

# ENERGY AUDITING AND MONITORING IN COMPANIES



To implement Article 8 (4-6) of the EU Energy Efficiency Directive (2012/27/EU), the UK government has set up ESOS (Energy Savings Opportunity Scheme) which requires large companies to carry out energy assessments in order to identify cost-effective saving measures.

This **concerns any company** which:

- employs more than 250 people,
- has an annual turnover in excess of €50 million (£38,937,777),
- has an annual balance-sheet total in excess of €43 million (£33,486,489),
- is not covered by an Energy Management System certified as complying with the EN ISO 50001 standard

## goal

By analysing the structures (building, insulation, etc.), users will seek to assess **passive energy efficiency**. Then, using high-performance equipment and smart measurement, test and control systems (variable speed drives or load-shedding devices), it will be possible to optimize operation and, more generally, improve **active energy efficiency**.

## regulatory framework

By 5th December 2015, the companies concerned must have carried out an audit covering 65% of their energy bills in order to identify the potential sources of energy savings. The energy audit must be performed in line with the general methodological and quality requirements regarding preparation, execution and reporting, as defined by the **EN 16247-1** standard. This will all be done within the framework of an environmental management system compliant with the **ISO 14001** standard. Subsequently, the audit will have to be repeated every four years, covering 80% of energy bills.

If improvements are made, new measurements must be performed to assess their impact. Measurement plans will be implemented for this regular monitoring, in compliance with the requirements of the ISO 50001 standard.

## auditors

The audit may be performed by an external service provider or a person in the company. External service providers are considered competent for this type of audit if they hold a quality label in the areas covered by the energy audit (buildings, industrial processes or transport). In-house staff are considered competent if they have the appropriate skills to fulfil the requirements of the audit methodology (training, experience, etc.).

## EN 16247-1 standard

The EN 16247-1 standard defines the general methodological and quality requirements for preparation, execution and reporting of the audit. These methods are defined according to the activity audited:

- for buildings: EN 16247-2:2014
- for industrial processes: EN 16247-3:2014
- for transport: EN 16247-4:2014

In all cases, measurement campaigns are necessary to check the efficiency of the equipment, the periods when it is used and the real condition of the building shells.

## report

When the audit is finished, a report must be presented to the company and the UK Environment Agency. It must indicate:

- the scope of the audit performed
- consumption and the type of energy used (electricity, gas, etc.)
- the possibilities for improvement in terms of energy efficiency, as well as the cost of the improvements and the extent of the potential annual energy savings, thus giving an idea of the payback period for these improvements.

## PLAN

## Do

## ACT

## CHECK



### electricity consumption

An electricity consumption profile will be established to identify the improvements needed to reduce consumption. This can be done by positioning loggers at different points in the electrical installation. They should be set up:

- At the level of the main meter
- On the feeders of electrical switchboards or low-voltage general switchboards
- At the level of the end-equipment (machines, desktop workstations, heating, etc.)

The quality of the electrical energy is important for limiting overconsumption. The following values are measured:

- Voltage and current
- Active power and energy
- Reactive and distorting power and reactive energy
- Power factor ( $\cos \phi$ )

These various values are recorded over different representative periods (one day, one month, etc.), at a sampling rate which depends on the system audited (machinery, desktop computing, etc.). Various measuring instruments can be used to perform these measurements:

- Current, voltage, power and energy loggers
- Multimeter clamps for measurements on three-phase or single-phase systems
- Meters

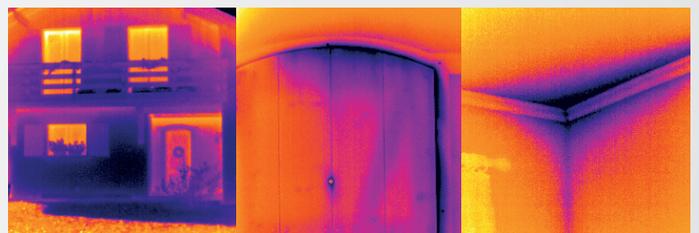
When the audit is finished, a permanent installation must be set up to ensure regular energy monitoring. This monitoring determines the energy consumption (electricity, water, gas, air, etc.) by type of usage. This makes it possible to make targeted improvements and then measure their impact very simply.

The results are then processed by all the departments concerned (maintenance, production, finance, general management) to reduce and allocate the genuine cost of the energy.

### thermography to assess the building's energy efficiency

Infrared thermography can be used to reveal heat losses and deduce the useless extra energy consumption which they represent. These losses are a potential source of savings. Thermal cameras are ideal for quickly detecting faults and irregularities such as:

- Insulation faults
- Air infiltration at openings (windows, doors)
- Thermal bridges
- Leaks
- Excessive humidity



It can also be used to detect faults on electrical installations or mechanical equipment. In this way, the auditor can quickly diagnose any points which may cause overconsumption. For example:

- Electrical problems: faulty contacts, overloads, unbalance, etc.
- Mechanical problems: wear points, adjustment errors, poor lubrication

# the energy audit and the measurements

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## Qualistar+ three-phase network and power analysers

Objectives: to record and quantify electrical consumption.

- Monitoring of the energy consumed and the active, reactive, non-active, apparent and distorting power values.
- Harmonics, THD
- Flicker
- Unbalance
- Voltage swells and dips
- Transients
- Frequency
- Inrush current
- Power factor (Cos φ)



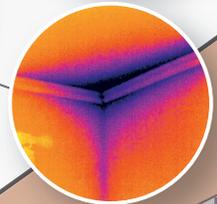
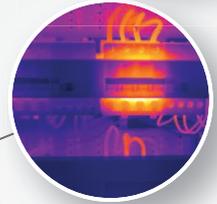
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## DiaCAM and RayCAM thermal cameras

Objective: to optimize energy consumption for heating purposes.

- Measurement of the surface temperature of an object or a partition
- Indoor temperature monitoring
- Detection of insulation faults and thermal bridges
- Detection of equipment malfunctions and overheating of rotating parts



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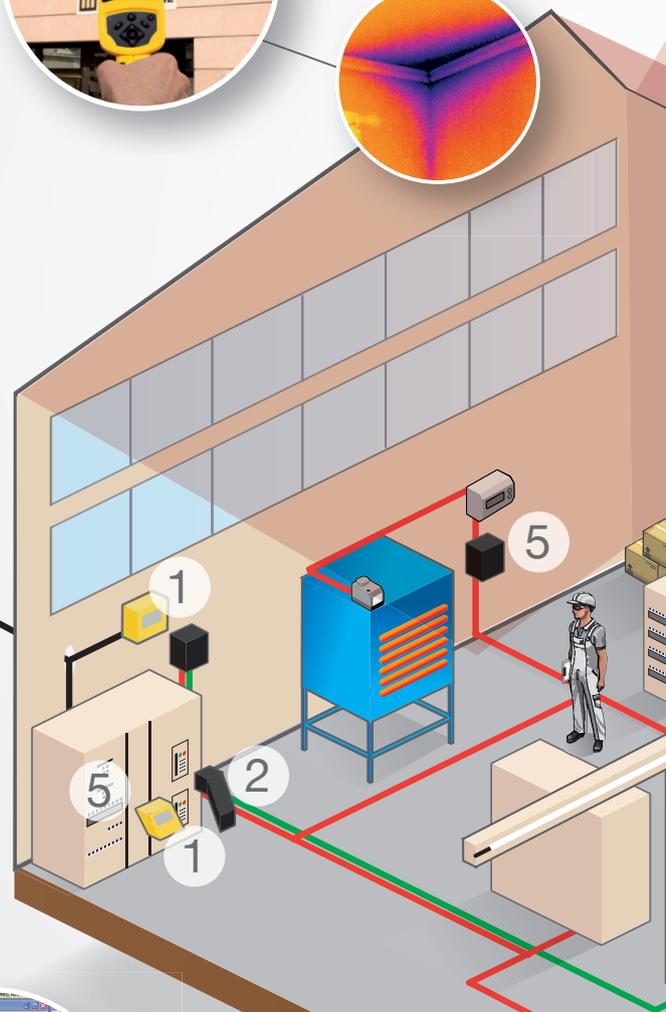


## Flow-rate / air-speed measurement C.A 1224, C.A 1226 or the multi-function C.A 1052

Objective: to match the flow-rates to the real requirements in order to achieve savings

- Adaptation of the air flow-rates to fit the requirements so that you can limit consumption and heating costs.
- Improvement of the energy efficiency of the equipment needed to provide the required flow-rates with minimum consumption.
- Measurements to check that the actual flow-rates are not greater than the recommendations.
- Pressure: 0 to 1,000 mm H<sub>2</sub>O, ±0.2 % of reading + 1 mm H<sub>2</sub>O

Electricity  
supplier

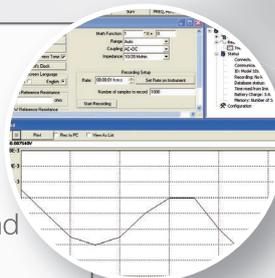


**DataView**

Software platform for processing and analysing the data.

Users have direct access to:

- real-time display
- processing of the recorded data and alarms
- report generation for energy surveys



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### PEL102 and PEL103 power and energy loggers

Objective: to identify the causes of overconsumption by equipment or over-billing. The energy logger measures the voltage, current, power and energy parameters useful for comprehensive surveys of electrical installations.

- Recording and metering of electrical consumption
- Possibility of installing in a network to provide several metering points simultaneously
- Simple, straightforward installation without cutting off the electricity supply



6



### C.A. 811 / C.A. 813 luxmeters

Objective: to ensure that the lighting is correctly sized.

- Check on whether all the lights are necessary for user comfort
- Reduction of power consumption while guaranteeing sufficient lighting (lighting management mode, choice of light fittings, colours of partitions, etc.)



6

7



### C.A. 1510

#### Assessment of performance

- Verification of air-renewal efficiency by measuring the level of CO<sub>2</sub>
- Temperature / RH / CO<sub>2</sub> monitoring

#### Assessment of comfort

- Air-tight buildings with low ventilation flow-rates are incompatible with good air quality
- Hygrothermal comfort criteria with CO<sub>2</sub> level

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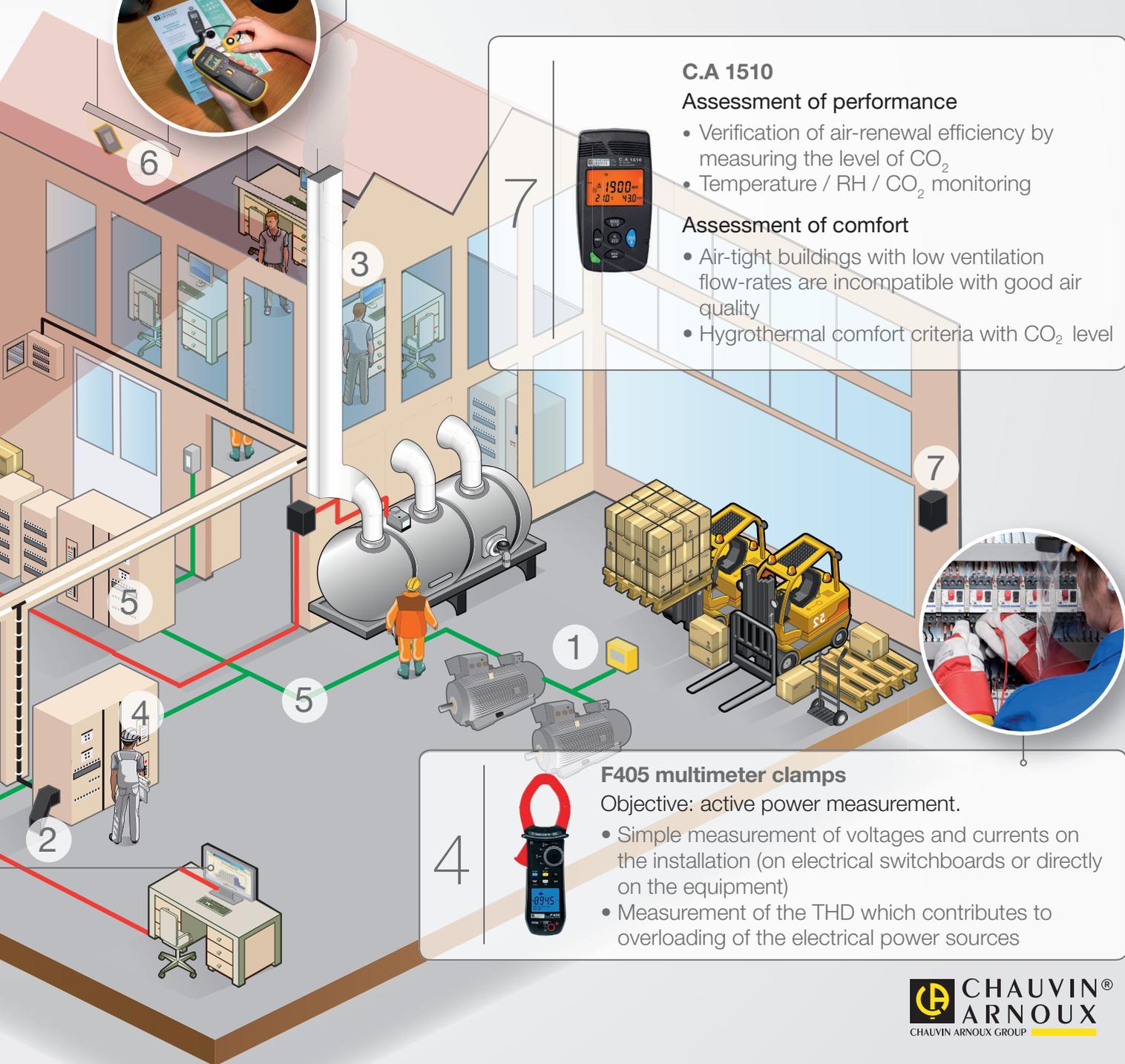
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### F405 multimeter clamps

Objective: active power measurement.

- Simple measurement of voltages and currents on the installation (on electrical switchboards or directly on the equipment)
- Measurement of the THD which contributes to overloading of the electrical power sources



# the permanent measuring system

Once you have identified the points requiring improvement, **you can set up a measurement and metering plan**. A permanent measuring system is then necessary to monitor energy **performance** over time. It can be used to identify the deviations with regard to the reference framework defined by the organization's energy policy after the decisions concerning improvement or monitoring resulting from the survey. According to ISO 50001, **the measuring system must be part of a continuous improvement process**. ENERDIS proposes a comprehensive solution for energy performance monitoring with its meters, power monitors, pulse concentrators and **E.online** software Energy Information System. This guarantees long-term control and monitoring of the energy data and Energy Performance Indices (EPI). Rational testing of the effectiveness of the energy-saving and optimization operations undertaken is guaranteed by means of clearly comprehensible information: graphs and dashboards present the hourly, daily, monthly and annual data. All the targets highlighted (CO<sub>2</sub>, EUR, kWh, M<sup>3</sup>, etc.) are constantly monitored.

1



### Memo 4 - Submeter

Objective: metering, submetering, energy monitoring and rebilling

- Single-phase, direct connection up to 45 A
- Integrated RS485 Modbus communication
- Double-tariff and bidirectional metering

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### ULYS meter

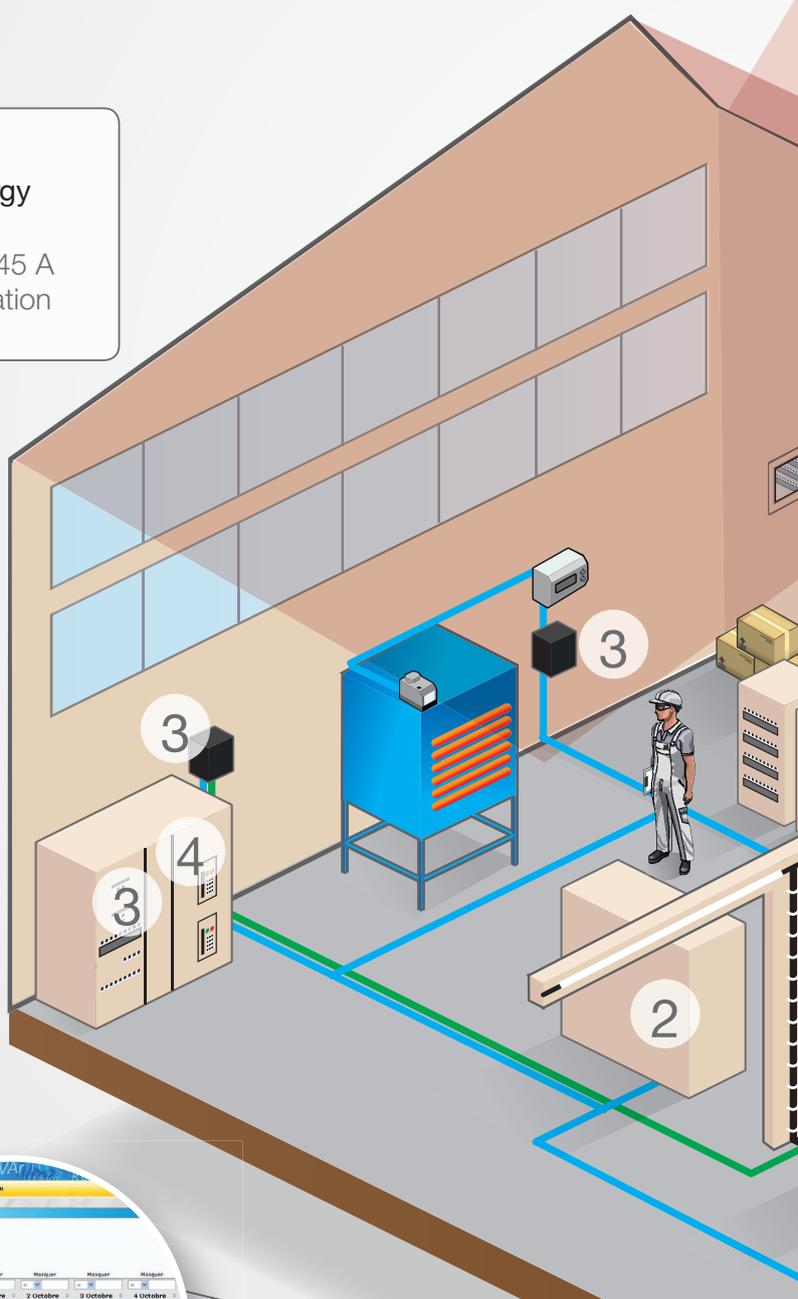
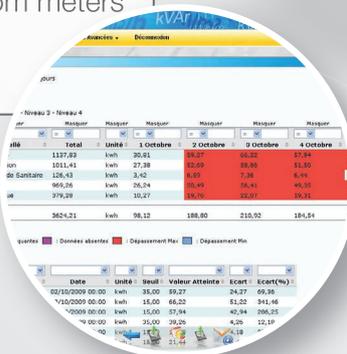
Objective: energy management applications

- Multiple measurements: U, V, I, PF, F
- Compact : 4 DIN modules
- Accuracy: Class 1 as per EN IEC 62053-21
- Direct connection or via CT
- Integrated RS485 Modbus or Ethernet communication



Software for remote retrieval of the recorded data, display, alarms and generation and distribution of analyses and reports

- Allocation and rebilling of energy costs
- Remote data retrieval from meters
- Display and mapping of consumption



3



### ELOG Web Box Data Logger

Objective: to collect and centralize the data in various formats from multi-brand, multi-function equipment (meters, sensors, power monitors, PLCs, etc.)

- Interoperability with multi-brand, multi-function equipment
- Large number of communication ports (2xRS485, Ethernet, 5 pulse inputs)
- Recording capacity of 3 months for 50 variables
- Access to the recordings in a universal format (JSON - Web services)

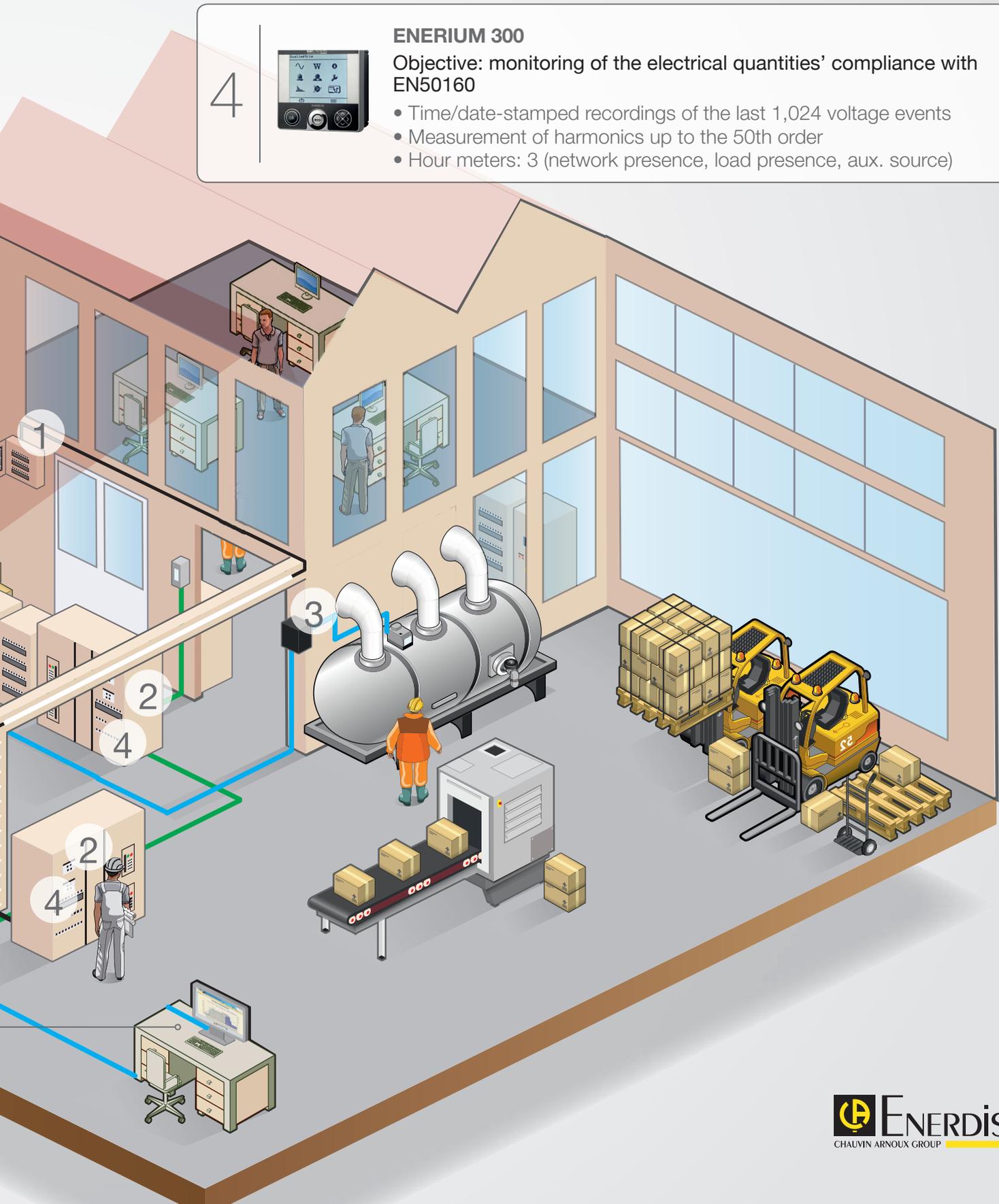
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### ENERIUM 300

Objective: monitoring of the electrical quantities' compliance with EN50160

- Time/date-stamped recordings of the last 1,024 voltage events
- Measurement of harmonics up to the 50th order
- Hour meters: 3 (network presence, load presence, aux. source)





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**FRANCE**  
**CHAUVIN ARNOUX**  
 Tel: +33 1 44 85 44 38  
 Fax: +33 1 46 27 95 59  
 export@chauvin-arnoux.fr  
 www.chauvin-arnoux.com

**UNITED KINGDOM**  
**CHAUVIN ARNOUX LTD**  
 Unit 1 Nelson Ct, Flagship Sq, Shaw Cross Business Pk  
 Dewsbury, West Yorkshire - WF12 7TH  
 Tel: +44 1924 460 494  
 Fax: +44 1924 455 328  
 info@chauvin-arnoux.co.uk  
 www.chauvin-arnoux.com

**Middle East**  
**CHAUVIN ARNOUX MIDDLE EAST**  
 P.O. BOX 60-154  
 1241 2020 JAL EL DIB - LEBANON  
 Tel: +961 1 890 425  
 Fax: +961 1 890 424  
 camie@chauvin-arnoux.com  
 www.chauvin-arnoux.com

