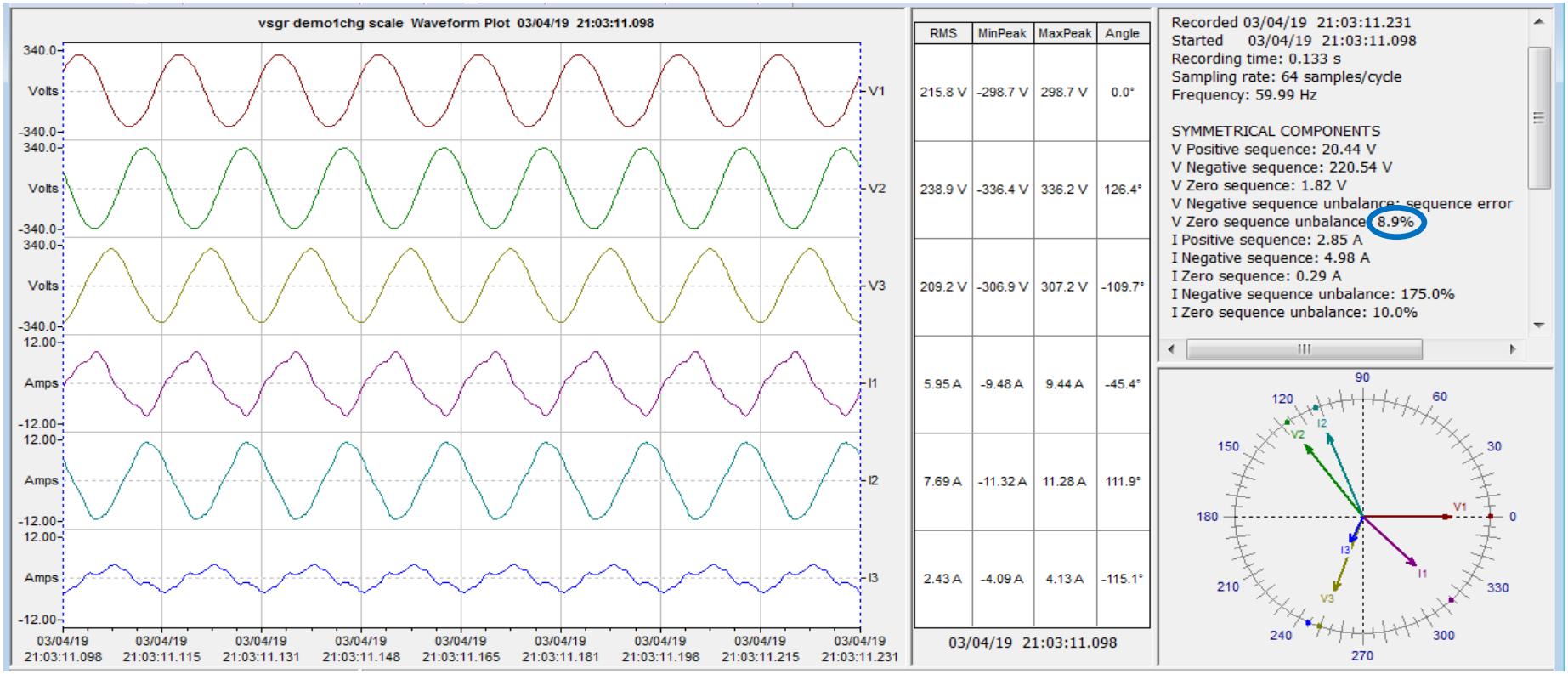
1. PROTECTED- Normal condition — Electrical System protected by *Phaseback VSGR*

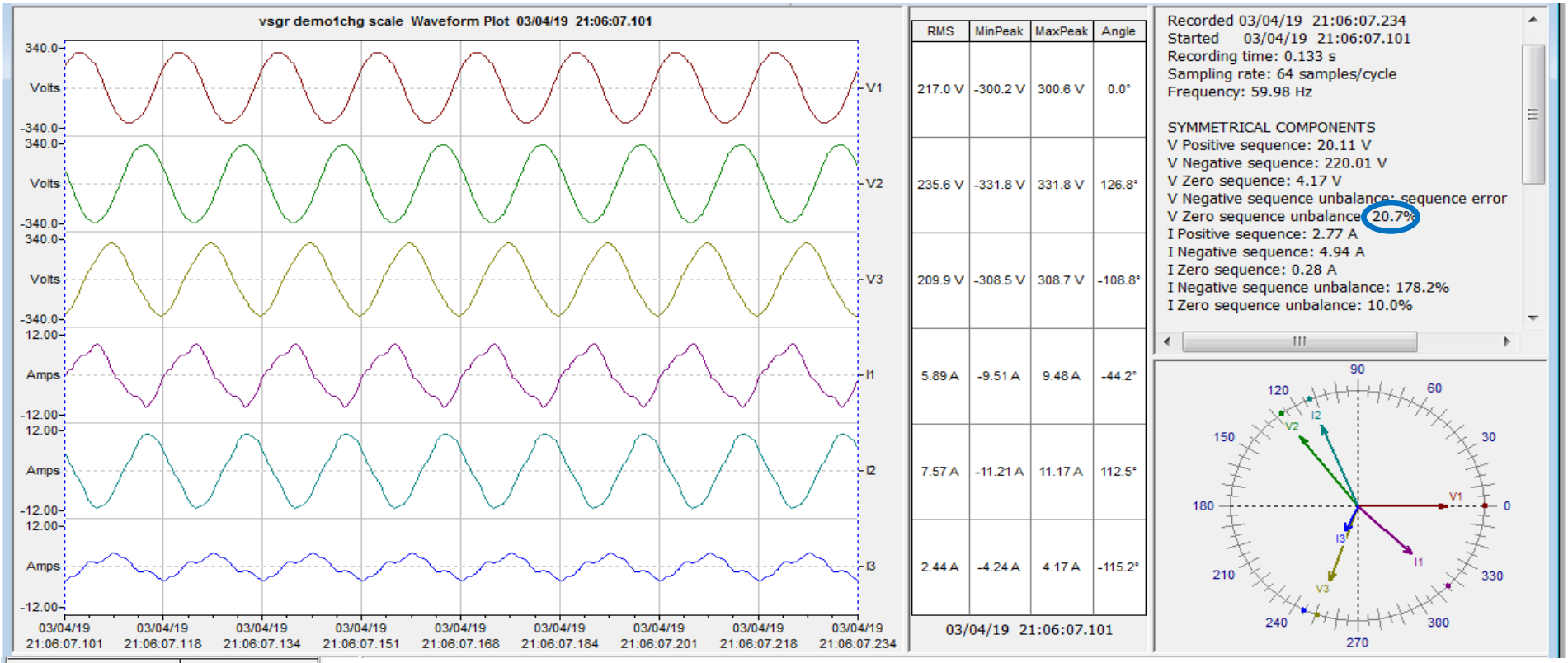


Parameter	Value
V1	213
V2	236
V3	206
I1	6
I2	8
I3	2
In	1
kW	3
kvar	1
kVA	3
PF	0.913
FREQ	59.98
V1 THD	4.0
V2 THD	0.7
V3 THD	5.1
I1 THD	16.8
I2 THD	7.1
I3 THD	27.7

<u>With VSGR protecting the electrical system,</u>

- Voltage surges are neutralized.
- Arcing ground faults are corrected, alarmed, & the system continues to operate.
- Electrical noise & harmonics are corrected, minimizing the operational issues.
- Voltages ph/grnd are corrected, stopping single phase sags & single phase events.
- Phase Angle displacement is corrected — Controls, after outage, work as before.
- Arc Flash events caused by single phse ground faults are prevented.
- **(85% of Arc Flash events are caused this way)**

2. **PROTECTED** Arcing Ground Fault begins — System is protected by ***Phaseback VSGR***

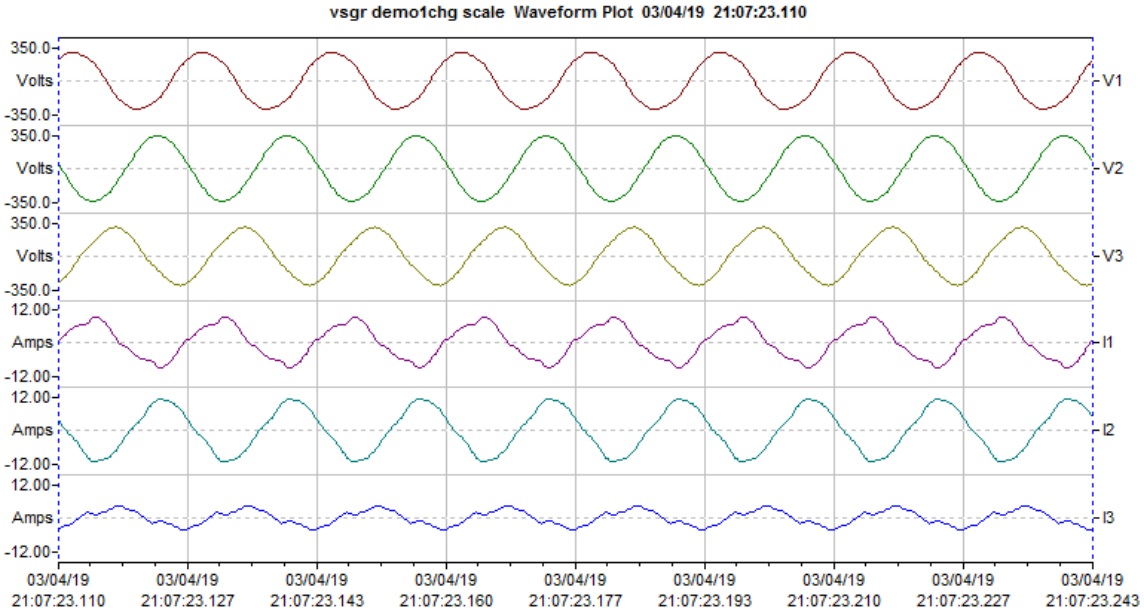


Parameter	Value
V1	214
V2	233
V3	207
I1	6
I2	7
I3	2
In	1
kW	3
kvar	1
kVA	3
PF	0.913
FREQ	59.97
V1 THD	4.0
V2 THD	0.9
V3 THD	5.1
I1 THD	16.4
I2 THD	6.5
I3 THD	27.9

<u>With VSGR protecting the electrical system, during a fault condition,</u>

- The fault is not allowed to develop.
- The system to continues to operate.
- Electrical noise & harmonics & operational issues are minimized.
- Voltages ph/grnd are corrected, stopping single phase sags & single phase events.
- Phase Angle displacement is corrected
- Arc Flash events are prevented. (**85% of Arc Flash events are caused this way**)

3. UNPROTECTED Normal condition — System is unprotected



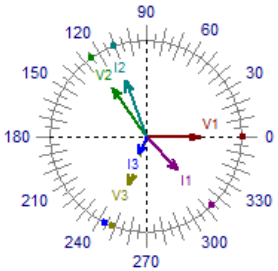
	RMS	MinPeak	MaxPeak	Angle
V1	214.9 V	-298.2 V	298.2 V	0.0°
V2	243.8 V	-342.1 V	342.4 V	124.9°
V3	207.9 V	-304.3 V	304.6 V	-111.6°
I1	5.83 A	-9.29 A	9.29 A	-46.3°
I2	7.68 A	-11.36 A	11.39 A	109.9°
I3	2.57 A	-4.31 A	4.39 A	-116.4°

03/04/19 21:07:23.110
x = 0.000 ms

Recorded 03/04/19 21:07:23.243
Started 03/04/19 21:07:23.110
Recording time: 0.133 s
Sampling rate: 64 samples/cycle
Frequency: 59.99 Hz

SYMMETRICAL COMPONENTS
V Positive sequence: 20.17 V
V Negative sequence: 221.63 V
V Zero sequence: 2.35 V
V Negative sequence unbalance: sequence error
V Zero sequence unbalance: 11.6%
I Positive sequence: 2.76 A
I Negative sequence: 4.99 A
I Zero sequence: 0.28 A
I Negative sequence unbalance: 180.7%
I Zero sequence unbalance: 10.3%

Parameter	Value
V1	213
V2	242
V3	206
I1	6
I2	8
I3	3
In	1
kW	3
kvar	1
kVA	3
PF	0.912
FREQ	59.92
V1 THD	4.5
V2 THD	1.1
V3 THD	4.6
I1 THD	16.5
I2 THD	7.1
I3 THD	26.9

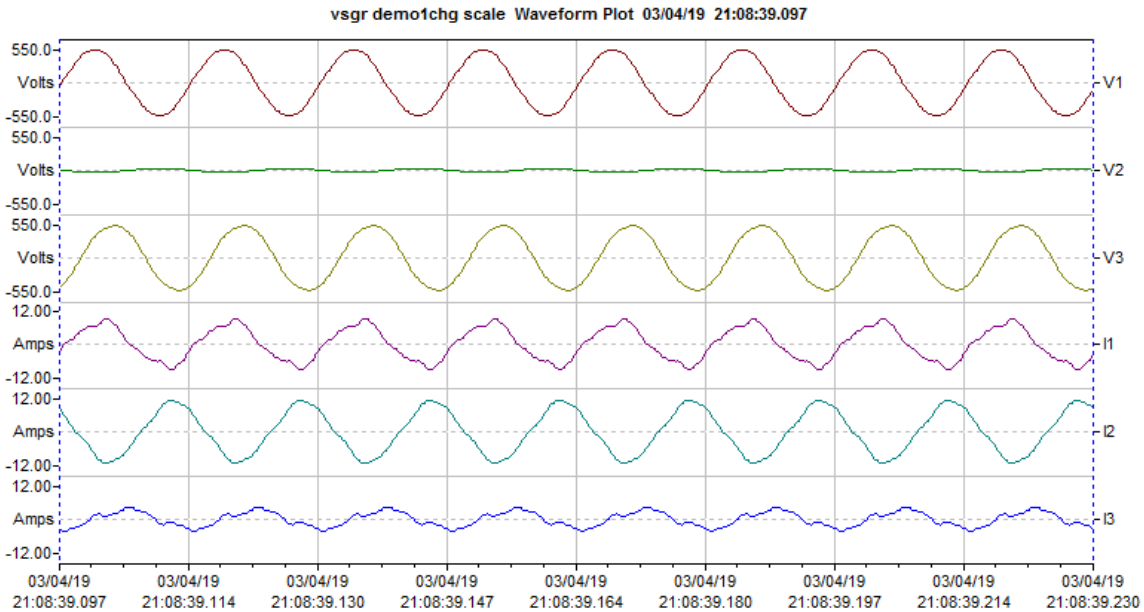


Electrical System Risks are:

1. Voltage Transients
2. Electrical Noise & Harmonics
3. Single Phase Sags
4. Voltage swells
5. Outages
6. Faults or Arc Flash events

Developing Ground Faults (Arcing Ground) can cause all of these system problems.

4. UNPROTECTED Arcing Ground Fault condition — System is unprotected

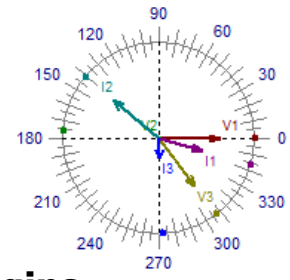


	RMS	MinPeak	MaxPeak	Angle
V1	386.9 V	-541.4 V	541.6 V	0.0°
V2	16.4 V	-21.0 V	21.2 V	175.4°
V3	383.4 V	-529.5 V	529.9 V	-52.6°
I1	5.73 A	-9.22 A	9.18 A	-16.5°
I2	7.61 A	-11.25 A	11.21 A	139.8°
I3	2.54 A	-4.24 A	4.28 A	-87.2°

03/04/19 21:08:39.097
x = 0.000 ms

Recorded 03/04/19 21:08:39.230
Started 03/04/19 21:08:39.097
Recording time: 0.133 s
Sampling rate: 64 samples/cycle
Frequency: 60.00 Hz

SYMMETRICAL COMPONENTS
V Positive sequence: 21.69 V
V Negative sequence: 218.63 V
V Zero sequence: 225.01 V
V Negative sequence unbalance: sequence error
V Zero sequence unbalance: 1037.6%
I Positive sequence: 2.73 A
I Negative sequence: 4.93 A
I Zero sequence: 0.30 A
I Negative sequence unbalance: 180.6%
I Zero sequence unbalance: 10.8%



Parameter	Value
V1	384
V2	17
V3	381
I1	6
I2	8
I3	3
In	1
kW	3
kvar	1
kVA	3
PF	0.923
FREQ	59.98
V1 THD	2.2
V2 THD	0.0
V3 THD	3.2
I1 THD	16.6
I2 THD	6.8
I3 THD	27.2

Typical electrical system, as a Ground Fault condition begins

- The Arcing ground fault pulls Voltage 2 down.
- V 2 drops, while V1 & V3 go to the ph/ph voltage range—Single phase condition.
- System Depends on the relays to open breaker(s), shutting it down.
- Electrical noise, harmonics & operational issues are likely to cause the controls to malfunction, as this happens.
- Phase Angles are displaced, and will contribute to control lockup, upon restart.
- **85% of Arc Flash events are caused this way.**