TINITRON INC.

RTPFC

Real Time Cycle To Cycle Power Factor Correction System

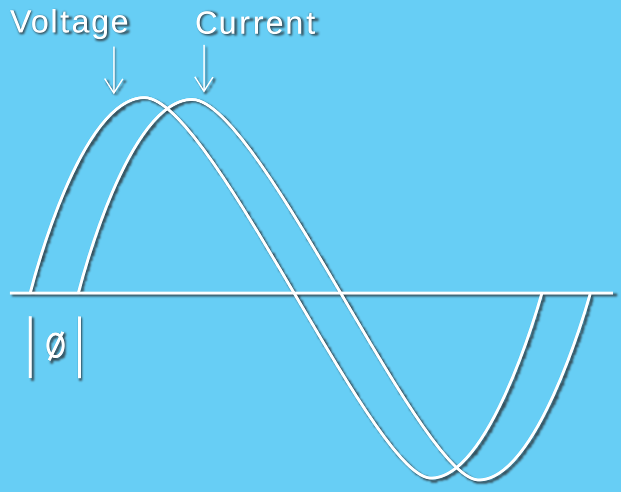
Features:

- Maintaining PF at 1.00 Reducing Electricity Bills
- Under Adverse Operating / Electrical Condition
- System Guaranteed Against Failure
- High Speed Power Factor Correction
- Provision Of Detuned Reactors:

  In The Panels For Reliable Operation

  In The Presence Of Harmonics
- Prevents Damage To Sensitive

  Electronic Equipment
- Fast Transient Free Switching
- Thyristor Switching



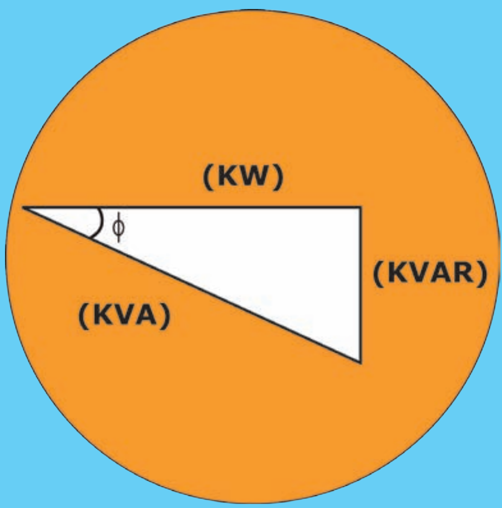
"Tinitron, Inc. has systems that can suit any requirements"

Power Factor Correction For Optimum Utilization & Power Quality

What is Power Factor?

Power factor reflects how efficiently industries & organizations use electricity. Power factor compares the amount of useful work that is extracted from the total amount of electric energy supplied. It is the consine of the phase angle between voltage and current, and is also expressed as ratio of actual power (KW) to the apparent power (KVA).

As the angle get larger (caused by increasing reactive power) the power factor gets smaller. In fact the power factor can vary from 0 to unity and can be either inductive (lagging) or capacitive (leading).



$$\cos \phi = \frac{\text{Actual Power (KW)}}{\text{Apparent Power (KVA)}}$$

The Need

As can be seen from Power Factor definition, if PF is near unity, the Apparent Power (KVA) value approaches near Actual Power (KW). This is possible if, and only if KVAR (reactive power) is kept to a minimum.

In practice, this reactive power KVAR is inductive in nature (major loads are inductive). This reactive power is compensated by countering it with capacitive KVAR in the circuit and can bring system KVAR value near Zero.

If this is achieved

- PV comes near unity
- Reduction in KVA reduces the burden on the electrical system, so the electrical components like transformers, cables and switchgears have to handle less current.
- Reduction in KVA causes max demand requirement to reduce and thus reducing electricity bills.
- PF improvement gives reduction in electricity bills.
- Supply voltage fluctuations are reduced, giving better reliability to the equipment connected on it.

In practice, the electrical load is continuously changing with time, as do the values of KW, KVA, and KVAR. So to maintain PF near 1.00, a required variable is the KVAR value of the capacitor to be inserted. This necessitates the use of dynamic PF compensation.

The Type Of System To Be Selected Depends On....

- Load changing speed and pattern
- Harmonic contents on system
- Maintenance requirements

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COMPARISON

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- No inrush current due to precise auto zero voltage search logic. No current or voltage surge.
- As there is no inrush current, transformers are never subjected to short circuit currents and hence the life of the transformers increase.
- Solid state devices are used to work at very low voltages. As a result there is no chattering, no wear, and no tear.
- Compensation at extremely low voltage is possible.
- The point of capacitor switching is controlled and increases the life of the capacitor and switching unit.
- As there is no moving part involved, maintenance cost is negligible.
- Solid state devices are used for switching, therefore an unlimited number of switching operations are possible.
- With only one controller, it displays all electrical parameters and printout facility is possible.
- With the latest technology, your electricity savings will be almost 10-12%.
- RTPFC system is available with built-in capacitors, and very compact in size.

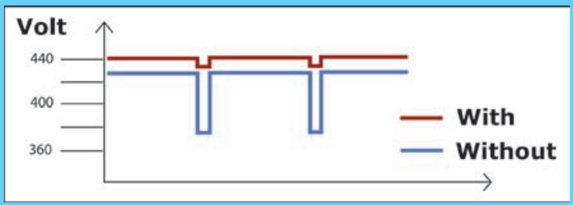
Outstanding Value and Quick Return On Investment (ROI) with Two–Year Average Payback Period!

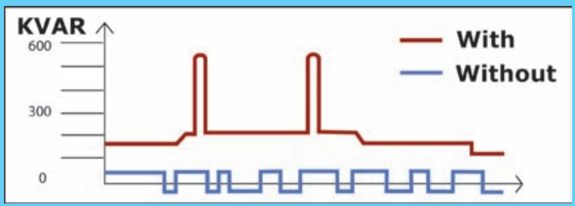
Conventional APFC

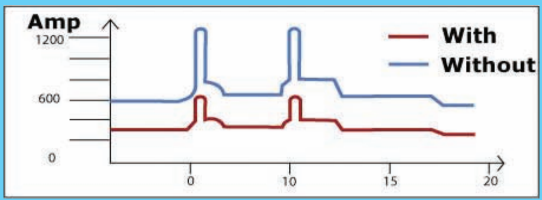
- Large switching surges even as high as 200 times of rated capacitor current.
- Repeated and momentary short circuits due to capacitor switching will have an impact on the life of the transformer.
- The contactor chatters at low voltages resulting in a very high inrush current.
- Compensation at low voltage is not possible, resulting in wear and tear of mechanical parts.
- High inrush current increases the possibility of capacitors exploding and catching fire because the excessive pressure generated inside the capacitor unit, so life of capacitor progressively deteriorates.
- Very high maintenance cost. Contactors will be required to be replaced often.
- Very short life of contactor due to electromechanical switching.
- Various meters at various places are very difficult to monitor and there is no provision for printout facility.
- With out-dated systems power losses are greater.
- Needs separate panel for capacitors and size will be almost double.

Real Time Cycle To Cycle Power Factor Correction System (RTPFC)

Tinitron's RTPFC systems utilize solid state switching that switch power capacitor groups into the network without creating switching transients. Connection to the network is performed during capacitor current 'Zero Crossing', providing smooth connection to the capacitor group. There is no limit to the number of corrections since the switching elements do not wear out or deteriorate during the switching process. This is a unique and modern solution to compensate for fast changing reactive power. The RTPFC system has the ability to control the power factor in real time. This system incorporates high-end micro-processor based measuring circuits and within a span of 1 to 2 cycles of AC waveform, it calculates the PF and connects required groups to the network.

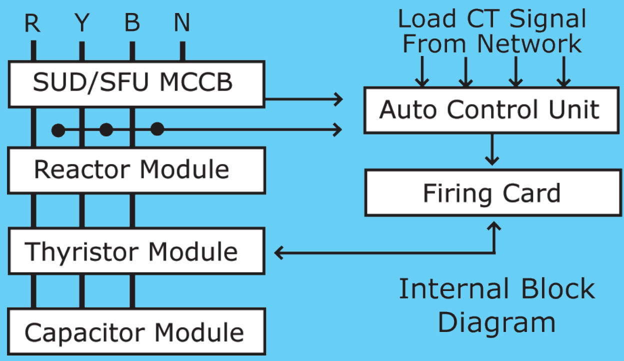






Reactive Power Compensation For Spot Welding Gun Stations

Spot welding loads fluctuate rapidly and consume large amounts of reactive power. Resultant voltage sags tend to reduce welding quality and can impact welding productivity. In addition these loads often create a high level of voltage flickering, which frequently exceed the recommended IEEE limits. Tinitron RTPFC system prevents voltage drop and flickering, substantially reduces the current and compensates reactive energy, increases process output, and improves welding quality.



Internal Block Diagram

Reactive Power Compensation For Generators

Conventional electro-mechanically switched reactive power compensation systems are automatically disconnected when there is a utility power failure and the diesel generator is engaged. Diesel generators are a 'soft' source and cannot tolerate over compensation of reactive energy which in turn results in an over voltage situation. These conventional systems require a relatively long time to disconnect the previously energized capacitor groups, resulting in a leading power factor and increased voltage to the extent that the capacitors or generator could be catastrophically damaged. The RTPFC eliminates this problem by detecting the loss of utility power and determining that the generator is coming on line. Also, the RTPFC system controls the power factor according to needs specified while it increases efficiency and stability of the engine-generator system.

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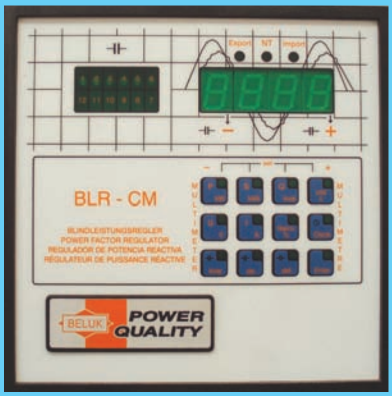


Technical Features Of High Speed Controller

- Controller designed for smooth and surge-free switching of capacitors through thyristors.
- Programmable 4/6/8/12/16 steps for switching.
- Digital display for instantaneous values of various electrical parameters like voltage, current, capacitor current, power factor, active power, reactive power, apparent power, injected capacitive KVAR, capacitive power to reach target power factor, voltage and current harmonics (optional).
- PC interface conforming to RS232 / RS485 to download electrical parameters.
- Target power factor selectable from 0.85 lag to 0.95 lead in steps of 0.01.
- Protections: high voltage, low voltage, over temperature, and voltage imbalance.
- RMS measurements of voltage and currents of all three phases.
- User friendly parameters.
- Standard 144x144 flash mounting.

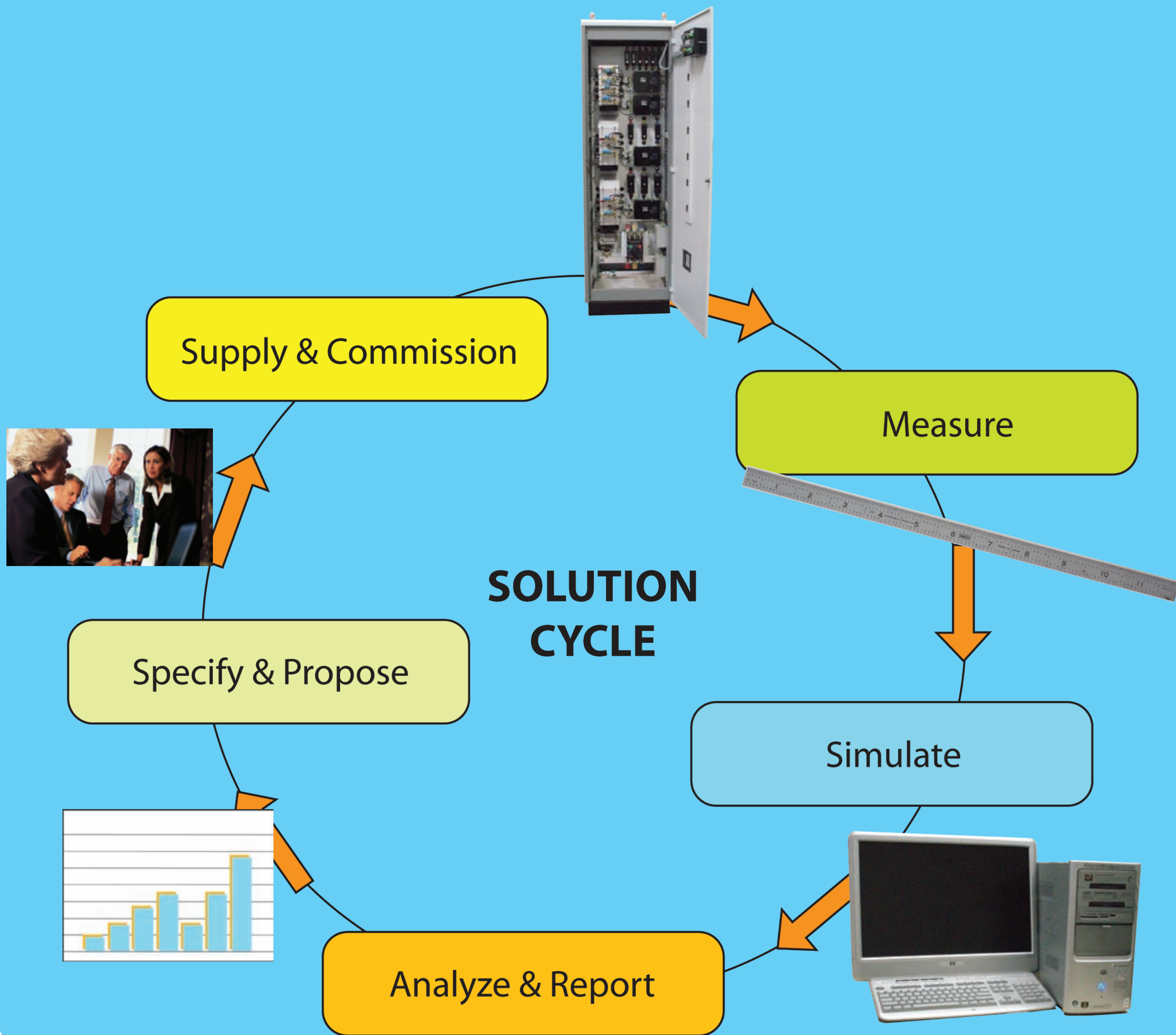
Harmonic Effect & Filters

In modern industries usage of AC/DC drives, UPS, computers, arc furnaces, powerharmonic (both voltage and current) has become a serious problem. The harmonics generated by these non-linear loads are a major obstruction to maintaining power quality. These are a major reason for equipment failure, losses in distribution lines, malfunctioning of electronic equipment, measurement errors in metering systems, loss of data in other electronic devices, and overloading transformers and other components. The problem is eliminated by providing appropriate filters which suppress the harmonics and protects the voltage and current waveform by blocking the ill effects to the capacitors.

Application

The RTPFC system is suitable for many industries including pulp & paper, cement, heavy industry, plastic, steel, forging, processing, welding, garments, leather, chemicals, wire drawings, hotels, hospitals, commercial & office complexes, and more.

SOLUTION CYCLE



SELECTION CHART

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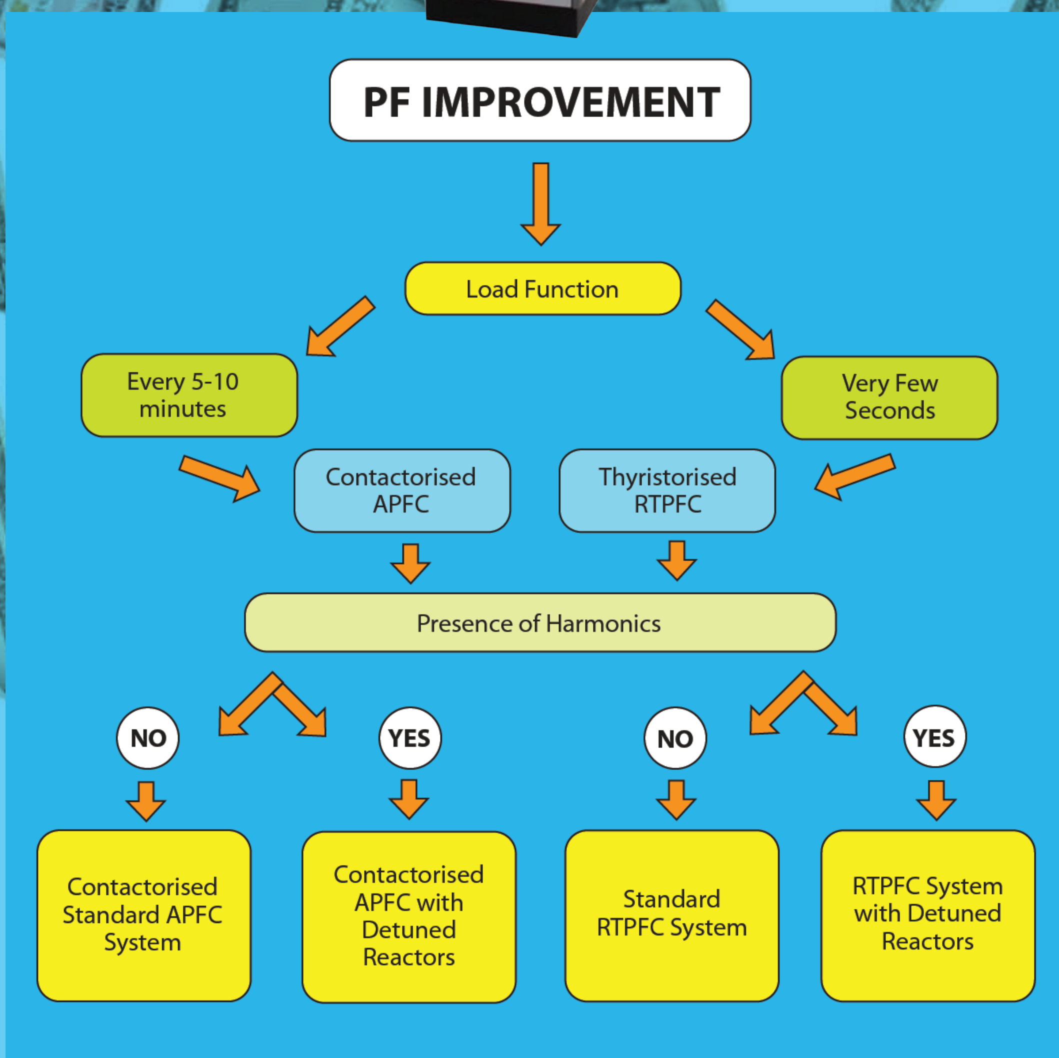

How to calculate required capacitor KVAR

If present Power Factor is known, you can use the following table to calculate required capacitive KVAR to achieve the Power Factor to the targeted value.

Kilowatt Multiplier Table

Target P.F.	Unity	0.99	0.98	0.97	0.96	0.95
Present P.F.	**Multiplying Factor**					
0.70	1.020	0.878	0.811	0.769	0.729	0.691
0.71	0.992	0.850	0.783	0.741	0.701	0.663
0.72	0.963	0.821	0.754	0.712	0.672	0.634
0.73	0.936	0.794	0.727	0.685	0.645	0.607
0.74	0.909	0.767	0.700	0.658	0.618	0.580
0.75	0.882	0.741	0.673	0.631	0.591	0.553
0.76	0.855	0.713	0.652	0.604	0.564	0.526
0.77	0.829	0.687	0.620	0.578	0.538	0.500
0.78	0.803	0.661	0.594	0.552	0.512	0.474
0.79	0.776	0.634	0.567	0.525	0.485	0.447
0.80	0.750	0.608	0.541	0.499	0.459	0.421
0.81	0.724	0.582	0.515	0.473	0.433	0.395
0.82	0.698	0.556	0.489	0.477	0.407	0.369
0.83	0.672	0.530	0.463	0.421	0.381	0.343
0.84	0.654	0.504	0.437	0.395	0.355	0.317
0.85	0.620	0.478	0.417	0.369	0.329	0.291
0.86	0.593	0.450	0.390	0.343	0.301	0.264
0.87	0.567	0.424	0.346	0.317	0.275	0.238
0.88	0.538	0.395	0.335	0.288	0.246	0.209
0.89	0.512	0.369	0.309	0.262	0.230	0.183
0.90	0.484	0.341	0.281	0.234	0.192	0.155
0.91	0.453	0.310	0.250	0.203	0.161	0.124
0.92	0.426	0.283	0.223	0.176	0.134	0.097
0.93	0.395	0.252	0.192	0.145	0.103	0.066
0.94	0.363	0.220	0.160	0.113	0.071	0.034
0.95	0.329	0.186	0.126	0.079	0.037	
0.96	0.292	0.149	0.089	0.042		
0.97	0.250	0.107	0.047			
0.98	0.204	0.060				
0.99	0.143					

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