

JOINT SERVICE POWER EXPO

2009

CLARY CORPORATION

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*CRITICAL POWER NEEDS TO EFFECTIVELY
MAINTAIN CONTROL & COMMUNICATIONS
FOR LIFE & SAFETY IN BOTH COMBAT
AND NON COMBAT CONDITIONS*

ELECTRICAL POWER



Basic Electrical Power is an essential element for all military operations regardless of command or country .

Loss of power as well as bad power causes all critical systems including logistics and weapons systems to fail.

From the military perspective, electrical power encompasses the entire spectrum of portable sources as well as primary power generation, and distribution systems that support all facets of military operations.

Command, control, communications and Intelligence functions are all highly reliant on clean and reliable power. The growing dependence on electricity is a continual increase in the quantity and quality of power to all support operations.

The need for power availability is critical-----but the need for power protection is just as critical and is paramount to the power source in many applications.

MILITARY POWER SOURCING



- *Military power ranges from the power produced by a civilian primary generation system or grid to stand alone military prime generation systems ranging from 0.5 kilowatt generators to 800 kilowatt generator systems.*
- *Complete portability and self containment are critical to all tactical as well as non-tactical systems.*
- *In addition to these typical power sources, greatly increased requirements have surfaced for man portable battery systems for the increased sophistication of soldier carried combat electronics.*
- *Vehicular and shipboard power systems present new and different challenges and new specialized power protection systems.*



MILITARY POWER SOURCING



- *Substantial research is being conducted and in field trials for man power packs to power battlefield electronics.*
- *Promising designs of miniaturized fuel cells sourced with methanol are being field tested today.*
- *In addition, a lightweight water-based fuel cell system is being field tested.*
- *Battery technology is of prime importance for hundreds of man pack applications as well as thousands of field and naval applications.*
- *Lithium, lithium-ion, zinc-air, nickel-metal hydride, technology is growing rapidly in addition to lead-acid, carbon-graphite, zinc-carbon & zinc-chloride dry cells₅*

MILITARY POWER SOURCING



- *Present use of lithium sodium dioxide batteries is wide spread. Five to 10 years ago a soldier would consume 3 to 4 watts of power on a typical mission.*
- *Today, we are seeing numbers as high as 20/25 watts of power on a mission.*
- *To provide his 20 watts, a soldier carry as many as 8 2.2 lb LSD batteries in addition to smaller alkaline batteries for a total of about 20 lbs, more than his rifle ammo.*
- *New technologies such as Lithium carbon monofluoride and lithium manganese dioxide are showing promise.*

MILITARY POWER SOURCING



- *The advent of fuel cells research covers a wide spectrum of applications from the miniaturized versions for laptop computers to large systems to power hybrid vehicles, to straight electrical power generation for tactical as well as non-tactical operations.*
- *Fuel cell power is clean, easily regulated and totally self contained, no moving parts.*
- *While this is a promising technology with significant testing both in the lab and the field being done by the military as well as the civilian communities, it still is expected to be some years before it will become a significant source of power to the world.*

COTS vs MIL SPEC



- *In the early 1990's our political system decided that the military could more effectively upgrade all of its computer, electrical and electronic needs by utilizing COTS (commercial of the shelf) equipment to replace MIL SPEC components and more quickly upgrade electronics & computer equipment at a cost savings.*
- *It was ultimately found that this equipment had to be modified to work effectively in a military environment. There was some savings, however, MIL SPEC's were shown to still be needed and much modifications were required.*
- *MIL SPEC's must still be met and are required.*

POWER PROTECTION REQUIREMENTS



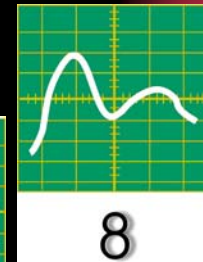
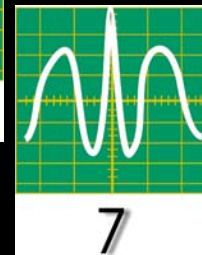
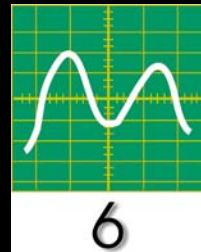
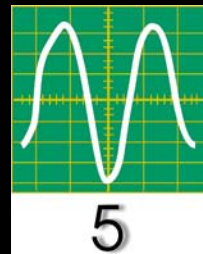
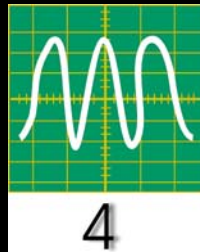
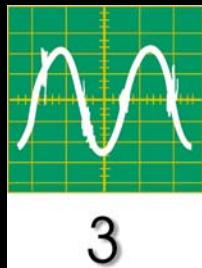
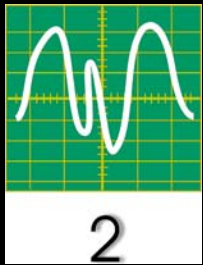
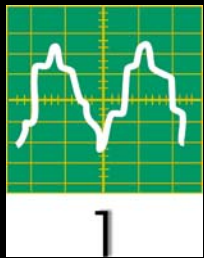
- *While many power sources are required for the military, power protection is just as critical.*
- *Power protection is most critical to infrastructure, vehicle and naval shipboard applications.*
- *The increased sophistication of the computer systems utilized by all services required increased sophistication of power protection and uninterruptible power systems.*

THREE CRITICAL POWER POINTS



- *RELIABLE Power-----Is CRITICAL to effectively maintain control and communications for life and safety.*
- *Power CAPACITY-----Is CRITICAL because power generation being from unknown sources or varied self contained generator systems that have unknown regulation capabilities.*
- *QUALITY Power----Is CRITICAL because of increased sophistication of equipment. Bad power decreases reliability, and increases damaged equipment as well as replacement costs for damaged equipment.*

The NINE greatest power quality problems



1 Frequency & Harmonics

2 Transients

3 Line Noise

5 Power Surges

6 Brownouts Sags

7 Spikes

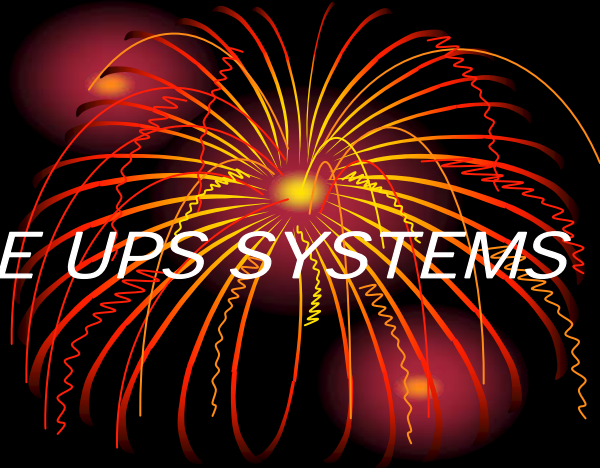
8 Overvoltage

9. Power Failure

POWER PROTECTION & UPS SYSTEMS



- *Spike and surge suppression is first basic protection device utilized. This system is inexpensive and provides minimal protection.*
- *Battery Backup Systems similar to APC products are part time protection, providing power only when utility power is lost.*
- *Uninterruptible Power Systems (UPS) are the only full time protection, providing clean regulated power to all loads, at all times.*



BATTERY BACKUP vs TRUE ONLINE UPS SYSTEMS

- *Available Power Protection for Computer & Electronic Systems is achieved by--- Multiple types of power protection systems.*
- *First there is the basic--- BATTERY BACKUP (BBS) system. This is least expensive system that only provides power from its batteries when utility power is lost. This is a standby LINE-INTERACTIVE design concept. This is only ----PART TIME protection*
- *The second is a reverse conversion/bidirectional design which is a hybrid (BBS) design that still provides only PART TIME protection.*
- *The third is the ONLINE DUAL CONVERSION UPS SYSTEM. This is the ONLY-FULL TIME protection design for all operational systems.*

LINE INTERACTIVE BATTERY BACKUP SYSTEM



- *NO Real-Time Voltage Regulation or conditioning*
- *Inverter ONLY Functions When Utility Has Failed*
- *NO continuous power regeneration capability*
- *2-20ms Transfer Time*
- *Generator compatibility ONLY under special conditions*
- *Various types of sine wave power output – pure-square-stepped*
- *Load is NOT isolated from Utility Power*

TRUE Dual Conversion Real-Time ONLINE UPS



- *Always:*
 - *Isolates the Load From the Utility Input AC*
 - *Rectifies the Input AC to DC then through DC to AC inverter*
 - *Real-Time Power Factor Corrects to Unity: $pf=1$*
 - *Generates A True Clean Sine Wave Output With the Inverter continuously inline to all loads*
 - *Supplies Fully Regulated & Isolated Voltage To all Loads*
 - *Synchronizes to the Input Phase of utility power*
 - *Online mode sync to utility with no break, maintains timing*
 - *Zero Transfer Time*
 - *Compatible with mobile 120 V inverters*
 - *Battery charging system fully temperature compensated*
 - *Battery charging system independent of inverter₁₅*

KEY DIGITAL UPS SYSTEMS COMPONENTS



- *UPS is fully Programmable & Software Controlled*
 - *Controls all Calibration and Synchronization Circuits*
 - *Matches the Input and Output Frequencies (PLL)*
 - *Allows Safety and Manual Bypass to Function Correctly*
 - *Insures Constant, Clean and Regulated Output Voltage*
 - *Monitors & Protects Overloading*
 - *Monitors All Vital Statistics and Alarm Points*
 - *Controls, Monitors and Regulates All Operational Stages Within the UPS*
 - *Monitors and Corrects Utility input Power Factor*
 - *Provides full time LINE and LOAD Regulation*

VOLTAGE REGULATION

The Key To Effective Protection



- It is common knowledge that the greatest danger to hardware and software are daily power problems. A Bell Labs study has shown blackouts account for less than 5 % of power disturbances. The other 95 % is comprised of daily power problems like sags, surges, noise, brownouts and voltage/frequency deviations.*
- This “Power Pollution” wears and tears hardware and software, leading to premature failures and costly outages as well as major decreases in public safety.*

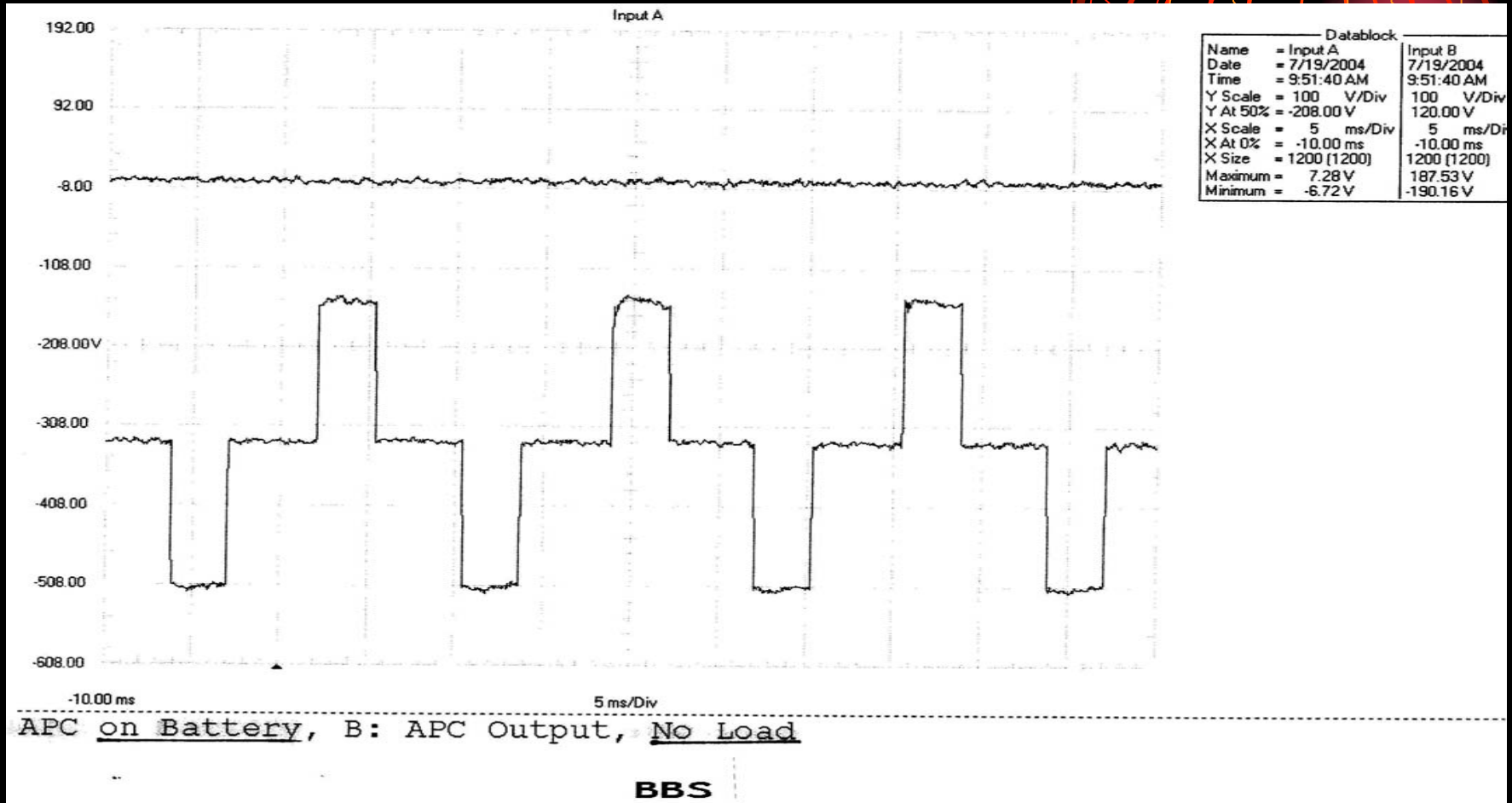
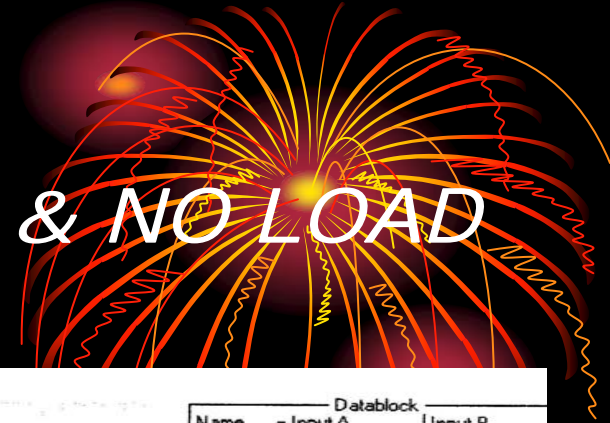
POWER WAVEFORM EXAMPLES



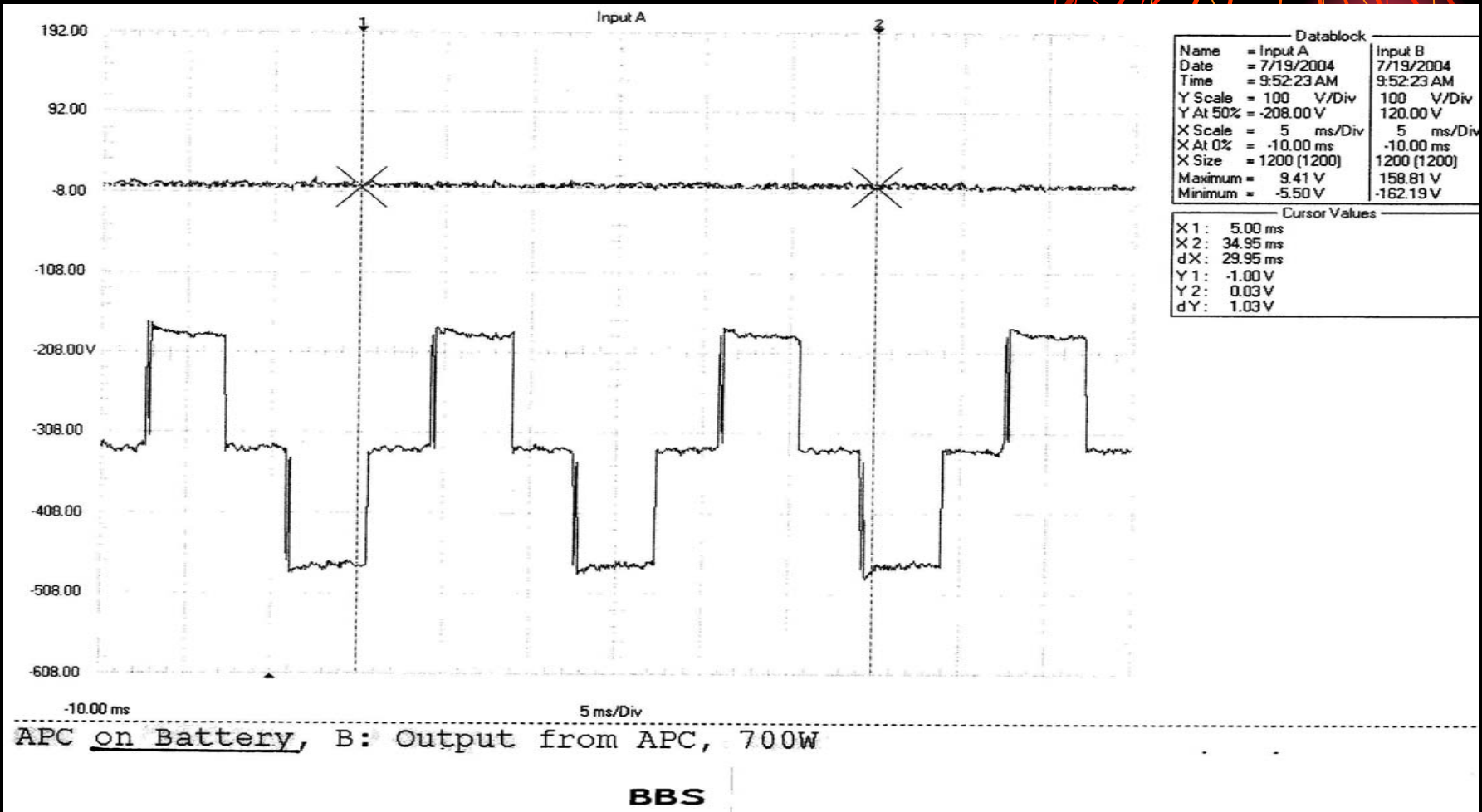
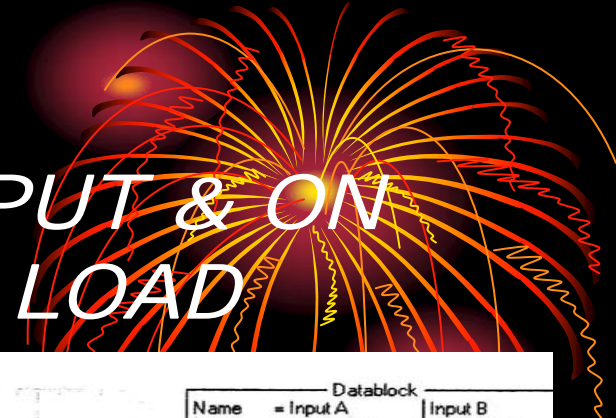
*1. The following slides are actual waveforms which show dirty or bad power sources as input to a **ONLINE UPS** system and the resultant **CLEAN-REGULATED** power output from the UPS.*

*2. Additional waveform examples show the relationship of dirty or bad power and the effects of using a typical **BBS-Line** interactive system for protection.*

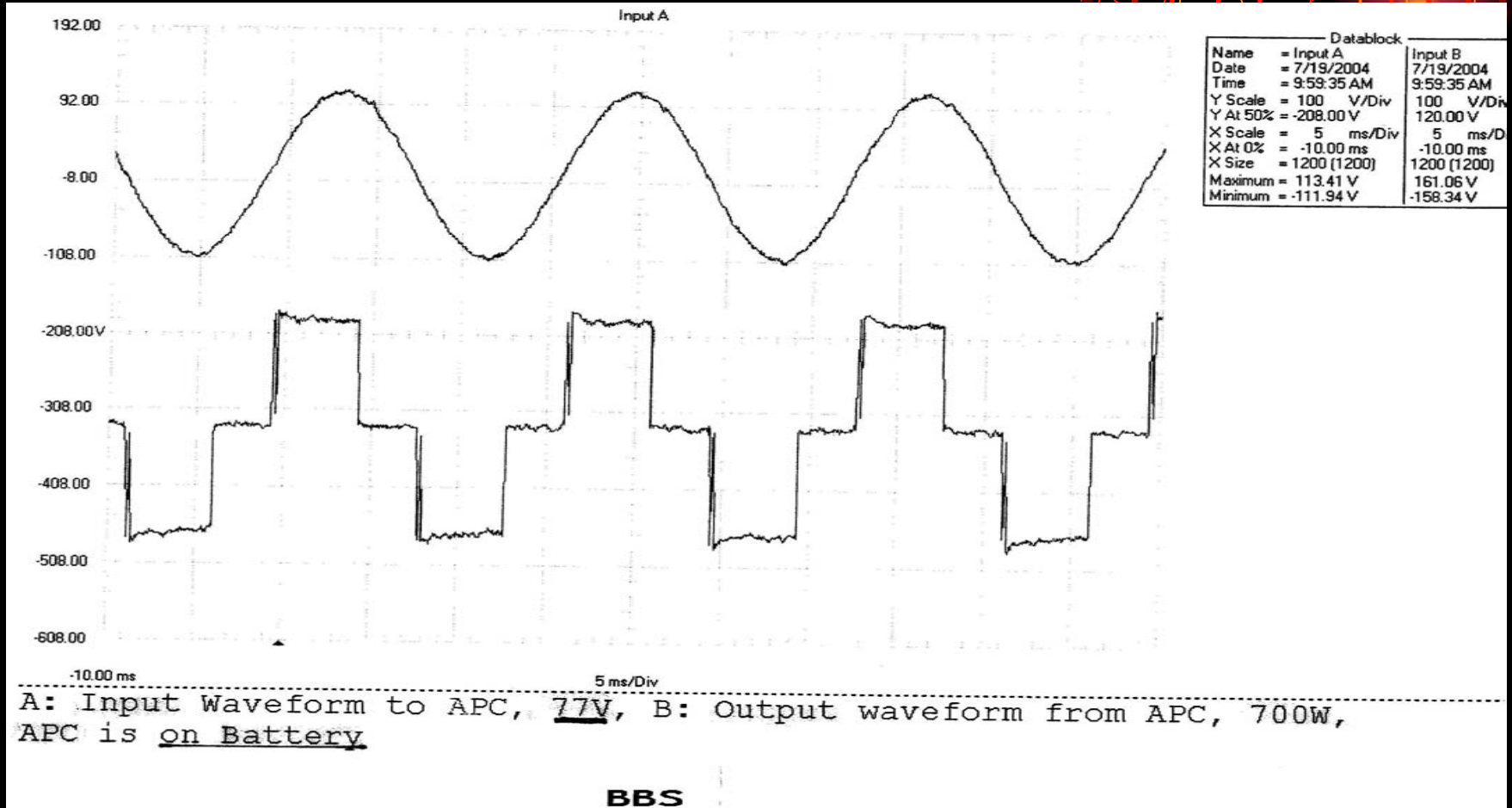
TYPICAL BBS - NO AC INPUT & NO LOAD



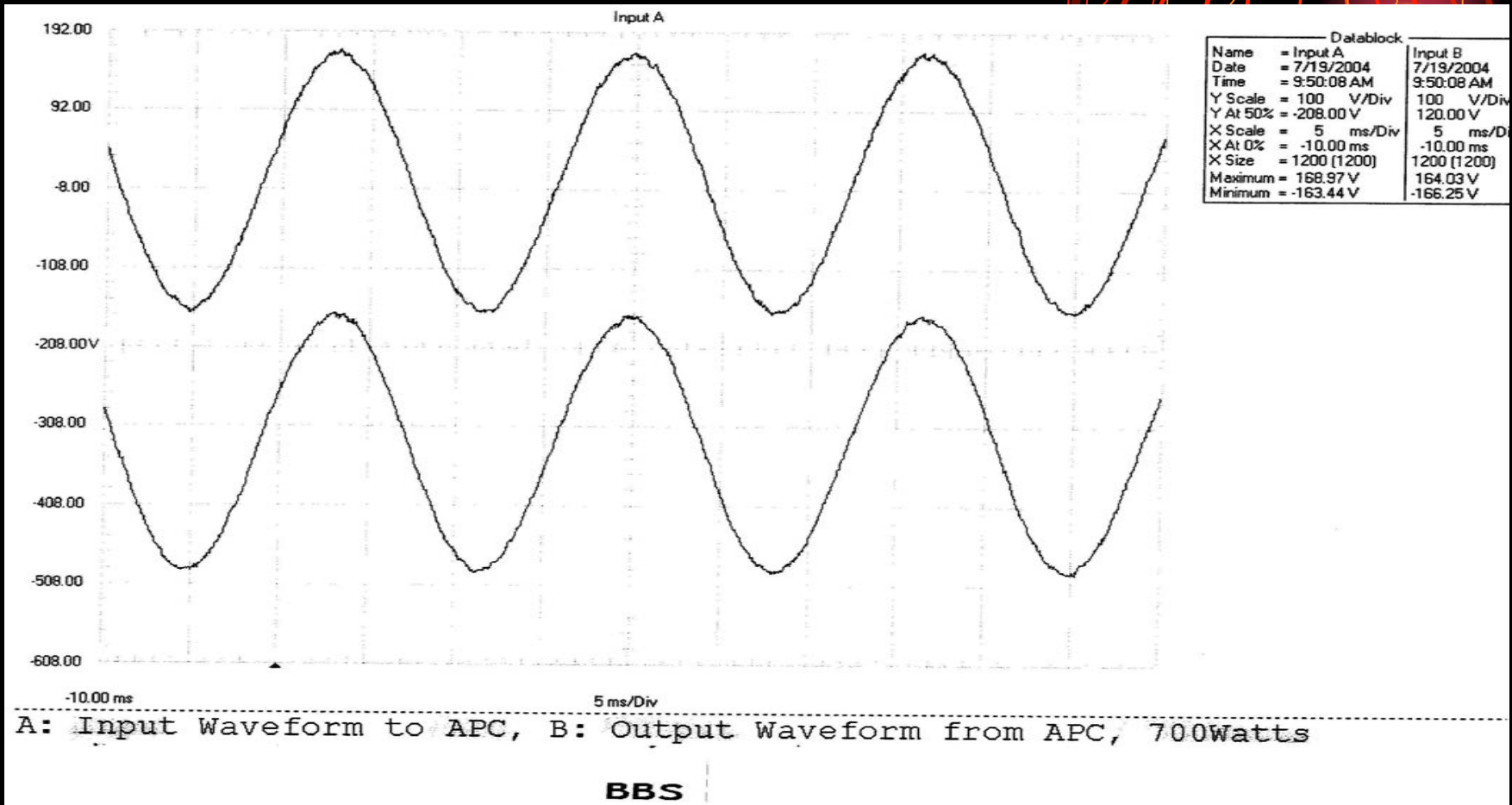
TYPICAL BBS WITH NO AC INPUT & ON BATTERY SUPPORTING 700W LOAD



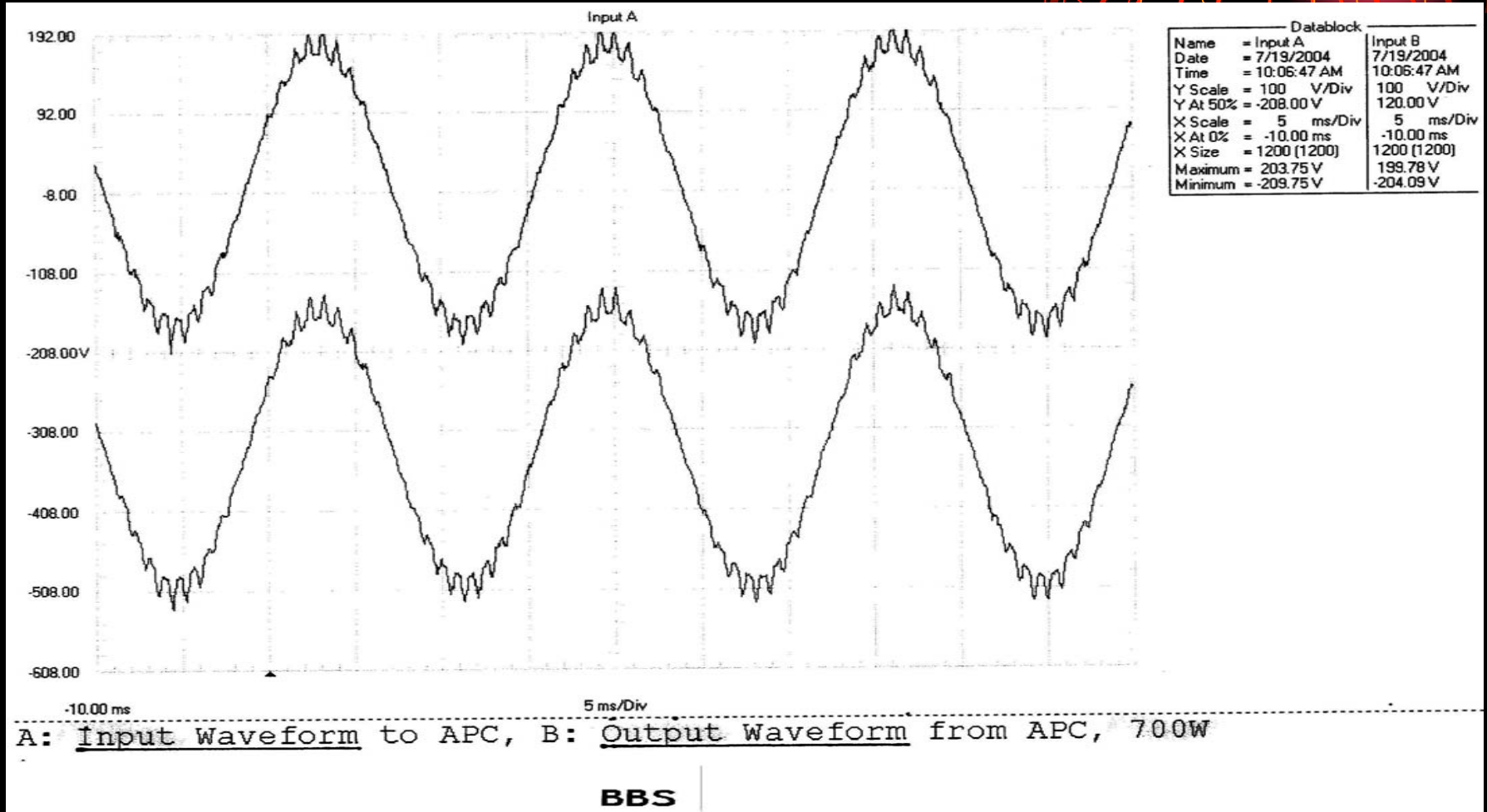
TYPICAL BBS WITH 77VAC INPUT & ON BATTERY OUTPUT WITH 700W LOAD



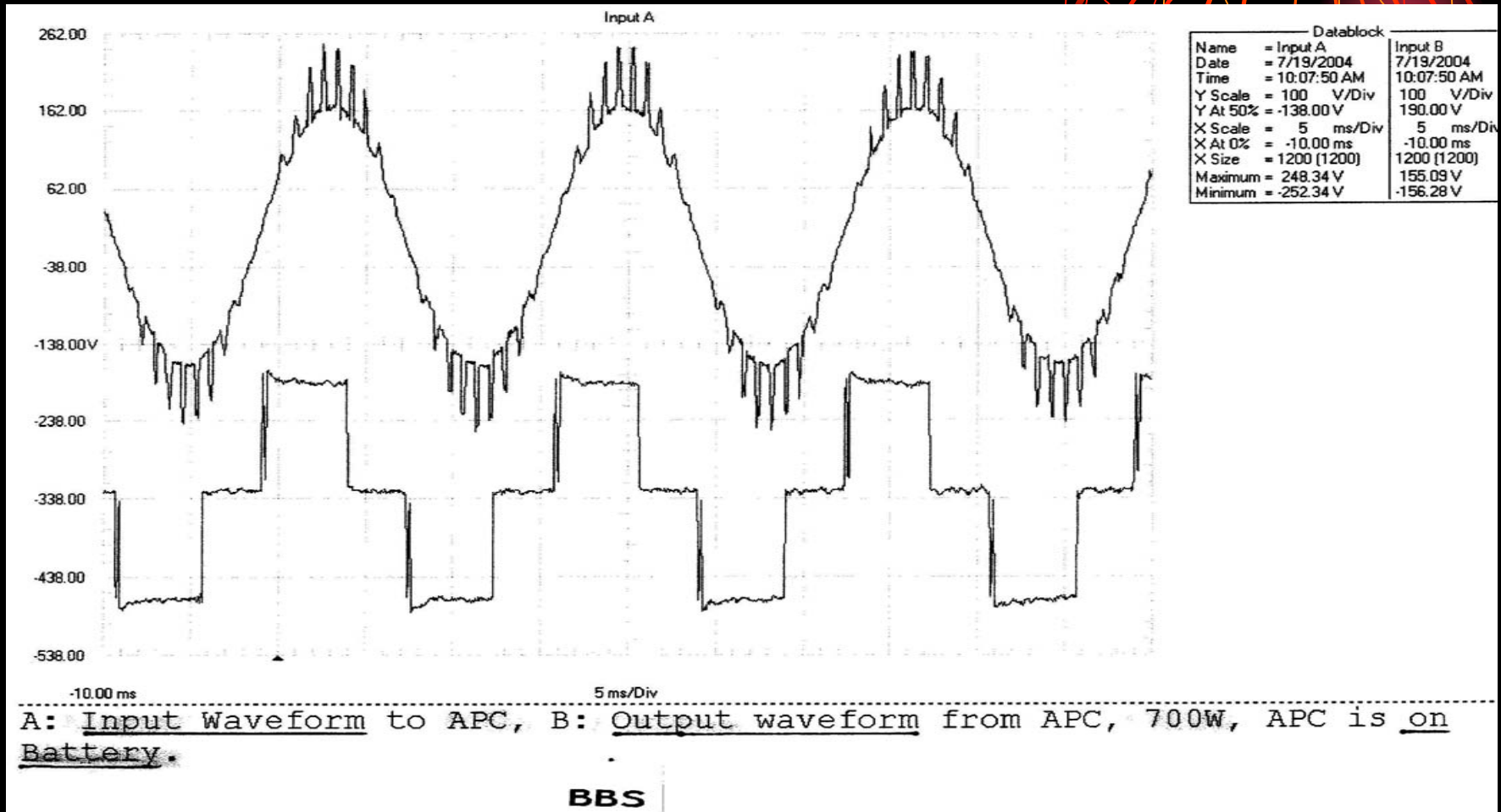
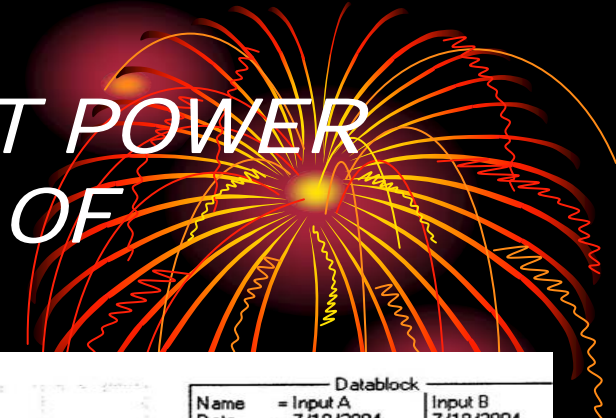
TYPICAL BBS WITH & 700 WATT LOAD SHOWING SAME UTILITY POWER IN & OUT



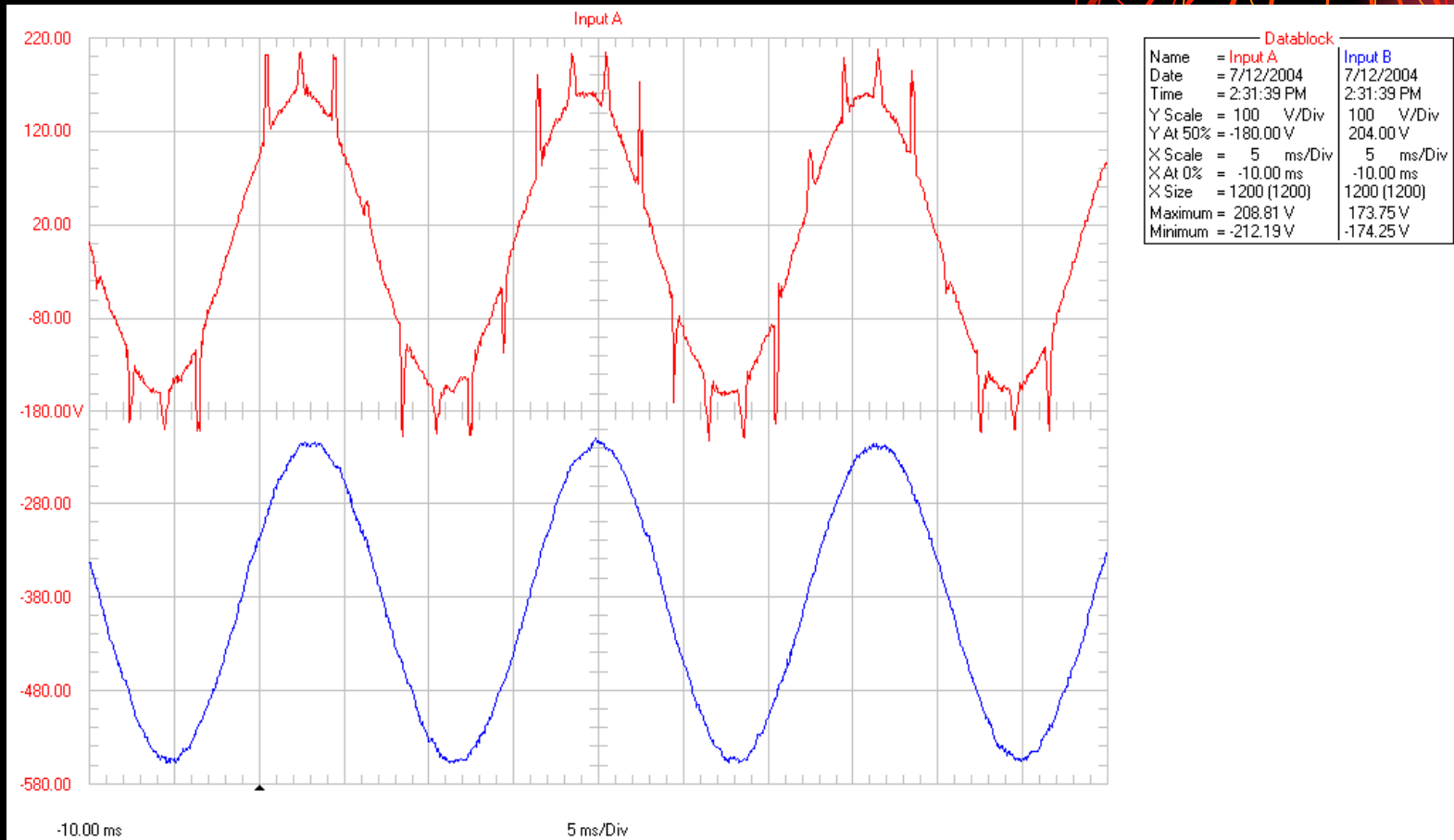
TYPICAL BBS UNIT PASSING DIRTY POWER THROUGH UNIT TO 700 WATT LOAD



TYPICAL BBS - DIRTY INPUT POWER CAUSING BBS TO RUN OFF OF BATTERY POWER

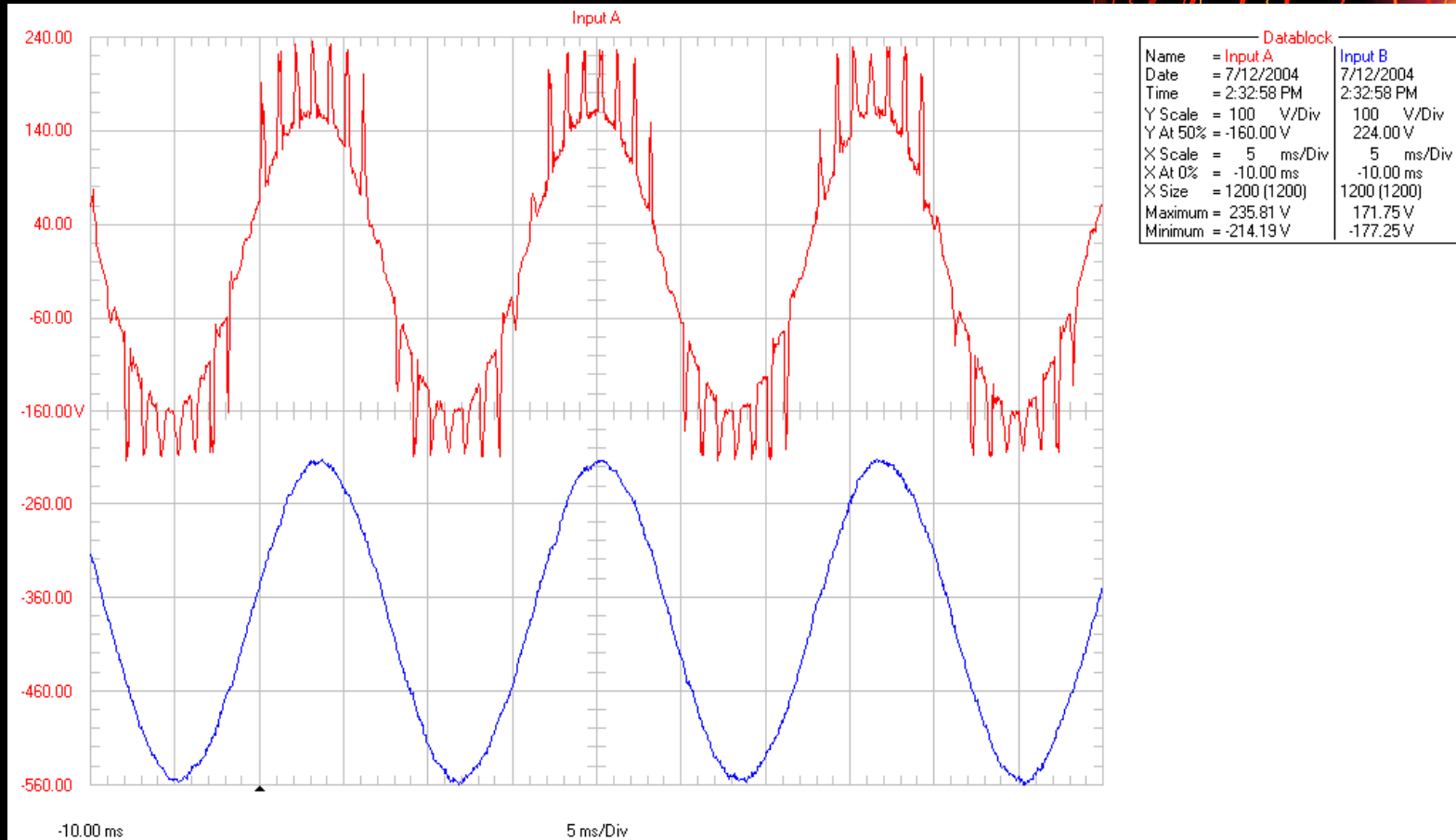


EXAMPLE OF DIRTY INPUT POWER AND CLEAN OUTPUT POWER OF A 1250 VA UPS



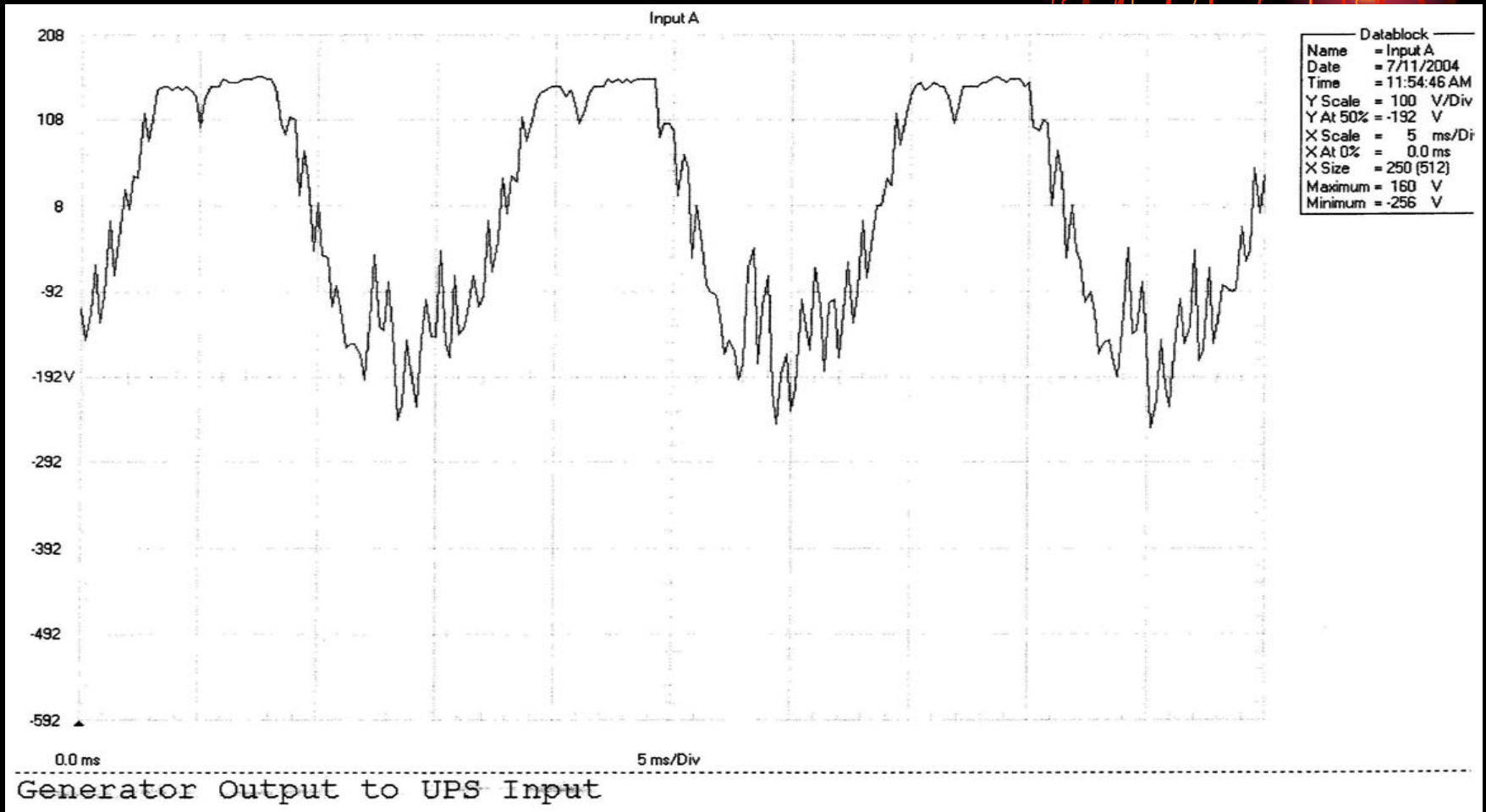
Input A: Input to UPS using Agilent AC Power Source. Input B: Output of UPS w/875 Watts Linear Load. SP1250PD, -44R3.99

EXAMPLE OF NOISY INPUT POWER AND CLEAN OUTPUT POWER OF A 1250 VA UPS

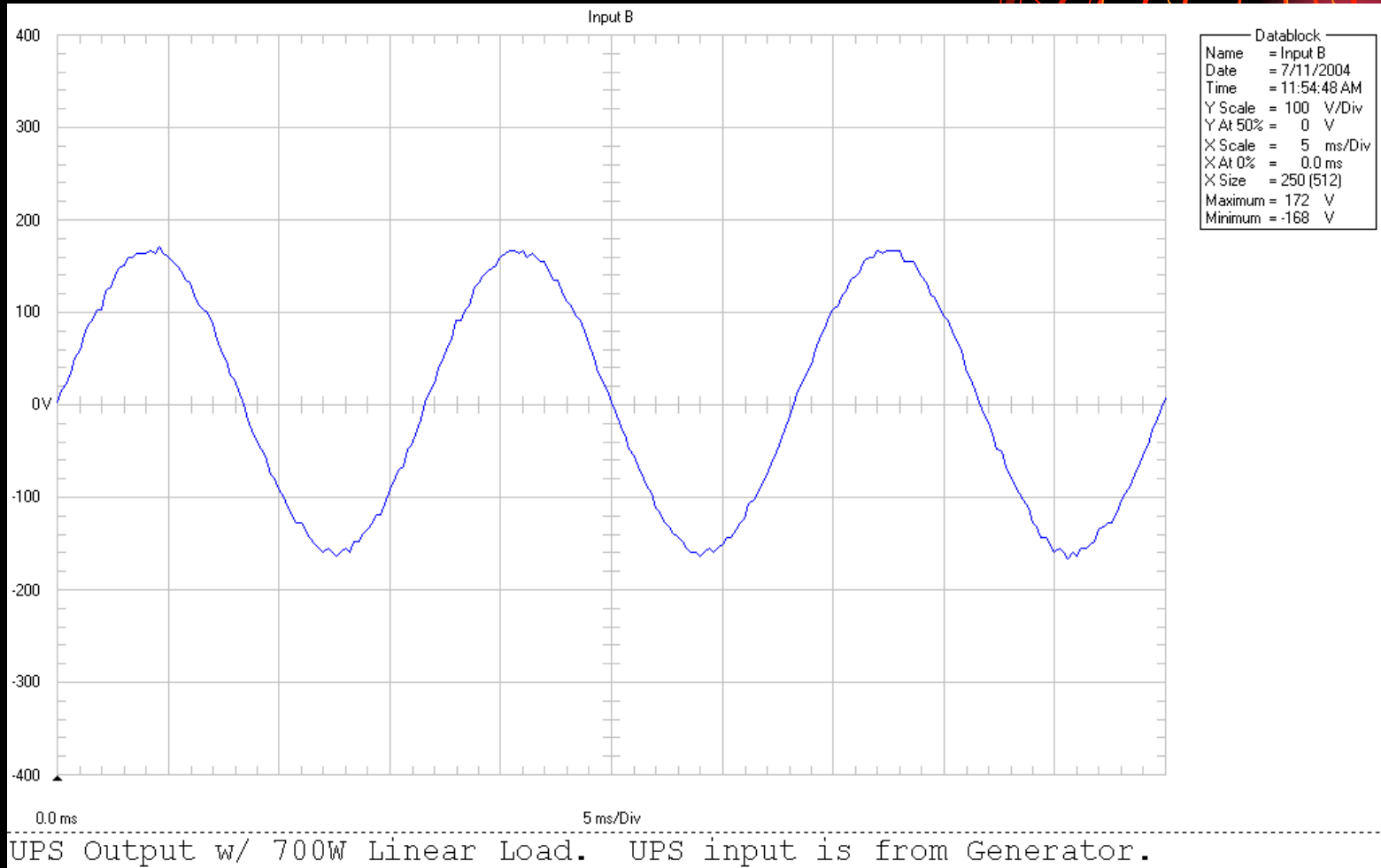


Input A: Input to UPS using Agilent AC Power Source. Input B: Output of UPS w/875 Watts Linear Load. SP1250PD, -44R3.99

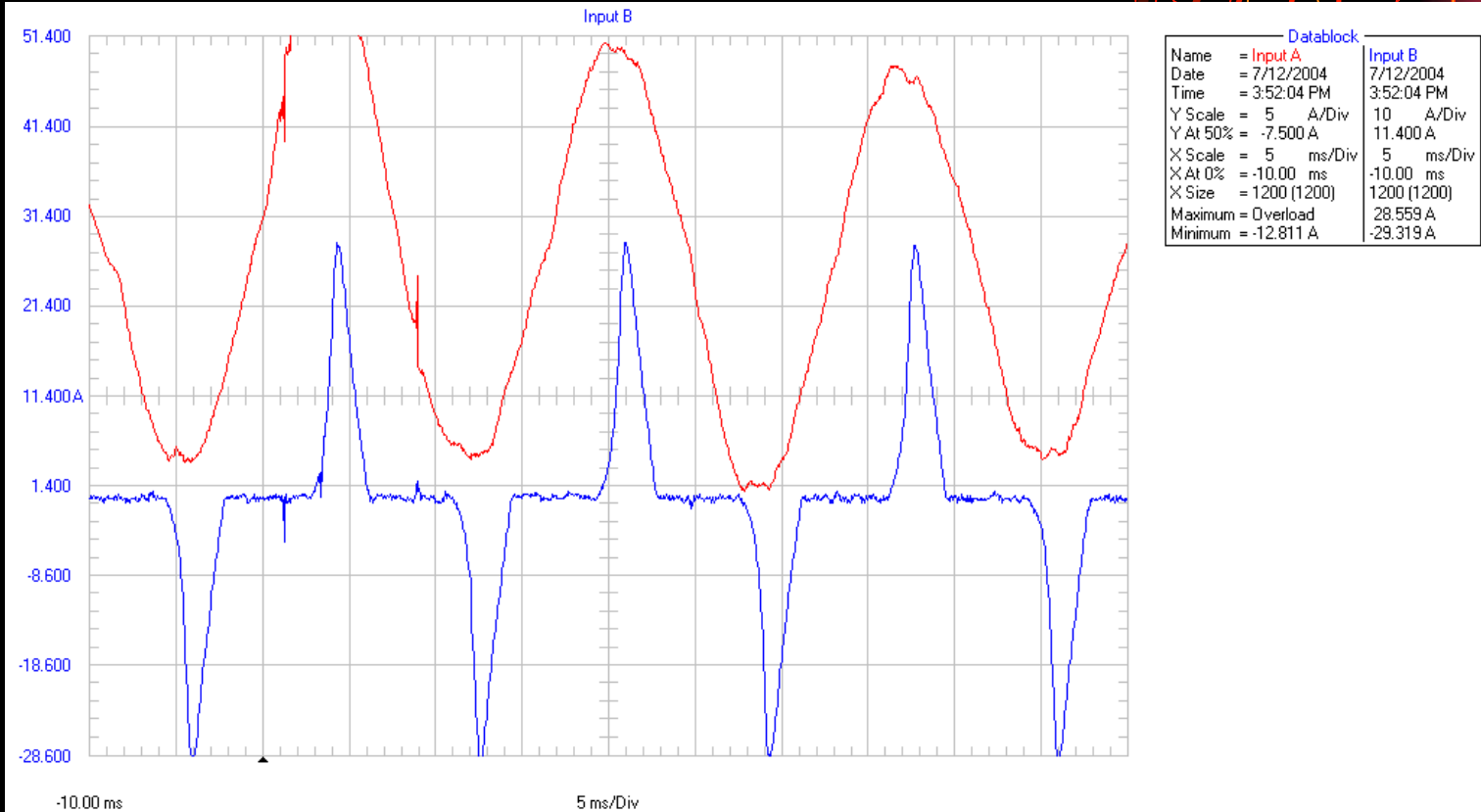
ERRATIC GENERATOR OUTPUT TO UPS



UPS OUTPUT WITH GENERATOR INPUT



TYPICAL INPUT/OUTPUT CURRENT OF A 1250 VA UPS



Input A: Input Current Input B: Output Current, 875 Watts Non-Linear,
SP1250PD, -44R3.99



THANK YOU

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