

# EM - ENERGY SOLUTIONS

## ELECTRO MAGNETIC ENERGY SOLUTIONS

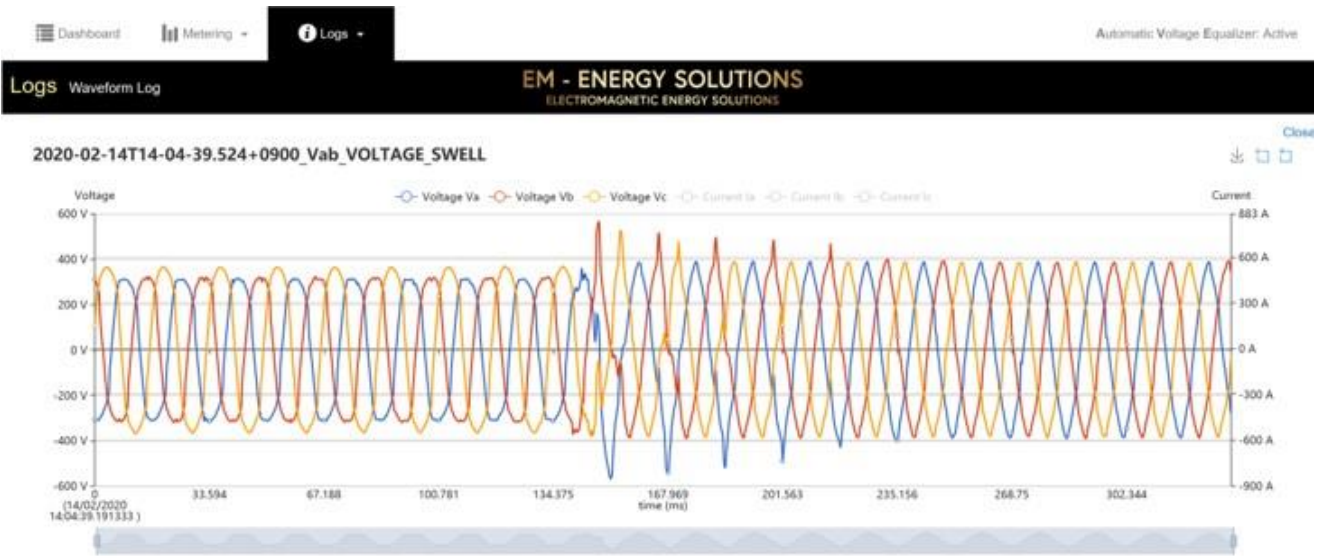
### Automatic Voltage Equalizer – AVE

Voltage Balancing | Surge Suppression | Network Analyzer  
Low, Medium & High Voltage Systems

The Automatic Voltage Equalizer is an outgrowth of Wye Broken-Delta grounding transformer technology, in use for many years in industries utilizing three-phase ungrounded power. This type of system grounding has several very important benefits. Fault current can usually be limited to less than ten amps, thus preventing a) significant equipment damage, and b) by limiting incident fault-energy, arc-flash is not possible. Tests of this type of system grounding reveal that such units may react in as little as 1 ms to a voltage balance upset while correcting the loss of phase voltage. The AVE then re-balances the system voltages, thus restoring the proper phasor relationships. This is offered in order to minimize production systems upset and avoid heat stress on rotating equipment. The AVE is a parallel-connected device connected to your main switchgear fed by a 30 amp three-phase breaker and equipment ground.

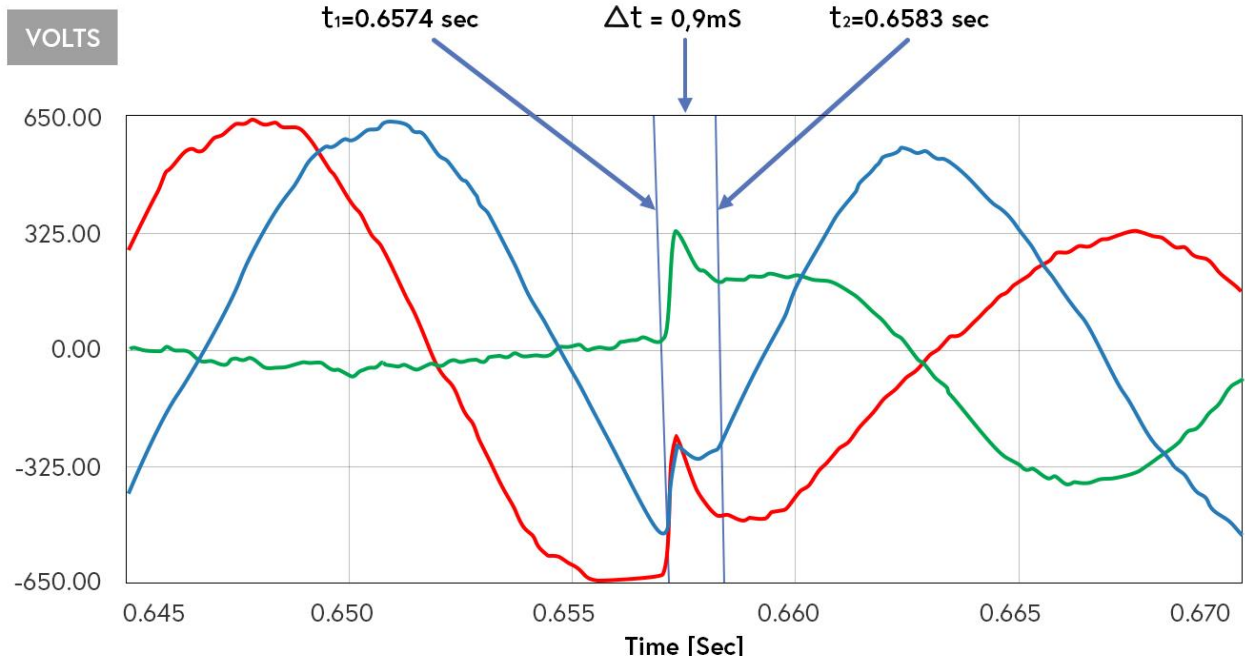


# Voltage Balancing



The Waveform log above is captured by EMES PQA during welding machine operation and shows the exact moment when AVE is activated. The Waveform before the AVE activation is distorted with a high voltage unbalance (8-9%). After AVE activation, we see a short transitional period of 30-40ms where the unit stabilizes the system, mitigates harmonic distortion, eliminates transients, and reduces voltage unbalance (0.5%). After the AVE is activated, we can see a perfect sine wave and a 100% balanced system.

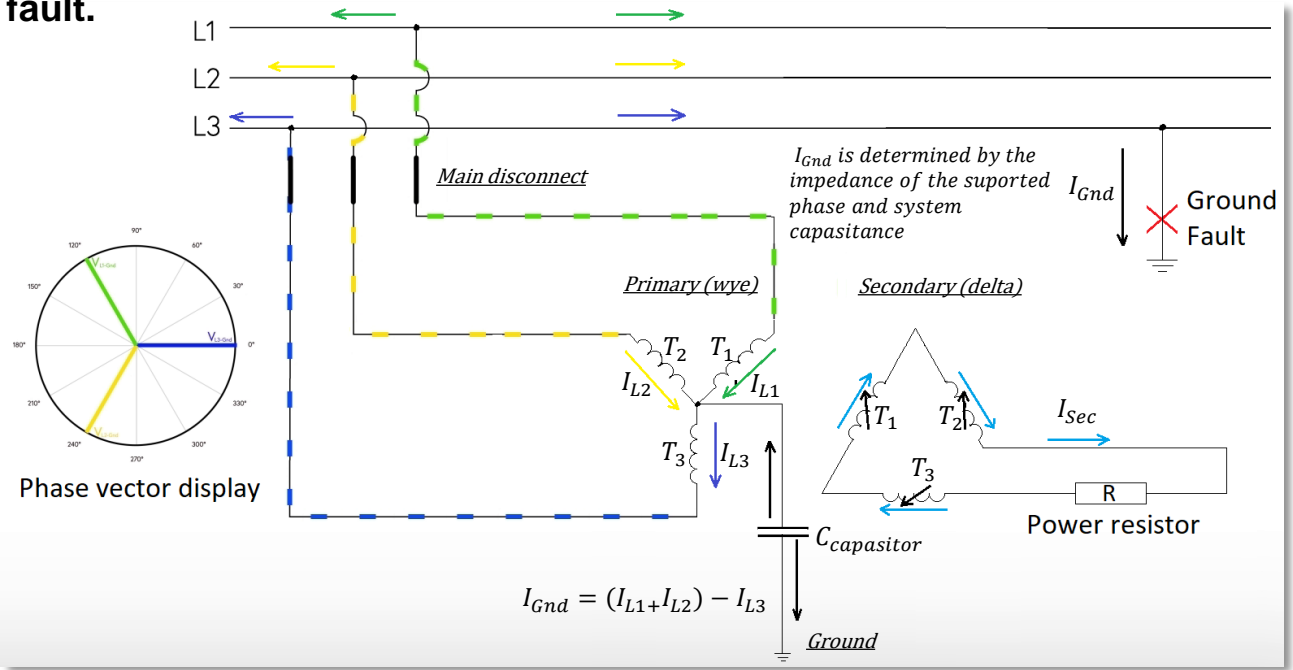
## Loss of Phase (grounded) speed of operation



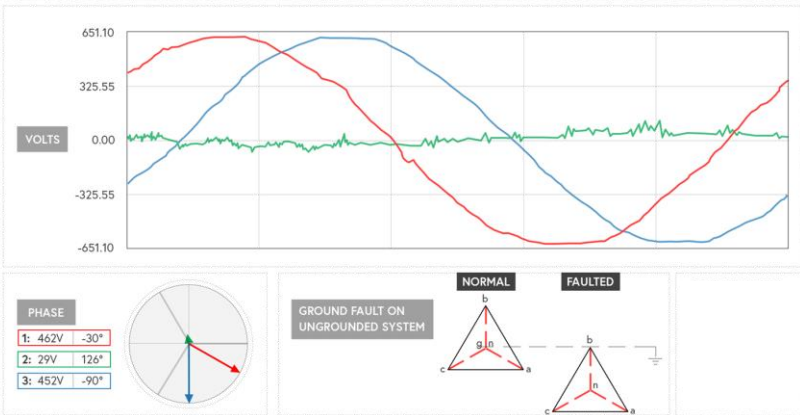
Picture shows how fast the AVE reacts to a voltage imbalance and stabilizes the system. The reaction time is less than 0.9ms.

# Reacting to Ground Fault

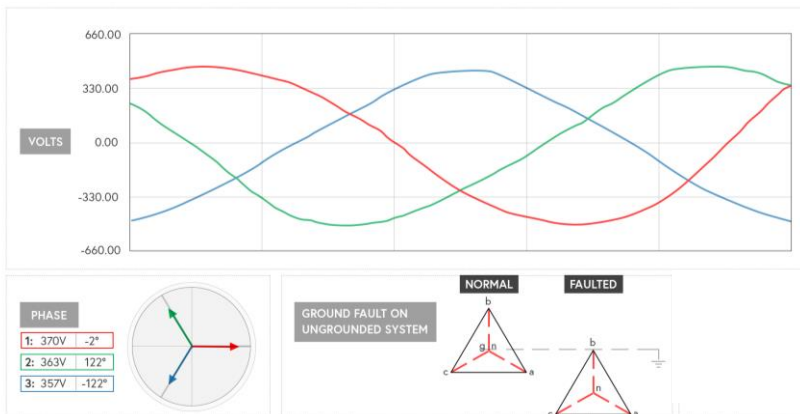
## Basic circuitry of AVE during ground fault.



## Ground fault recovery with AVE

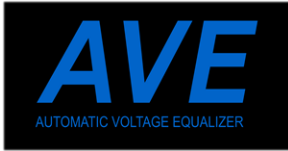


Graph shows waveform and phasor diagram for a 3-phase distribution system with ground fault on phase B with AVE deactivated.



Graph shows waveform and phasor diagram for a 3-phase distribution system with ground fault on phase B when AVE is activated.

# Product range and benefits



## Benefits

- Stabilize and balance phase voltage
- Eliminate transients and short circuit
- Reduce dangers of arc flash
- Reduce harmonic distortion
- Cancel out harmonic frequencies
- Reduce energy consumption
- Extend lifespan of electrical motors and components
- Permit greater cable lengths between VFD and motor
- Eliminate VFD transients and distortions
- Reduced  $I^2R$  losses
- Reduced downtime
- Save costs
- Reduces CO<sub>2</sub> emissions

Unit type	AVE	AVE Fixed	AVE Mini	AVE High Voltage	AMO
Voltage class [Vac]	250/480	250/480/690	250/480	1500/5000/7500 /15000	250/480/690
kVA rating [kVA]	3000/6000	1200/3000/6000	400/800/1200	-	100//200/400
Power quality meter	✓	✓	Optional	✓	×
Web interface	✓	✓	Optional	✓	×
Cloud solution	Optional	Optional	Optional	✓	×
Floor mounting	Optional	Optional	Optional	✓	Optional
Weight [lbs/kg]	308/140	364/165	198/90	-	-
Size [Inch/mm]	31,5×47,2×15,8/800x1200x400	31,5×47,2×15,8/800x1200x400	23,6×39,37×15,8/600x1000x400	-	-
Distribution system	Gr/Ungrounded	Gr/Ungrounded	Gr/Ungrounded	Gr/Ungrounded	Gr/Ungrounded