
# The Fairford System and Energy Optimising

In the late 1970's it was thought that the NASA method of energy optimising could be incorporated into a microcomputer and at the same time be developed further to control the starting current of a three phase induction motor. This lead to a group of people dedicating their time to researching the principles of soft starting and writing the software for what, in those days, was an advanced microcomputer.

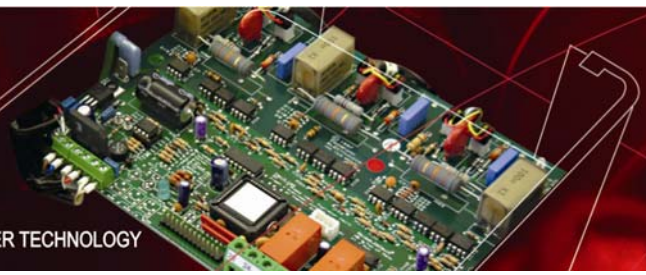
By 1983 we began trading commercially starting to supply custom designed printed circuit boards and custom designed soft starters to some of the leading control gear and specialist soft start companies throughout the world. We still do and you will find our products in many guises.

Therefore 'The Fairford System' is unique in the way it developed not only the design of control boards, but also the software that controls the way in which the Soft Starters work. I.e. the soft start sequence, the dwell period, the Energy Optimising sequence and the soft stopping sequence. Now with the QFE Soft Starter 'The Fairford System' has gone a step further. With LCD display and keypad, programmable relays, inputs and outputs. Also new automatic features for starting and stopping take us another step forward in 'The Fairford System' as they cater the ramp profile for your specific application with no further adjustment needed.

'The Fairford System' also relates to the Energy Optimising System (optimising the voltage applied to the motor). In reality there are only two algorithms for calculating the correct voltage, one using power factor and the other using back EMF. Both of these techniques are covered by various patents, Allen Bradley have access to patents relating to back EMF and Fairford own ones relating to power factor. Therefore if some other company is claiming an energy optimising system their patent status must be dubious !
As we have stated earlier, we do supply custom designed printed circuit boards and custom designed Soft Starters to some of the leading control gear and specialist soft start companies throughout the world. So some companies that you come across may have our Energy Optimising System within their Soft Starter.

All Soft Starter manufactures will have heard of Fairford Electronics, because we have either dealt with them in the past, deal with them now, or they have based their soft starting system upon ours. It was Fairford Electronics who developed and introduced Soft Starting to the market place in the form it is perceived today. Soft Starters have now become an accepted form of starting within industry. Mr. R.E. Bristow our former Technical Director is also part of the IEC Committee that drafted the International Standard for Soft Starters IEC 60947-4-2; EN 60947-4-2 'AC Semiconductor Motor Controllers and Starters'.

We therefore consider ourselves one of the main players within the industry using our name, vast expertise and experience gained over the years when introducing and selling Soft Starters in the market place today.



There is a need to be able to understand, explain and sell the benefits of the Fairford Energy Optimising system. Please find attached the QFE Applications manual. Refer to section 3.4 'The Principles of the Optimising Mode' page 3-18. This will help in understanding the operation and benefits of the Energy Optimising System.

Regarding the amount of savings that can be achieved, please refer to section 3.4.6 ‘Estimating Energy Savings’ page 3-22. These figures are taken from the University of Surrey, Motor Efficiency Testing in 1988. We have found these figures reliable and a realistic level of the amount of energy saving that can be achieved.

In the US however, the benefits of Electronic Optimisation can be more pronounced due to the historical difference between the typical supply voltage and the motor design voltage. US motors are designed to operate within a voltage range of 460V ± 10%. With typical supply voltages being 480V or more, this means that many motors are running at or near the top end of their supply voltage range. With their cores highly excited. In this condition, the increased motor terminal voltage results in reduced motor efficiency due to higher magnetising losses and variable $I^2R$ losses. It is very difficult to predict typical savings that can be made when optimising motors which are highly fluxed since motor characteristics vary considerably between manufacturers and models. However, the total losses can be as much as 1.5 times the losses calculated from efficiency data provided by manufacturer’s catalogues. (It should be borne in mind that even this data is subject to a tolerance). Further, the voltage-dependent loss (no longer strictly the ‘iron loss’), becomes a larger proportion of the loss structure, giving the opportunity for significantly higher savings.

Not only do we have the significant benefits of energy saving on lightly loaded motors there are also the other indirect benefits from the effect of the Energy Optimising function. These are reduction of heating losses in cabling due to lower currents; potential reduction of maximum demand charges and reduced total energy demand. Further saving and other benefits derived from the soft starting process itself; reduced wear and tear; reduced maintenance, replacement costs and extended motor life due to the motor running cooler.

Over the years, we have written many articles about Energy Optimising a number of which are attached.

Please find attached the QFE - EMC technical manual. Section 4.7.3 'Emissions - Harmonics' outlines our position regarding harmonics. Due to our method of Thyristor triggering (opto triacs) this results in minimised harmonic effects compared with the traditional method of triggering using pulse transformers used by many manufacturers. Pulse transformers may be particularly noisy when used on optimising systems.

The QFE Soft Starter range has the Fairford System of Energy Optimising incorporated as standard. This will function automatically normally requiring no set-up or adjustment. If the motor is lightly loaded the QFE Soft Starter will automatically Energy Optimise the system. Alternatively if a bypassing contactor is fitted this will automatically be detected and the optimising disabled.


There are a number of companies having a very poor name in the market place for misleading people with claims for the amount of energy that can be saved on lightly loaded applications. Typically, a power reduction of 20 to 30% is possible if the motor is running very lightly (<40%) loaded. However, this is 20 – 30% of the already low load. It is the 20% that catches people's attention and some companies convey this to the end customer without clarifying the already low load. Customers tend to think it is 20% of 90kW i.e. 18kW.

Here is a typical example of the type of savings, which are practical.
A 415V 90kW motor running at full load will take about 160 Amps. Directly coupled to the mains and running unloaded the current generally falls by about half to 80 Amps with a poor power factor. Fitting a QFE Soft Starter and running it in the Energy Optimising mode will typically reduce the current by half again to 40 Amps and improve the power factor.

Now if we look at the power taken by the motor, directly coupled to the mains and running unloaded this typically falls to about 10% of full load, in this instance 9kW. Fitting a QFE Soft Starter and running it in the Energy Optimising mode we will reduce the power further by between 20% of 9kW (a saving of 1.8kW) and 30% of 9kW (a saving of 2.7kW). These approximations are in line with the many tests and results we have obtained over the years. They also tie in well with result obtained by using our estimator i.e. for 90kW nameplate motor estimated savings are 2.5% which equates to 2.25kW.
So therefore we have to be careful how this is represented to the end customer and explain the above clearly.

Other manufacturer's who have infringed either Fairford Electronics system or Allen Bradley's system of Energy Optimising will not be able to achieve any more savings as the end results will be similar. It must be remembered that it is Power that is paid for and not Amperes. The motor current and KVA will start to reduce much earlier than any power reduction will be evident. Please remember the only way of measuring the amount of power is by using a kilowatt hour meter. There are many electronic meters in the market place today claiming to measure true RMS. However, the algorithms embedded can be very poor, correctly measuring power when there is a full sine wave. Nevertheless, having difficulties when there is a chopped optimising waveform, thus care must be taken when selecting suitable instruments.

20% of 9kW and 2.5% of 90kW? For more clarification of energy saving please find attached the document 'Snake Oil' which looks at this in greater detail and was written with the sole purpose of showing certain companies 20% saving claims to be misleading people.

Applications where Energy Optimising is beneficial are invariably where the motors are lightly loaded or have been oversized for the load. Typical favourites are injection moulding machines, large saws, crushers and grinders. These are all high inertia applications and care must be taken in the selection of the Soft Starter to ensure that it is capable of the extended start. Once these applications have reached full speed very little power is used for the process since the kinetic energy in the flywheels, saw blades or rollers etc. is enough to do the work required.

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