A Comprehensive Comparison of AC Surge Suppression Technologies

Surgex vs Juice Goose

Tests Conducted from
August, 2011 to January, 2012

Report Compiled
June, 2012

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The Tests

The following tests were conducted over an extended period using three different types of measuring equipment and three different methodologies. The test processes were scientific. Although several of the tests were conducted over several days and, therefore, technically in different environments, the results of the tests are consistent and plausible.

Juice Goose in no way challenges or refutes any performance claims made by Surgex regarding the performance of their products and welcomes any additional information or data which can contribute to a more enlightened comparison and application of AC power conditioning and surge suppression technologies.

Oneac OneGraph - September and November 2011

Juice Goose technicians used an Oneac OneGraph power analyzer to record AC line disturbances over extended periods of time in order to judge the effectiveness of Juice Goose and Surgex AC surge protectors. While no pure control system was possible in this methodology, the process was unbiased and scientific and the results are meaningful. The OneGraph produces a running tape record of power line disturbances over seven to eight hour periods. (Oneac, a division of Chloride, was founded in 1979. It designs and manufactures single-phase and three-phase power conditioners, filters, uninterruptible power supplies, and communication line protectors.)

September 14 - 15, 2011 - On September 14, the OneGraph recorder was set up at the Juice Goose facilities to record a base line of power disturbance events. No intentional line noise was introduced nor was there any filtration or treatment of the power line leading into the recorder. A recording was made for each the normal mode (line - neutral) and common mode (neutral - ground). This recording (Exhibit 1) shows a high volume of normal mode surge events. Many of those events exceeded 10 volts. Non were recorded at dangerous levels.

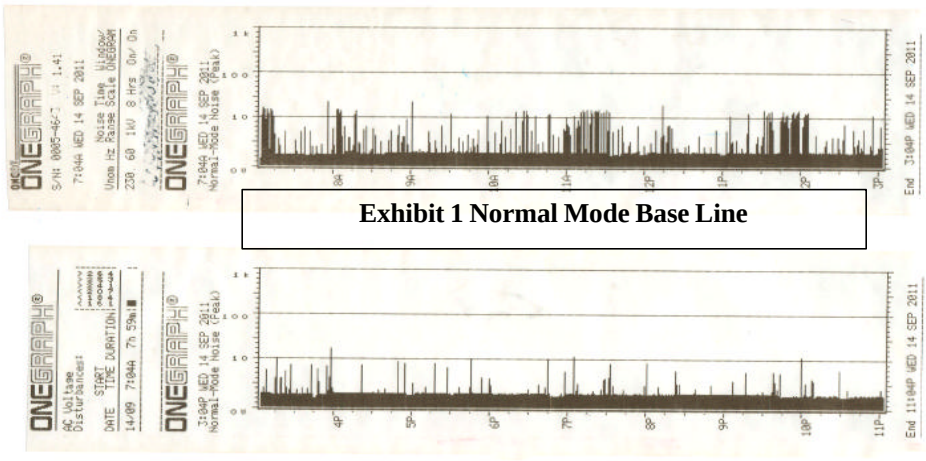


Exhibit 1 Normal Mode Base Line

At the same time a record was made of common mode (neutral - ground) line disturbances. Exhibit 2, below, shows a significant volume of ground line noise with some events exceeding the magnitude of those found between line and neutral.

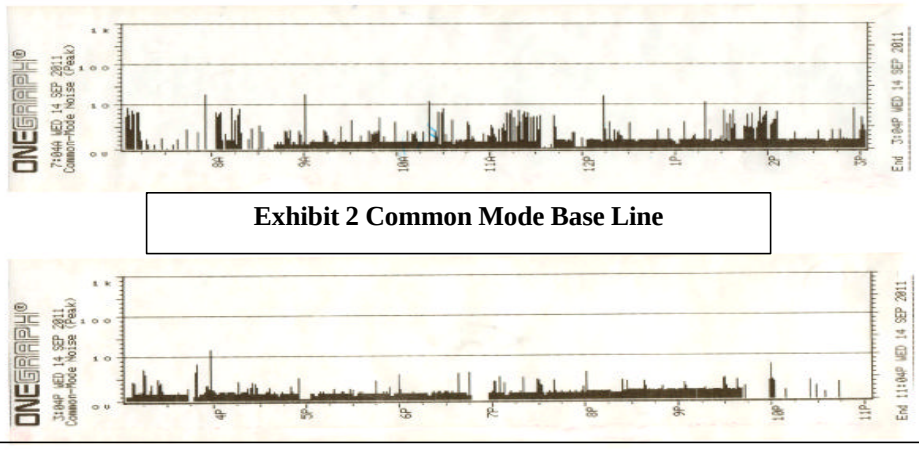


Exhibit 2 Common Mode Base Line

The next day, September 15, a similar set of recordings was made. This time the Juice Goose RX10-SCS was plugged into the wall before the OneGraph. All power recorded by the OneGraph passed through and was filtered by the Juice Goose RX10-SCS. Clearly fewer surge events reached the recorder. And, those that did were of lower magnitude. See Exhibit 3.

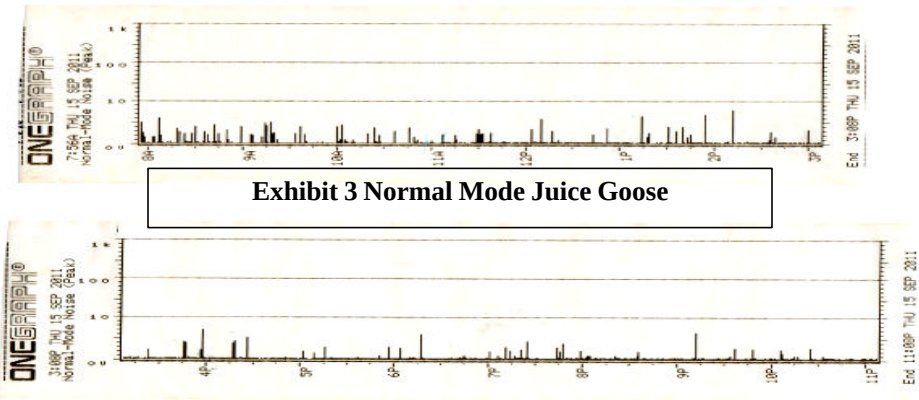


Exhibit 3 Normal Mode Juice Goose

Impressively, the OneGraph recorded no common mode, ground line disturbances when the RX10-SCS was used. See Exhibit 4

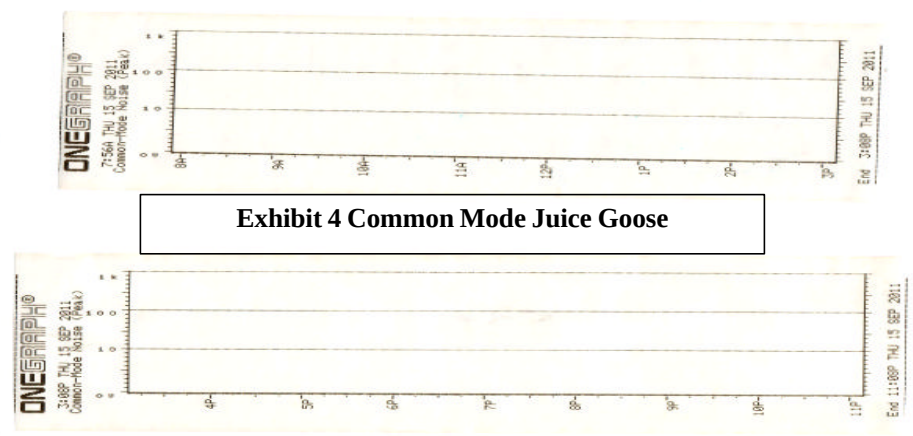
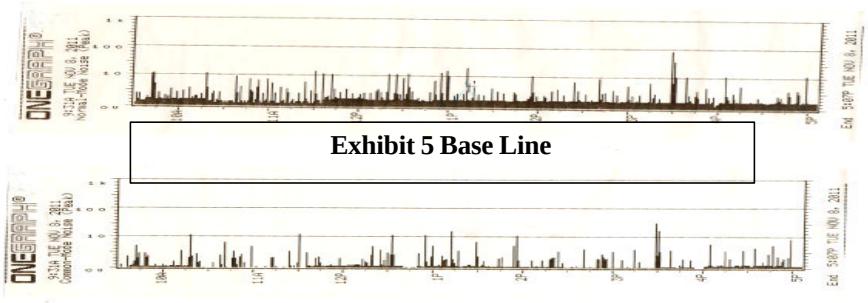
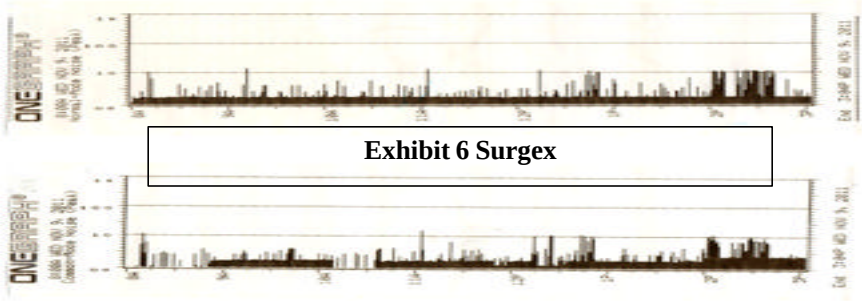


Exhibit 4 Common Mode Juice Goose

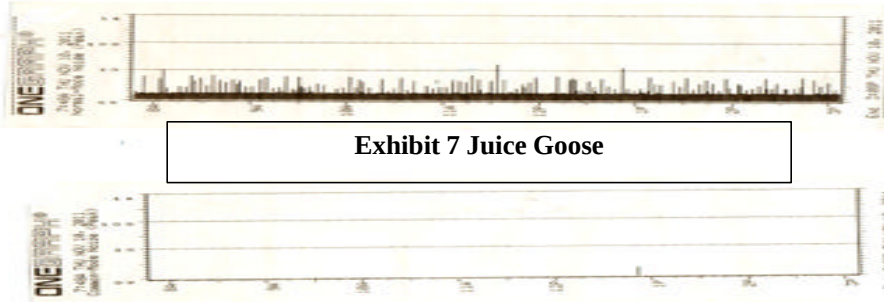
November 8 - 10, 2011 During a second round of tests using the OneGraph on November 8, 2011, a base line record was made, followed by two additional test periods, first using the Surgex SA-82, then using the Juice Goose RX10-SCS. Because these testing periods were shorter, both normal mode and common mode are shown in the same exhibit. The base line test (Exhibit 5) shows a good deal of surge activity, including one particularly impressive normal mode event registering approximately 100 volts over standard.



On November 9th, a similar surge event recording was made, this time plugging the OneGraph into a Surgex SA-82. All power recorded by the OneGraph was first passed through the Surgex device. The recording in Exhibit 6 shows a volume of line disturbances both on normal and common mode. Most of those were limited to 10 volts. A significant amount of common mode ground noise was recorded.



On November 10th, the Juice Goose RX10 was installed in the test in place of the Surgex SA-82 and the recorder was set to run for the same period of time. See Exhibit 7. The OneGraph shows a marked reduction in normal mode AC line disturbances. The recorder picked up no trace of common mode line noise on the ground.



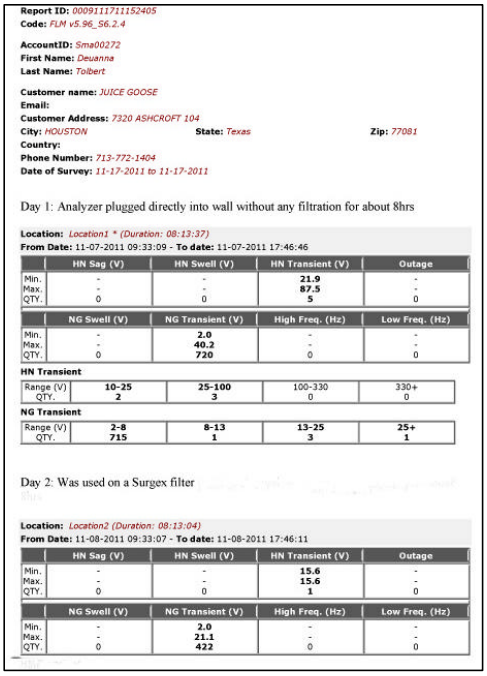
Power Quality Analyzer Tests - November 2011

Smart Power is a Houston based electrical equipment development company. Juice Goose called on them to help conduct a series of tests regarding the efficacy of power conditioning and surge protection products. The first tests were conducted at Juice Goose's facility on November 7 - 9 using the Smart Power, *Power Quality Analyzer*. When plugged into a wall, that device records the number of normal and common mode AC line surges over a period of time and reports that data sorted by the voltage magnitude of those events.

The *Power Quality Analyzer* recorded data for approximately eight hours in each of three cases, one with no filtration (base line) and one each measuring the performance of the Surgex SA-82 and the Juice Goose RX10-SCS. Data collected by the analyzer were then downloaded by Smart Power who compiled the following report, dated November 17. See Exhibit 8.

The November 7 unfiltered **Base Case** report shows five normal mode surges between 21.0 and 87.5 volts. During the Base test period there were seven hundred twenty common mode, ground line surges between 2.0 and 42.2 volts. The **Surgex** test was conducted on November 8. It shows one normal mode surge measuring 15.6 volts. There were also four hundred twenty two common mode surges in a range from 2.0 to 21.1 volts. On November 9 that test was repeated for the **Juice Goose** line filter. That test shows no recorded surge events on either hot, neutral or ground.

Exhibit 8
Normal & Common
Base, Surgex and Juice Goose



Report ID: *0009111711152405*
Code: *FLM v5.96_S6.2.4*

AccountID: *Sma00272*
First Name: *Deuanna*
Last Name: *Tolbert*

Customer name: *JUICE GOOSE*
Email:
Customer Address: *7320 ASHCROFT 104*
City: *HOUSTON* **State:** *Texas* **Zip:** *77081*
Country:
Phone Number: *713-772-1404*
Date of Survey: *11-17-2011 to 11-17-2011*

Day 1: Analyzer plugged directly into wall without any filtration for about 8hrs

Location: *Location1 * (Duration: 08:13:37)*
From Date: 11-07-2011 09:33:09 - **To date:** 11-07-2011 17:46:46

	HN Sag (V)	HN Swell (V)	HN Transient (V)	Outage
Min.	-	-	**21.9**	-
Max.	-	-	**87.5**	-
QTY.	0	0	**5**	0

	NG Swell (V)	NG Transient (V)	High Freq. (Hz)	Low Freq. (Hz)
Min.	-	**2.0**	-	-
Max.	-	**40.2**	-	-
QTY.	0	**720**	0	0

HN Transient

Range (V)	10-25	25-100	100-330	330+
QTY.	**2**	**3**	0	0

NG Transient

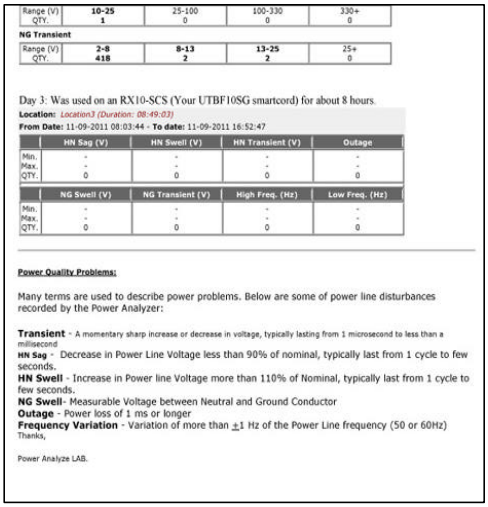
Range (V)	2-8	8-13	13-25	25+
QTY.	**715**	**1**	**3**	**1**

Day 2: Was used on a Surgex filter

Location: *Location2 (Duration: 08:13:04)*
From Date: 11-08-2011 09:33:07 - **To date:** 11-08-2011 17:46:11

	HN Sag (V)	HN Swell (V)	HN Transient (V)	Outage
Min.	-	-	**15.6**	-
Max.	-	-	**15.6**	-
QTY.	0	0	**1**	0

	NG Swell (V)	NG Transient (V)	High Freq. (Hz)	Low Freq. (Hz)
Min.	-	**2.0**	-	-
Max.	-	**21.1**	-	-
QTY.	0	**422**	0	0



Range (V)	10-25	25-100	100-330	330+
QTY.	**1**	0	0	0

NG Transient

Range (V)	2-8	8-13	13-25	25+
QTY.	**418**	**2**	**2**	0

Day 3: Was used on an RX10-SCS (Your UTBF10SG smartcord) for about 8 hours.

Location: *Location3 (Duration: 08:49:03)*
From Date: 11-09-2011 08:03:44 - **To date:** 11-09-2011 16:52:47

	HN Sag (V)	HN Swell (V)	HN Transient (V)	Outage
Min.	-	-	-	-
Max.	-	-	-	-
QTY.	0	0	0	0

	NG Swell (V)	NG Transient (V)	High Freq. (Hz)	Low Freq. (Hz)
Min.	-	-	-	-
Max.	-	-	-	-
QTY.	0	0	0	0

Power Quality Problems:

Many terms are used to describe power problems. Below are some of power line disturbances recorded by the Power Analyzer:

Transient - A momentary sharp increase or decrease in voltage, typically lasting from 1 microsecond to less than a millisecond
HN Sag - Decrease in Power Line Voltage less than 90% of nominal, typically last from 1 cycle to few seconds.
HN Swell - Increase in Power line Voltage more than 110% of Nominal, typically last from 1 cycle to few seconds.
NG Swell- Measurable Voltage between Neutral and Ground Conductor
Outage - Power loss of 1 ms or longer
Frequency Variation - Variation of more than ±1 Hz of the Power Line frequency (50 or 60Hz)
Thanks,

Power Analyze LAB.

Surge Generator Tests - Common Mode, August 2011

In August, 2011 Smart Power performed a series of sophisticated laboratory tests to determine how much power surge would travel along the ground path (common mode) through the **Surgex** and **Juice Goose** surge protectors. Both components were subjected to an IEEE 62.41 Category A, 3,000 volt / 200 amp ring wave.

The **Surgex SA-82** had little effect on the ground line, allowing a 2,620 volt surge, as shown on line "M" on Exhibit 9. Lines "3" and "4" show peak current on the ground line as 131 amps. When a similar test was conducted in March, 2004 a 1,000 volt surge to the Surgex Model SX-908 allowed a 855 volt pass through.

Exhibit 10 shows results of the August, 2011 test results applied to the **Juice Goose RX10-SCS**. The maximum ground line power surge was 8.98 volts and 3.0 amps. In March, 2004 the Juice Goose devices passed only 0.2875 volts when subjected to a 3,000 volt common mode ring wave surge.

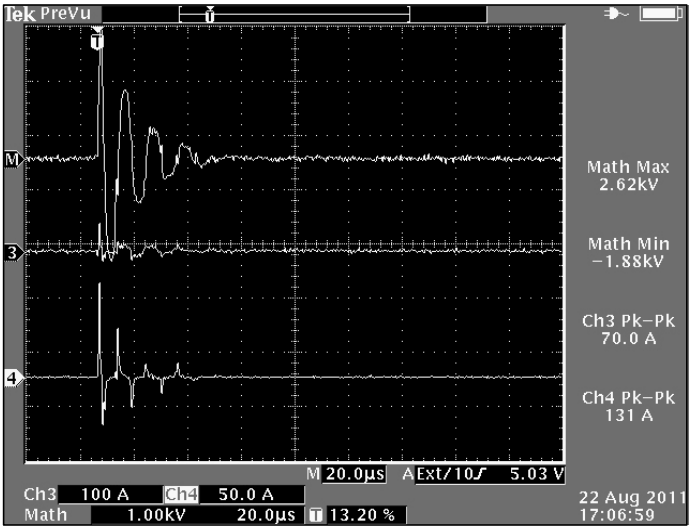


Exhibit 9
Common Mode
Surgex

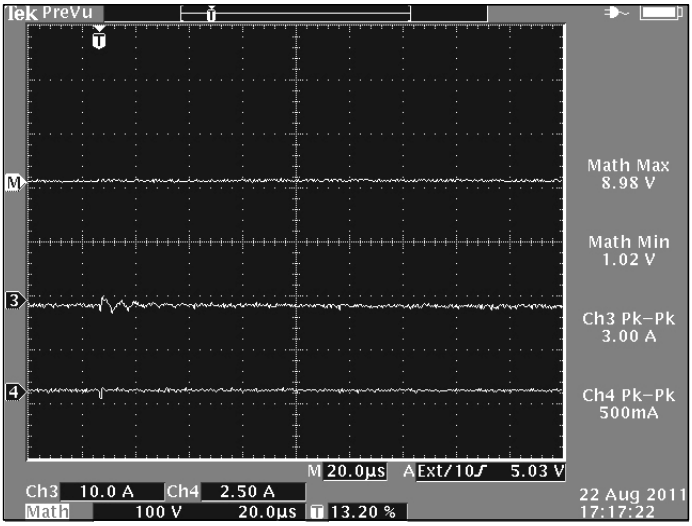


Exhibit 10
Common Mode
Juice Goose

Surge Generator Tests - Normal Mode, January 2012

In January, 2012 Juice Goose called on Smart Power to conduct laboratory tests to determine the levels of normal mode protection provided by products from **Surgex** and **Juice Goose**. The tests created a standardized, high amplitude surge, introduced it into a surge protector and measured the output using a precise oscilloscope with screen capture capability. In the tests results shown below, both components were subjected to an IEEE 62.41 Category A, 6,000 volt / 500 amp ring wave.

When the **Surgex SA-82** was subjected to that power pulse between line and neutral (normal mode), the resulting surge output was measured at a maximum of 80.0 volts. Previous tests conducted in March, 2004 on the Surgex Model SX-908 resulted in a normal mode pass through surge of 192.0 volts when subjected to a similar ring wave. Surge output from the **Juice Goose RX10-SCS**, when subjected to the same January, 2012 pulse was a maximum of 14.0 volts. The surge output in March, 2004 was 3.7 volts.

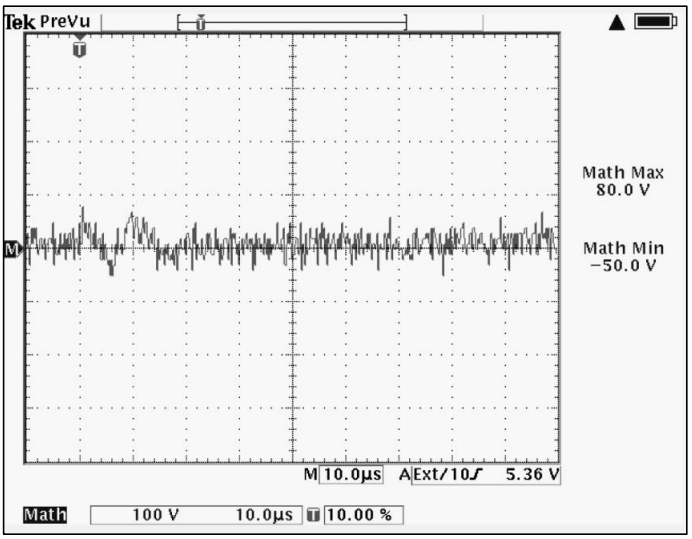


Exhibit 11
Surgex

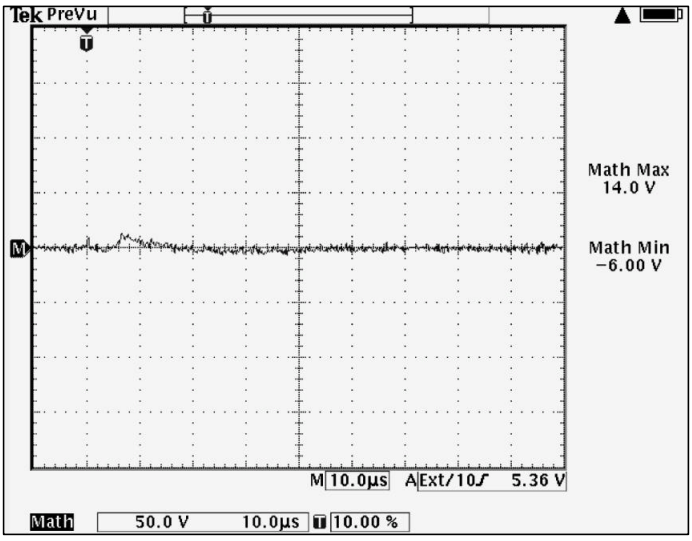


Exhibit 12
Juice Goose