Voltage Control Guard One

White Paper

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Abstract

The Voltage Control Guard One provides for lower home or business energy consumption through stabilization of the neutral-grounding system. The Voltage Control Guard One is applicable in single and multi-phase building power systems that do not employ their own dedicated substation.

GiG^2

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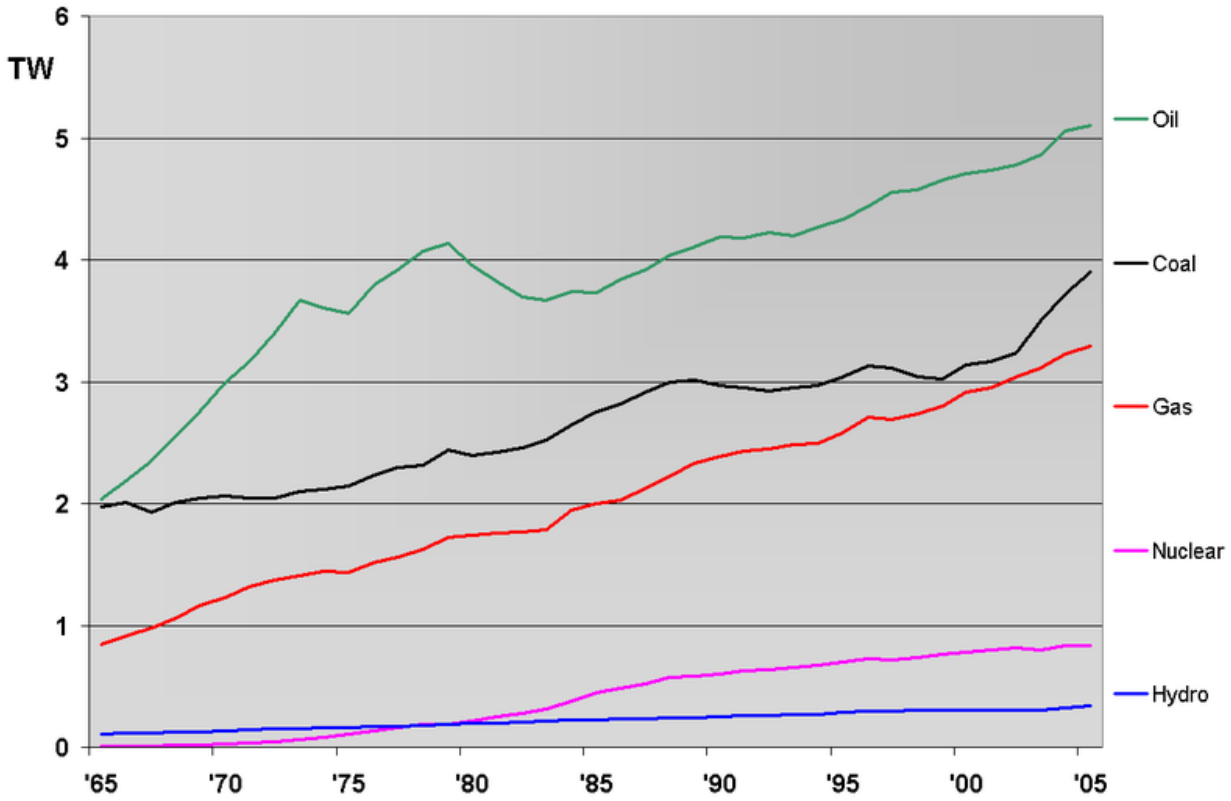
Introduction

GIG^2 is excited to present the Voltage Control Guard. Energy conservation is an ever increasing priority. Energy costs continue to increase as a result of higher levels of demand on limited energy production resources. The Voltage Control Guard has been shown to decrease energy usage and therefore monthly electric bills in residential, commercial, and light industrial applications. GIG^2 single-phase residential customers are regularly seeing reduction in electrical usage, measured in Kilowatt hours, ranging from 15 to beyond 25 percent. Commercial and light industrial customers using three-phase power systems are recognizing savings of 5 to over 20 percent. In most cases this corresponds to similar percentage savings in the monthly cost of electricity.



World Energy Consumption (TerraWatts)

Effects on Local and Neighborhood Distribution Systems

Extensive testing has been done to determine if the Voltage Control Guard One negatively impacts the local power distribution system within a structure or the wider distribution network serving neighboring buildings.

Impact on Total Harmonic Distortion

The Voltage Control Guard One has been tested in both single phase and three phase applications to determine if the total harmonic distortion is affected. Testing using an Extech 382905 capable of measuring to the 99^{th} harmonic has shown that the total harmonic distortion does not change with the application of the Voltage Control Guard One. This was true for both systems with high levels of total harmonic distortion due to the presence of a large number of non-linear loads, and systems that employed a higher number of resistive loads and therefore had lower total harmonic distortion.

Impact on Power Factor

Power factor testing was performed using the Extech 382905 on both three-phase and single phase systems with varying loads and real world power factors with and without the Voltage Control Guard One. No change was observed in the measured power factor when the Voltage Control Guard One was added to the circuit.

Independent Lab Correlation

Independent Testing Results

The data presented in the tables below was created based upon 3rd party independent testing done at the request of some of our more skeptical potential customers. The analysis of the results presented below shows that the Voltage Control Guard One does, indeed, save electrical power. The testing here shows savings of 4.84% and 5.00%. This testing documents that the Total Harmonic Distortion and Power Factor were not adversely affected. These results come from a 240V three phase light-industrial / commercial environment without the benefit of installation by a trained GIG[2] installer and could likely be improved upon.

Table One Readings

		Without	With
Voltage	Phase A	121.1	120.9
	Phase B	122.6	122.1
	Phase C	121.9	120.7
	Neutral	0.44	0.47
Current	Phase A	14.4	12.9
	Phase B	21.7	21.3
	Phase C	14.8	14.7
	Neutral	7.7	7.3
Voltage THD	Phase A	5.60%	5.60%
	Phase B	5.80%	5.90%
	Phase C	5.60%	5.70%
	Neutral	--	--
Current THD	Phase A	6.40%	6.40%
	Phase B	4.40%	5.20%
	Phase C	9.20%	9.30%
	Neutral	--	--
Power Factor	Phase A	1	1
	Phase B	0.99	0.98
	Phase C	1	1

GIG2 Calculations

	Without	With	Delta	Percent
Power Phase A	1743.84	1559.61	184.23	10.56%
Power Phase B	2633.816	2548.715	85.1004	3.23%
Power Phase C	1804.12	1774.29	29.83	1.65%
Total Power	6181.776	5882.615	299.1604	4.84%
Savings		**4.84%**		

Table Two Readings

		Without	With
Voltage	Phase A	121.1	121
	Phase B	121.3	121.2
	Phase C	122.2	122.5
	Neutral	0.58	0.31
Current	Phase A	33.1	31.8
	Phase B	23.8	23.4
	Phase C	45.7	41.8
	Neutral	18.3	15.1
Voltage THD	Phase A	5.60%	5.60%
	Phase B	5.70%	5.70%
	Phase C	5.90%	6.00%
	Neutral	--	--
Current THD	Phase A	6.20%	5.90%
	Phase B	11.10%	10.60%
	Phase C	6.90%	6.40%
	Neutral	--	--
Power Factor	Phase A	0.99	0.99
	Phase B	0.99	0.99
	Phase C	0.99	1

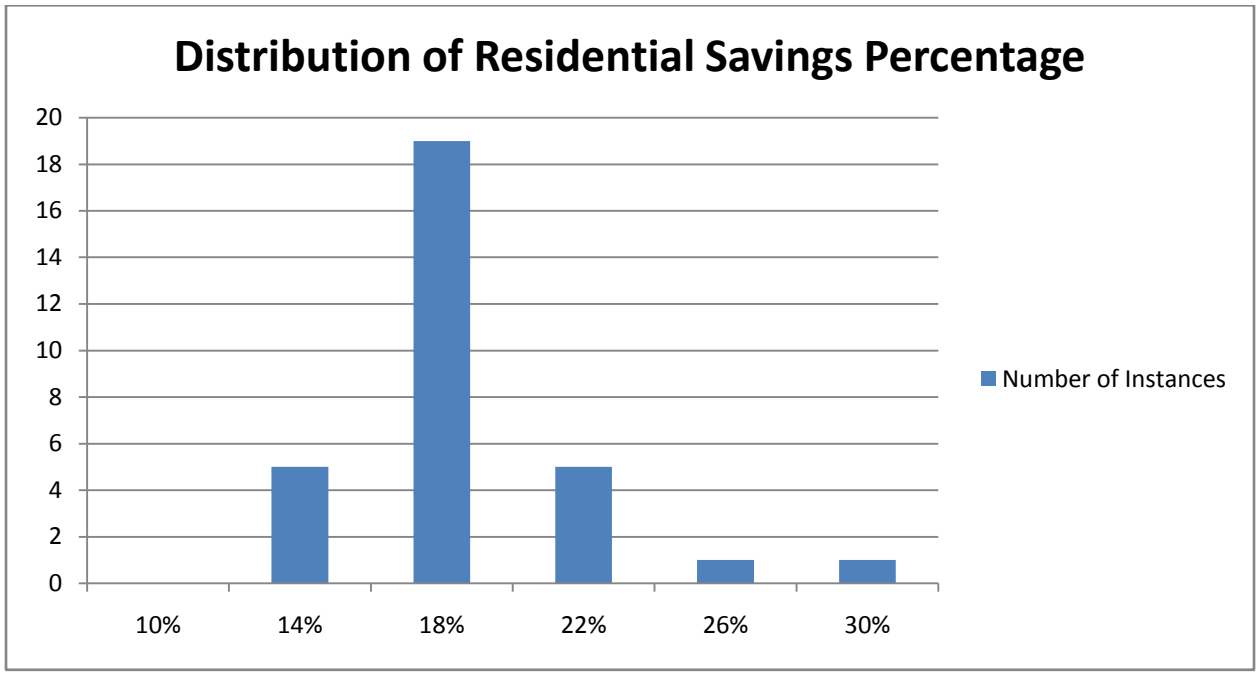
GIG2 Calculations

	Without	With	Delta	Percent
Power Phase A	3968.326	3809.322	159.0039	4.01%
Power Phase B	2858.071	2807.719	50.3514	1.76%
Power Phase C	5528.695	5120.5	408.1946	7.38%
Total Power	12355.09	11737.54	617.5499	5.00%
Savings		**5.00%**		

Field Data

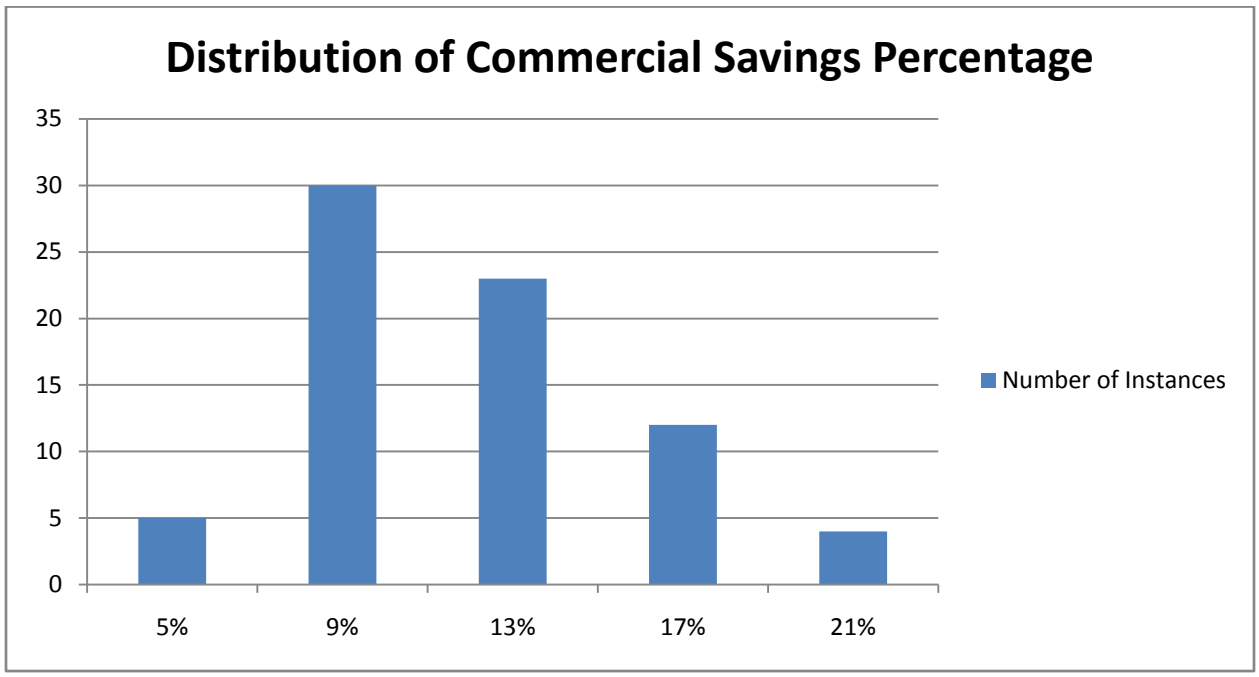
Residential Field Data

Field testing has demonstrated the effectiveness of the Voltage Control Guard at saving electrical power in residential, 120/240 volt, single-phase, applications. The data below represents the average monthly energy savings in percentage consumed for residential customers who have installed the Voltage Control Guard.



Commercial Field Data

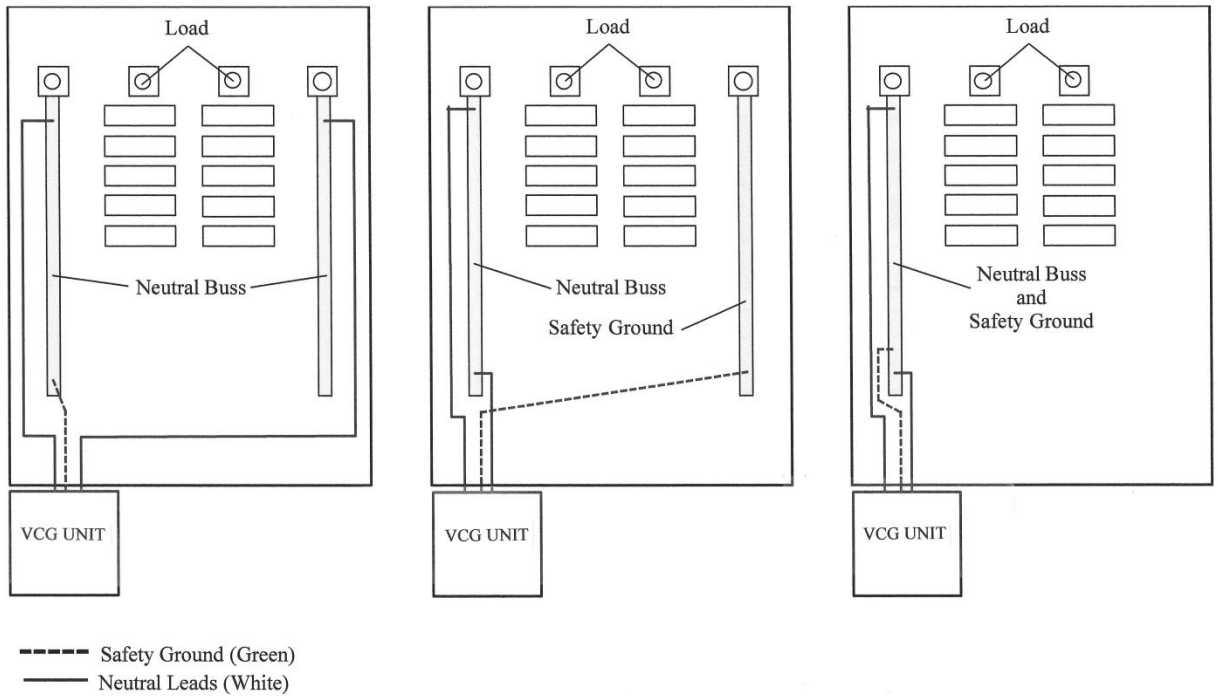
The results of testing in commercial and light industrial applications are depicted below. The effectiveness of the Voltage Control Guard in 240/480 volt, three-phase applications shows results ranging from 5 to over 20 percent.



Optimal Installation

GIG[2] has repeatedly observed that the effectiveness of the Voltage Control Guard is highly dependent on optimal installation of the device. Optimal installation will ensure the proper amount of neutral current flows through the Voltage Control Guard.

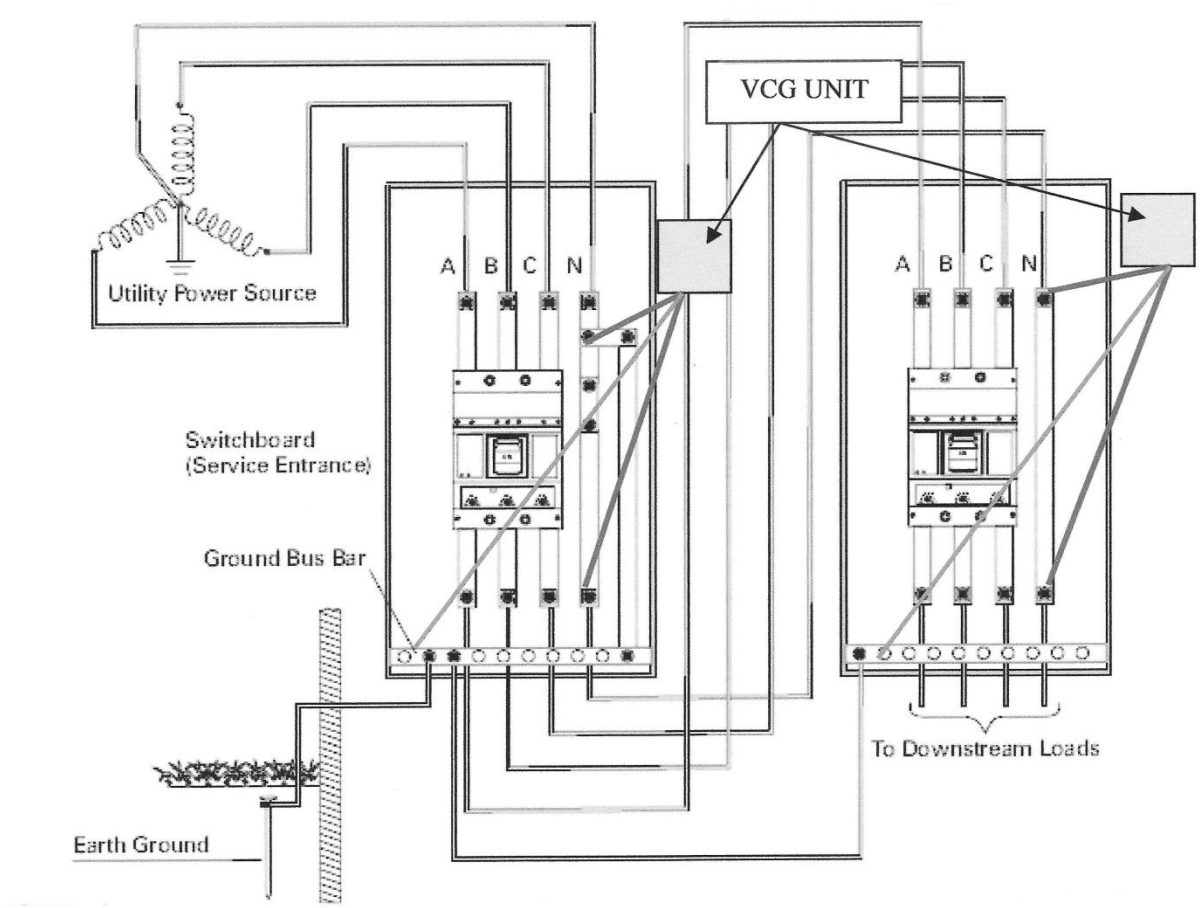
Optimal Single Phase Installation



As can be seen on the installation diagrams above, the Voltage Control Guard and the neutral bus bar form a current divider. The current flowing in the incoming neutrals from the loads is divided between the neutral bus bar and the Voltage Control Guard unit while trying to "exit" the building at the service connection lug. Thus the installer must apply some level of analysis to ensure that adequate current is forced through the Voltage Control Guard as described in the introduction to this section.

Additionally, it should be noted that the earth ground (green wire) forms a parallel circuit for neutral current to return to the substation or local step-down transformer. In properly "neutraled" systems the amount of current flowing through the earth ground is insignificant when compared with the neutral wire or Voltage Control Guard.

Optimal Installation in Three Phase Applications



Similarly to the single phase application, in three phase applications the Voltage Control Guard and the neutral bus bar form a current divider. Although the goal remains to obtain an optimal level of current in the Voltage Control Guard, it is often times difficult to obtain the same magnitudes seen in residential applications. This is due to the fact that most industrial three phase power systems are expressly designed with neutral current minimization as a key parameter. However our results show that three phase applications can still receive beneficial results through the reduction of energy consumption and power spending.