Spang Power Electronics™

PROJECT PROFILE

Spang Digital Power Controllers Save $24,000/year in Power Costs…...and More!

Spang Power Electronics saved its industrial heating Customer over $2000 per month in real utility power costs with the successful application of ***850 Series Digital Power Control*** technology. The installation of four 853, three phase, digital AC power controllers resulted in a number of measurable benefits for the Customer. For the process evaluated, these included a:

- ***5% reduction in monthly utility power costs***
- ***17.5% improvement in Power Factor***
- ***66% reduction in total voltage harmonic distortion***
- ***53% reduction in total current harmonic distortion***
- ***reduction in Radio Frequency Interference (RFI)***
- ***virtual elimination of peak power fluctuations***

Convinced of tangible benefits from the controls upgrade, the Customer isolated the process, conducted comparative process measurements and calculated the cost benefits from the use of the Spang ***853 Digital Power Controllers***. The result…..over $2000/mo. savings which justified a ***three month payback on the investment!***

853 Digital SCR Power Controller

The Product

The Spang ***853 Digital Power Controller*** is a state-of the-art three phase AC power controller built around digital micro-processor technology. The processor power and flexibility allow Users to:

- ***integrate power control into automation systems***
- ***software select operating modes***
- ***connect to communication networks***
- ***optimize processes***
- ***enhance process reliability and troubleshooting***

The ***853 Digital Power Controllers*** offers the opportunity to convert existing power controllers to ***Synchronous (Zero Cross)*** mode firing into a ***transformer coupled*** resistive heater load. This obsoletes the traditional need to power transformer coupled loads with phase angle controllers. Since many industrial heater applications require transformers the advantages are significant with the ***853 Digital power Controller.***

For this application, the power controllers were furnished:

- as three phase 350AAC units
- w/integral Local Digital Controls
- w/MODBUS connectivity to an Automation Direct PLC
- Fuseless design (eliminate I^2T fusing)
- 4-20ma analog input for temperature control

Background

The Customer produces a furnace processed product and chose to expand capacity, adding two identical furnaces equipped with Spang's digital power controller. The use of the ***853 Digital Power Controller*** provided an upgrade that could be operated initially, in Phase Angle mode (the historical method of control), and later reprogrammed to Zero Cross mode (the desired method of control). This flexibility facilitated the comparison of process quality and power cost levels. The specific ratings for the power systems in installed by the Customer in each of the four zones are listed below:

Input Voltage	480	VAC
Output Voltage	45	VAC
Output Current	2566	AAC
Power Rating	200	kW

The two furnaces each contain two ~200kW zones for a total of 800kW. When fully functioning, these furnaces represent ~50% of the total facility power consumption. The installation utilized identical power systems for each of the zones. Each zone included an 853 Digital SCR Power Controller and an output transformer feeding the resistive heating elements.

The Analysis

The benefits analysis was based on the direct comparison of phase angle to zero cross process heater control. Key to quantifying the benefits from the use of the digital power controller were accurate process measurements. A SquareD

POWERLOGIC Series 3000 circuit monitor installed on the primary feed for the facility was used to measure the power parameters. Initially, all zones were controlled in the phase angle fired mode and measurements recorded for the total process. Each zone was sequentially reconfigured to zero cross mode and measurements of the same parameters taken at each stage. A summary of the data is provided in the table below:

Condition	KW	KVA	PF
Start	827	1170	0.706
Zone #1 zero crossover	830	1120	0.740
Zone #2 zero crossover	832	1070	0.780
* Zone #3 zero crossover	938	1172	0.800
* Zone #4 zero crossover	927	1116	0.830
*Loads in addition to the furnace loads were powered ON during this phase of the measurements			

The data illustrates that the KW requirements remained constant while the KVA demand reduced substantially. A corresponding increase in power factor (PF) occurred at each stage.

The cost impact of this change in control mode depended on the power costs actually charged to the Customer. Following are the power consumption rate schedule applied to the facility by the utility company:

Description	Rate($)	Per
Generation – Energy	0.01968	KWH
Generation – Capacity	4.995	KVA
Transmission	2.23	KVA
Distribution	2.774	KVA
Transition – Energy	0.00527	KWH
Transition – Capacity	1.212	KVA
Loss Charges – Energy	0.00187	KWH
Loss Charges – Capacity	0.43	KVA
Total KWH Charge	0.02682	KWH
Total Demand Charge (kVA)	11.641	KVA

The energy cost analysis illustrated below is based on one month of continuous operation at a base load of 900KW. This analysis assumes all four zones running in either phase angle or zero cross mode.

Description	Phase Angle	Zero Crossover
KW	900	900
Hours	720	720
KWH	648,000	648,000
Cost of KWH	$17,379.36	$17,379.36
PF	0.706	0.830
KVA	1,275	1,084
Demand Cost (kVA)	$14,842.28	$12,618.84
Total Cost	$32,221.64	$29,998.20
Savings per month		$2,223.43

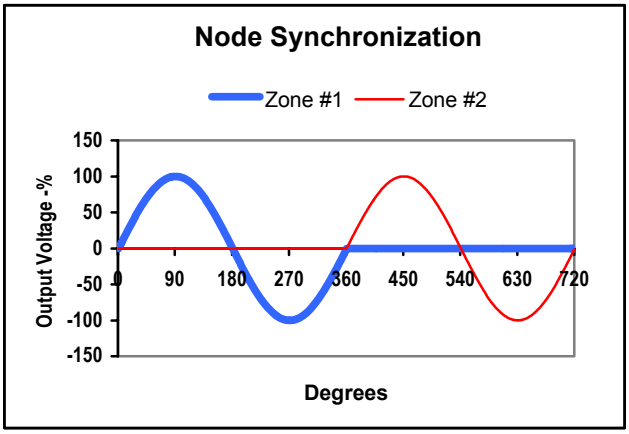
Zero Crossover Energy Savings
$ 2,223/month

Other process and power consumption benefits were measured as a result of the transition from phase angle to zero cross control. Total harmonic distortion (THD) was reduced on the system. The table below shows the THD for both voltage and current as each zone was changed from phase angle to zero cross control mode.

Condition	Voltage THD	Current THD
Start	4.3%	17.2%
Zone #1 zero crossover	3.5%	15.3%
Zone #2 zero crossover	2.7%	13.5%
* Zone #3 zero crossover	1.8%	10.7%
* Zone #4 zero crossover	1.5%	9.1%
*Loads in addition to the furnace loads were powered ON during this phase of the measurements		

The flexibility of the ***853 Digital Power Controller*** allows the User to minimize power peaks associated with multiple zones of heater control, when firing in unison in zero cross mode. Firing in unison can elevate power peaks causing power dips, commonly seen as flickering lights.

The ***853 Digital Power Controller*** provides the functionality of ***node synchronization*** for multi-zone applications. Multiple units can be configured to fire at specific times, exclusive of network connections. For example, two zones operating at 50% are each ON for one cycle; Zone #1 during the first cycle and the Zone #2 during the second cycle. This is illustrated in the graph below. The resultant power draw from the distribution system is constant and peak power fluctuation zero.



Applying this technique to multiple zero crossover units minimizes the power fluctuation to acceptable levels.

Arrange for the use of an 850 Series Digital Power controller demo unit to evaluate energy savings and other benefits in your application. Contact:

Spang Power Electronics

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