tax breaks and refunds
- Potential for environmental tax breaks and refunds

We reserve the right to make technical changes.

… creating the basis for extensive and actionable analyses.
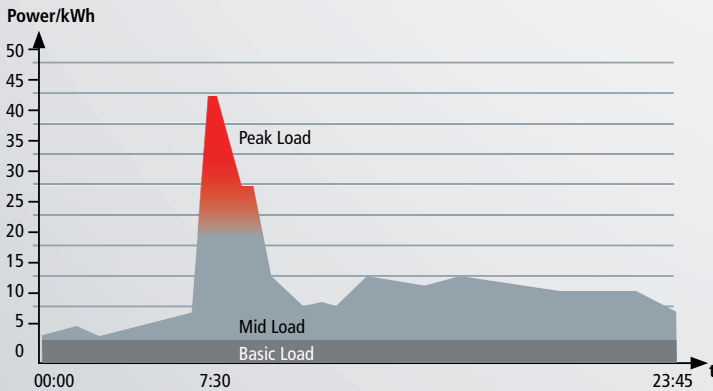
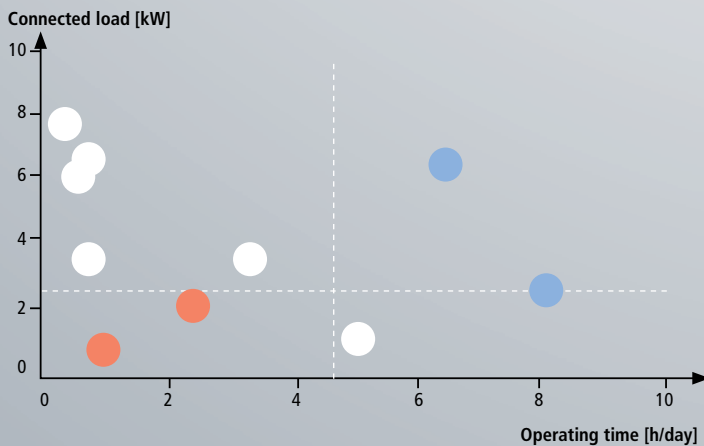## Load curve determination with PC-based control.

PC-based control supplies the data on the basis of which load curves are created, the peak loads are determined and peak load compensation is enabled.

Power/kWh

Graph axis labels: 50, 45, 40, 35, 30, 25, 20, 15, 10, 5, 0

Peak Load

Mid Load

Basic Load

00:00   7:30   23:45   t

Operation during analysis with PC-based control.

PC-based control supplies data on the basis of how to best determine the percentage of total load attributable to each individual load as well as the basic and mean loads.

Power/kWh

Graph axis labels: 25, 20, 15, 10, 5, 0

Peak Load

Mid Load

Basic Load

0 % 10 % 20 % 30 % 40 % 50 % 60 % 70 % 80 % 90 %

Total execution time

—— Energy consumption

Portfolio comparison with PC-based control.

PC-based control can also help illustrate and compare the energy consumption data of individual machines in relation to other machines.

Connected load [kW]

Graph axis labels: 10, 8, 6, 4, 2, 0

0   2   4   6   8   10

Operating time [h/day]

An energy data management system from Beckhoff enables you to achieve transparency regarding energy consumption in your enterprise and helps tailor your energy management precisely to your real world consumption characteristics. With the data provided by the Beckhoff system you can precisely determine peak loads and carry out peak load compensation. The percentage of the total load attributable to each individual load can be determined with great precision, and using the portfolio comparison you can identify the "energy hogs" in your production and initiate the appropriate measures via comprehensive energy management. All analyses take place with the help of the data provided from the automation controller: It could hardly be any simpler or more integrated.

- PC Control supplies all data for energy consumption analysis
- Precise peak load determinations
- Operating duration analyses
- Portfolio comparisons

Transparent energy data management:
With PC-based Control.
For further information see
▶ **www.beckhoff.com/energy-data-management**

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