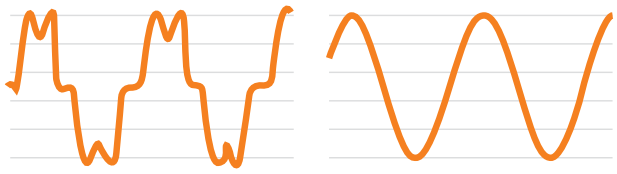
FUSECO

# Power Quality Solutions

# What is Power Quality?



DIRTY POWER CLEAN POWER

For electrical systems to function in their intended manner without significant loss of performance or life, they require a supply of electricity that is of good quality. Good quality electrical power has the following characteristics:

- It must have a continuity of service (not be interrupted).
- It must have a very low Harmonic content.
- It must have a very low variation in the voltage magnitude.
- It must have very low transient voltages and currents.

The term 'clean power' is used to describe electricity that is considered to be of good quality with particular reference to a very low harmonic content. Therefore, 'dirty power' is used to describe electricity that is considered to be of low quality with particular reference to a very high harmonic content. Harmonics are additional frequencies beyond the fundamental frequency (50Hz) and their presence in an electrical system distorts the clean shape of a sine wave. RFI is a high frequency disturbance that affects an electrical circuit due to either electromagnetic conduction or electromagnetic radiation emitted from an external source.

Most electrical devices (such as motors) need clean electricity to function properly.

# The effects of Low Quality "dirty" Power

If you occasionally experience some unexplained occurrences such as flickering lights, alarms going off, or MCB's, MCCB's, RCD's and Earth Leakage devices tripping for no apparent reason, you are most likely experiencing harmonics in your electrical environment. Other signs are cables running hot, hot switchboards or overheating motors. If you are replacing your motor's bearings & insulation often, that's a strong indication of the presence of harmonics. Harmonics are very harmful within an electrical system and can have serious consequences, including reducing the life of equipment. Harmonics cause things to run hot, which cause stress on the cables and equipment. In the long term, this degrades an electrical system. The presence of harmonics will also mean that although you will get billed for the power that you are supplied, a large percentage of that power may be unusable.

If you are occasionally experiencing interference with your telephone system, flickering computer monitors, reliability issues with computer networks, instrumentation errors, or misbehaving electronics you are most likely experiencing RFI in your electrical environment. RFI can wreak havoc with your electronics, computers and telephones, making your workplace difficult to work in. Since most machines have control electronic circuits, they may become difficult to control or unreliable. RFI The disturbance may interrupt, obstruct, degrade or limit the effective performance of the circuit.

# Power Quality Solutions

Power Quality products act as filters in electrical systems to limit harmonics and radio frequency interference (RFI). Essentially, they turn 'dirty' power into 'clean' power. Variable Speed Drives (VSD's) are prolific creators of harmonics in electrical systems and as a result, most of the harmonic mitigation effort focuses on the input side and output side of a VSD.

Depending on the specific situation, there are a variety of products that are used to mitigate harmonics.

In addition, there are many ways to reduce the effects of RFI, depending on your application. For conducted RFI, you can choose from a large range of RFI filters, chokes & pulse transformers. RFI filters are available as feedthrough components, or as PCB filters, IEC inlet filters and power entry modules, 3-phase filters, 3-phase and neutral line filters, output filters, EMC/EMI chokes and pulse transformers. For radiated RFI, you can choose from a large range of shielding products.

Fuseco's Power Quality Consultants can assist by conducting a site analysis or simply providing advice based on the details of the particular electrical system. Below is a brief summary of the product groups used to improve power quality.

# Power Quality Solutions

FUSECO

## ACTIVE HARMONIC FILTERS

Mainly used for group harmonic compensation at the main switchboard.

- Reduction of harmonics to 5% or less.
- Reactive current control.
- Load side transient suppression.
- Load side surge suppression.
- Reduction of supply sags and surges.
- Improves electrical system efficiency.
- Reduces operations and maintenance costs.
- Meets the IEEE519 Standard.

## LINE REACTORS

Also known as Inductors, Chokes & Line Filters.

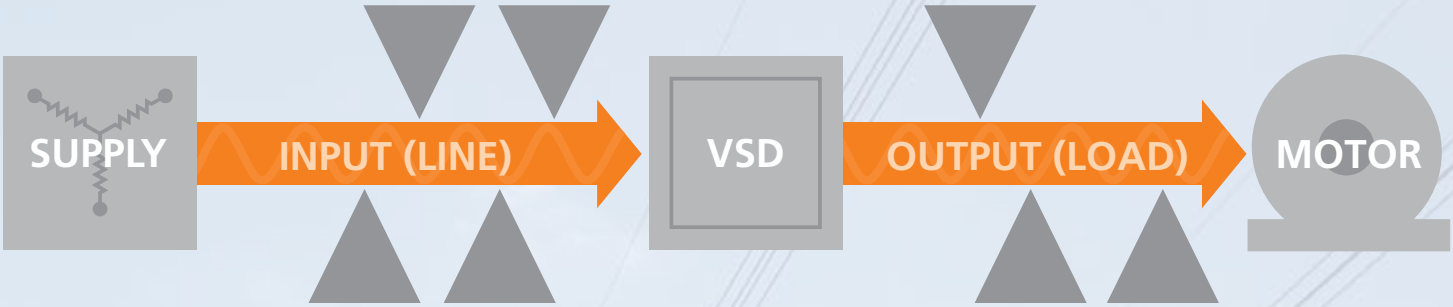
For use on the input of a VSD / Inverter or other non-linear devices.

- Virtually eliminate nuisance tripping.
- Extend life of semiconductors.
- Reduce harmonic distortion.
- Reduce surge currents.
- Improve true power factor.

## SINEWAVE FILTERS

In addition to protecting the motor, the sine-wave filter also provides protection for the VSD/inverter.

- Unshielded motor cables can be used, lower project costs.
- Motor operating life is increased.
- Longer motor cables possible.
- Significantly lower eddy current and stray flux losses.
- Significant reduction of bearing currents.
- Eliminate torque ripple.
- Eliminate voltage wave reflection.
- Reduces motor noise, vibration and heat.




## PASSIVE HARMONIC FILTERS

Also known as 'Low Pass Filters'.

For reducing harmonics at the VSD / Inverter or other non-linear devices.

- Reduction of harmonics to 5-6%
- Reduce cable heating and line losses.
- Improve power factor and reduce system loss.
- Minimise interference with other equipment.
- Improved system voltage/current waveform.
- Prevent nuisance tripping of fuse and circuit breakers.
- Meets the IEEE519 Standard.

## RFI FILTERS

RFI Filters are used to block emitted and radiated radio frequencies that cause electronic/electrical interference.

- Reduce inverter instability.
- Improve radio reception.
- Improve television reception.
- Reduce control systems interference.
- Block Radar and Sonar disruption.

## LOAD REACTORS

Also known as Motor Chokes, Load Filters & Inductors.

For use on the output of a VSD / Inverter or other non-linear devices.

- Protect motors from long lead effects.
- Reduce reflective currents.
- Reduce Harmonic Distortion.
- Reduce Surge Currents.
- Reduce Motor Temperature.
- Reduce Motor Audible Noise.

## dV/dT FILTERS

dV/dT filters are designed to protect AC motors from the destructive effects of long lead peak voltages.

- Increase bearing life and up-time.
- Reduce common mode noise and currents.
- Prevent voltage spikes from exceeding 1kV.
- Reduction in motor peak voltages.
- Protection of motor insulation.
- Reduction of motor temperature.

# Harmonic Mitigation

## REACTORS, LINE AND LOAD

| | |
|---|---|
| Current Range: | 1A – 2200A |
| Voltage: | 415V, 690V, 1000V |
| Impedances: | 0.8%, 1.5%, 3%, 4%, 5% |
| Construction: | IP00, IP20, Nema 3R<br>Universal mounting brackets (suit existing mounting holes) |
| Warranty: | Life of the Drive with which they are installed |

## PASSIVE HARMONIC FILTERS

| | |
|---|---|
| Power Range: | 4kW – 710kW |
| Voltage: | 415V, 690V |
| Construction: | IP00, IP20, IP54,<br>KP (Components Package) |
| Complies with: | IEEE-519 |
| Warranty: | 3 Years |
| Options: | Other Voltages and kW's available on request.<br>Contactors to switch out the capacitors at low power settings. |

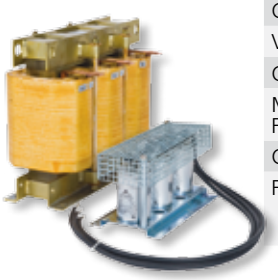
## dV/dT FILTERS

| | |
|---|---|
| Current Range: | 2A – 750A (Can be connected in parallel for larger currents) |
| Voltage: | 240V, 480V, 600V |
| Construction: | IP00, IP20, Nema 3R |
| Warranty: | 18 months |
| Features: | For use with up to 300m cable length (1000m also available).<br>Up to ten motors can be used with the one dV/dT filter. |

## ACTIVE HARMONIC FILTERS

| | |
|---|---|
| Current Range: | 25A – 400A (1200A available by parallel connection) |
| Voltage: | 415V, 690V |
| Performance: | Up to the 50th harmonic |
| Response Time: | < 1 mS |
| Switching Frequency: | 10kHz |
| Construction: | IP20, IP54 |
| Controllers: | Digital LCD screen or Touch screen HMI's |
| Communications: | Ethernet, RS485, Modbus |
| Warranty: | 1 year |
| Options: | 3 wire and 4 wire systems<br>Open loop and closed loop control |
| Benefits: | One solution for harmonics and power factor correction |

## SINE WAVE FILTERS



| | |
|---|---|
| Current Range: | 4.5A – 1200A |
| Voltage: | 415V, 690V |
| Construction: | IP00, IP20 |
| Motor Frequency: | 0 – 200Hz |
| Complies with: | IEC 60034-17 & Nema-MG1 |
| Features: | Up to 2000m cable length<br>Provides a degree of dV/dT restriction |

# RFI Filters

**SINGLE PHASE**
**1, 2 or 3 Stage**

**3 PHASE**
**Multi Stage**

**3 PHASE + NEUTRAL**
**Multi Stage**

| | |
|---|---|
| Current Range: | Up to 2500A |
| Voltage: | 240V, 415V, 690V, 1000V |
| Phases: | Single phase and three phase (3 wire and 4 wire) |
| Stages: | 1, 2 or 3 Stage |
| Construction: | IP20 |
| Features: | Low leakage versions available for medical and RCD applications.<br>EMC compliance. |

# Power Quality Audit

Power quality audits can be carried out on site to assess your Harmonic Mitigation needs. The site surveys are conducted by Fuseco's expert Power Quality team using specialised equipment. A report is prepared with recommendations on solutions to return your systems to IEEE 519, IEC 519 harmonic levels. Please contact Fuseco to discuss your requirements with our technical support team.

# Also available from FUSECO:

## FUSES

## LOAD BANKS

- Generator sets, UPS, Battery and Ground power system testing
- Reduce 'wet stacking' in diesel engines
- Periodic testing of stand-by generator sets
- Load optimisation in prime power applications
- Portable and fixed, indoor and outdoor

## VOLTAGE STABILISERS

- Used in areas with weak or unstable supply
- Reduced stress on electrical/electronic equipment
- Improve power factor and efficiency
- Uniform quality of supply and reduced tripping

## SURGE PROTECTORS

- Protection from voltage spikes, surges, transients
- Industrial, commercial or domestic
- Operability indication
- Dry contacts for remote status indication
- Din rail and panel mount

## TRANSFORMERS

- Phase Shift, Pulse, Toroidal and Dry Type
- Step-up, step-down
- Low & Medium Voltage
- Multi-tap
- Aluminium or copper windings
- IP00, IP20, IP42, IP54
- Tropic proof, marine grade
- Aluminium or steel enclosures
- Continuously variable

# Conversion table:

| Horsepower | Kilowatts | AMPS |
|---|---|---|
| 0.5 | 0.37 | 1.3 |
| 0.75 | 0.55 | 1.9 |
| 1 | 0.75 | 2.4 |
| 1.5 | 1.1 | 3.3 |
| 2 | 1.5 | 4.3 |
| 3 | 2.2 | 5.6 |
| 4 | 3 | 7.6 |
| 5.5 | 4 | 9 |
| 7.5 | 5.5 | 12 |
| 10 | 7.5 | 16 |
| 15 | 11 | 23 |
| 20 | 15 | 31 |
| 25 | 18.5 | 38 |
| 30 | 22 | 46 |
| 40 | 30 | 61 |
| 50 | 37 | 72 |
| 60 | 45 | 87 |
| 75 | 55 | 105 |
| 100 | 75 | 140 |
| 120 | 90 | 170 |
| 150 | 110 | 205 |
| 175 | 132 | 261 |
| 215 | 160 | 300 |
| 270 | 200 | 385 |
| 335 | 250 | 460 |
| 375 | 280 | 520 |
| 420 | 315 | 590 |
| 450 | 335 | 620 |
| 475 | 355 | 650 |
| 540 | 400 | 730 |
| 600 | 450 | 820 |
| 670 | 500 | 920 |
| 750 | 560 | 1030 |
| 850 | 630 | 1150 |
| 900 | 670 | 1225 |
| 950 | 710 | 1300 |
| 1100 | 800 | 1450 |
| 1350 | 1000 | 1770 |

FUSECO

www.fuseco.com.au
sales@fuseco.com.au

Unit 4/1-7 Friars Road
Moorabbin VIC 3189
Melbourne, Australia

1300 FUSECO
P: 03 9555 3722
F: 03 9555 3944