
**Power Quality
Monitors
and
Stray Voltage
Investigations**

Using a power disturbance analyzer on stray voltage investigations

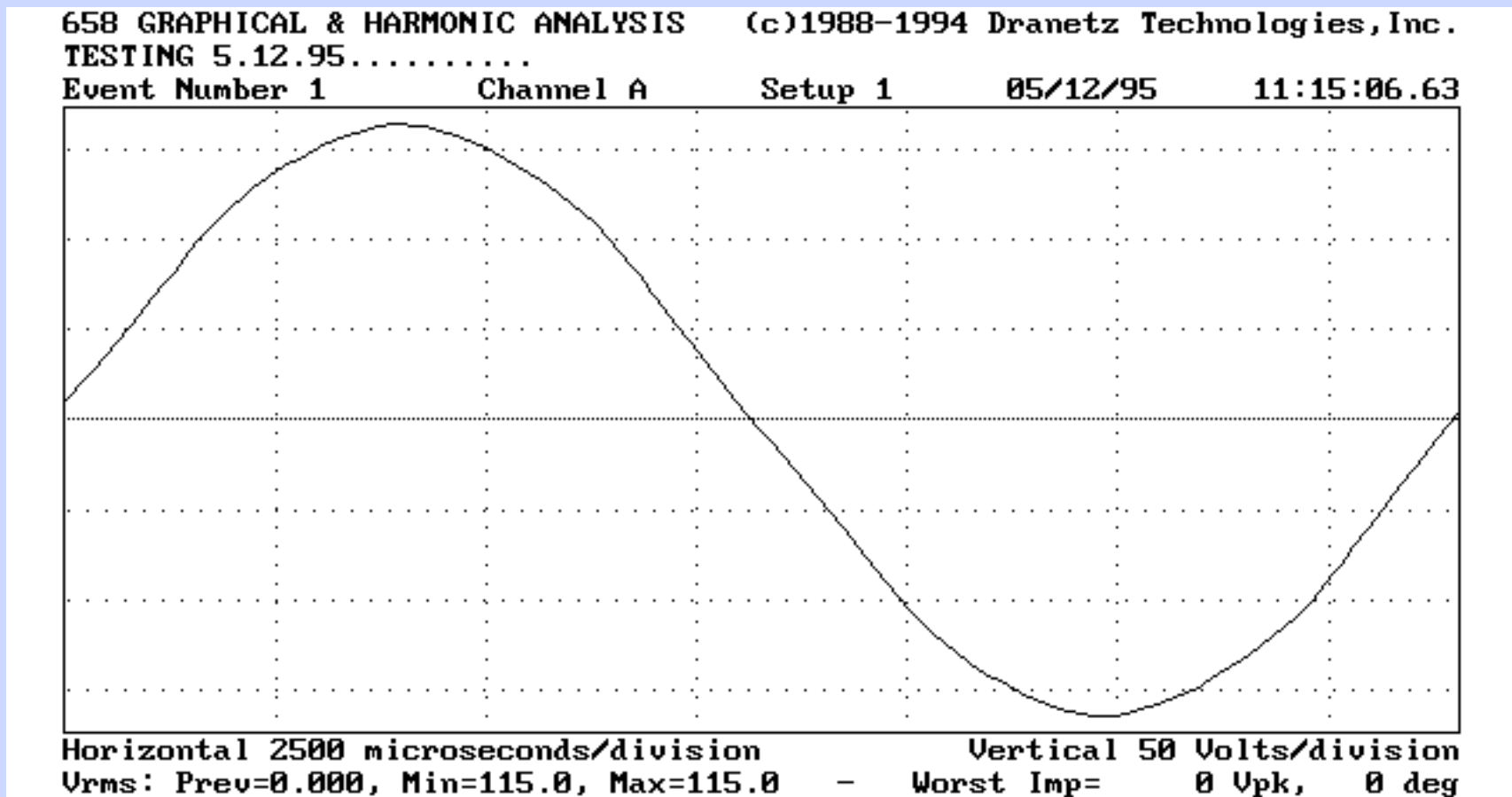
- **1. Input Impedance Test**
- **2. DC Blocking Test**
- **3. Floating Zero**
- **4. Steady-state Voltage Resolution**
- **5. Impulse Voltage Measurements**
- **6. Impulse Voltage Resolution**
- **7. Wave Form Display Resolution**

Should power disturbance monitors be used on stray voltage investigations?

- ❖ **Routine electrical events that happen on the 120, 208, 240, 277 or 480 volt system do not directly impact cow contact voltages.**
- ❖ **Using remote measurements to interpolate the resulting cow contact voltage.**
- ❖ **Power disturbance analyzers designed for 120 volt systems and above do not have the proper range or resolution.**

When using a disturbance monitor, you can expect to see the following:

- ▶ A normal 120 to 480 volt wave form, typical for either voltage or current.



Sags and swells

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NESTLE

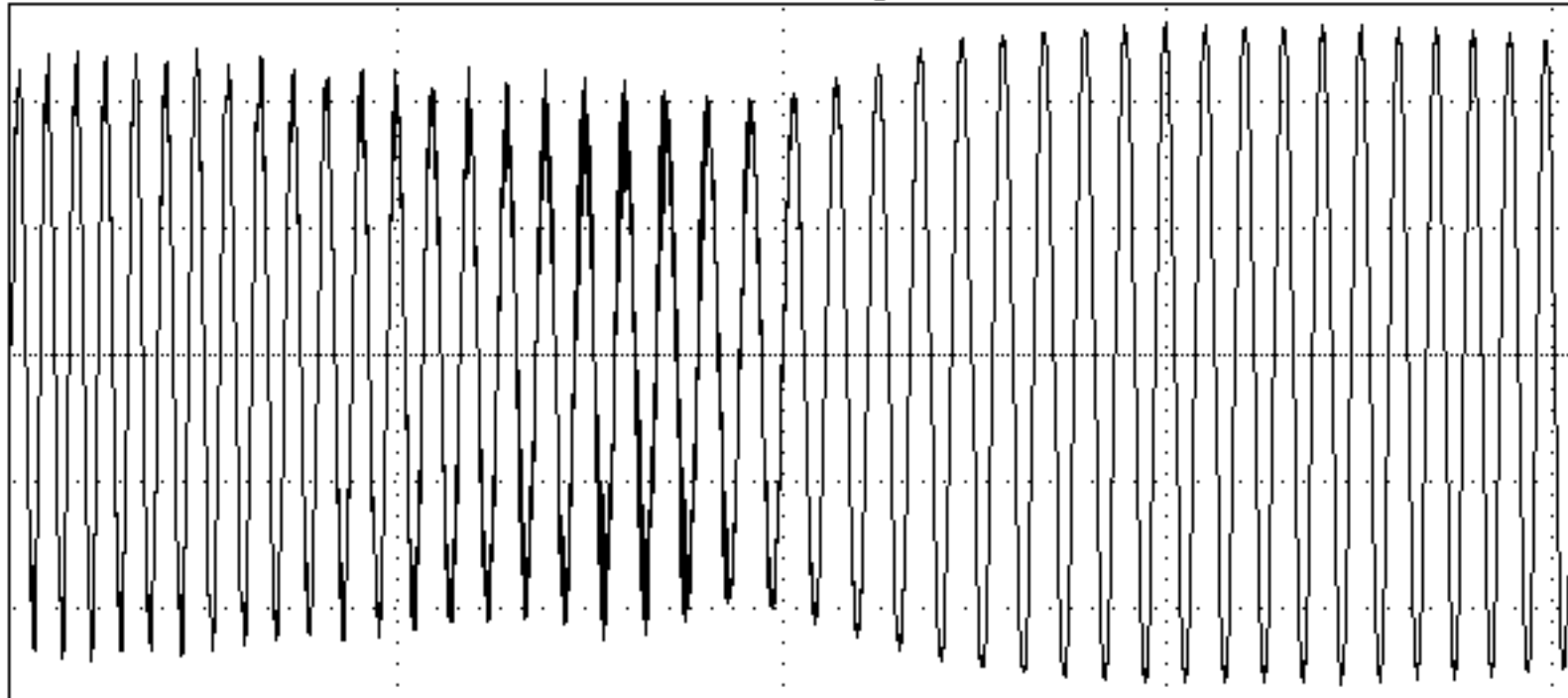
Event Number 225

Channel A

Setup 16

08/27/96

11:50:59.46



Horizontal 250 milliseconds/division

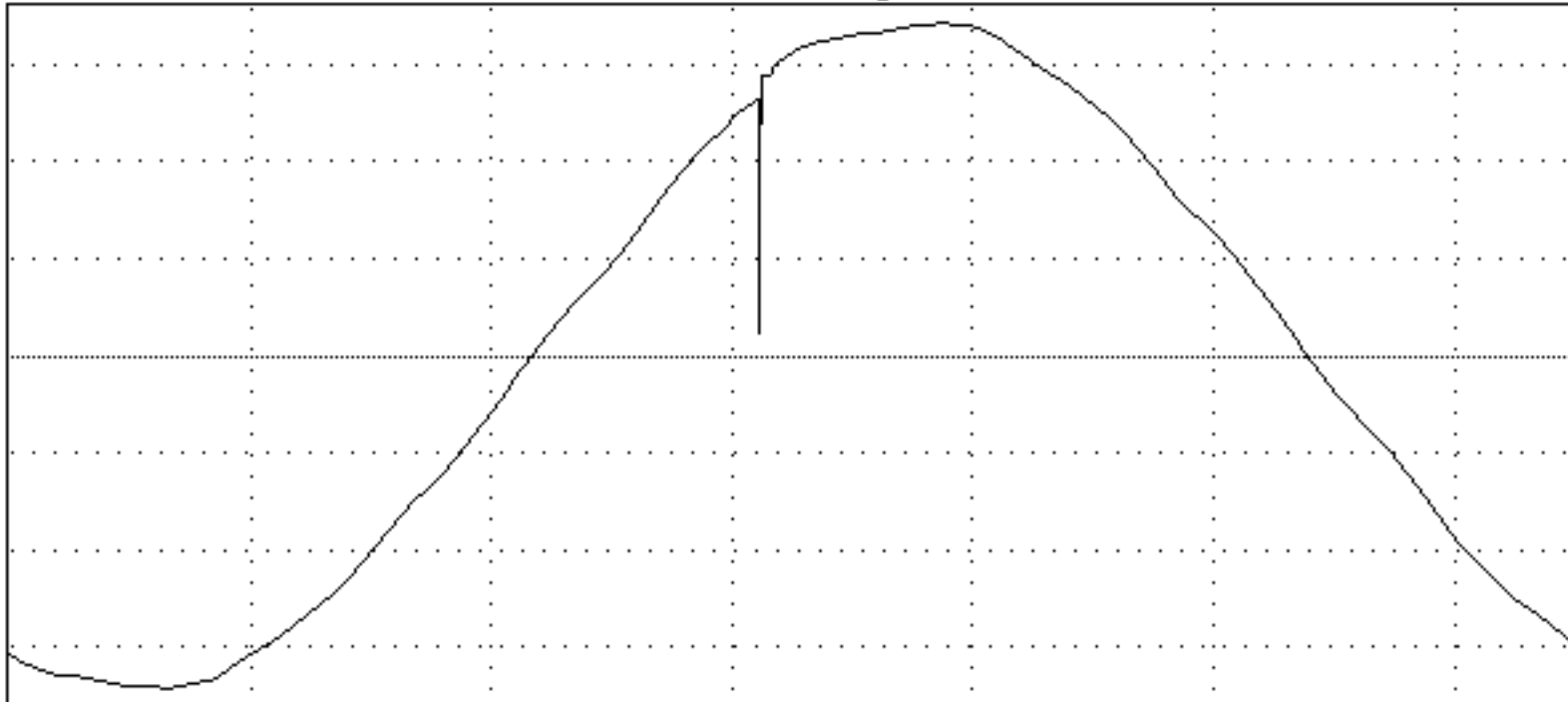
Vertical 50 Volts/division

Urms: Prev=76.50, Min=73.19, Max=87.69

- Worst Imp= 0 Upk, 0 deg

Voltage “spikes” or “high frequency noise”

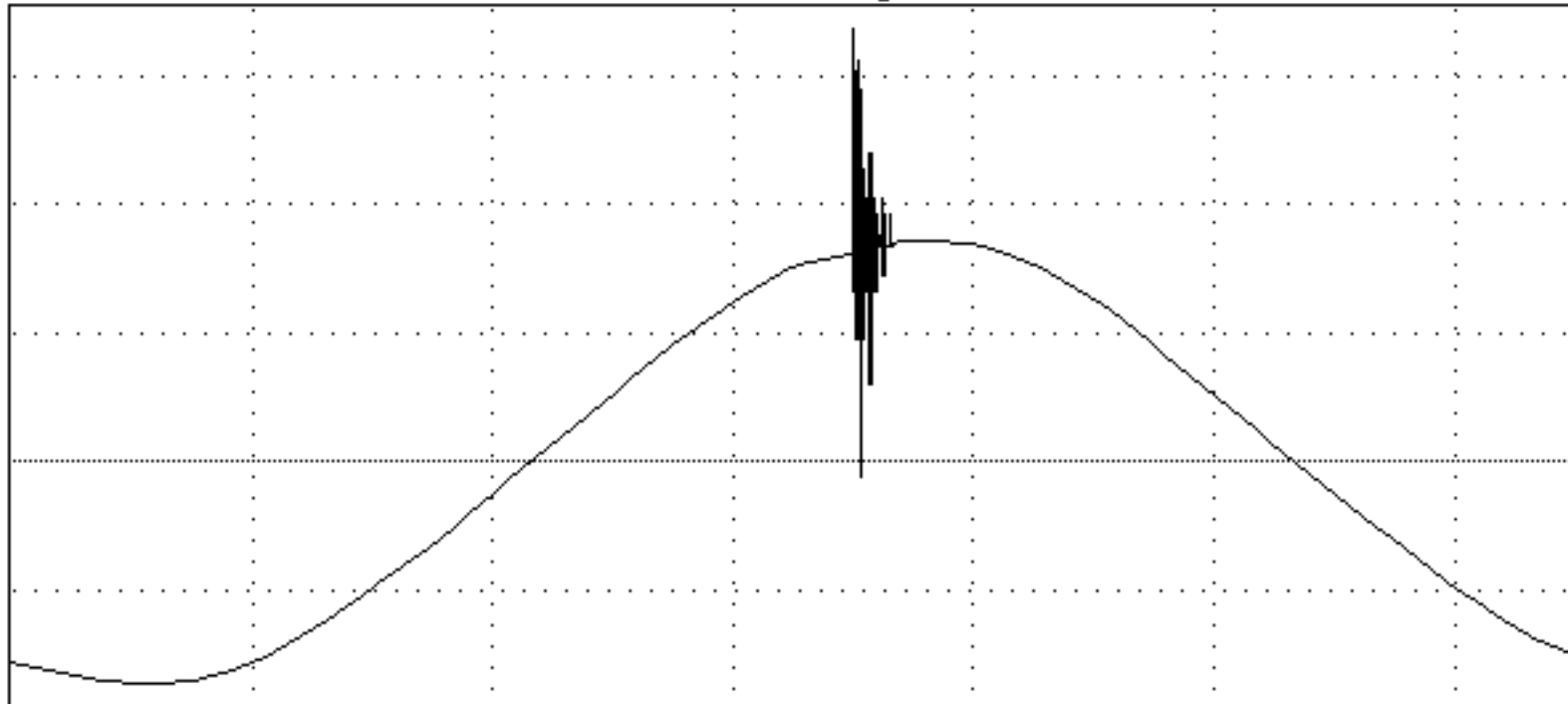
658 GRAPHICAL & HARMONIC ANALYSIS (c)1988-1994 Dranetz Technologies, Inc.
COLUMBUS COMM. IQ TC
Event Number 11 Channel C Setup 6 10/12/95 08:40:41.74



Horizontal 2500 microseconds/division Vertical 50 Volts/division
Urms: Prev=121.4, Min=121.5, Max=121.5 - Worst Imp= -119 Upk, 54 deg

Noise

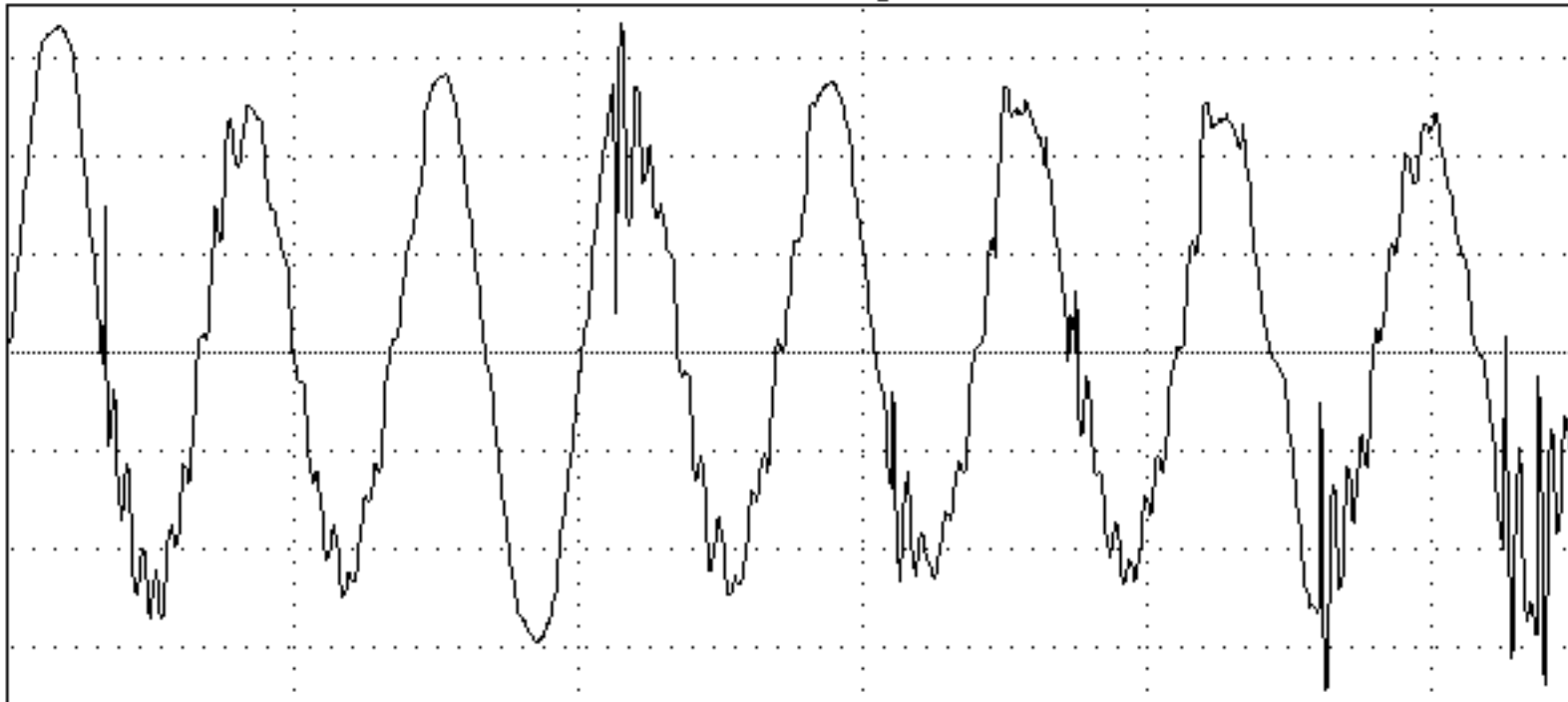
658 GRAPHICAL & HARMONIC ANALYSIS (c)1988-1994 Dranetz Technologies, Inc.
COLUMBUS COMM. IQ TC
Event Number 18 Channel C Setup 6 10/13/95 09:48:03.73



Horizontal 2500 microseconds/division Vertical 100 Volts/division
Urms: Prev=121.0, Min=121.8, Max=121.8 - Worst Imp= -175 Upk, 75 deg

Or “noise” can be continuous

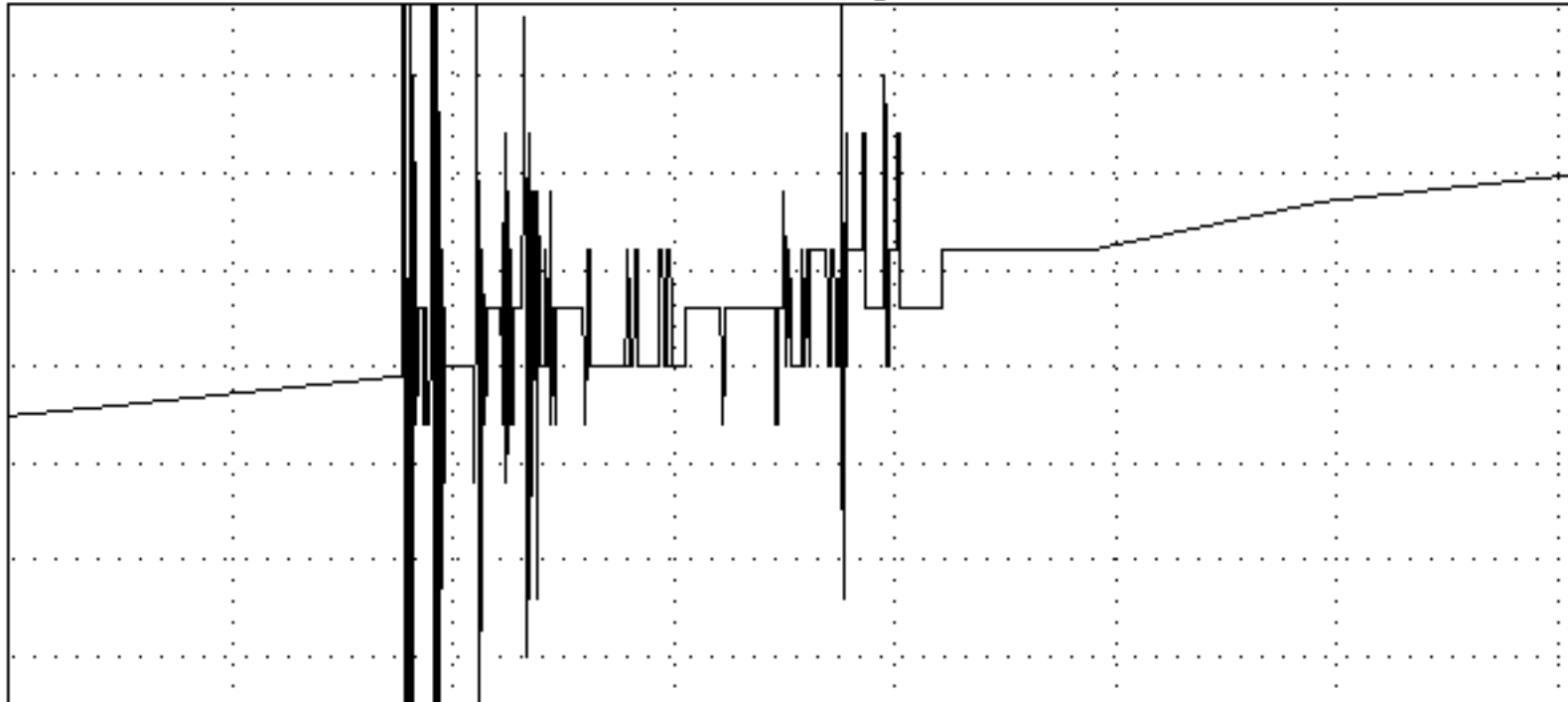
658 GRAPHICAL & HARMONIC ANALYSIS (c)1988-1994 Dranetz Technologies, Inc.
NESTLE
Event Number 400 Channel A Setup 16 08/27/96 11:53:36.11



Horizontal 25 milliseconds/division Vertical 50 Volts/division
Urms: Prev=115.5, Min=81.59, Max=101.4 - Worst Imp= 0 Upk, 0 deg

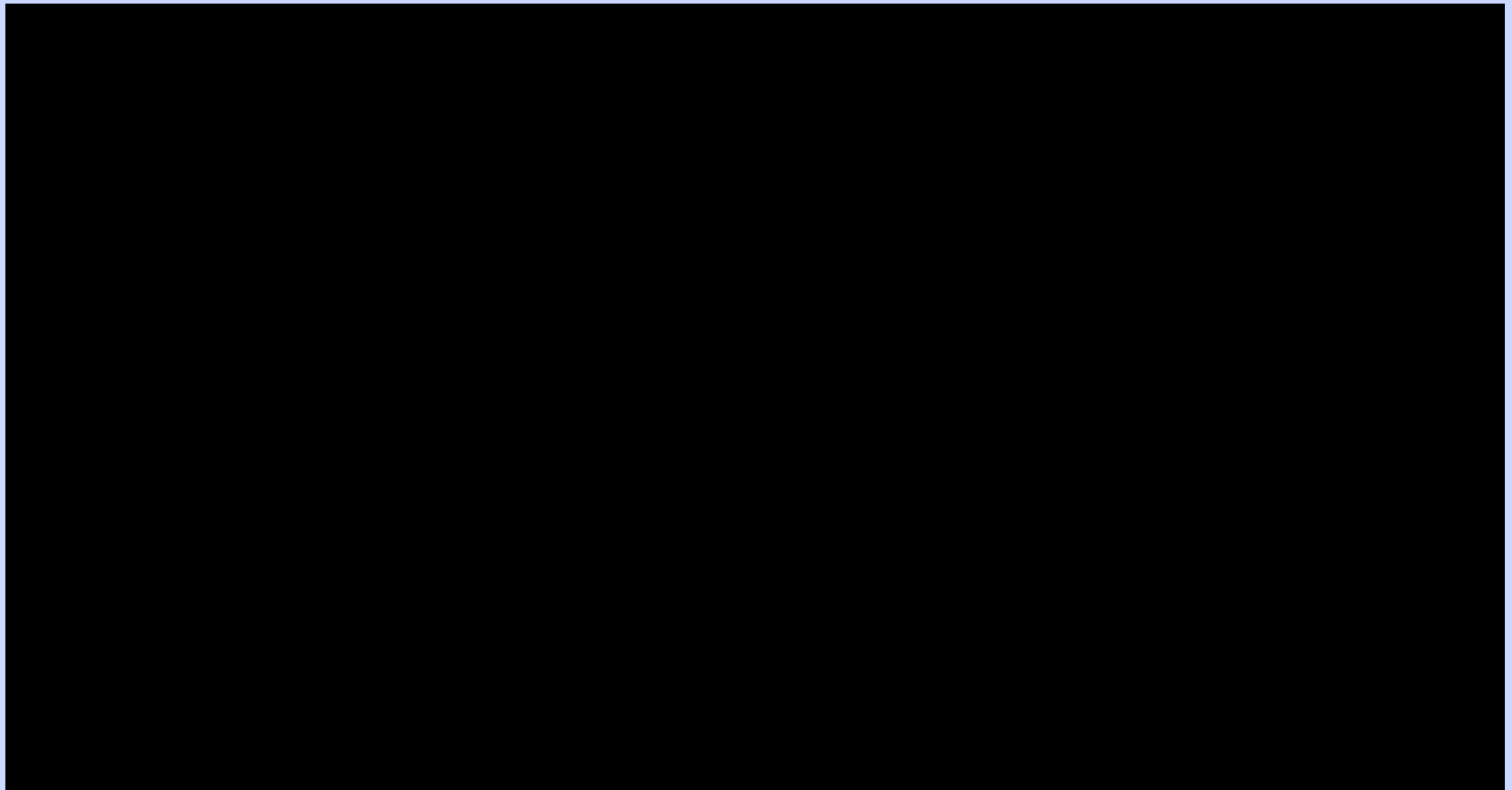
A blowup of the “high frequency noise”

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COLUMBUS COMM. IQ TC
Event Number 18 Channel B Setup 6 10/13/95 09:48:03.73



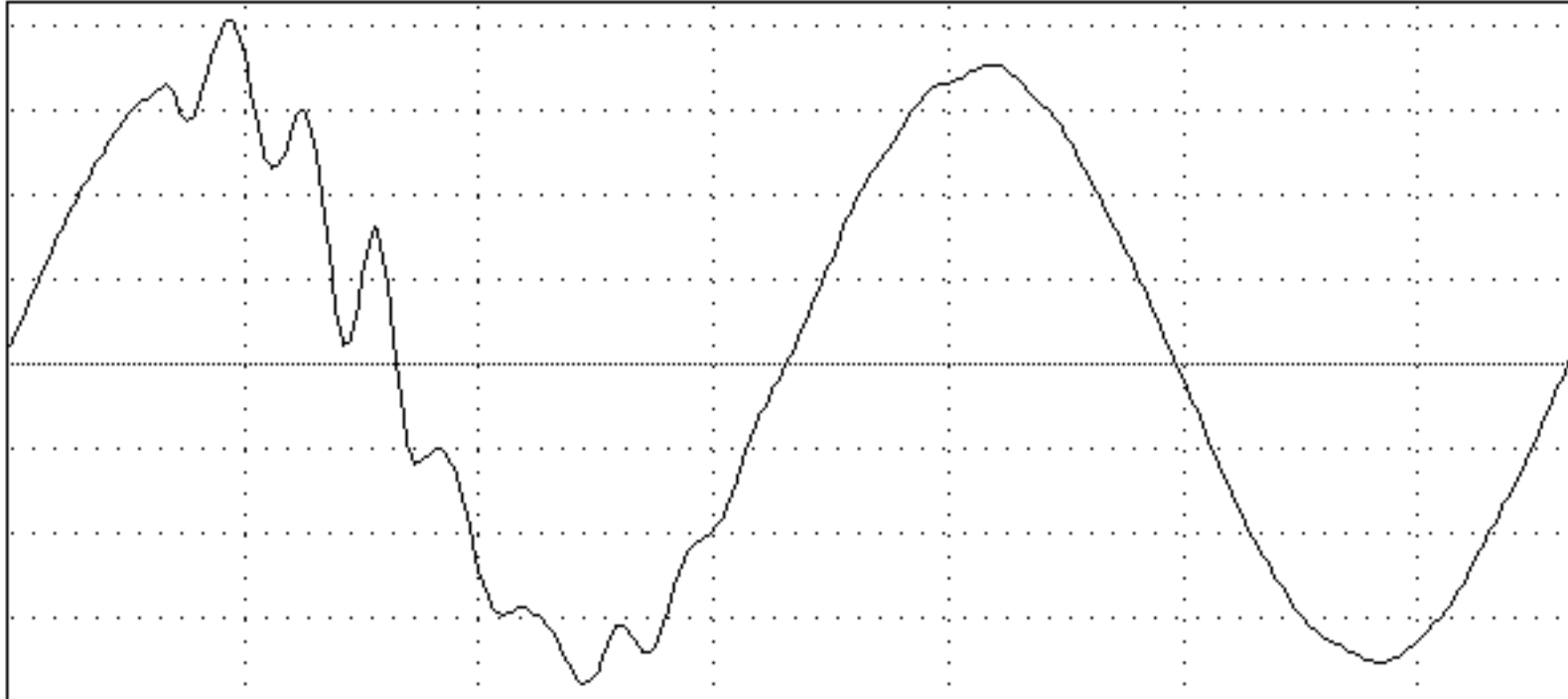
Horizontal 100 microseconds/division Vertical 20 Volts/division
Urms: Prev=122.9, Min=122.8, Max=122.8 - Worst Imp= 254 Upk, 315 deg

Spikes



Variable speed motor “Drop-Out”

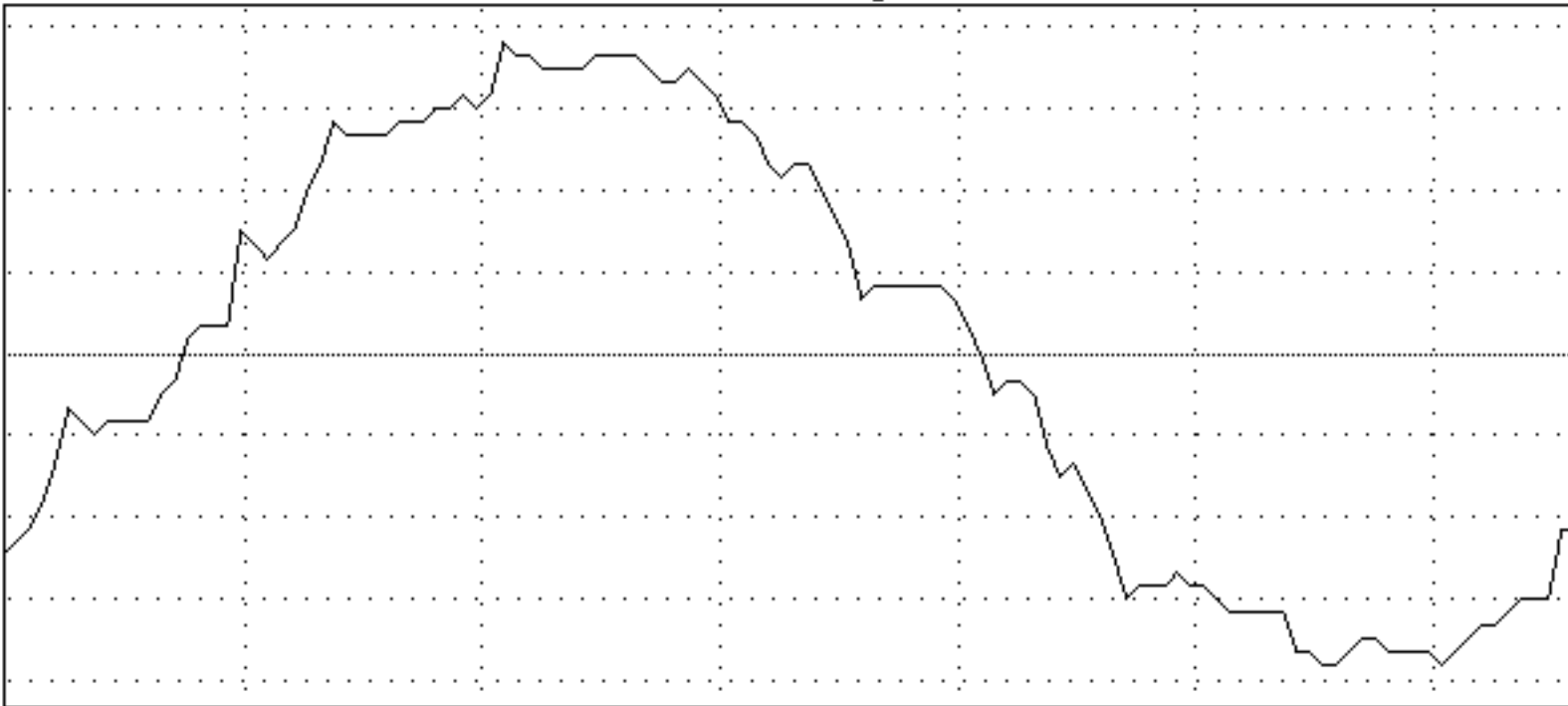
658 GRAPHICAL & HARMONIC ANALYSIS (c)1988-1994 Dranetz Technologies, Inc.
COLUMBUS COMM. IQ TC
Event Number 103 Channel A Setup 6 10/25/95 05:55:08.37



Horizontal 5 milliseconds/division Vertical 50 Volts/division
Urms: Prev=122.8, Min=123.6, Max=124.5 - Worst Imp= 0 Upk, 0 deg

Severely distorted voltage or current wave form?.. Or an operator error?

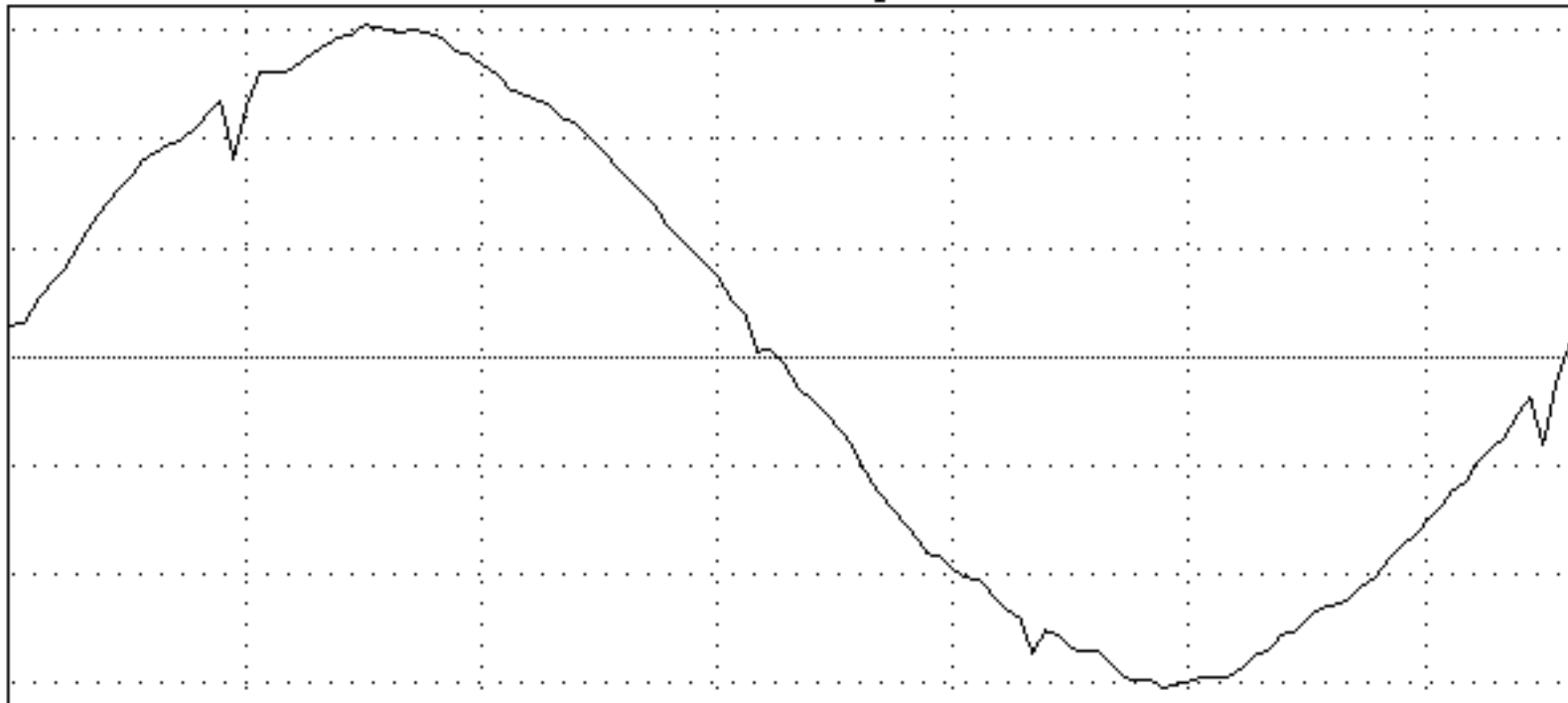
658 GRAPHICAL & HARMONIC ANALYSIS (c)1988-1994 Dranetz Technologies, Inc.
CLINTONVILLE 10.4.95
Event Number 87 Channel B Setup 1 10/04/95 10:41:10.18



Horizontal 2500 microseconds/division Vertical .05 Amps/division
Arms: Prev=.1309, Min=.1299, Max=.1299 - Worst Imp= 0 Apk, 0 deg

Line notching

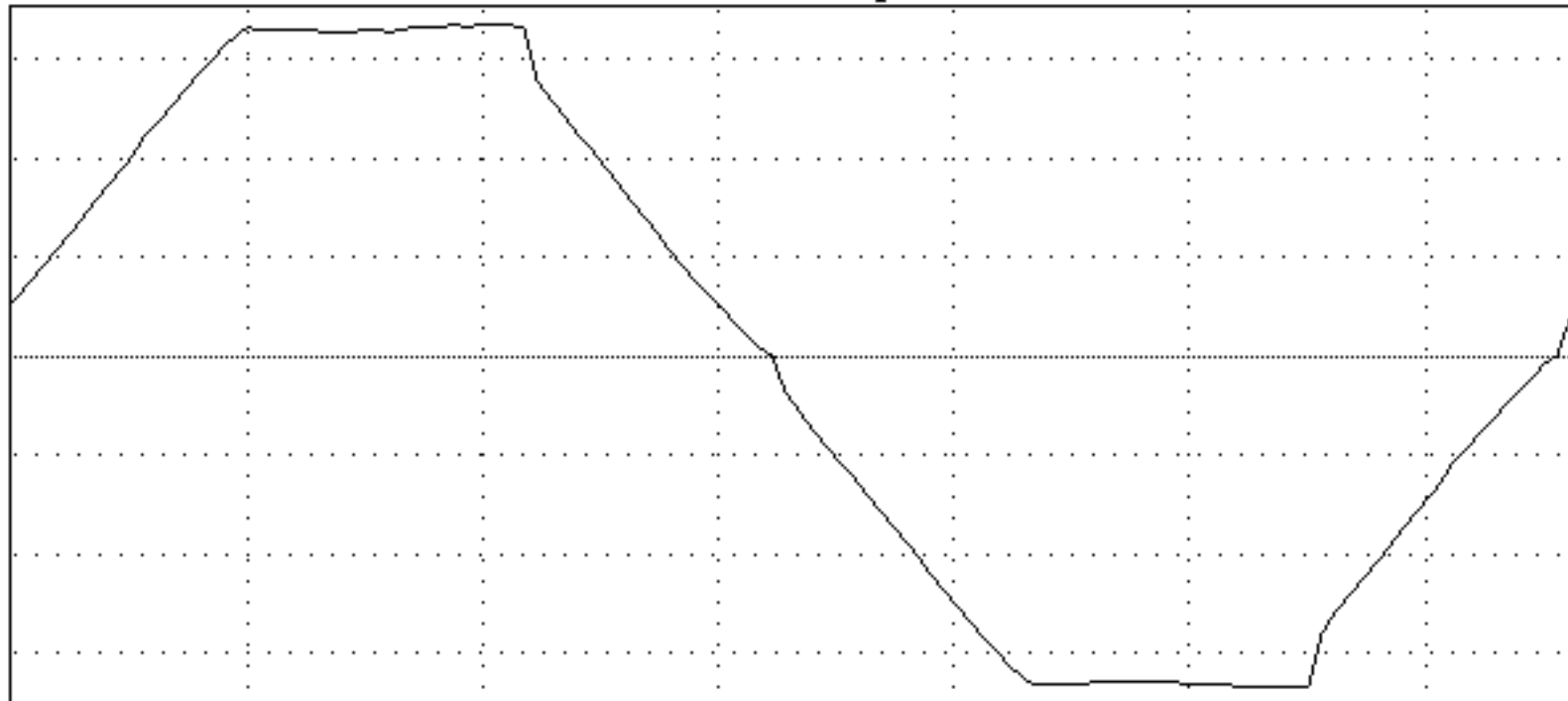
658 GRAPHICAL & HARMONIC ANALYSIS (c)1988-1994 Dranetz Technologies, Inc.
CLINTONVILLE 10.4.95
Event Number 87 Channel A Setup 1 10/04/95 10:41:10.18



Horizontal 2500 microseconds/division Vertical 100 Volts/division
Urms: Prev=208.8, Min=208.5, Max=208.5 - Worst Imp= 0 Upk, 0 deg

Harmonics

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U OF W
Event Number 44 Channel A Setup 1 01/11/94 10:55:42.17



Horizontal 2500 microseconds/division Vertical 200 Volts/division
Urms: Prev=495.1, Min=495.7, Max=495.7 - Worst Imp= 0 Upk, 0 deg

The wave form above is the “time domain” representation of the wave form. We can use a “frequency domain” representation of the wave form as shown below:

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C Forster 608.835.9009

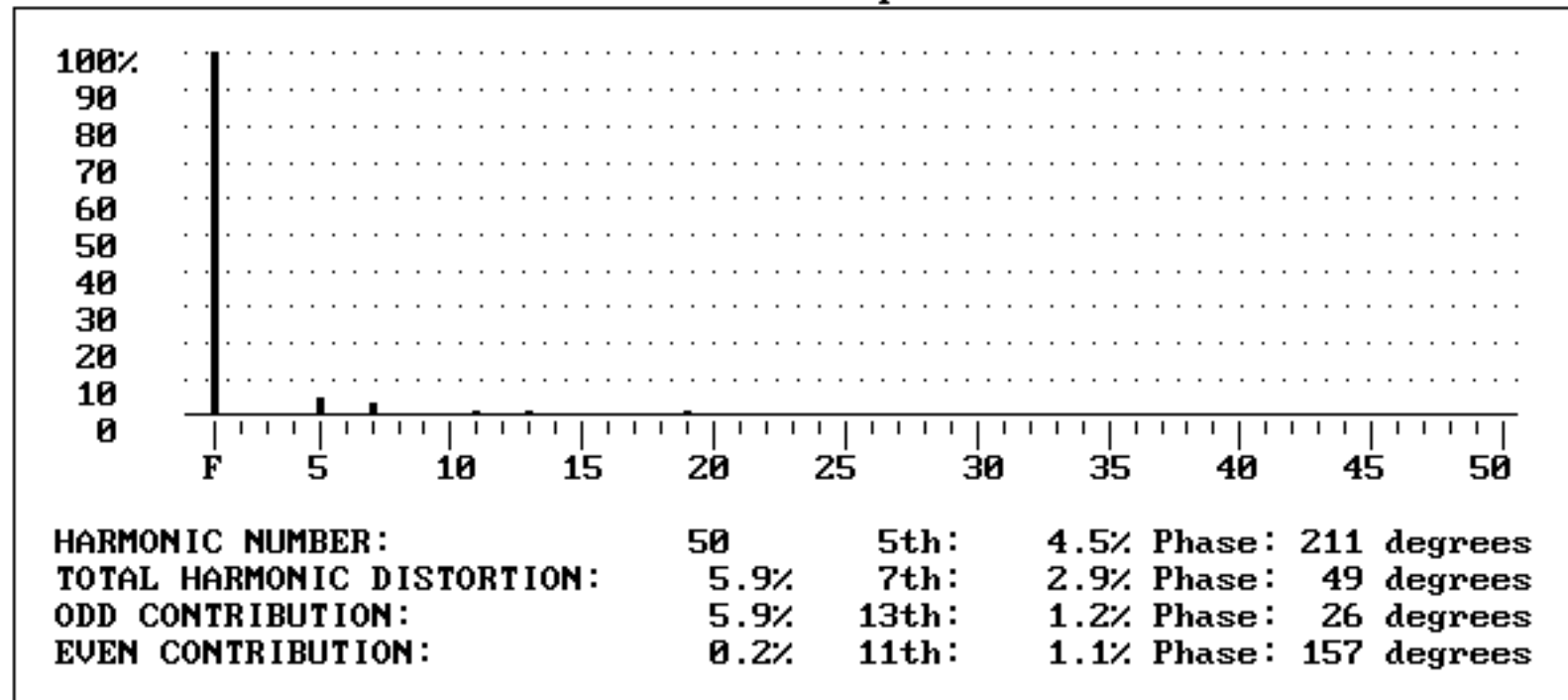
Event Number 44

Channel A

Setup 1

01/11/94

10:55:42.17

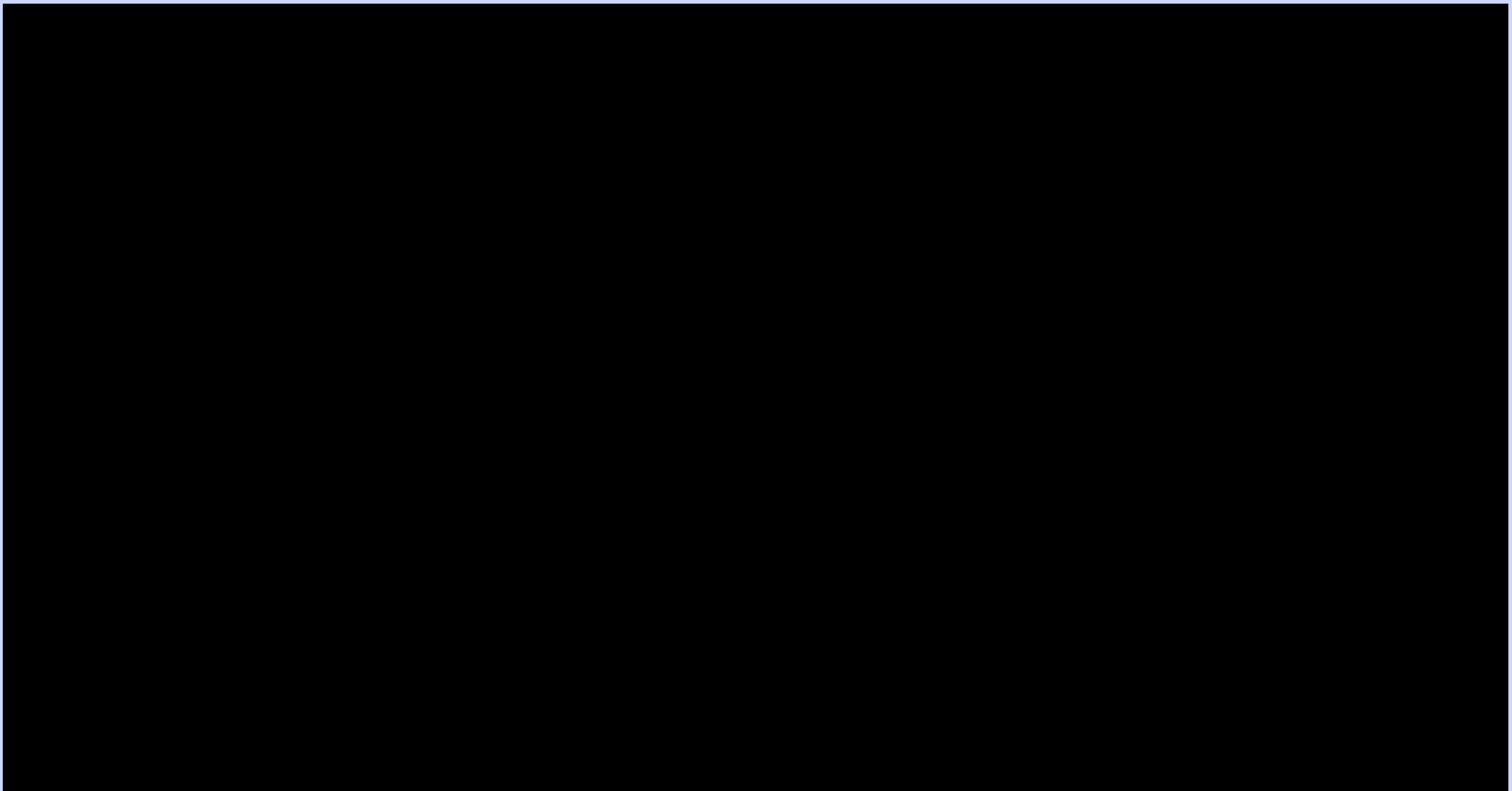


Horizontal: Harmonic Number

Vertical: % of Fundamental

Frequency: 60.0 Hz

When time and frequency domains collide



When a total harmonic distortion (THD) analysis is performed on a recorded impulse, strange outputs occur.

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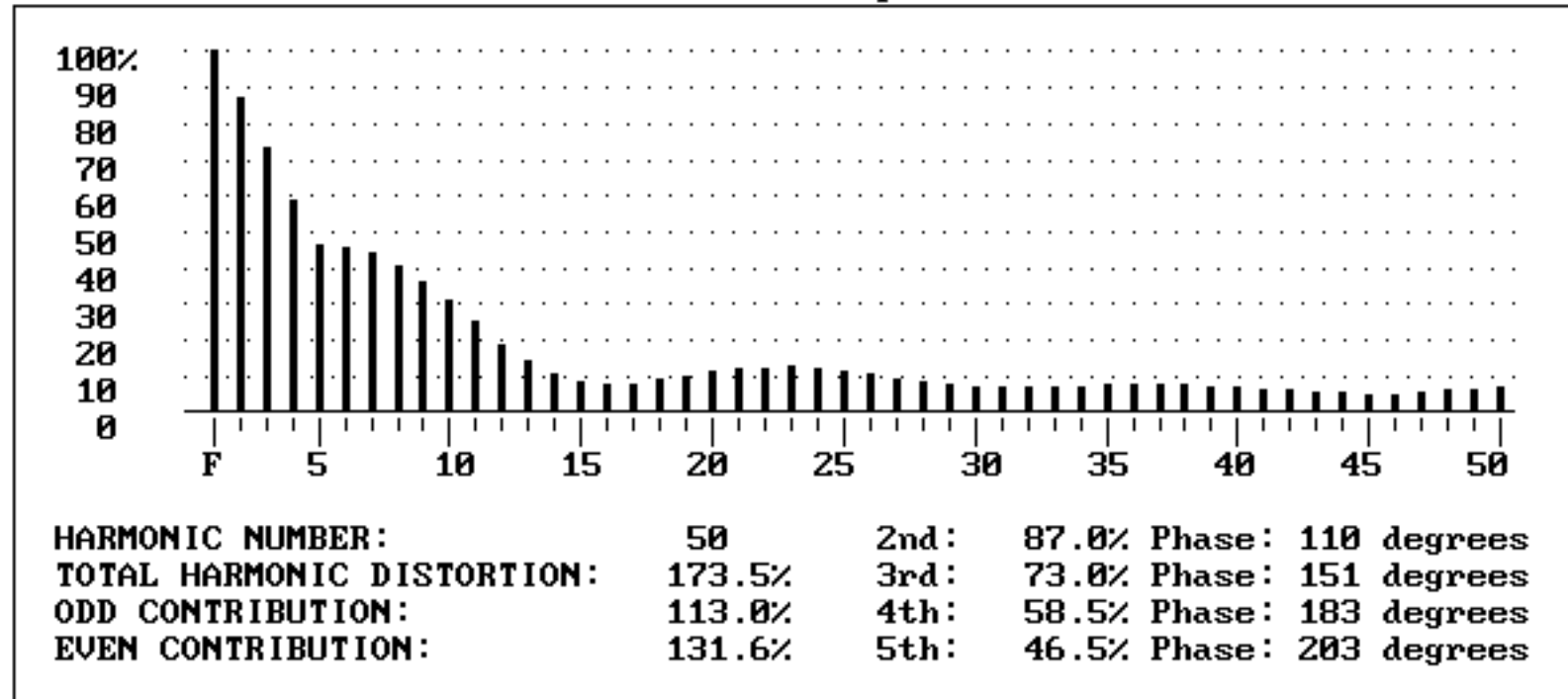
Event Number 68

Channel A

Setup 16

03/17/97

15:24:09.99



HARMONIC NUMBER: 50 2nd: 87.0% Phase: 110 degrees
TOTAL HARMONIC DISTORTION: 173.5% 3rd: 73.0% Phase: 151 degrees
ODD CONTRIBUTION: 113.0% 4th: 58.5% Phase: 183 degrees
EVEN CONTRIBUTION: 131.6% 5th: 46.5% Phase: 203 degrees

Horizontal: Harmonic Number

Vertical: % of Fundamental

Frequency: 60.0 Hz

Conclusion

- **Use the disturbance monitor to monitor incoming power quality if you are curious, but use proper tools designed for cow contact measurements if you need to identify or resolve a stray voltage problem.**