

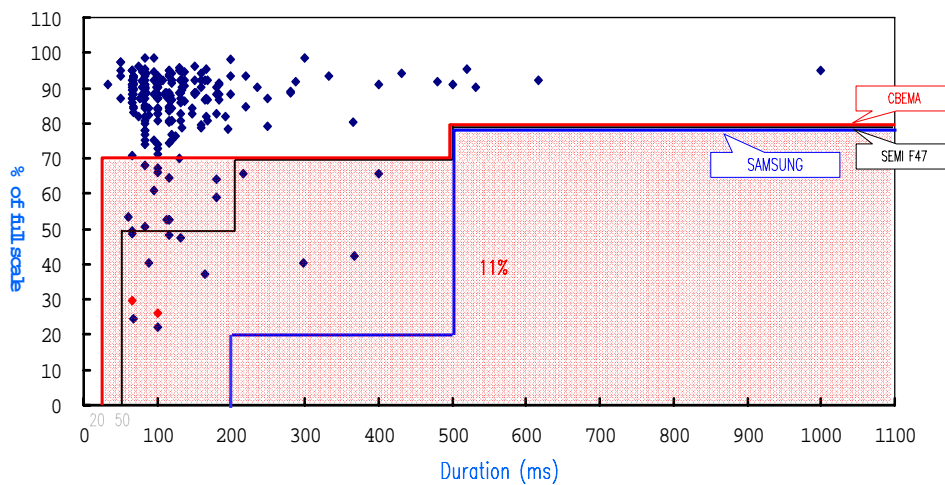


## Application of Custom Power to Mitigate Power Quality Disturbances

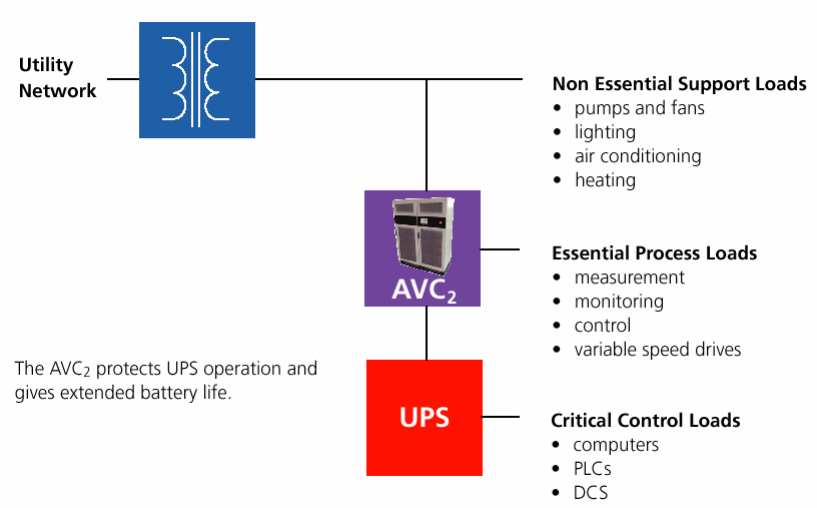
By:- Vernon Pryde

*continuous clean power*

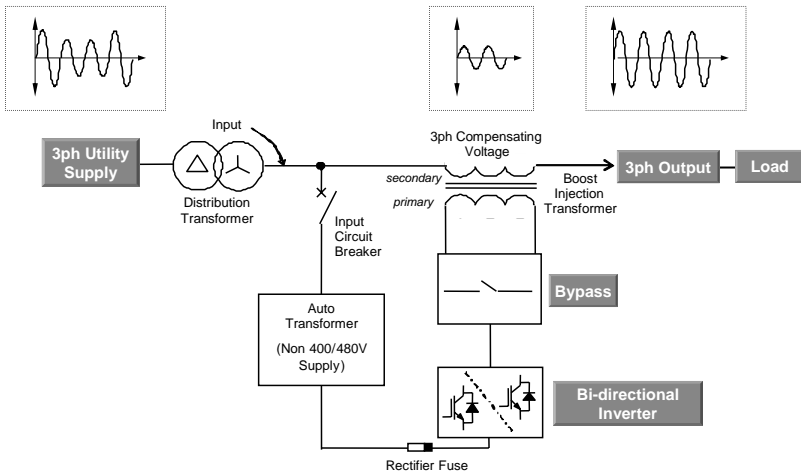
### Voltage Sag Semiconductor FAB 1995-2005



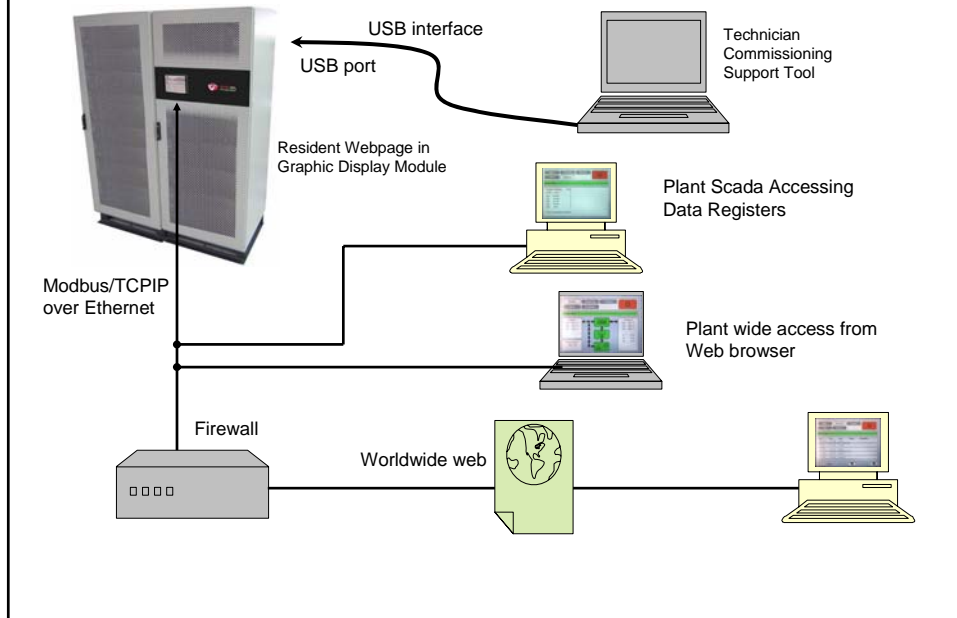
# Typical Factory Configuration



# Single Line Diagram



## Full Web and Plant System



## Vectek Case Studies

- ▶ 1. Bottling Plant Florida USA
- ▶ 2. Plastic Extruder Auckland New Zealand
- ▶ 3. Solar Panel Manufacturer Maryland USA
- ▶ 4. Semiconductor FAB China
- ▶ 5. Printing Press USA
- ▶ 6. Container Crane Hong Kong
- 7. Church Vapour Lights Samoa

**Case Study One:**

***Rum Bottling Plant,  
Jacksonville,  
Florida.***

**2MVA, AVC, Rum bottling, Jacksonville, Florida.**



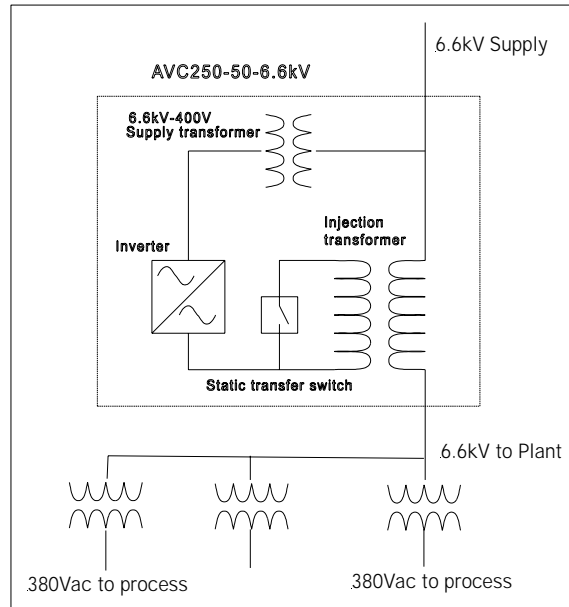
## AVC Installed Over Christmas 2003



## 26KV MV Installation



## Medium Voltage AVC



## The “Product” High Speed Bottling Line



## Rum Bottling Site Data

- Working 2 x 10 hour shifts = 3,750 cases/hr
- 9 Bottling Lines
- Facility produces 75,000 cases per day
- Largest size bottles run at 400/min
- Miniatures run at 1000/min
- When an unexpected stoppage occurs it can take over one hour to restore production to normal line speeds
- Factory stated maintenance costs \$350k p.a. for replacement parts damaged by unplanned stoppages

## Factory Assumptions

- If lines are down for 40 minutes then 2500 cases are lost
- If a value of U\$10 per case were assumed, this would equate to U\$25,000 per event
- The actual figure may be higher, say 40k-50k per event
- No details are available for scrap costs, lost taxes, rework, overtime to recover lost production etc

## Assumed Factory Savings

- Historically 20 unplanned stoppages p.a. - \$500k cost
- Factory volunteered - maintenance costs cut by \$250k p.a.
- Jan-Dec 05 490 events occurred below 87% (IEEE Level)
- If only 10% of events would have stopped production  
this would be 47 events @ \$25k each = \$1,175,000
- Total Assumed Savings = \$1.425 million
- The Assumed payback period is less than 1 year



## History Of Events

	>87%	>80%	>70%	>60%	Lost
Jan	3	2	3	1	1
Feb	2	3	1	2	0
Mar	3	2	1	4	1
Apr	1	4	0	0	1
May	10	2	1	4	0
Jun	13	16	15	10	1
Jul	112	15	1	5	3
Aug	16	9	2	5	0
Sep	57	35	12	24	7
Oct	4	4	0	2	0
Nov	14	26	10	2	0
Dec	13	5	0	0	0
Total	248	123	46	59	14

Lost events include 7 hurricane induced complete outages

## Hurricane Frances Sweeps Into Florida



**VECTEK**  
Electronics Ltd

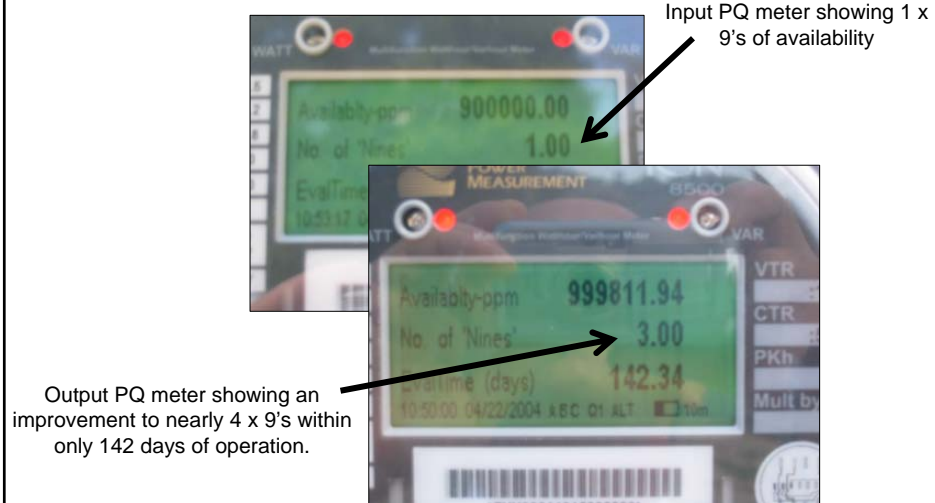
### VECTEK NEWS

**Vectek Voltage Conditioner Weathers the Storm**

The Vectek AVC installed in Jacksonville Florida had more than electrical sags to handle in its first year of operation.

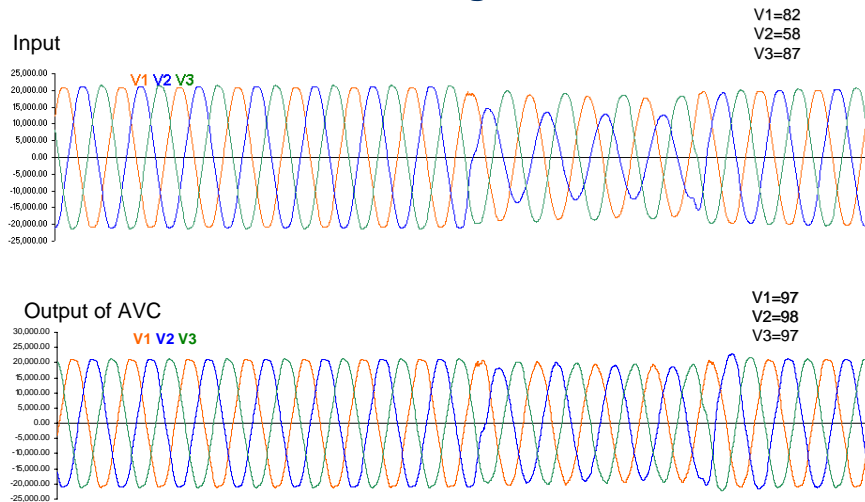
The image shows a news banner for Vectek News. At the top left is the Vectek Electronics Ltd logo. The main title is 'VECTEK NEWS' in large red letters. Below that is a sub-headline 'Vectek Voltage Conditioner Weathers the Storm' in blue. Underneath is a paragraph: 'The Vectek AVC installed in Jacksonville Florida had more than electrical sags to handle in its first year of operation.' The bottom half of the banner features a photograph of a coastal area during a storm, with a boat docked at a pier, palm trees, and a fence in the foreground.

## Installed On Time, On Budget



2MVA, 26KV installation

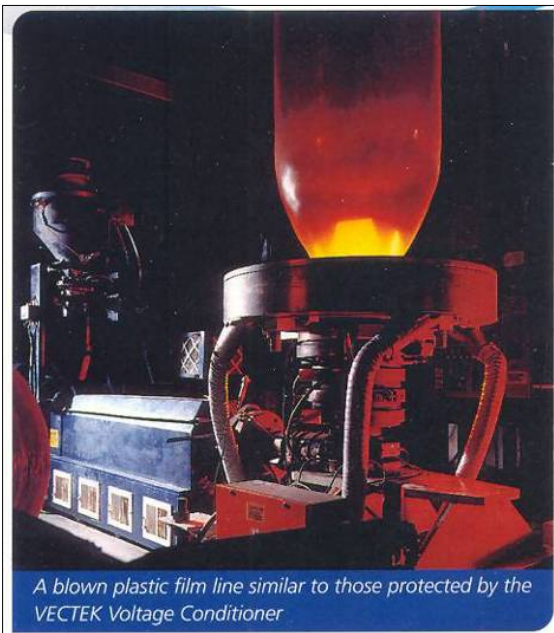
## Transmission Sag Correction



## Case Study Two: Amcor Flexibles New Zealand

- Plastic Extrusion Company
- Auckland New Zealand
- Installed AVC December 1998
- 1MVA 400V 50Hz

### Amcor Flexibles



**VECTEK ENGINEERED SOLUTIONS**  
Amcor Flexibles benefit from Vectek 1 MVA voltage conditioner

Amcor Flexibles is a leading blown plastic film manufacturer in New Zealand. The company has a long history of producing high quality plastic film for a wide range of applications. In 1998, Amcor Flexibles installed a new 1 MVA voltage conditioner from Vectek to protect its investment in its plastic film line.

The new voltage conditioner was installed to protect the investment in the plastic film line. The conditioner is designed to provide high quality power to the plastic film line, ensuring that the quality of the plastic film is maintained. The conditioner is also designed to protect the investment in the plastic film line from power quality issues.

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## **Problem**

- Extruded barrier film. Up to 9 layers
- Nylon particularly problematic
- Long set-up times
- 30 minutes to recover a fault
- Multilayer scrap is non-recoverable
- Less than 100% rolls are not accepted

## **Cost**

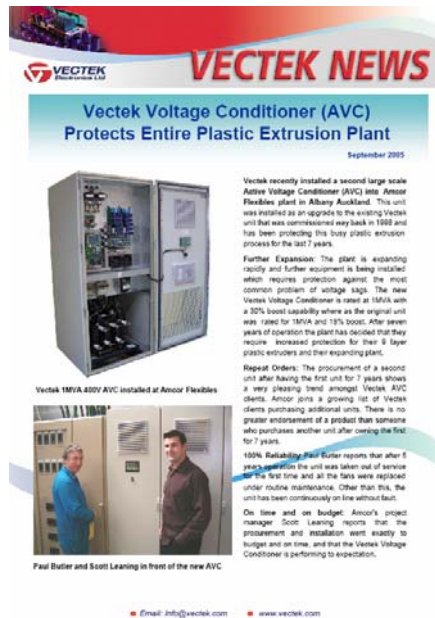
- Scrap material \$2000 / event minimum
- Depending on roll build. 4 hrs/roll
- 24/7 operation. Electrician callout per event
- Unless restored within 30 mins, pull-down of extruder

## The Solution

- Trailed 300kVA on one of 6 extruder lines
- Operations staff demanded unit for “their” line
- 1000KVA Installed Dec 1998 (10 years in operation)
- Amcor MD “before the AVC, the slightest flicker of the lights and we had trouble, but now we never worry”

## Show of Faith

- May 2005, Amcor installed another 1000kVA unit at their expanded plant. This was 7 years after buying the first unit!



**VECTEK NEWS**

**Vectek Voltage Conditioner (AVC)  
Protects Entire Plastic Extrusion Plant**

September 2005

Vectek recently installed a second large scale Active Voltage Conditioner (AVC) into Amcor Flexibles plant in Albany Auckland. This unit was installed as an upgrade to the existing Vectek unit that was commissioned way back in 1998 and has been protecting this busy plastic extrusion process for the last 7 years.

**Further Expansion:** The plant is expanding rapidly and further equipment is being installed which requires protection against the most common problem of voltage sags. The new Vectek Voltage Conditioner is rated at 1000kVA with a 30% boost capability where as the original unit was rated for 300kVA and 15% boost. After seven years of operation the plant has decided that they require increased protection for their 8 layer plastic extruders and their expanding plant.

**Repeat Orders:** The procurement of a second unit after having the first unit for 7 years shows a very pleasing trend amongst Vectek AVC clients. Amcor joins a growing list of Vectek clients purchasing additional units. There is no greater endorsement of a product than someone who purchases another unit after using the first for 7 years.

**100% Reliability:** Paul Butler reports that after 6 years operation the unit was taken out of service for five days and all the fans were replaced under routine maintenance. Other than this, the unit has been continuously on line without fault.

**On time and on budget:** Amcor's project manager Scott Leaning reports that the procurement and installation went easy to budget and on time, and that the Vectek Voltage Conditioner is performing to expectation.

**Vectek 1000kVA AVC installed at Amcor Flexibles**

**Paul Butler and Scott Leaning in front of the new AVC**

✉ Email: [info@vectek.com](mailto:info@vectek.com)    🌐 [www.vectek.com](http://www.vectek.com)

**Case Study Three:  
Solar Panel Manufacturer  
Maryland**

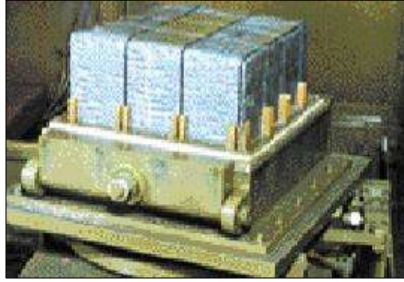


**Frederick, Maryland**



AVC Installation site 2002

## Production Of A Solar Cell



Silicon ingots are cast in an electric furnace, then mounted on the saw carriage  
As presented to the saw they are valued at \$2000/brick



## Abrasive Wire Saw



Endless loop abrasive wire saw, simultaneously slices 2 bricks over a 4 hour period.

## Assembly Process



6" wafer processed and ready for assembly into matrices for mounting and interconnection.

## The Problem

- 15 wafer saws susceptible to sags
- Wire breaks damaged 2 bricks
- Replacing the wire took 6 hours



## The Cost

- Broken saw wire, 2 bricks @ \$2000
- Up to 15 saws on site
- plus lost production down stream
- plus downtime
- Maintenance costs
- \$4000 to \$40,000 per event

## The Solution



1600kVA AVC installed Aug 2002

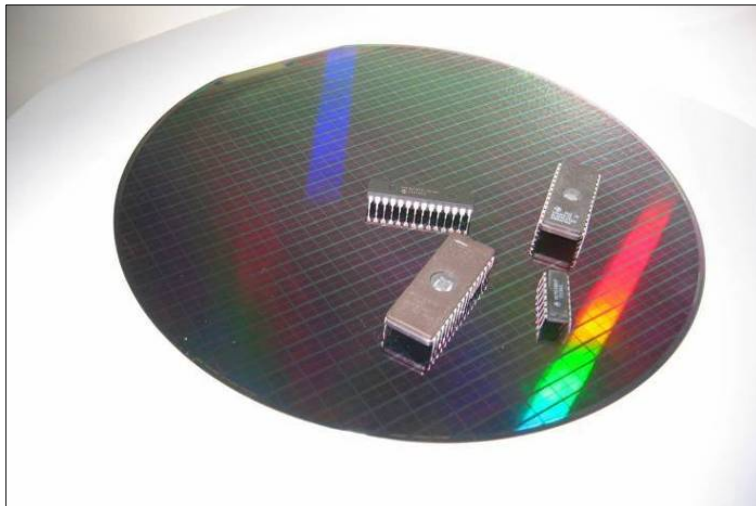
### **The Results**

- Solar Manufacturer says “the results were dramatic. Productivity losses on protected saws were eliminated”
- “Pay back was under one year”
- “Production managers asked why only half the plant was protected”
- During thunderstorms, unprotected plant was shutdown.

### **Show of Faith**

- Finally, after 3 years the plant purchased a second unit to protect the remaining facility.

### **Case Study Four: Semiconductor FAB Plants**



The most sensitive industry to voltage sags



FAB environment. The most PQ sensitive industry

### **The Problem**

- The “series” nature of the process
- Any disturbance results in a total loss
- Major events, in excess \$1million
- No rework, days to recover
- Hugely competitive business

One of the worlds leading semiconductor FABs had a MV switch fail during 2007. The plant went down for 8 hours. They announced a \$50 Million loss to the stock market for this 1 event.

## **The Traditional Solution**

### UPS's

- large floor space
- low efficiency
- high capital cost
- significant operational costs
- growing resistance to “battery” based solutions.

## The New Modern Solution

AVC's

- 98-99% efficiency
- Small foot print
- Extremely high integrity
- Low maintenance

## >400MW Installed Units



#1 LCD Manufacturer

#3 Memory Manufacturer



## 1.5MVA 208V AVC



Protecting multiple FAB production tools

## Process Protection



75KVA Protecting  
Vacuum Pumps

650KVA Protecting  
semiconductor FAB  
line



## 50 x 650kVA AVC In FAB Plant



Sag Depth	175kVA	75kVA	50kVA	25kVA	Avg
10-20%	1	4	2	4	2.8
20-30%	7	6	9	4	6.5
30-40%	19	16	20	21	19.0
40-50%	5	6	1	3	3.8
>50%	0	0	0	0	0.0

Logging for one month  
including a snow storm

## >100MW of AVC's inside a 200MW FAB Facility



**>75MW In Two Plant Rooms Wuxi China**

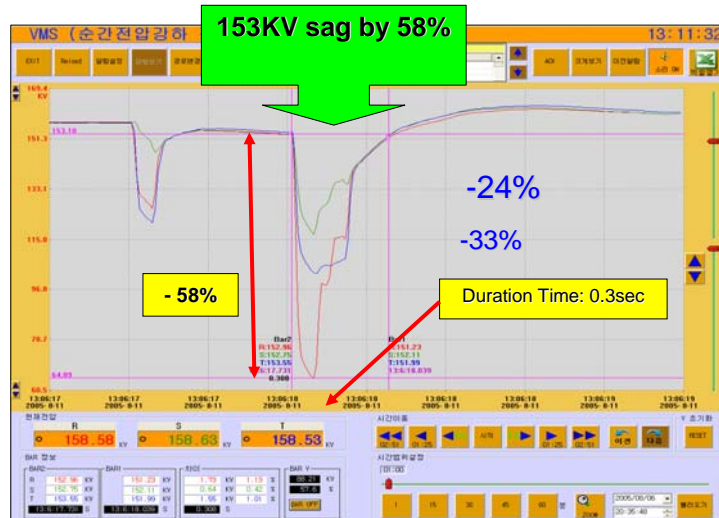


**52 x AVC1250kVA Units in Memory FAB, Korea**





## Voltage Sag 13:00hr Aug. 11. 2005



Over 300 pieces production machinery protected.

## Case Study Five: High Speed Printing Press Florida

- A high speed printing press in Florida
- Multiple sags during the “Storm Season”
- The cost / event was not large, however, the number of events was
- Significant “clean-up” and “re-start” time after each sag.

## High Speed Printing Press



Hi-speed, multi-colour printing presses

## 3MVA AVC Controller Section



3000KVA, 480Vac, 60Hz Vectek AVC

## **Out Door 3MVA Installation**



## **Case Study Six: Container Crane Hong Kong**

- Air Cargo Handling
- Automatic Stacker Reclaimer Crane
- Hong Kong
- Installed AVC March 2007
- 300kVA 400V 50Hz

## Hong Kong Airport



1000's of containers per day



Automatically stacked and reclaimed, by robotic container crane system

## **Weather Created Voltage Disturbances**

- Crane malfunctions:-
  - Jams a container mid cycle
  - Crane has to be manually reset
  - Staff have to physically enter the crane
  - Risk of personal injury. Safety Issue
  - Damaged Container and Crane
- Airliner penalty charges for delayed flights

## **AVC Solution**

- Eliminates Voltage Sags from Crane
- Corrects sags when crane lifting (motoring)
- Corrects sags when crane is lowering (regenerating)

***Case Study Seven:  
Protecting Church Vapour Lighting***

**Protecting Church Vapor Lighting in Samoa**



Island power was causing premature light bulb failure  
(some lights actually falling from the ceiling onto the congregation!)

## Within hours of installation, the unit was recording significant sag events, which it eliminated

Vectek AVC Active Voltage Controller - Microsoft Internet Explorer

http://192.168.0.132/page\_event.htm?StatusPage\_status.html&page=topicoff.html

Status Event log Summary Product

Status: RUN

Lines per page: 10 20 50 100 200 500 Refresh AutoRefresh

Range (1-10) 11:20 21:30 31:40 41:50 51:60 61:70 71:80 81:90 >>

#	Date	Time	Type	Origin	Description
1	2007-11-25	06:35:19.37	Sag end	Running	Running 340 ms, 97%, 98%, 92%, 98%, 99%, 99%
2	2007-11-25	06:35:19.03	Sag start	Running	Running
3	2007-11-24	18:44:16.70	Sag end	Running	Running 150 ms, 94%, 86%, 90%, 98%, 99%, 99%
4	2007-11-24	18:44:16.55	Sag start	Running	Running
5	2007-11-24	18:44:13.76	Sag end	Running	Running 150 ms, 94%, 86%, 90%, 98%, 99%, 99%
6	2007-11-24	18:44:13.61	Sag start	Running	Running
7	2007-11-21	23:54:22.71	Sag end	Running	Running 570 ms, 90%, 91%, 91%, 97%, 99%, 99%
8	2007-11-21	23:54:22.14	Sag start	Running	Running
9	2007-11-21	23:04:17.79	Sag end	Running	Running 1110 ms, 90%, 91%, 91%, 97%, 99%, 99%
10	2007-11-21	23:04:16.68	Sag start	Running	Running

Next page >>



## AVC as opposed to UPS

**VECTEK**  
Electronics Ltd

**The case for the Vectek AVC: an alternative to the UPS**

The UPS has become one of the most significant PQ solutions to be applied to industrial plants. However there are other options worthy of investigation and a new Active Voltage Controller from Vectek Electronics is making those inroads into the domain of the more traditional solutions. Vernon Pryde presents the case for the AVC.

Today more and more plants together with the most sensitive applications to PQ (power quality) issues. These are the high-end applications to PQ (power quality) issues. These are the high-end applications to PQ (power quality) issues. These are the high-end applications to PQ (power quality) issues.

**Type of Faults**

A sag is defined as a drop in voltage to 90% of nominal for a duration of 10% to 90% of a cycle. A sag is defined as a drop in voltage to 90% of nominal for a duration of 10% to 90% of a cycle. A sag is defined as a drop in voltage to 90% of nominal for a duration of 10% to 90% of a cycle.

**Causes and Effects**

The most common cause of sag is a short circuit in the power system. This is caused by a fault in the power system. This is caused by a fault in the power system. This is caused by a fault in the power system.

**Checking the PQ records**

Checking the PQ records is a critical step in identifying power quality issues. This involves monitoring the voltage and current over a period of time. This involves monitoring the voltage and current over a period of time. This involves monitoring the voltage and current over a period of time.

Download at:  
[www.vectek.com](http://www.vectek.com)



*Thank you*

*continuous clean power*