

POWER FACTOR

INCREASE THE EFFICIENCY OF YOUR POWER SYSTEM

The efficient use of electricity is important to your business. The power factor your business or plant runs at can have a huge impact on your day-to-day running costs. A poor Power Factor (PF) unnecessarily adds to electrical inefficiencies and as any business owner knows, inefficiencies cost money. Power factor correction is a relatively unknown technology that can change the way you use electricity to both increase efficiency and reduce power costs.

A non-technical explanation is the easiest way to understand the principles behind power factor. The following analogy can be used to describe poor power factor:

A small carriage on a railway track is being pulled by a horse that is offset to the side of the track (Figure 1). The pull that is directly between the horse and cart (red line) is the apparent power - kiloVoltAmperes (kVA) - used to do the work. The actual work done by the horse is seen when the carriage moves along the track (green line), or the real power - kiloWatts (kW). The

pull, at a right angle to the track (blue line), does no effective work. This is the reactive power - kilovoltamperes reactive (kVAR). The horse would ideally pull the carriage directly down the railway track so the apparent power equals the real power (no red or blue lines), thus minimising wasted energy.

Just as with the carriage being pulled in an offset manner, electrical power can be used inefficiently, thereby creating what is called *poor power factor*. Electric motors are often a cause of poor power factor but this can be easily corrected by the connection

of a power factor correction unit (PFCU). Auto Control Systems will install a PFCU with a controller that will help manage the electricity that flows through your electrical system. Capacitors form a part of the PFCU and are connected to the electricity supply to help control power flow (Figure 2).

The Technical Details

Power factor, in an alternating current (AC) circuit, is the ratio of actual power in watts to the apparent power in volt-amperes. If the current (measured in

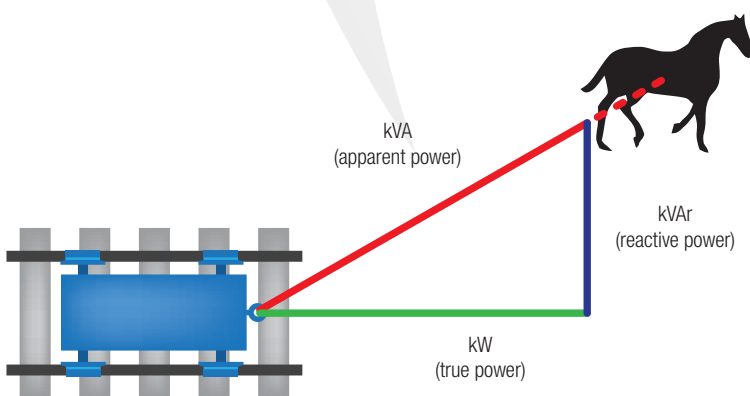


Figure 1



Figure 2

Amperes) and volts are in phase with each other, then the power factor is at 1.0 or *unity*, as it is also referred to. When there is a level of reactance in the circuit, the current and voltage will be out of phase and there will be parts of each cycle where there is misalignment of the phases. This results in the current being negative and the voltage positive. This constitutes a bad power factor.

There is zero power flow when the current and voltage are out of phase by 90°, as is the case with purely inductive or capacitive circuits (reactive circuits). However, the power factor value normally remains somewhere between the dimensionless values of 0 and 1 as circuits will usually contain a combination of both reactance and resistance. Electric motors cause the current to lag behind the voltage in which case the power factor will also lag. Capacitors in the PFCU enable the current to lead the voltage meaning that the power factor will also be leading.

The relationship between the components of power flow and power factor are best

understood when seen in a diagram like the power triangle (Figure 3).

The Benefits

Power factor should always be improved as a poor power factor increases line losses which, in turn, increases power bills. The amount of current in a circuit correlates with the *apparent power* line (Figure 3) therefore the larger the current, the greater will be the heating and line losses in the cables supplying the load.

When poor power factor is reduced, the current and the line losses falls as the *apparent power* approaches the *real power*. Some power companies will impose penalty fees for having a poor power factor (generally below 0.85) in an effort to encourage power factor correction. A typical ROI analysis of the installation of a power factor correction unit will generally show a pay back within 12 - 24 months.

How We Can Help

In an effort to help you overcome a potentially poor power factor, Auto Control Systems can install a logger in your

main switchboard which, for 7-14 days will log your power use. The instrument then returns to us measurements of voltage, current, active/reactive/apparent power, electrical harmonics, and several other valuable statistics.

We use information from your recent power bills to use for comparative data and perform a cost-benefit analysis. Auto Control Systems also notes the details of your distribution board and incoming cables.

Once the data logging is complete, we remove the instrument and download the saved information. Scrutiny of that data then takes place to determine what power factor your business generates. This is imperative for us to be able to provide you with the right solution.

Following this data analysis, we provide an estimated cost to install a Power Factor Correction Unit should the data indicate that it may be worth your consideration.

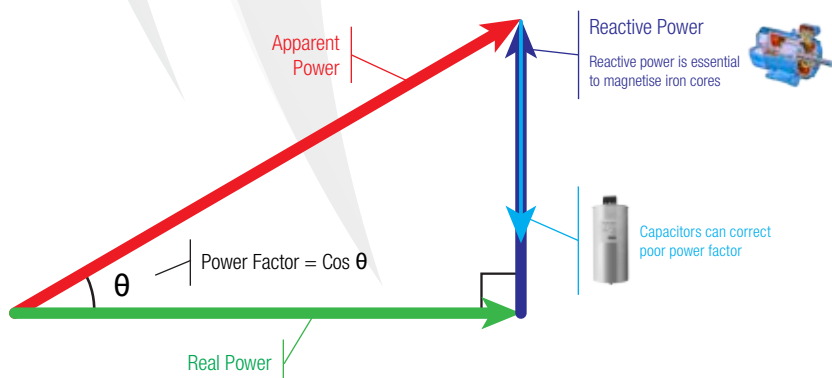


Figure 3

Benefits can include:

- Reduced power bill
- Additional electrical capacity on main switchboard/street transformer
- Reduced line losses in electrical system
- Reduced maintenance requirements for electrical equipment downstream from PFCU
- Increased efficiency and motor life-span, lighting and other electrical equipment
- Suppression of harmonics that can damage sensitive equipment; eg. laptops
- Improved protection of electrical equipment from short-term power surges