

Bowers

 **Intellivolt**

TWO TECHNOLOGIES, ONE SOLUTION



Bowers
 **Electricals Ltd**

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The smart transformer has arrived,
combining two proven technologies
in one revolutionary package.

To save you more.

The Bowers Intellivolt® reduces the carbon footprint and electricity bills of sites on which it is installed by integrating - for the first time ever - a super low loss distribution transformer with voltage optimisation technology.

Bowers Electricals is a leading UK manufacturer of power, distribution and low-loss transformers and has spent four years developing the Intellivolt at its Derby headquarters, in co-operation with voltage optimisation industry leaders iVolt.

By offering two technologies in one solution, the Bowers Intellivolt® not only offers maximum savings, but also reduces losses, installation costs, cabling and maintenance issues. Unlike any other transformer on the market, it also incorporates iVolt's patented Intelligent Real Time (IRT) Energy Monitor technology, which enables users to pinpoint savings remotely, accurately and in real time.

HOW THE BOWERS INTELLIVOLT® SAVES MORE

The Bowers Intellivolt® transformer offers energy savings via two technologies:

1 THE BOWERS ECODSIGN SUPER LOW LOSS DISTRIBUTION TRANSFORMER

The main distribution transformer inside the Bowers Intellivolt® is built using the same tried and tested technology that Bowers uses in the manufacture of its Super Low Loss Ecodesign range.

2 AWARD-WINNING VARIABLE REDUCTION VOLTAGE OPTIMISATION

Integrated into each Intellivolt is an award-winning fourth generation voltage optimisation system which monitors and reduces the incoming voltage to the optimum level for both energy efficiency and savings.

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THE BOWERS ENERGY SAVING TRANSFORMER (B.E.S.T.)

The losses which occur in distribution transformers can be divided into two groups and explained as follows:

- No load losses - also known as iron losses – occur as soon as the transformer is energised and are constant across all loads
- Load losses - I²R losses and stray losses, also known as copper losses

No load losses are the losses within the transformer core and are attributed to the hysteresis and eddy losses consumed in fluxing the core of the transformer. These losses are permanently evident as soon as the transformer is energised, regardless of the load, as they are the power required to flux the transformer core. As the maximum value of flux hardly varies between no load and full load, they are considered constant at all loads.

The no load losses are therefore considered wasted energy, used to magnetise the core – it is load independent and it is a constant loss, irrespective of the load current.

Load losses are also considered as the wasted energy consumed when a current passes through

a resistance and comprises losses due to the DC resistance of the windings, plus the stray and eddy losses due to the AC supply frequency. This loss is approximately proportional to the square of the load (I²R losses).

To reduce the no load losses, the Bowers Intellivolt® is manufactured using the highest grade commercially available low loss core steel at the company's headquarters in Derbyshire. The cores are assembled to the highest standards, using the specialist techniques and expertise possessed by the highly-skilled team at Bowers Group's UK factories. This results in a considerable reduction in the no load loss value.

To reduce the load losses, which are approximately equivalent to the square of the load, the Bowers Intellivolt® is manufactured using only the highest grade low resistance copper with a larger cross sectional area.

Highly specialist winding techniques, including wire, strip and foil winding perfected by the Bowers team, all contribute to the Intellivolt's status as one of the most efficient combined optimisation transformer products manufactured anywhere in the world.

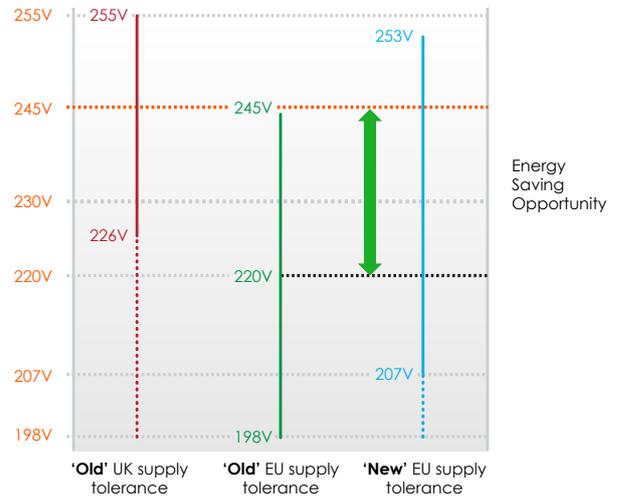
... AND A GROUNDBREAKING VOLTAGE OPTIMISATION SYSTEM

In the UK, generating companies are required to provide customers with a voltage of between 216V and 253V. This voltage at any given site fluctuates significantly throughout the day and averages across the UK at 242V.

In Europe, however, the standard voltage has historically been 220V and electrical equipment is therefore specified and built to operate most effectively and efficiently at 220V single phase or 380V three phase. Applying higher than nominal voltage to equipment reduces efficiency and wastes energy.

iVolt's sophisticated variable voltage optimisation system is incorporated into the new Intellivolt and works by monitoring and automatically reducing a site's incoming voltage to a steady 220V (+/- 1.5%). This alone delivers typical energy savings of 12%. For example, in the case of an induction motor, supplying at optimum voltage will help prevent excess heat and vibration. The motor will still provide the same output torque and speed if it is designed to run at a lower spot voltage and will therefore last longer and run more efficiently if run at its optimum voltage.

REDUCING MAINS VOLTAGE TO SAVE ENERGY AND REDUCE COSTS

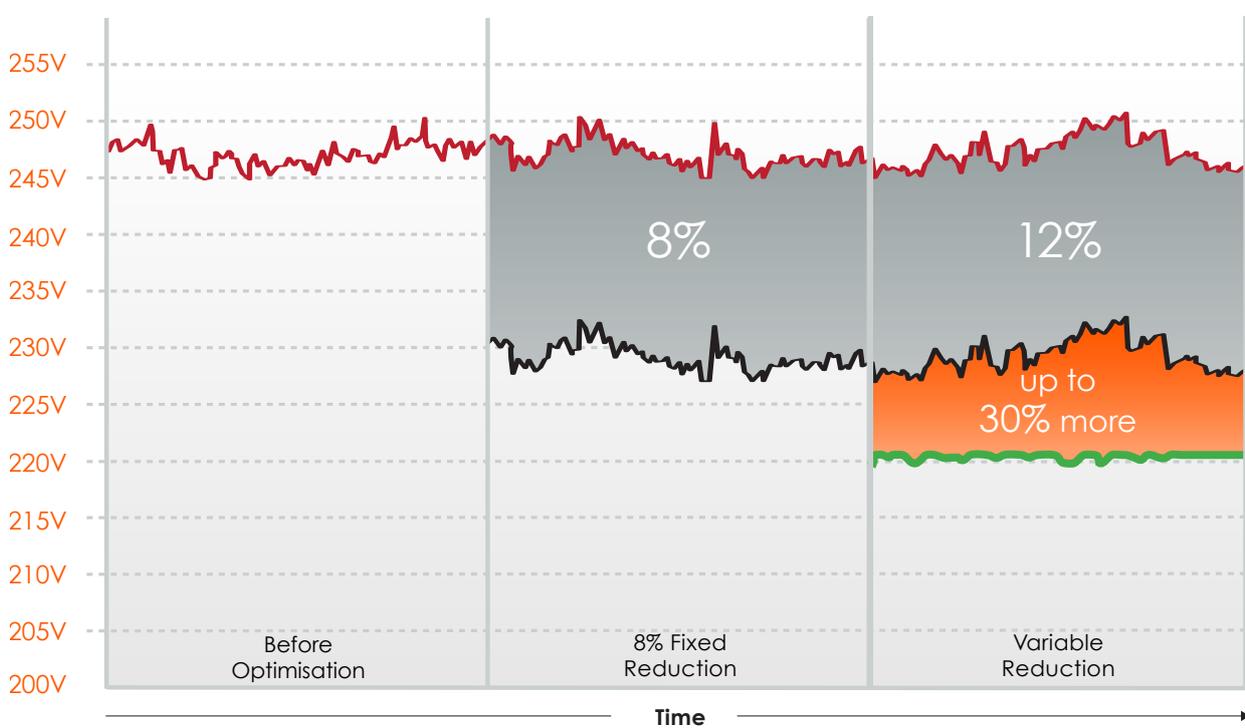


A typical industrial site in the UK will have an 11kV to 415V (on load) distribution transformer giving an output of 240V per phase and a limited adjustment of $\pm 2.5\%$ and 5% on the HV side. This adjustment has to be done under isolated conditions via an off circuit tap changer, and so a high and variable input voltage will often be seen at the customer's LV output side. Over recent years this has led to the rise of many voltage optimisation companies who provide low voltage optimisation units specifically to control the voltage and combat this wasted

energy. VO units are installed between the site distribution transformer and the client's low voltage equipment.

Using voltage optimisation units with electrical equipment such as refrigeration or air cooling devices, 3-phase motors, high-intensity discharge or fluorescent lighting has been proven to reduce energy consumption substantially and to create real financial savings as well as prolonging the service life of a lot of electrical equipment as a result.

HOW THE BOWERS INTELLIVOLT - WITH IVOLT'S VARIABLE VOLTAGE REDUCTION TECHNOLOGY - SAVES MORE



STATE OF THE ART V.O.

First generation fixed step-down voltage optimisation systems reduce voltage by a set amount, typically 4 to 8%. Second generation units see voltage being reduced mechanically to match the peaks and troughs of incoming voltage, thereby ensuring that output voltage is fixed close to 220V (or the desired site voltage) as possible. Third generation units use more reliable solid state technology, with no moving

mechanical parts, to get appreciably closer to a steady 220V. Fourth generation VO, of which iVolt is the only example, is an intelligent variable device with patented IRT Energy Monitor technology and a cloud-based measuring system. Commensurate with its status as the world's first smart transformer, the Bowers Intellivolt® incorporates this state of the art fourth generation technology.

WHY COMBINE THE TECHNOLOGIES? AND WHO CAN BENEFIT?

For HV connected customers, who own their own distribution transformer, the installation of a separate voltage optimisation unit can be costly, take up valuable space, and means more equipment to maintain. Even if the transformer in question is one of the latest Super Low Loss types, with all the added benefits - including the ability to drop the voltage by a fixed amount via a tap changer

- further savings are possible with the addition of voltage optimisation technology. While voltage reduction via tap changers has been proven to deliver worthwhile savings, tap changers do not take into account variable input voltages, and so require their output voltages to be set much higher than variable voltage optimisation units allow, in order to avoid the risk of brownouts.

► THE SOLUTION: Integrated low-loss transformer technology with voltage optimisation

The Bowers Intellivolt® differs from anything else on the market, anywhere in the world, because it features a fixed ratio distribution transformer with no tap changer. Instead, it has its own integral voltage optimisation solution built in.

The integrated VO electronically ensures that each phase of the output voltage is always fixed to within 1.5 % of the desired voltage (generally 220V 1ph or 380V, 3ph) irrespective of load. This results in a voltage reduction of, on average, 12% based on a standard 433V (no load) distribution transformer.

Each phase of the Intellivolt transformer output is independently and automatically set to the controlled voltage and monitored in order to resolve any phase imbalance problems. There are nine tap-settings for optimal accuracy, with thyristor-based switching between each tap to ensure stability and reliability.

The Bowers Intellivolt® also uses a programmable micro-controller system to control the tap switching. Measuring the incoming voltage more than 3,000 times per second, it selects the appropriate tap by activating the thyristor switch. The micro-controller also measures the frequency of the mains supply and compensates accordingly. This means that the unit will work automatically over a frequency range of 45 - 75Hz.

This combination of controllable interfacing, transformers and a micro-controller system results in a voltage stabiliser which has no moving parts and responds quickly to voltage variations, providing a stable output voltage at the voltage set per phase by the client. Because the output voltage is controlled and stabilised, this further helps to reduce wasted energy and losses caused by spikes and harmonics - saving even more on bills and in carbon emissions.

REAL TIME MEASUREMENT OF ENERGY SAVINGS - with remote interrogation and control

Integrated into every Intellivolt is iVolt's award-winning and patented Intelligent Real Time (IRT) Energy Monitor technology, which enables accurate tracking of savings.

This unique and groundbreaking device measures energy consumption levels as accurately as data generated by meter readings and provides facility managers with crucial data. The information, calculated by comparing energy consumption with and without optimisation over a defined period, can also be transmitted via an optional GPRS communications module for use in remote building energy management systems.

SITE SURVEYS

If a client is interested in reducing their energy costs by replacing a site's existing distribution transformers with a Bowers Ecodesign transformer – or has considered voltage optimisation – then the starting point is a site survey to identify the best solution for the client. All sites are different and the most appropriate energy-saving solution will depend on the client's network and types of loading.

A survey will be carried out by a highly-trained Bowers engineer and, where necessary, will include 3-phase power logging and analysis. The most cost-effective solution, the estimated energy savings that an Intellivolt smart transformer would achieve, and a predicted return on investment for all options will be estimated.

SITE INSTALLATION

The Bowers team also offers complete installation of the Bowers Intellivolt and all other Bowers and associated high and low voltage products by highly trained engineers. All installations will include an upfront quotation, backed by detailed method and risk assessments at the point of installation, with installation and test certificates offered on completion.

WHY CHOOSE BOWERS?

Proudly designing and manufacturing here in Britain, where our expertise and cutting edge engineering are world renowned, Bowers Electricals boasts a prestigious list of clients from across the public and private sectors. The team has worked on projects everywhere from small industrial developments to major infrastructure schemes including large scale power stations, government buildings, hospitals, schools and universities, wind and solar farms and throughout the heavy power engineering industry.

Since its beginnings four generations ago as an electric motor and transformer rewinding

business, the company has moved into the supply of new and refurbished power and distribution transformers, HV and LV switchgear and all manner of associated products and services.

Championing the use of British materials and suppliers whenever possible, the team specialises in distribution and power transformers up to 25MVA at 33000V at its headquarters in Heanor, Derbyshire. Still managed day-to-day by the Bowers family that set it up, the company is now part of the Bowers Group of Companies which turns over in excess of £12million a year and employs 80 personnel.



For more information and a free site survey, telephone 01773 531531
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