CHAUVIN ARNOUX

Improving our own Energy Efficiency

Having written extensively about energy efficiency over the last 6 years it was always obvious that we ought to look at getting our own premises in order. However, the Chauvin Arnoux UK facility is on a long-term rental agreement, and getting permission to make improvements to the electrical infrastructure turned out to be a much more laborious process than that of understanding and logging our electrical usage, and making the subsequent improvements.

But with landlord negotiations now well behind us, the interesting part of the journey has begun, and over the coming few months, details of the process, measurements, conclusions, and improvements will be serialised here in Energy Manager Magazine.

Chauvin Arnoux UK operates from a 2-floor concrete block and steel constructed unit on an industrial estate in Yorkshire, typical of many around the UK. A quick visual survey, always the best place to start, revealed that the lighting was all by way of fluorescent tubes, with other electrical loads consisting of 20 PCs with LED monitors and an array of printers, one colour photocopier, and a water cooler, in our ground floor offices. Also on the ground floor are a kitchen with a water heater, fridge, and microwave oven, and the warehouse with one PC and a banding machine.

Upstairs, apart from the aforementioned florescent lights, we have our server cabinet and the whole of the rest of the floor is an open plan video studio and training facility with a selection of occasionally used audio and video equipment.

What will probably turn out to be the biggest consumers of electrical energy in our facility, although they are currently switched off due to the heatwave we are experiencing, are a selection of wall mounted panel heaters located throughout the building. 9 rated at 3KW, 6 at 2KW and another 6 rated at 750W.

The suspended ceilings in the ground floor rooms were fitted with a total of 48 units, each containing 4 x 1200mm 36-Watt florescent tubes, and the warehouse and entire upstairs floor lit by 72 standard 2387mm 100-Watt tubes. Specifically, there were 15 in the warehouse and 57 upstairs.

Simply calculated, the 48 fittings totalling 6,912W, and 15 x 100W tubes in the warehouse, should give us a power consumption of 8412W downstairs, with another 5700W upstairs. Thus, with all the lights switched on, our theoretical total lighting power consumption would be 14,112W or 14.1KW.

While some of the items to be changed in pursuit of improved energy efficiency were glaringly obvious, like swapping out the fluorescent lights for LED replacements, measurements of the energy consumed before and after changes will indicate the actual savings made, and may

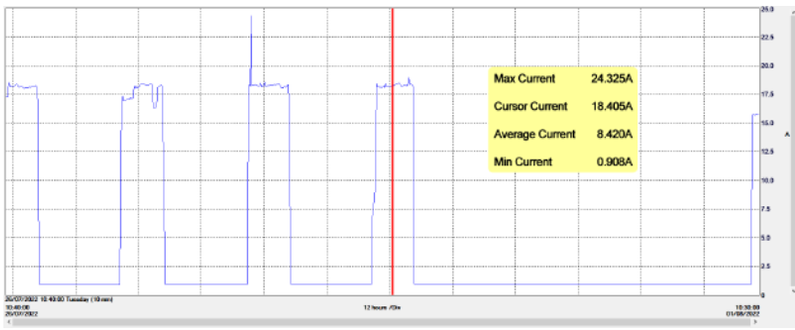
often be required as part of the financial justification.

Bearing in mind, also, that statistically UK businesses waste 46% of their electrical energy "out of hours", and more than 20% on inefficient equipment, we were intrigued to see what else our energy logging results would reveal.

Using a PEL104 Power and Energy Logger we measured and recorded the electrical consumption of our facility over a 6-day period, which included the weekend. And we did this on a variety of circuits so that we could identify exactly what electrical equipment was responsible for the various sets of power and energy consumption data.

Looking first at the ground floor lighting circuit we logged a current consumption averaging 18.4A during office hours, indicated by the current at the cursor position. The log started on a Tuesday, and it is clear to see the increase in power used during office hours on the Tue, Wed, Thu and Fri, followed by a large gap over the weekend, and the beginning of the following Monday's energy use. During these "office hours" the warehouse, which has no windows, had all its lights on, and the offices, which have many windows, had about a third of the lights switched on.

Since the PEL104 was set to measure and record voltage, current, power factor and harmonics, we also discovered our average supply voltage was sitting at 243.6V phase-neutral, and 422.3V phase-phase. More on that later. We also recorded the average power factor on the downstairs lighting circuit of 0.905.



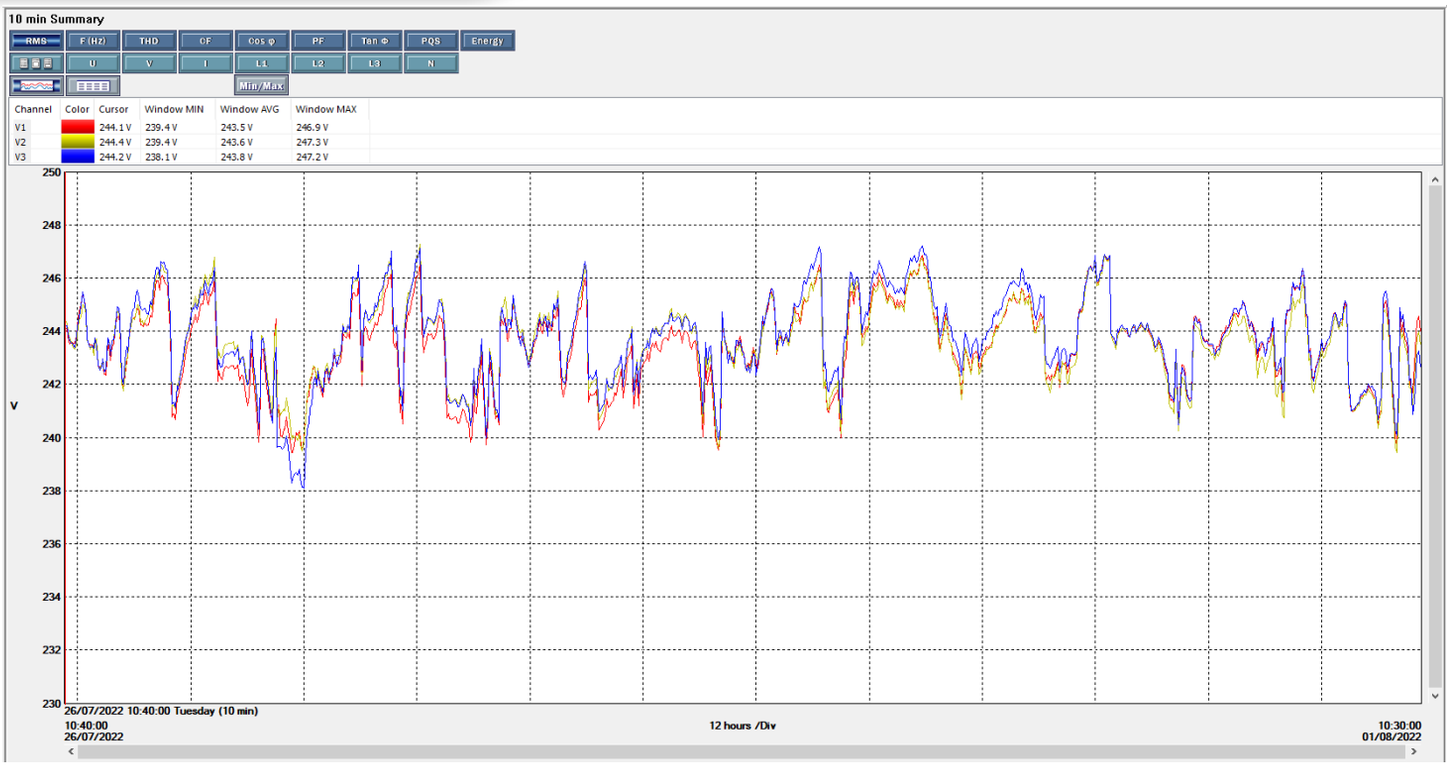
In previous articles we have discussed in detail the relationship between Real Power, Apparent Power, Reactive Power, and Power Factor. Suffice to say here that Real Power (Watts) = Apparent Power (VA) × Power Factor.

Accordingly, at 18.405A and 243.6V with 0.905PF we were consuming 4,058W or just over 4KW, as compared to the 8,412W we calculated would be consumed if all of the lights had been switched on.

Other points to note in the 6-day current log, were the visible increase in consumption on the Thursday morning, which occurred when a conference room was used for a short while, and it was somewhat comforting to see our out of hours usage down a 0.908A, although it will be nice when we find out where that is going.

Having measured and logged the lighting consumption we set about replacing all of the fluorescent tubes with LED lighting. The 4 tube fittings in the office were all changed to 1200X600 46W LED panels and the 100W tubes in the rest of the building replaced with 36W T8 8ft LED Tubes.

Obviously with the acceptable variation in mains supply voltage being 230 volts -6% +10%, this gives an allowed voltage range of 216.2 volts to 253.0 volts. And while it is true to say that our mains supply is within these tolerances, it is never the less, sitting in the upper region of the acceptable range. If we had a 10% reduction in supply voltage throughout the log, we would have had an average voltage of 233.6V and still have never dropped below 219.7V, 3.5V above the permissible minimum. This alone could reduce our lighting power consumption by 10%.



Interestingly, this "high" supply voltage is extremely common in the UK, and without getting into too much detail in this article, the utility could relatively easily reduce it. This could either be done at the local substation transformer by means of its incorporated tap changer, or at the higher transmission voltage level for a wider impact. Such action would both reduce the energy consumption (and bills) of their individual customers, and perhaps more importantly, reduce the total instantaneous energy demand on the grid. The latter being something that could help significantly in the current climate of impending potential energy shortages.

With regards to our own energy saving mission, having changed all of our fluorescent lighting for LED replacements, we have now started another power and energy logging session and will report back on the findings in the next part of this case study.

Chauvin Arnoux Ltd
Unit 1 Nelson Ct, Flagship Sq, Shaw Cross Business Park
Dewsbury, West Yorkshire - WF12 7TH
Tel: +44 1924 460 494
Fax: +44 1924 455 328
info@chauvin-arnoux.co.uk