GARD

Unparalleled Protection

System Grounding Options in MV and LV systems

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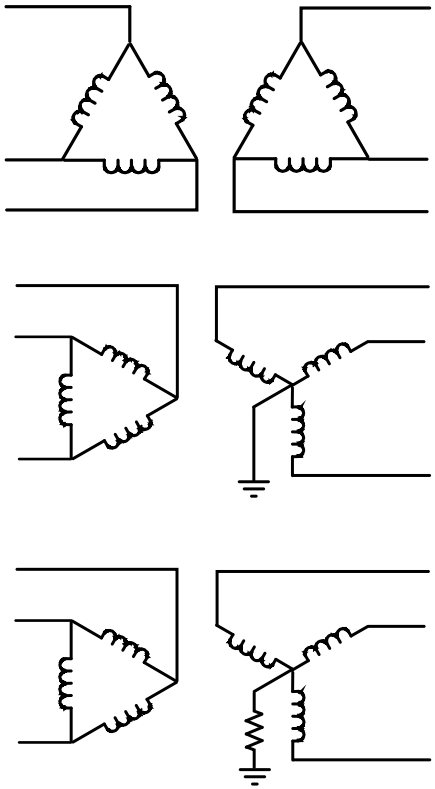
Power System Grounding Methods

- Ungrounded
- Solidly Grounded
  Corner Delta Grounded System
  Mid Phase Grounded System
- Resistance Grounded



Ungrounded Systems

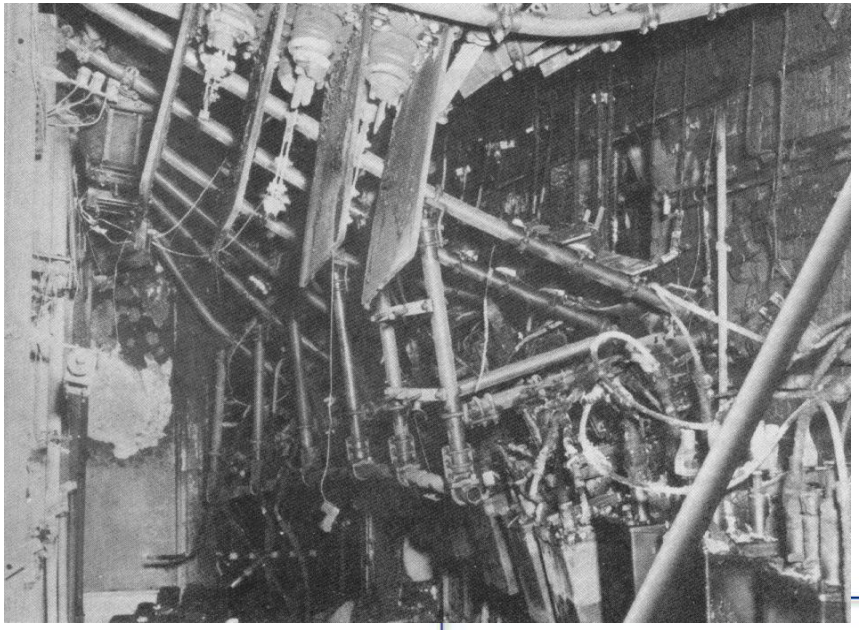
- Negligible fault current and no tripping on first ground fault
- Difficult to locate ground faults
- 5-6 times transient voltage escalation on intermittent, sputtering arcing ground faults due to DC voltage buildup across the stray capacitance to ground
- No longer used, Not recommended

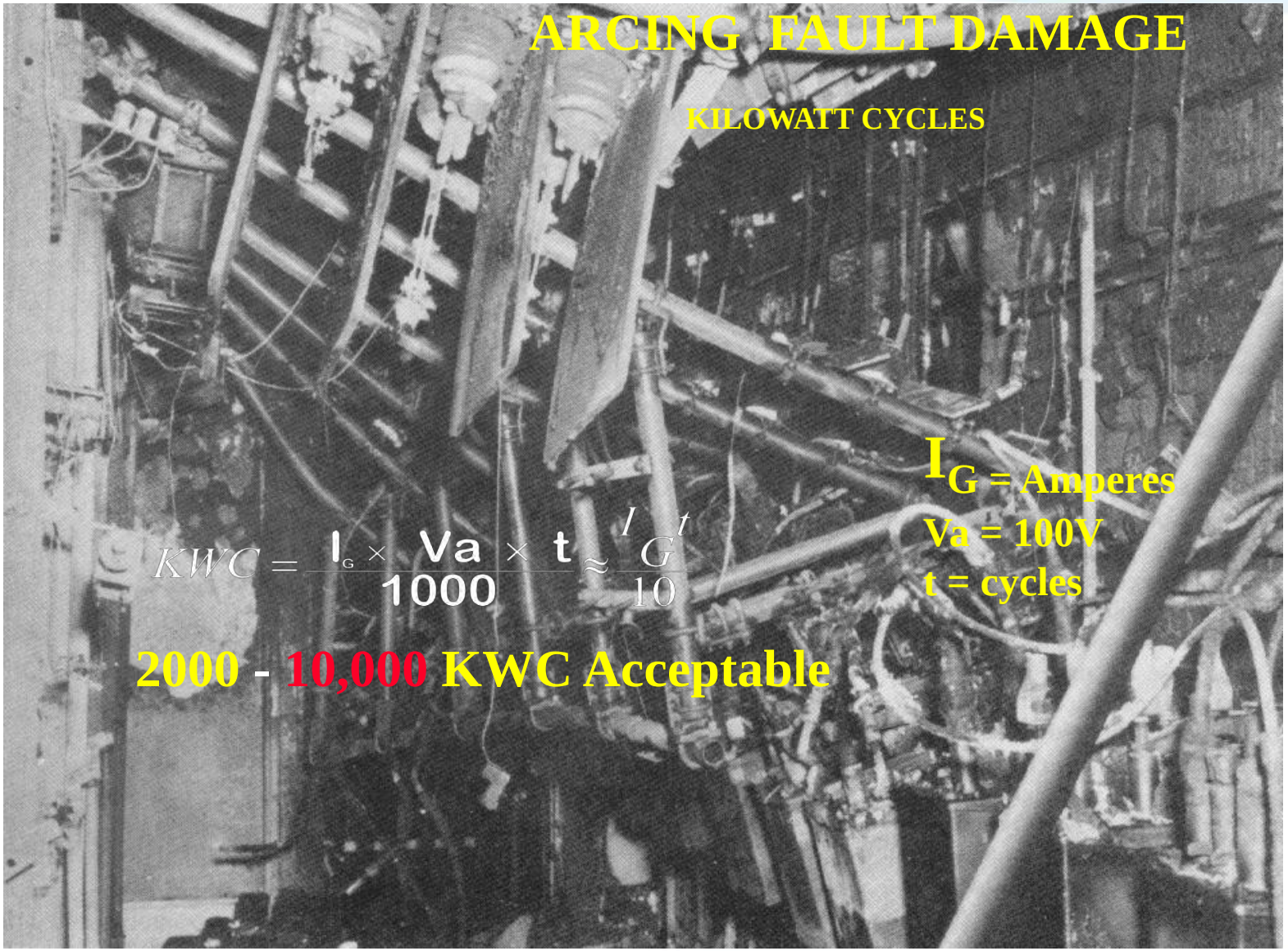
Solidly Grounded Systems

- Eliminates transient overvoltage problem associated with ungrounded systems
- Permits line-to-neutral loads (lighting, heating cables) when Neutral is distributed
- Ground faults easy to locate, but cause **unscheduled service interruption and substantial fault damage**
- **Danger from arcing ground faults at 480 V and 600V** , fault current could be less than half of short circuit current level. **Potential Arc Flash Hazard to people**
- Since 1970's, ground fault protection mandatory for solidly grounded 600V and 480 V services rated 1000A and higher by the CEC and the NEC Ground Fault Protection Relay required at service entrance set for 1200 A or less with time delay 1 sec or less
- **Mandatory for 120/208 V 3 Ph 4 W and 120/240 V 1 Ph 3 W**

Arcing Ground Faults

- Sustained arcing faults can release intense heat and mechanical energy causing **severe damage and injury**
- Fault current can be 50% of Isc or substantially less Arcing fault current given by IEEE 1584




ARCING FAULT DAMAGE
KILOWATT CYCLES
$KWC = \frac{I_G \times Va \times t}{1000} \approx \frac{I_G^2 t}{10}$
I_G = Amperes
Va = 100V
t = cycles
2000 - 10,000 KWC Acceptable

Resistance Grounding

- Used on LV (480 and 600 V) and MV systems to limit ground fault current
- No arcing ground faults as with solid grounding
- No overvoltages as with ungrounded systems
- Application started in Process Industries, Water and Waste Water, Hospitals, Data processing Centers
- Now practically used everywhere when 3 ph 3 wire distribution is used.

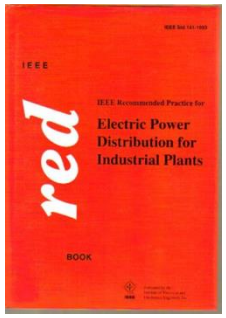
Resistance Grounding - IEEE

IEEE Std. 142-1991 Recommended Practice for Grounding of Industrial and Commercial Power System
1.4.3

The reasons for limiting the current by resistance grounding may be one or more of the following:

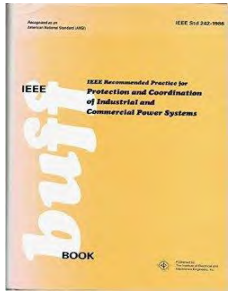
1. **to reduce burning and melting effects in faulted electric equipment, such as switchgear, transformers, cables and rotating machines.**
2. **to reduce mechanical stresses in circuits and apparatus carrying fault currents**
3. **to reduce electric-shock hazards to personnel caused by stray ground fault currents in the ground return path**
4. **to reduce arc blast or flash hazard to personnel who may have accidentally caused or who happen to be in close proximity to the fault current**
5. **to reduce the momentary line-voltage dip occasioned by the occurrence and clearing of a ground fault**

Reducing the Likelihood of Exposure
High Resistance Grounding

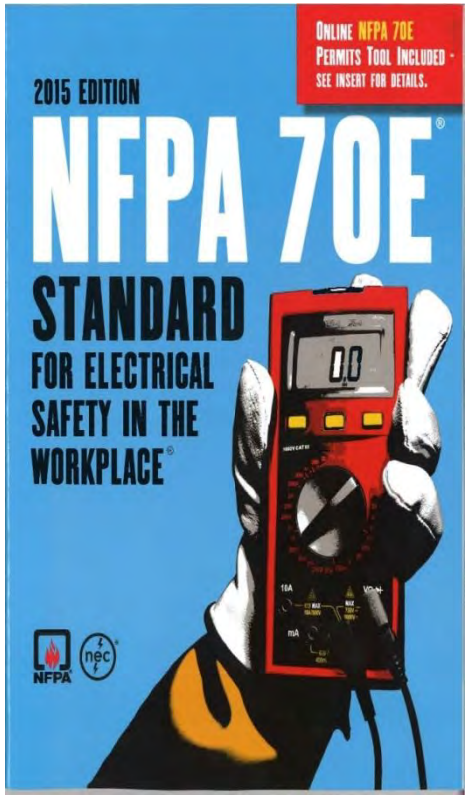


IEEE Std 141-1993 (Red Book)

7.2.2. High-resistance grounding provides the same advantages as ungrounded systems yet limits the steady state and severe transient over-voltages associated with ungrounded systems. There is no arc flash hazard *[for a ground fault on 480V and 600V systems]*, as there is with a solidly grounded system, since the fault current is limited to approximately 5A.



IEEE Std 242-2001 (Buff Book)
8.2.4
High-resistance grounding helps ensure a ground-fault current of known magnitude, helpful for relaying purposes. This makes it possible to identify the faulted feeder with sensitive ground-fault relays.



NFPA 70E / CSA Z462 Annex 0

General Design Requirements 0.2.1

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Informative Annex O Safety-Related Design Requirements

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(3) Enabling achievement of an electrically safe work condition

O.2.3 Incident Energy Reduction Methods. The following methods have proved to be effective in reducing incident energy:

(1) Zone-selective interlocking. A method that allows two or more circuit breakers to communicate with each other so that a short circuit or ground fault will be cleared by the breaker closest to the fault with no intentional delay. Clearing the fault in the shortest time aids in reducing the incident energy.

(2) Differential relaying. The concept of this protection method is that current flowing into protected equipment must equal the current out of the equipment. If these two currents are not equal, a fault must exist within the equipment, and the relaying can be set to operate for a fast interruption. Differential relaying uses current transformers located on the line and load sides of the protected equipment and fast acting relay.

(3) Energy-reducing maintenance switching with a local status indicator. An energy-reducing maintenance switch allows a worker to set a circuit breaker trip unit to operate faster while the worker is working within an arc flash boundary, as defined in NFPA 70E, and then to set the circuit breaker back to a normal setting after the work is complete.

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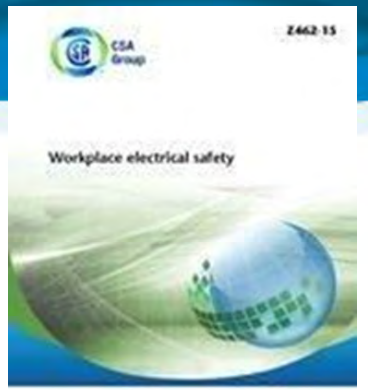

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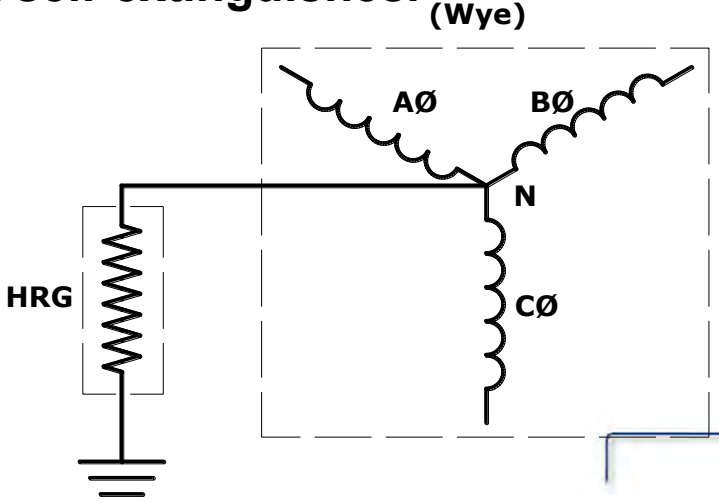
Reducing the Likelihood of Exposure

High Resistance Grounding

How Does HRG reduce Arc Flash?

According to Industrial Power System Grounding Design Handbook - 95% of all electrical faults are phase to ground faults.

By limiting the fault current to a low level, 10 amps or less, there is insufficient current for the arc to re-strike and it self-extinguishes.



Reducing the Likelihood of Exposure
High Resistance Grounding

FM Global 5-18 Protection of Electrical Equipment Single Phase and Other Related Faults

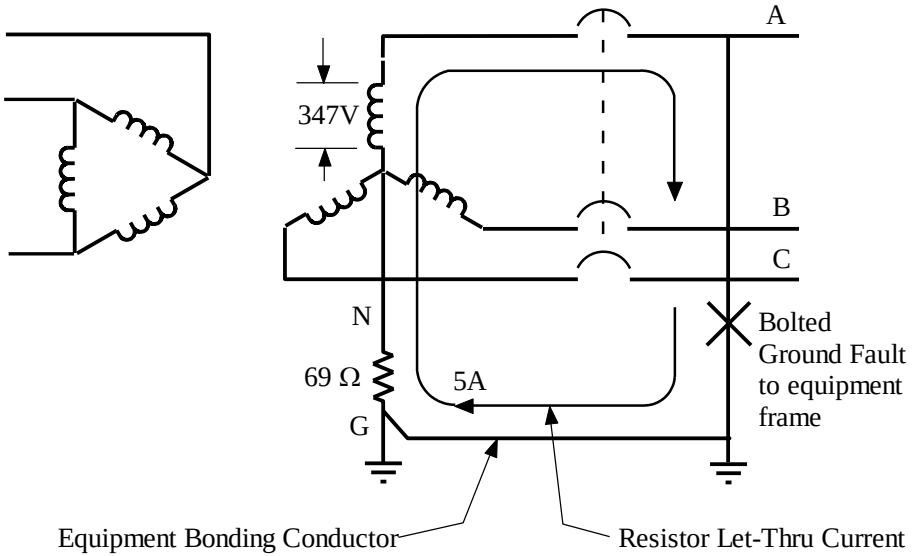
- **In ungrounded systems a phase to ground fault often produces dangerous overvoltage…**
- **Sustained arcing faults in low voltage apparatus are often initiated by a single-phase fault to ground which results in extensive damage to switchgear and motor control centers.**

FM Global 5-10 Protective Grounding for Electric Power Systems and Equipment

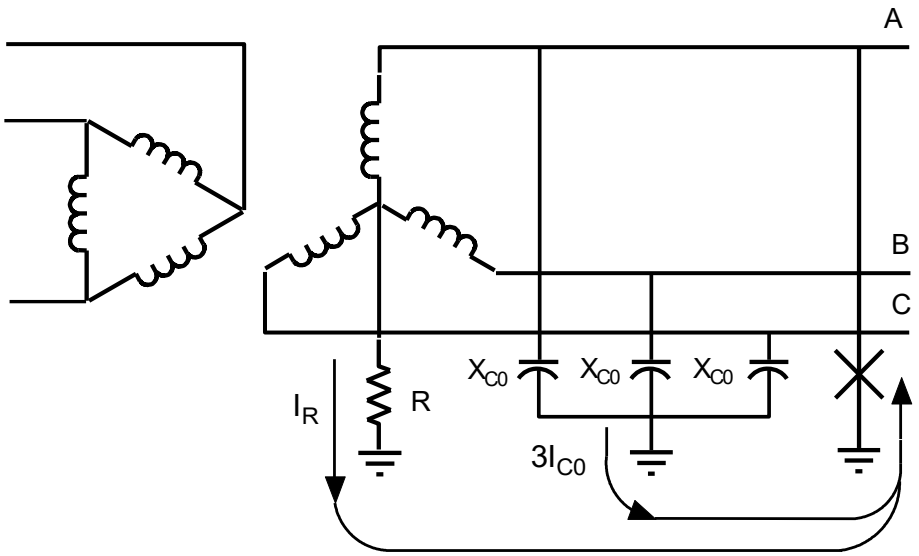
- **2.3.3.1 Unlike the ungrounded system the high resistance grounded system prevents transient overvoltage which can cause potential failure of insulation.**
- **2.3.4.1 Convert ungrounded systems to high resistance grounded systems.**

Resistance Grounding

- Resistor inserted between neutral and ground to limit ground fault current
- Resistor rated for line-to-neutral voltage



Fault Current on HRG System



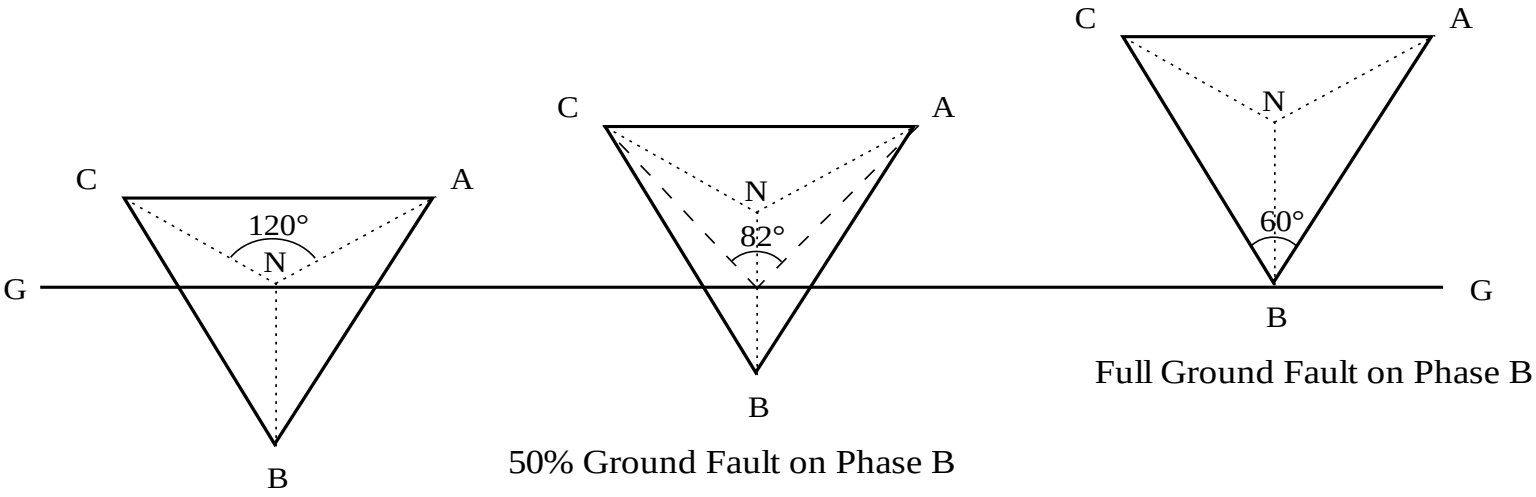
$$I_F = \sqrt{(I_R)^2 + (3I_{C0})^2}$$

I_R should overcome the $3I_{co}$
Contributed by net capacitance to ground

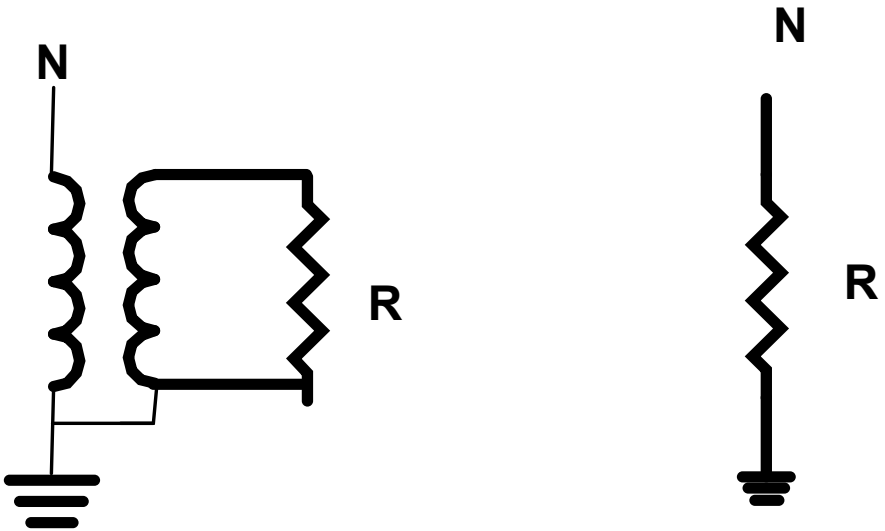
$$I_{F_{MIN}} = \sqrt{2}(3I_{C0})$$

At minimum fault current, $I_R = 3I_{C0}$

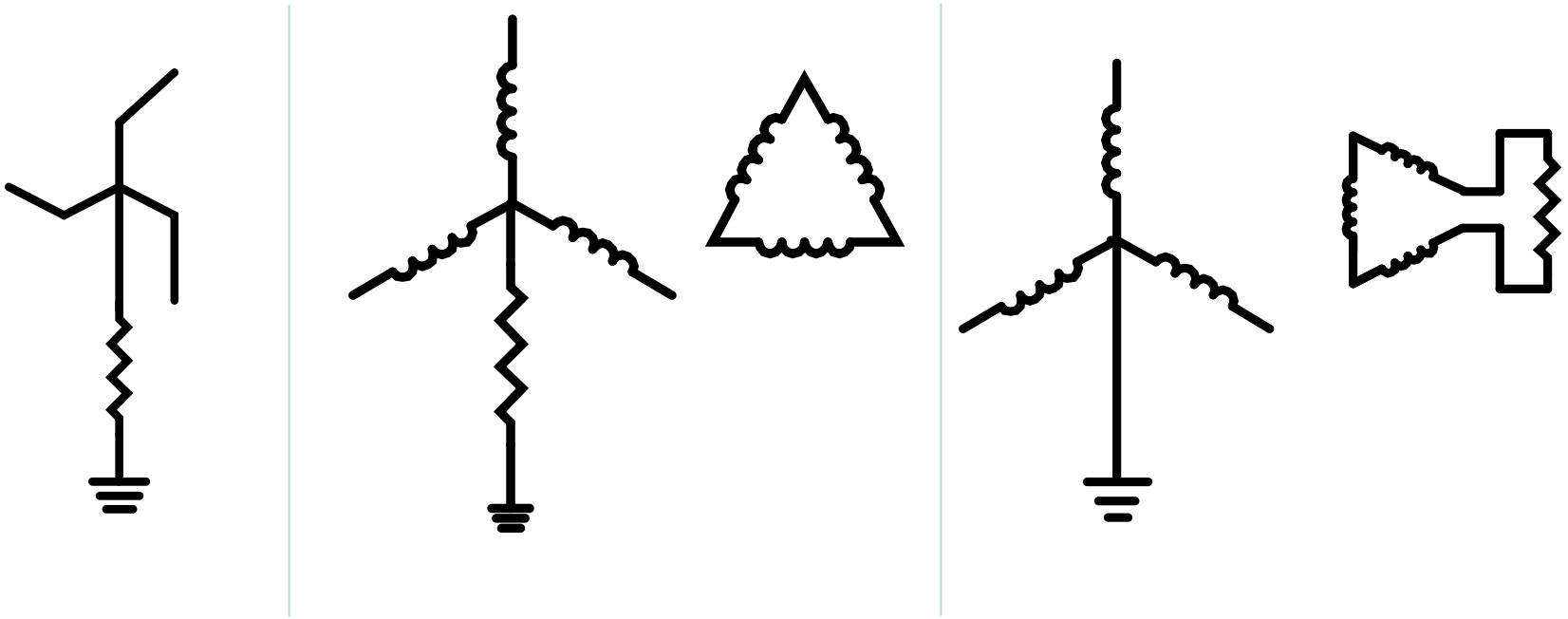
Ground Fault on High Resistance Grounded Systems



Methods of grounding: Neutral available



Methods of grounding
Neutral not available



High Resistance Grounding

Canadian Electrical Code : 10-302

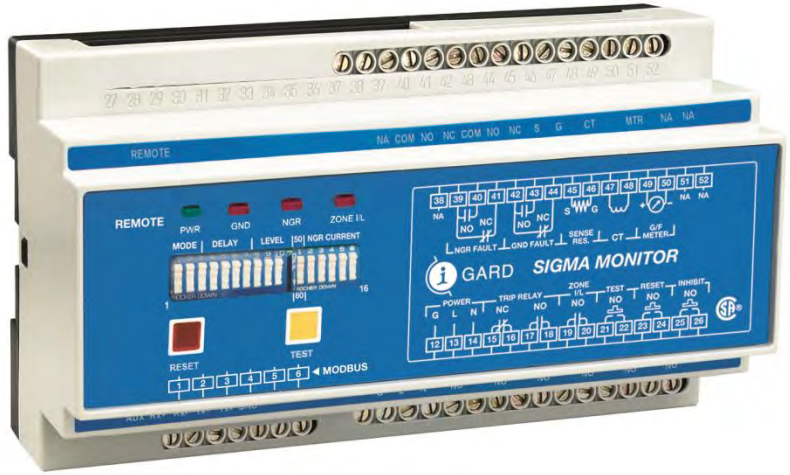
- Where a neutral grounding device is used on an electrical system operating at 5 kV or less, provision shall be made to automatically de-energize the system on the detection of a ground fault, unless:
  - The ground fault current is controlled at 10 A or less; and
  - A visual or audible alarm, or both, clearly identified to indicate the presence of a ground fault, is provided.

  The Neutral to Ground path must be monitored and alarm indicated , the signaling should remain continuous until the condition has been corrected

CSA 22.2 Part II #295-15
Neutral Grounding Resistors

- New Standard issued for certification
- Ratings : Continuous, 10 sec, 30 sec 1 Min
- Table 9 Max temp rise : 375 deg for continuous
  750 deg rise for short time rated
- 6.2.1 Temp coefficient of Resistance : Should not increase the resistance by more than 20%
- Annex C Recommends Resistance monitoring.

NGR Monitoring Ground Fault Relay



SIGMA 3

Description:

The I-Gard SIGMA RELAY is a combination of a Ground Fault relay and a Neutral-Ground path monitor.

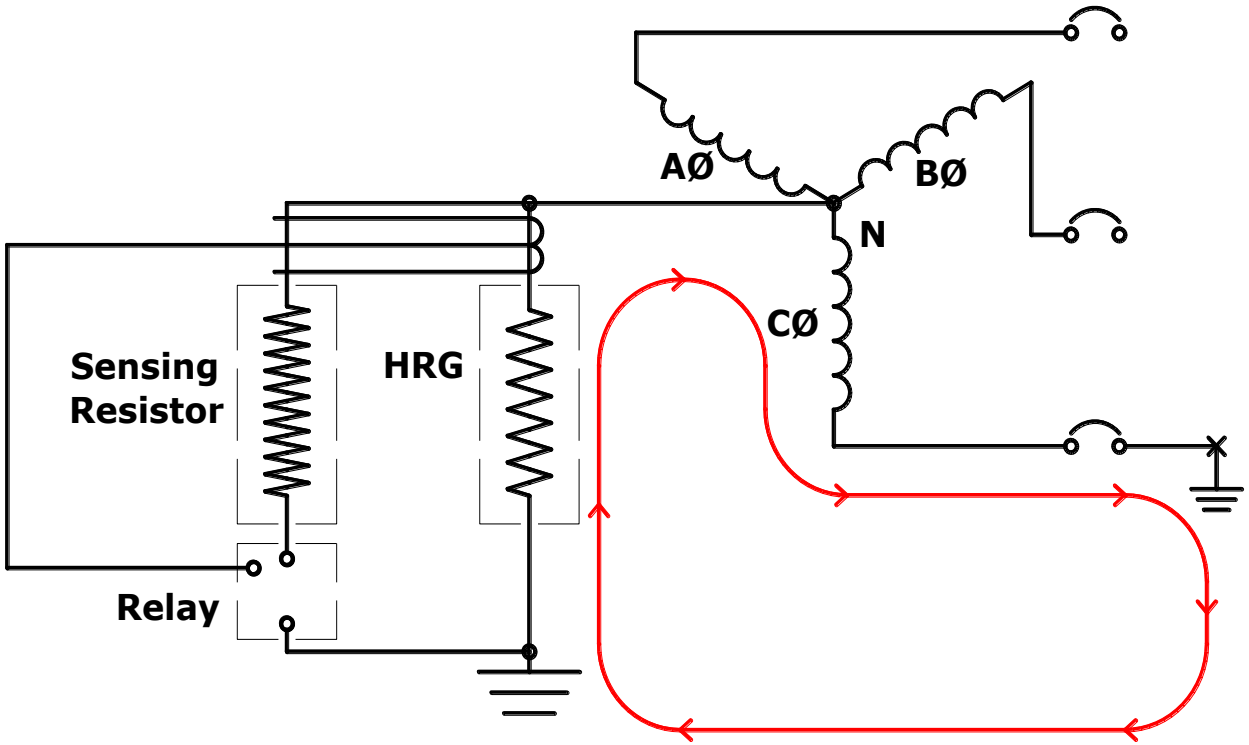
In distribution systems employing Resistance Grounding the SIGMA RELAY protects against ground faults and abnormal resistance values of the Neutral Grounding Resistor (NGR).

The SIGMA RELAY is specifically designed for a variety voltages and a variety of NGRs .

High Resistance Grounding

NGR Monitoring Ground Fault Relay & Sensing Resistor

Detects Open / Short Circuits and maintains Grounding



Loss of Ground in HRG Systems

High Resistance Grounding

- Limit ground fault current to 10 A or less
- Provides service continuity on first ground fault
- Prevents arc flash incidents on first ground faults
- Allows faults to be located without de-energizing feeders (ground fault pulse locating)
- Used in 3 phase 3 wire circuits at 480. 600 and 4160 V specially in continuous process industries, hospitals, data centers and station service in gen stations where unscheduled downtime is costly or cannot be tolerated.

Design Considerations when applying HRG Systems

HRG is the best Grounding Method available today

- First developed with resistor and pulsing contactor (Analog)
- Least Hazards of all grounding methods, but some points to note
  - Elevates Voltage to ground to Line to line voltage on L-G fault
    - ✓Trained Personnel
    - ✓Cables, TVSSs, VFDs Insulation
  - Line-to-Neutral Loads not served
  - Phase-to-ground-to-phase Faults
    - ✓Bypasses neutral grounding resistor
    - ✓Circuit breakers required rated for Line to line Voltage

Arc Flash Hazard: HRG Technology can play a role in prevention

HRG Systems Resolve these Hazards

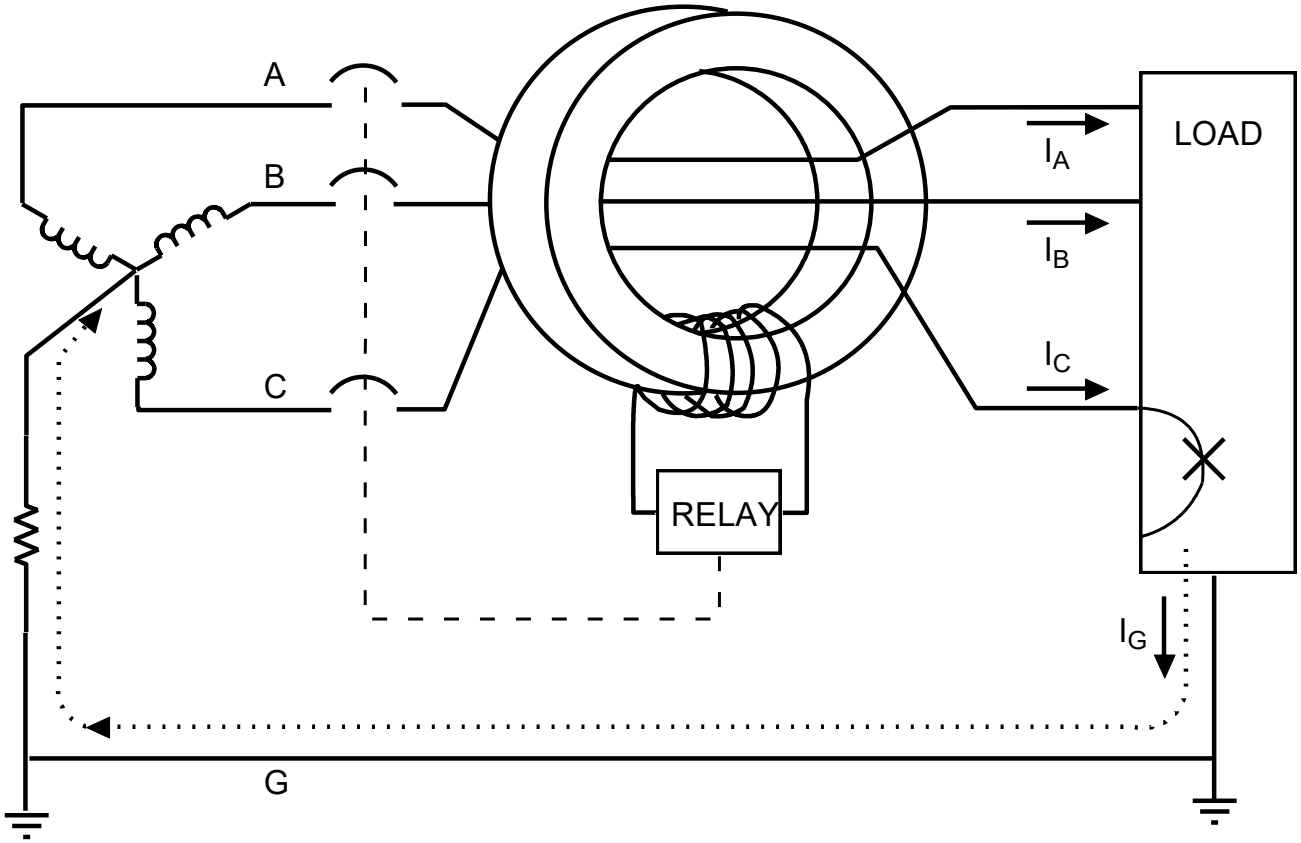
Distribution System Design Criteria

High Resistance Grounded

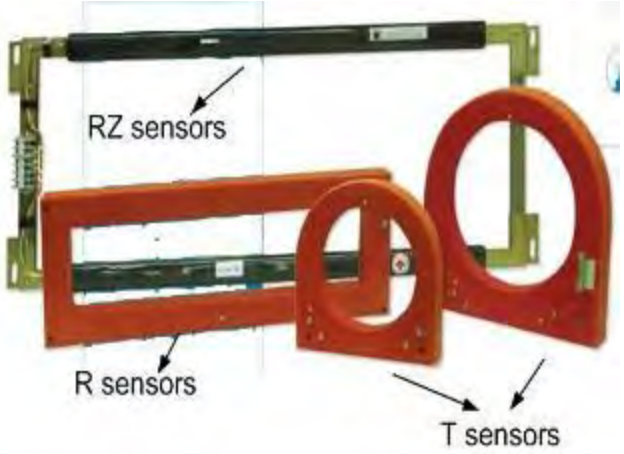
- **Reliability** Power continuity, No trips on ground fault
- **Safe** No Arc Blast or Flash Hazard on Ground Fault
- **Cost effective** 3 Wire Systems are cheaper than 4 wire
- **Scheduled Maintenance** Faulty equipment can continue to run, scheduled shut downs and lower repair costs

- **Prioritized load** Overcurrent Coordination maintained
  Selective second fault protection available

Sensing Ground Faults Using a Zero Sequence Sensor



Zero Sequence Sensors



Description:
The I-Gard zero sequence current sensors are used to detect ground leakage currents on medium or low voltage, grounded or ungrounded AC electrical systems. The output from the sensors is used to operate I-Gard ground relays to provide equipment or life protection depending on the relay selected.
The sensor should encircle the phase conductors and the neutral, if it exist s and is used, but not the grounding conductor or the shield of the cable.

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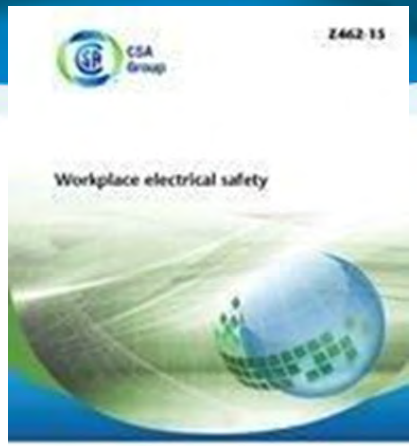

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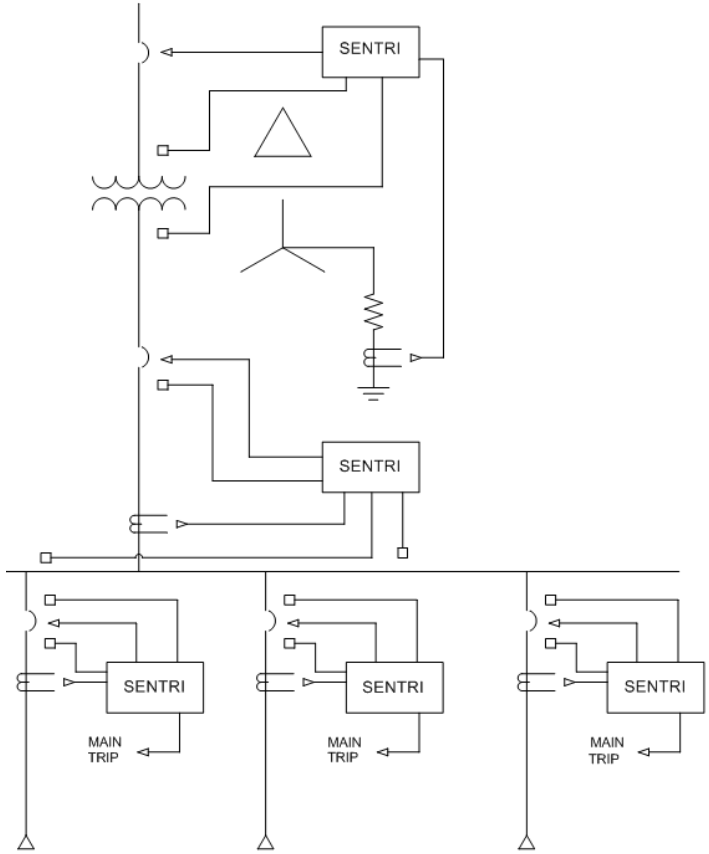
Zero Sequence Current Sensing and Arc Flash sensing Relay - Sentri

- Selective – identifies faulted feeder
- 3- Optical sensor Inputs
- Can provide Line side Arc Flash protection



HRG and Arc Flash Protection

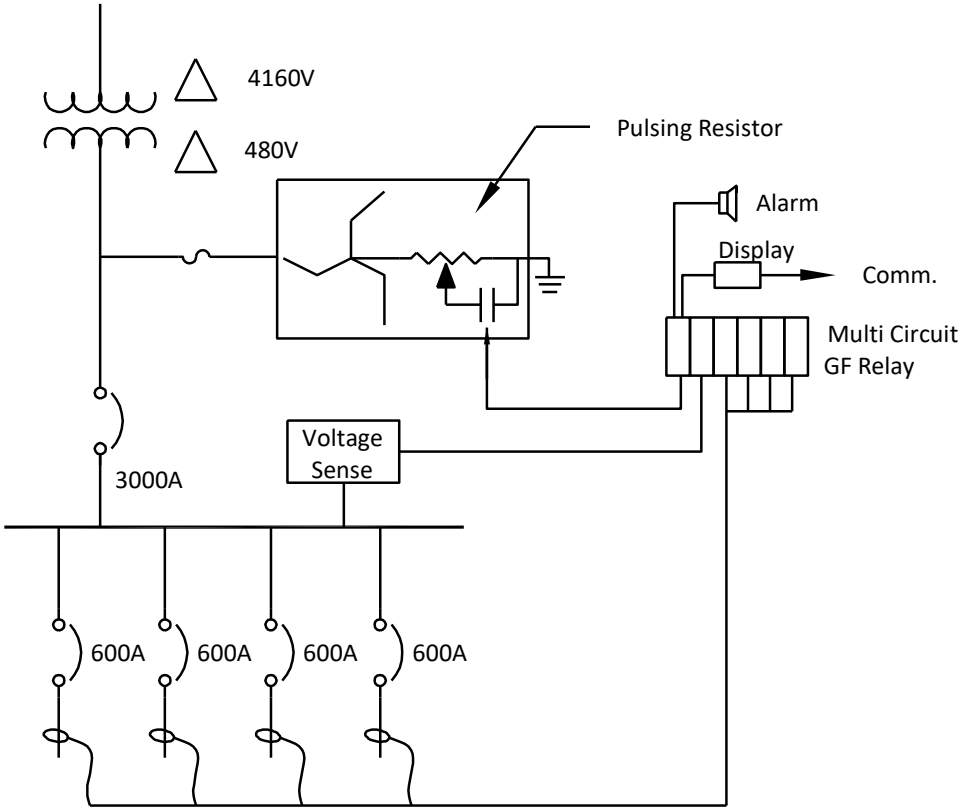
I-Gard Relays – DSP OHMNI

The industry's most advanced high resistance grounding and arc flash mitigation system, designed to protect your continuous process or critical power system from unnecessary outages and arc flash.

- **Voltage** Sensing GF Relay
- **Current** Sensing GF Relay
- **Arc Flash** Mitigation Relay
- Swbd **Multi-Feeder** GF Relay
- Swbd GF Relay with **2nd Fault Protection**
- GF Relay for **MCC's**

Single Source Systems

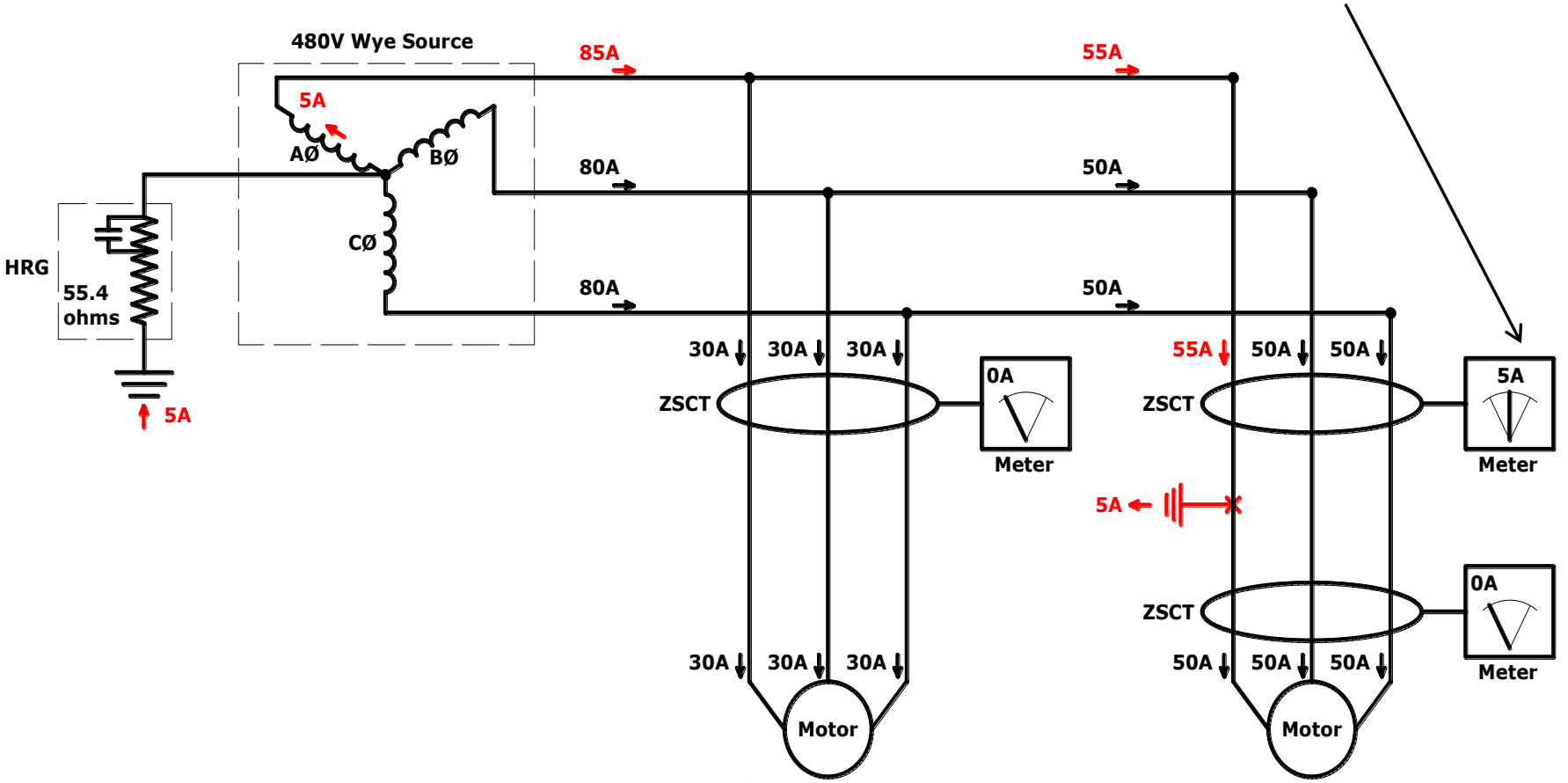
- **Apply Ground fault detection with Voltage to ground and Zero sequence current measurement on feeders – Alarm on first fault**



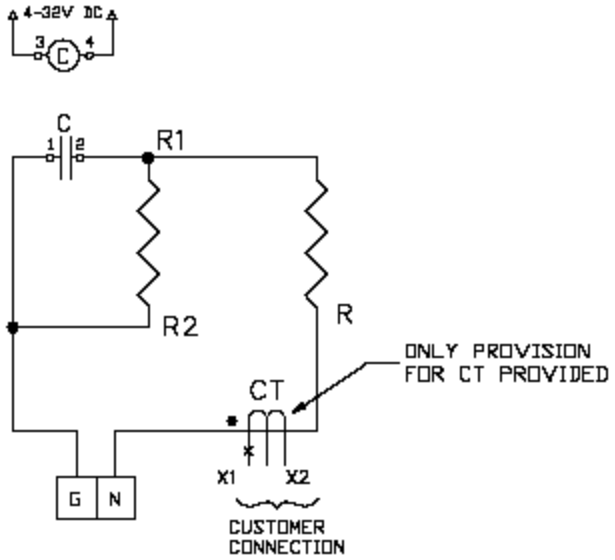
High Resistance Grounding

Method to quickly locate ground faults.

Meter reading will alternate showing high low pattern every 2 seconds.

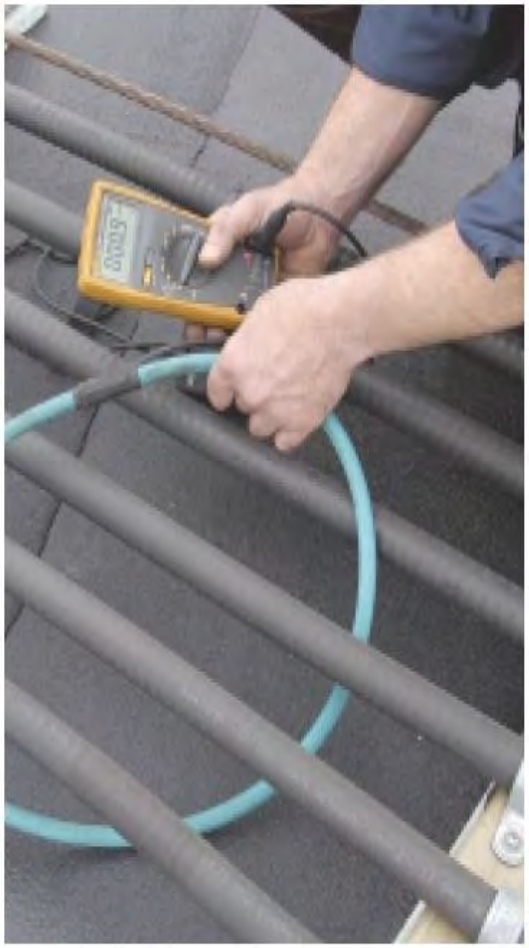


Portable Current Sensor for Fault Tracing



Pulsing NGR

Ground Fault Pulse Locating



Combination NGR and GF Relay

- SLEUTH
- For retrofit applications

GEMINI

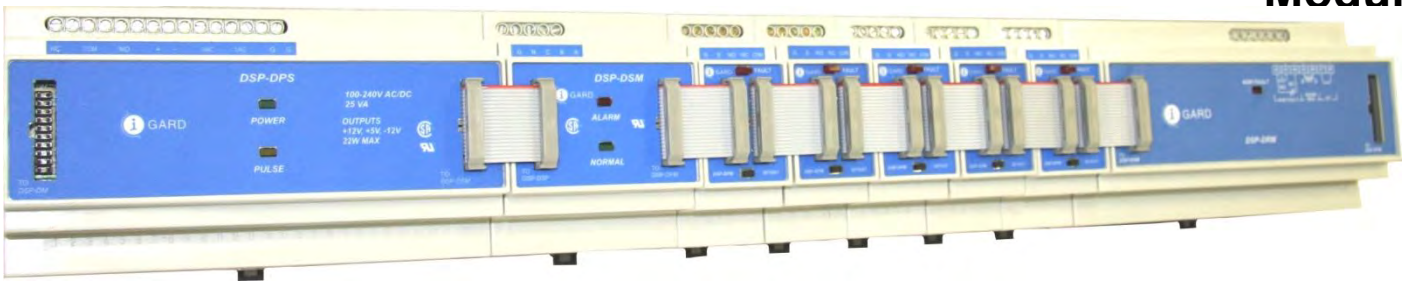
Twin path high Reliability Resistor and Monitoring Relay

GEMINI is a unique patented, fail safe, all-in-one neutral grounding system that combines ground fault protection with a redundant resistor system, in addition to a built-in resistor integrity monitoring relay. Providing protection against any compromising of the resistor integrity, the patented twin resistance paths in combination with the integrity monitoring relay form the heart of the GEMINI system.

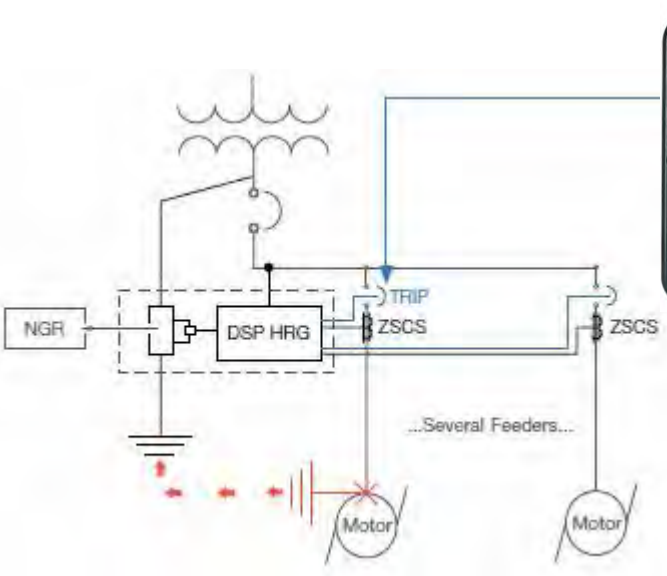
Multi-Feeder Ground Alarm Relay – OHMNI

Voltage Sensing Relay

Current Sensing Relay Modules



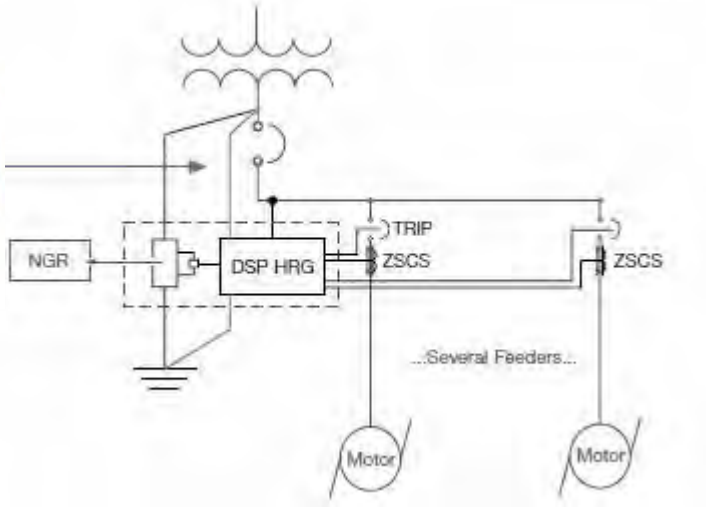
Faulted Phase and Faulted Feeder Identification



Options for Faulted Feeder:
- Alarm only (no Trip)
- Trip with time delay

2nd Ground Fault:
- Prioritize feeders
- Trips least important, maintaining operation on priority feeder
- Up to 50 feeders

DSP-DRM



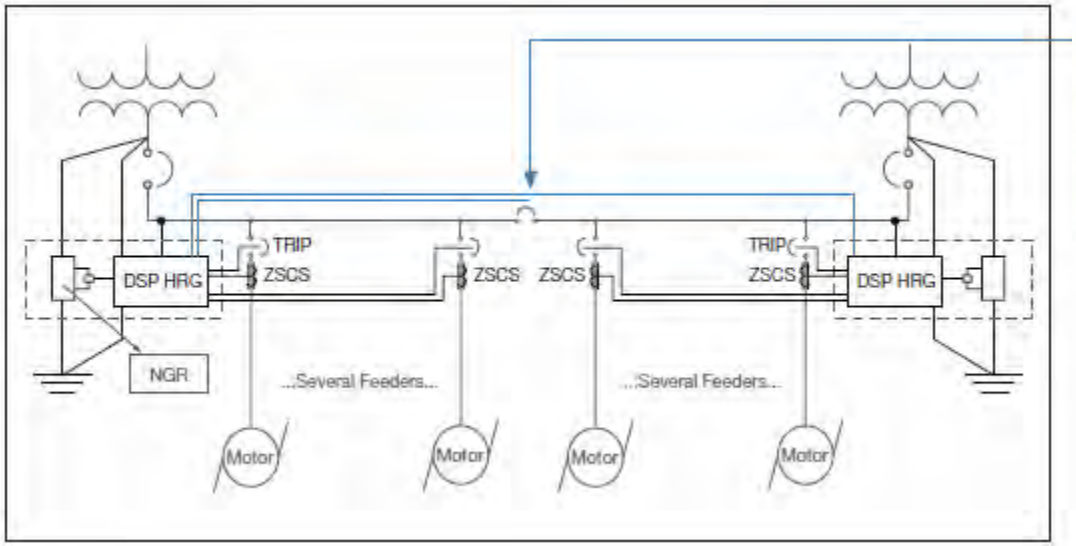
NGR Monitoring

System Ground Monitor:

- Continually monitors circuit from Neutral to Ground
- Alarms if OPEN circuit
- Alarms if SHORT circuit
- Complies with M421

Main –Tie - Main Application

DSP-CA



DSP-CAS

Cable Adapter CA(S):• Controlled by tie breaker contact
• Allows coordination of two systems either separately (Tie Open) or combined (Tie closed)

Arc Detection Module

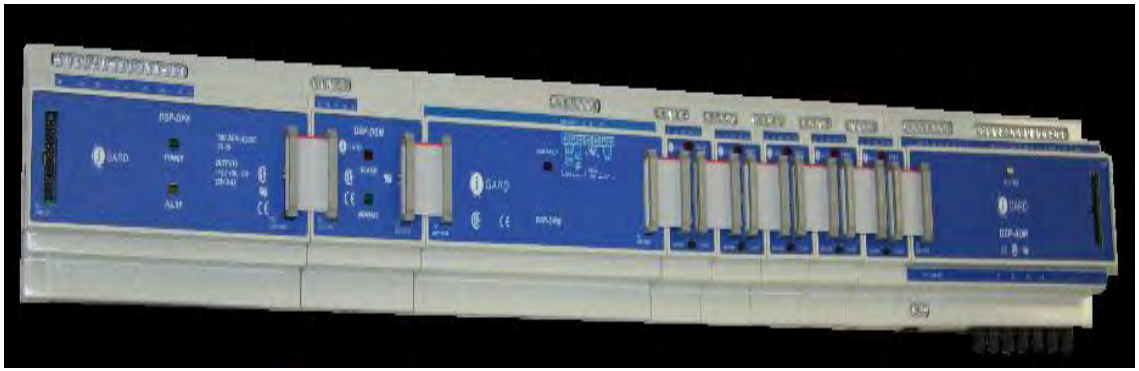
Device uses air pressure and/ or light sensing transducers to alert the system to electric arcs

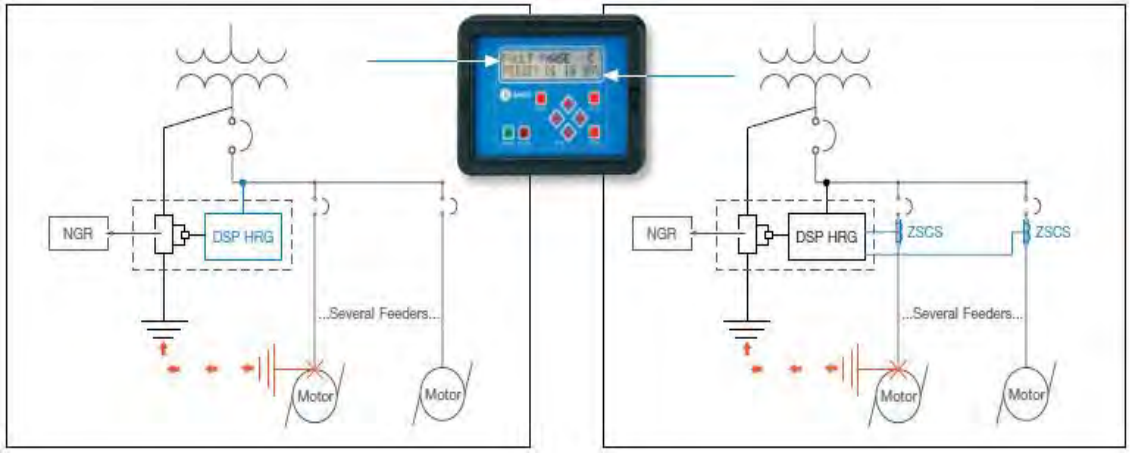
- Continuously monitors 21 possible fault location inputs.
- First line of defence in the arc detection feature of the DSP system

DSP-ADM

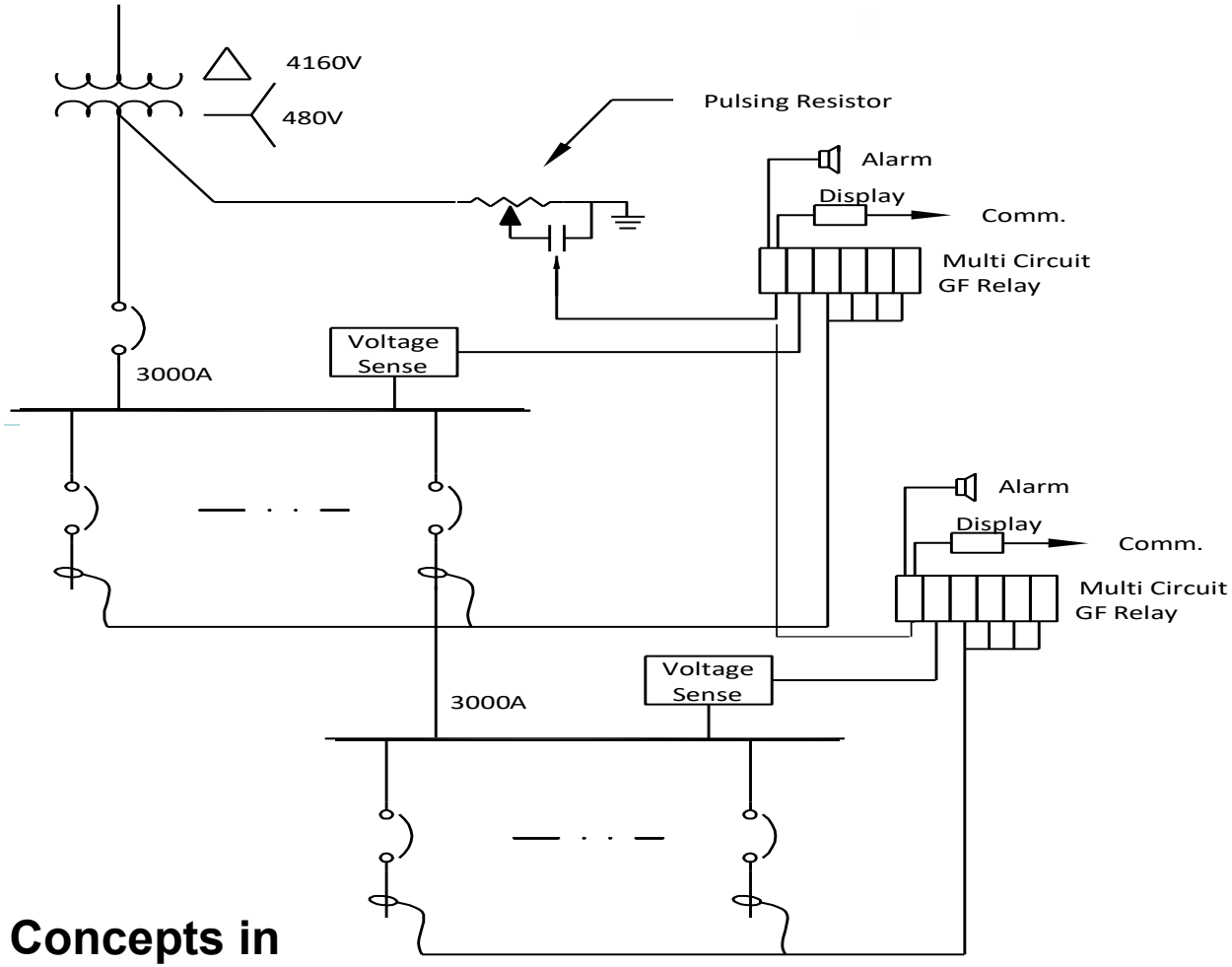
Total Solution HRG and Arc Detection in Integrated System

1. Faulted Phase Indication and Alarm
2. First fault alarm
3. Faulted Feeder Indication and options : Alarm only or trip with Time delay
4. Second Fault selective trip
5. Pulsing system
6. NGR Monitoring
7. Main -Tie –Main arrangements
8. Optical sensing Arc Detection Module Flash Trip
9. MODBUS Communication





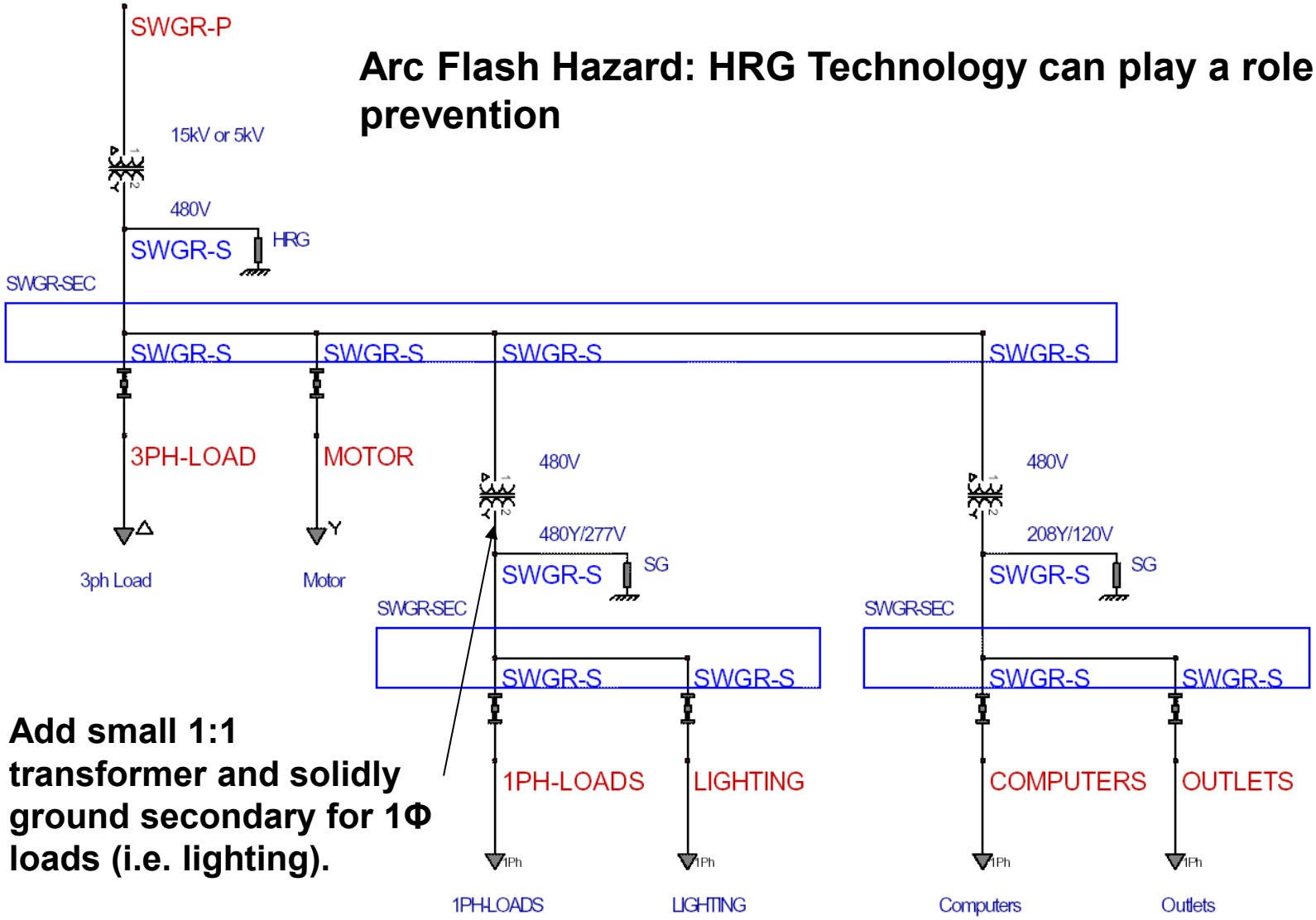
Single Source Fully Selective System



Advanced Concepts in High Resistance Grounding
IEEE IAS PCIC 2012

Serving single phase loads

Arc Flash Hazard: HRG Technology can play a role in prevention



Add small 1:1 transformer and solidly ground secondary for 1Φ loads (i.e. lighting).

GF Relay for Motor Control Centres – m-Gard

Can use external sensor
Communication to m-Gard-Sym, up to 50 units daisy chained

m-Gard Fits In MCC Bucket

mGARD Ground Fault Relay and mGARD-SYM

DIN Rail and flush mountable

- Built-in current transformer
  - Ideal for Motor Control Center (MCC buckets)
- DIP Switch selectable trip and delay levels
  - 4 Types available

  mGARD-10-A

  mGARD-10-A1

  mGARD-10-A2

  mGARD-100

  Communication to mGARD-SYM

Additional Advancements in HRG Systems

Communications

- RS232 (Serial) / RS485 (Modbus, Profibus) / TCP/IP (Ethernet)
- Control and monitor relay remotely via existing SCADA system

Data Logging & Trending

- Most ground faults are intermittent, so when you go to locate via pulse, fault may have cleared
- Data log can link ground faults with equipment starting or running

To Summarize

Hazards with Ungrounded Systems

- ✓Severe transient over-voltages
- ✓Cannot efficiently locate ground faults

Hazards with Solidly-Grounded Systems

- ✓Very high fault currents and time delays
  - ✓Causing severe arc blast / flash conditions
- ✓Ground fault coordination problems

Arc Flash Hazard: HRG Technology can play a role in prevention

To Summarize

High-Resistance Grounded Systems

Best Grounding Method today

- Resolves Ungrounded hazards
- Resolves Solidly-Grounded hazards

Technology continues to make HRG Systems safer than any other grounding method, but need help

Arc Flash Hazard: HRG Technology can play a role in prevention

Lower PPE with Advanced HRG

The Gardian *combines HRG technology and* optical arc mitigation that provides protection at the speed of light and lowers incident energy to safer levels resulting in needing lower category PPE.

Gardian

Protects against both ground faults and arc flash.

System Grounding Comparison

Reliability and Safety Impact	Ungrounded	Solidly Grounded	High Resistance Grounded	SENTINEL HRG	GARDIAN HRG
Process continuity under ground fault condition	✓	✗	✓	✓	✓
Control transient over-voltages	✗	✓	✓	✓	✓
Ability to locate ground fault	✗	✓	✓	✓	✓
Process continuity of critical process with second ground fault	✗	✗	✗	✓	✓
Arc Flash Mitigation for safety	✗	✗	✗	✗	✓

Reducing the Magnitude of Exposure

Arc Flash Relay

Protection at the Speed of Light

ARC-i-TEC: Optical Sensing Technology

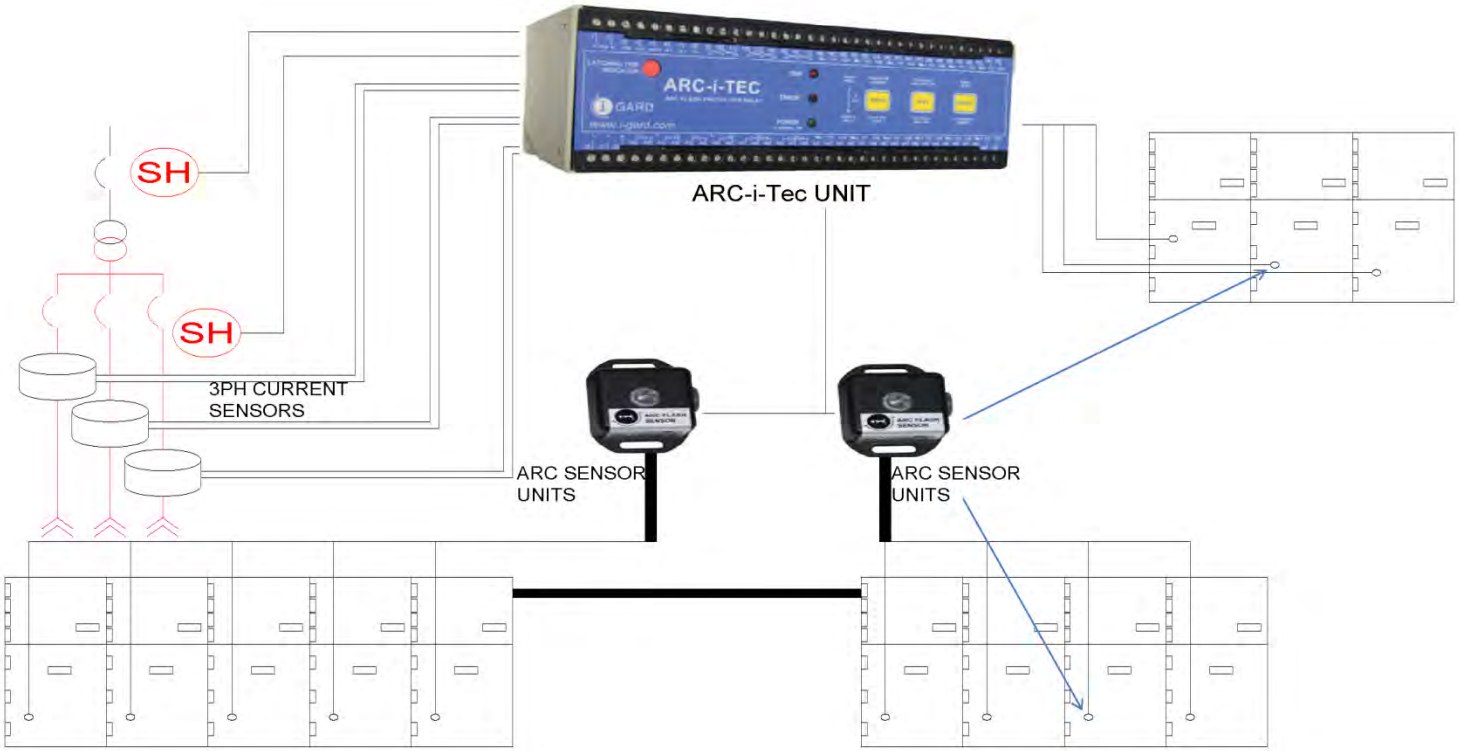
- Sense and initiate trip in 1ms
- Use current and light inputs – 12 optical sensors
- Simultaneously trip up to 4 breakers
- ModBus Communication
- BIT: Built in tester – checking integrity at all times

SENTRi :Optical Sensing Technology

- Arc flash 1ms speed
- 3 light sensors with optional pressure sensors
- Simultaneously trip up to 3 breakers
- ModBus Communication

Arc Detection and Mitigation

Using Arc-i-tec Current and Light



Reducing the Magnitude of Exposure

Arc Flash Relay

Incident Energy Comparison

PROTECTION TYPE	CLEARING TIME (SECONDS)	INCIDENT ENERGY (CAL/CM²)
51 Overcurrent	2.00	211
50 Instantaneous	0.450	47
I-Gard ARC-I-TEC	0.084	9

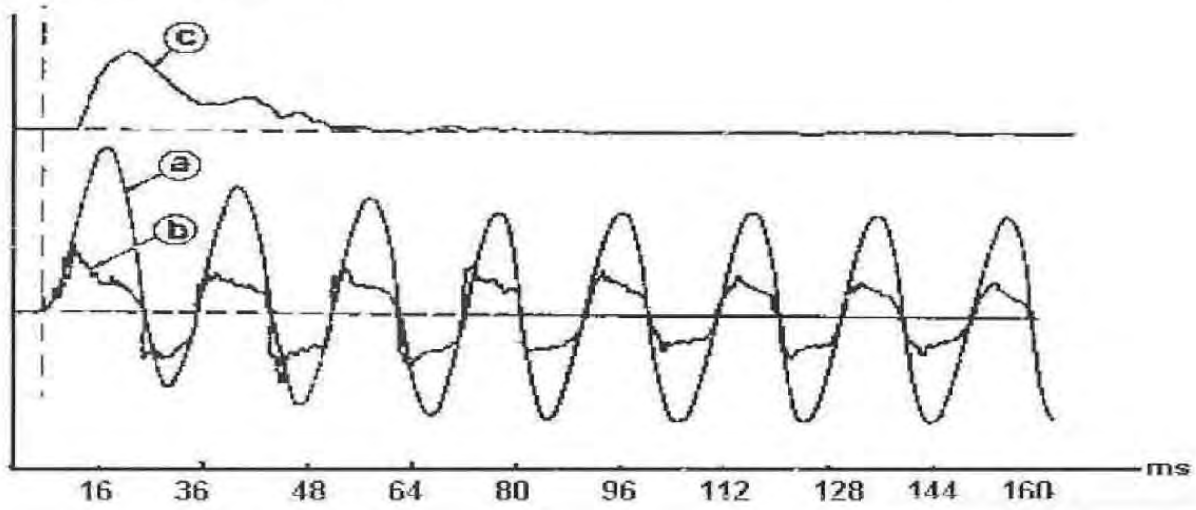
- Assumes breaker clearing time of 5 cycles
- 480V and 65kA bolted fault current, 18 inches

Arc Detection and Mitigation

Arcing is accompanied by radiation in the form of light, sound, heat and electromagnetic waves as well as an associated pressure wave.

Internal Arc

- **The energy developed by the internal arc generates heat and pressure; ex:**



- **a: short circuit current (phase with max asymmetry)**
- **b: arc voltage**
- **c: internal pressure**

Arc Detection and Mitigation

Two Direct Detection Methods

Pressure Arc Detector

- Detecting the pressure wave generated by the arc
- Detection time 8ms

Light Arc Detector

- Detecting the arc flash through optical arc detection
- Detection time 1ms

Informative Annex O Safety-Related Design Requirements

This informative annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

O.1 Introduction. This informative annex addresses the responsibilities of the facility owner or manager or the employer having responsibility for facility ownership or operations management to perform a risk assessment during the design of electrical systems and installations.

O.1.1 This informative annex covers employee safety-related design concepts for electrical equipment and installations in workplaces covered by the scope of this standard. This informative annex discusses design considerations that have impact on the application of the safety-related work practices only.

O.1.2 This informative annex does not discuss specific design requirements. The facility owner or manager or the employer should choose design options that eliminate hazards or reduce risk and enhance the effectiveness of safety-related work practices.

O.2 General Design Considerations.

O.2.1 Employers, facility owners, and managers who have responsibility for facilities and installations having electrical energy as a potential hazard to employees and other personnel should ensure that electrical hazards risk assessments are performed during the design of electrical systems and installations.

O.2.2 Design option decisions should facilitate the ability to eliminate hazards or reduce risk by doing the following:

(1) Reducing the likelihood of exposure

(2) Reducing the magnitude or severity of exposure

(3) Enabling achievement of an electrically safe work condition

O.2.3 Incident Energy Reduction Methods. The following methods have proved to be effective in reducing incident energy:

(1) Zone-selective interlocking. A method that allows two or more circuit breakers to communicate with each other so that a short circuit or ground fault will be cleared by the breaker closest to the fault with no intentional delay. Clearing the fault in the shortest time aids in reducing the incident energy.

(2) Differential relaying. The concept of this protection method is that current flowing into protected equipment must equal the current out of the equipment. If these two currents are not equal, a fault must exist within the equipment, and the relaying can be set to operate for a fast interruption. Differential relaying uses current transformers located on the line and load sides of the protected equipment and fast acting relay.

(3) Energy-reducing maintenance switching with a local status indicator. An energy-reducing maintenance switch allows a worker to set a circuit breaker trip unit to operate faster while the worker is working within an arc flash boundary, as defined in NFPA 70E, and then to set the circuit breaker back to a normal setting after the work is complete.

O.2.4 Other Methods.

(1) Energy-reducing active arc flash mitigation system. This system can reduce the arcing duration by creating a low impedance current path, located within a controlled compartment, to cause the arcing fault to transfer to the new current path, while the upstream breaker clears the circuit. The system works without compromising existing selective coordination in the electrical distribution system.

(2) Arc flash relay. An arc flash relay typically uses light sensors to detect the light produced by an arc flash event. Once a certain level of light is detected the relay will issue a trip signal to an upstream overcurrent device.

(3) High-resistance grounding. A great majority of electrical faults are of the phase-to-ground type. High-resistance grounding will insert an impedance in the ground return path and will typically limit the fault current to 10 amperes and below (at 5 kV nominal or below), leaving insufficient fault energy and thereby helping reduce the arc flash hazard level. High-resistance grounding will not affect arc flash energy for line-to-line or line-to-line-to-line arcs.

(4) Current-limiting devices. Current-limiting protective devices reduce incident energy by clearing the fault faster and by reducing the current seen at the arc source. The energy reduction becomes effective for current above the current-limiting threshold of the current-limiting fuse or current limiting circuit breaker.

0.2.2 Design option decisions should facilitate the ability to eliminate hazards or reduce risk by doing the following:

(1)Reducing the likelihood of exposure
= High Resistance Grounding

(2) Reducing the magnitude or severity of exposure = arc flash relays or active arc mitigation.

Incorrect Grounding Generator 3-Pole ATS with Solid Neutral

- Multiple neutral grounds
- Code violation, load current on bonding conductor
- Nuisance tripping on Neutral circulating current
- GFP may fail to trip

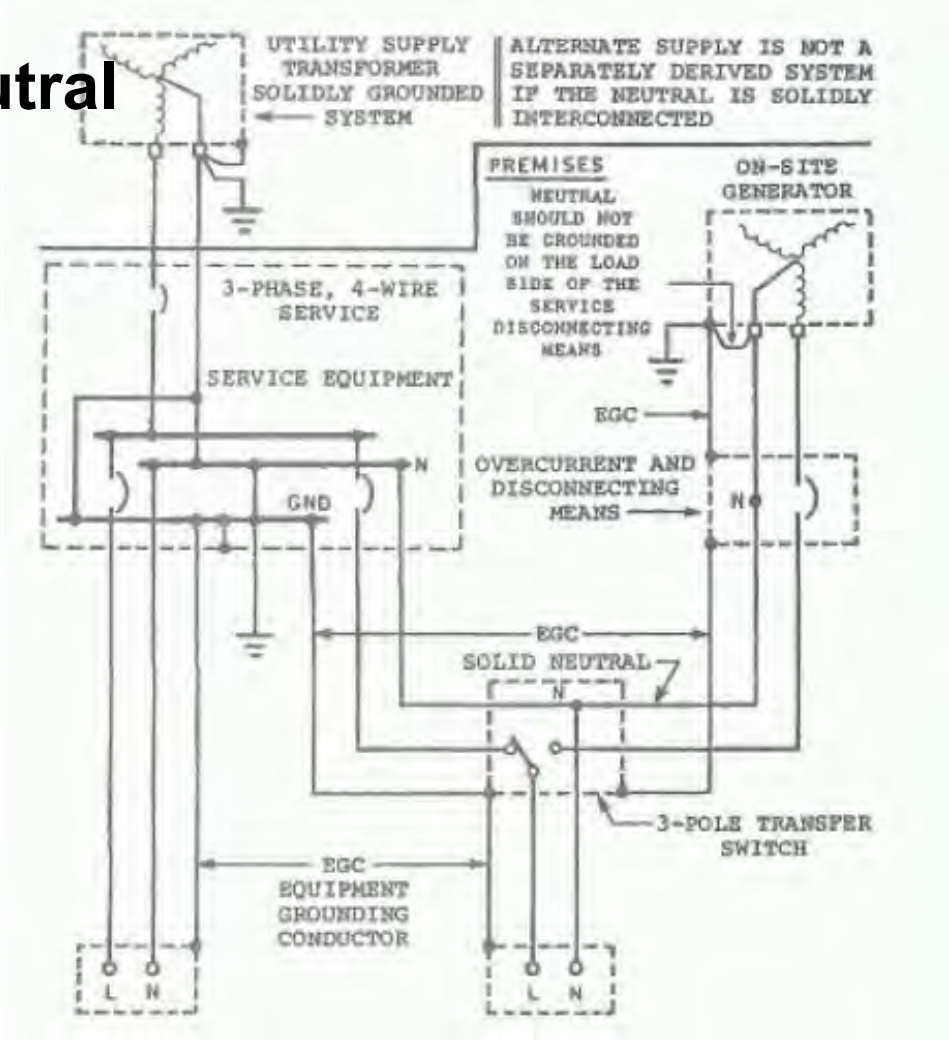


Figure 7-7
IEEE Orange Book
Std. 446-1995

Multiple Transfer Switches – Nuisance Ground Fault Trips

Must use four pole transfer switches

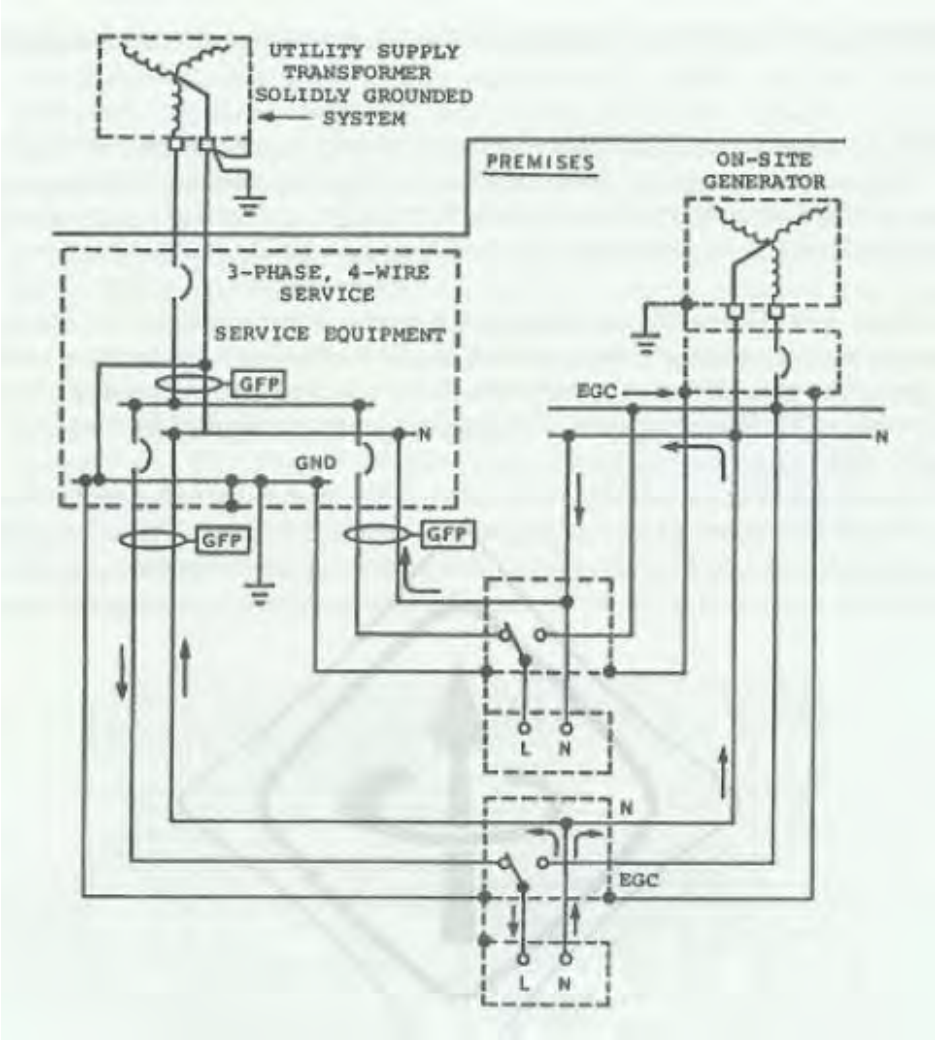
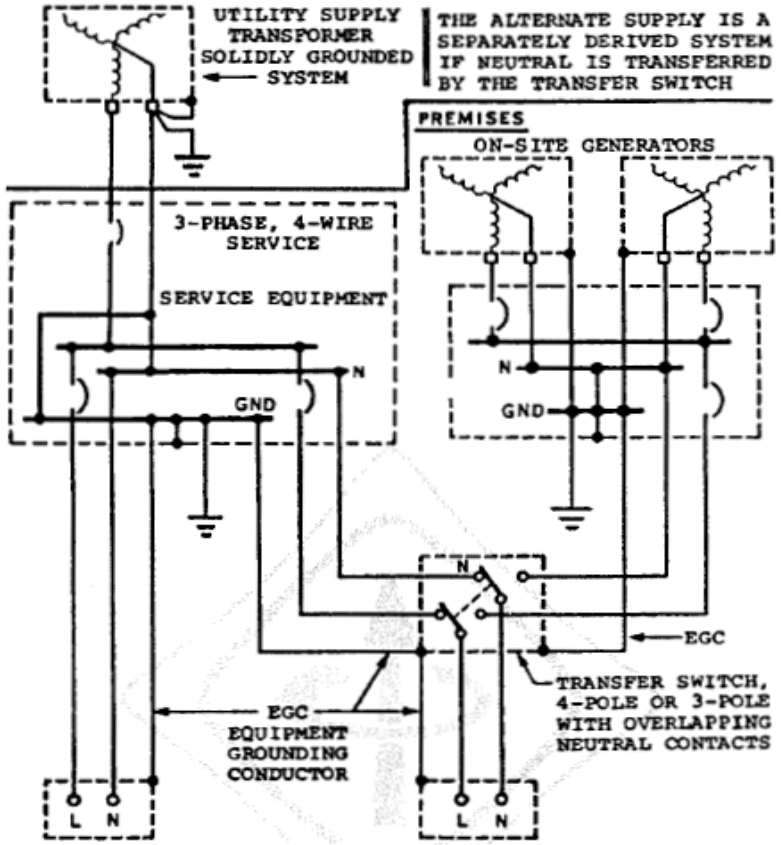


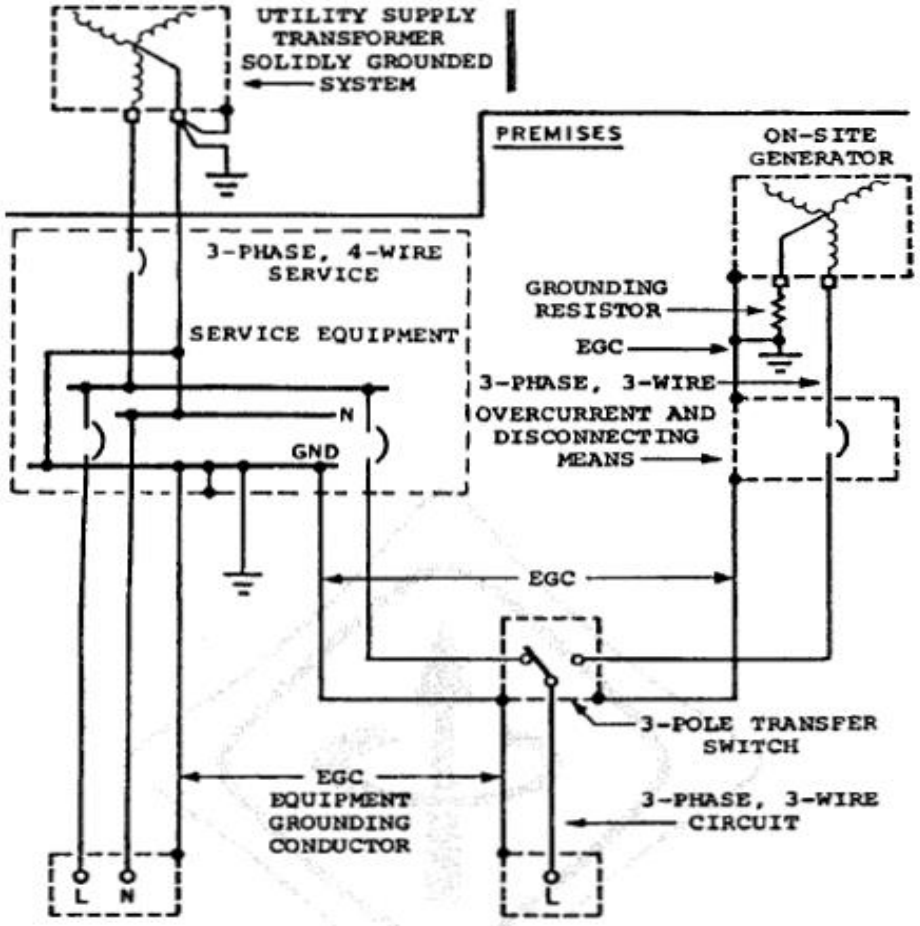
Figure 7-17 (a)
IEEE Orange Book
Std. 446-1995

4-Wire Emergency Loads: Parallel Generators



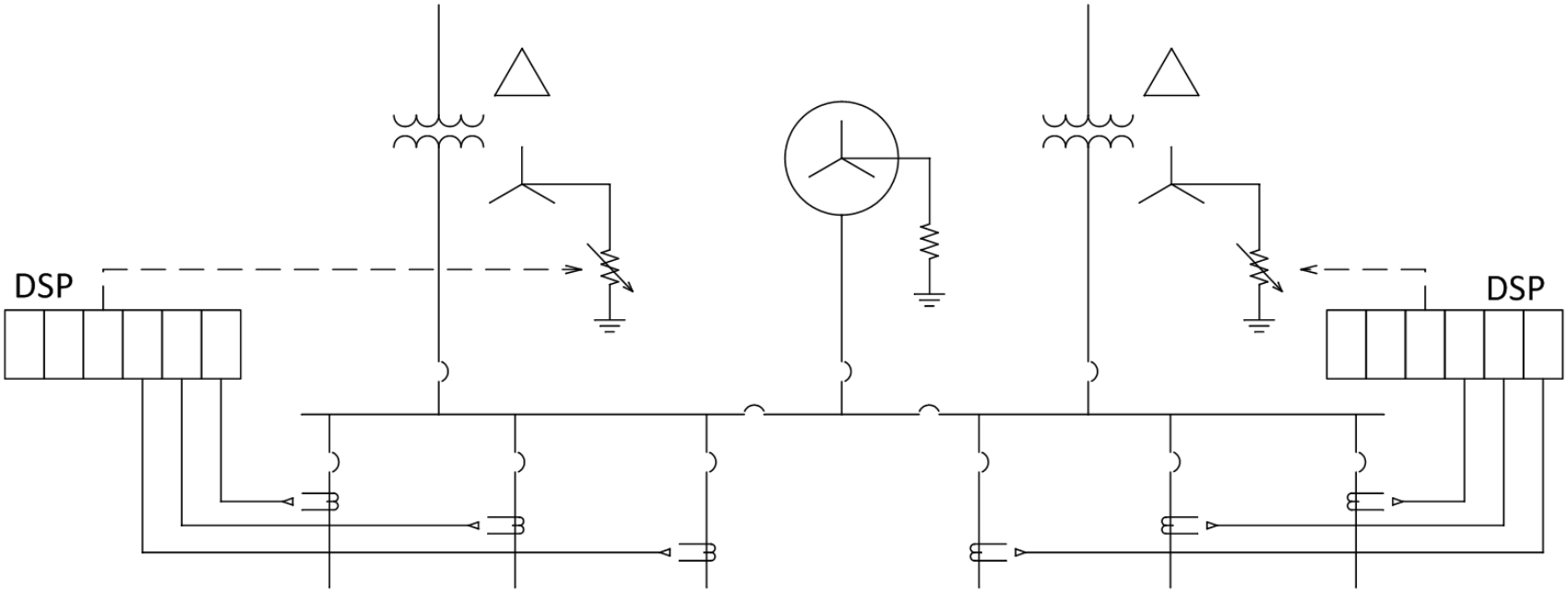
Source: IEEE Std 446-1995, Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications, Figure 7-13, p. 236.

Normal supply - 4wire solidly grounded 3-Wire standby *High Resistance Grounded*



Source: IEEE Std 446-1995, Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications, Figure 7-13, p. 246.

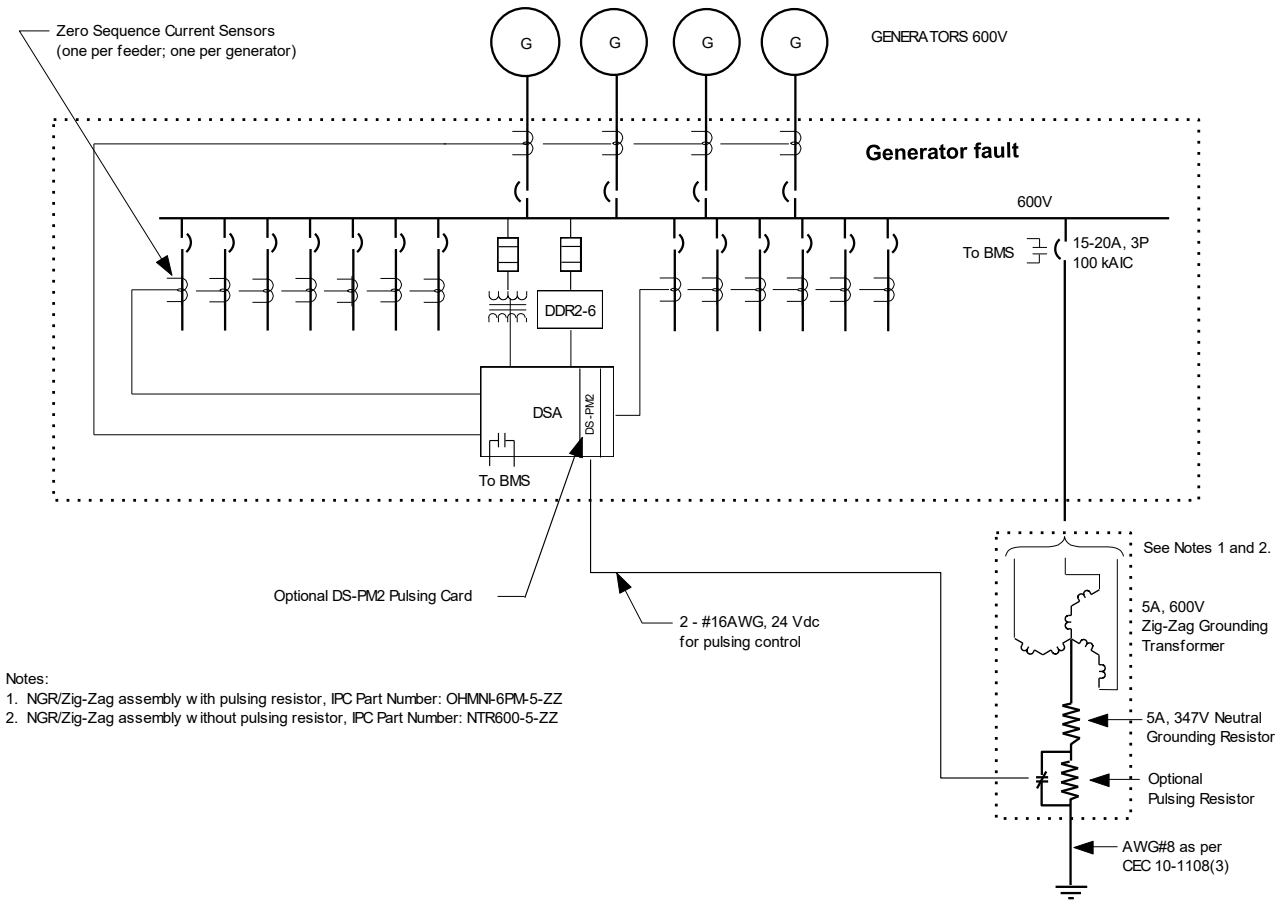
Integrating Standby Generator



Main-Tie-Main DSP System

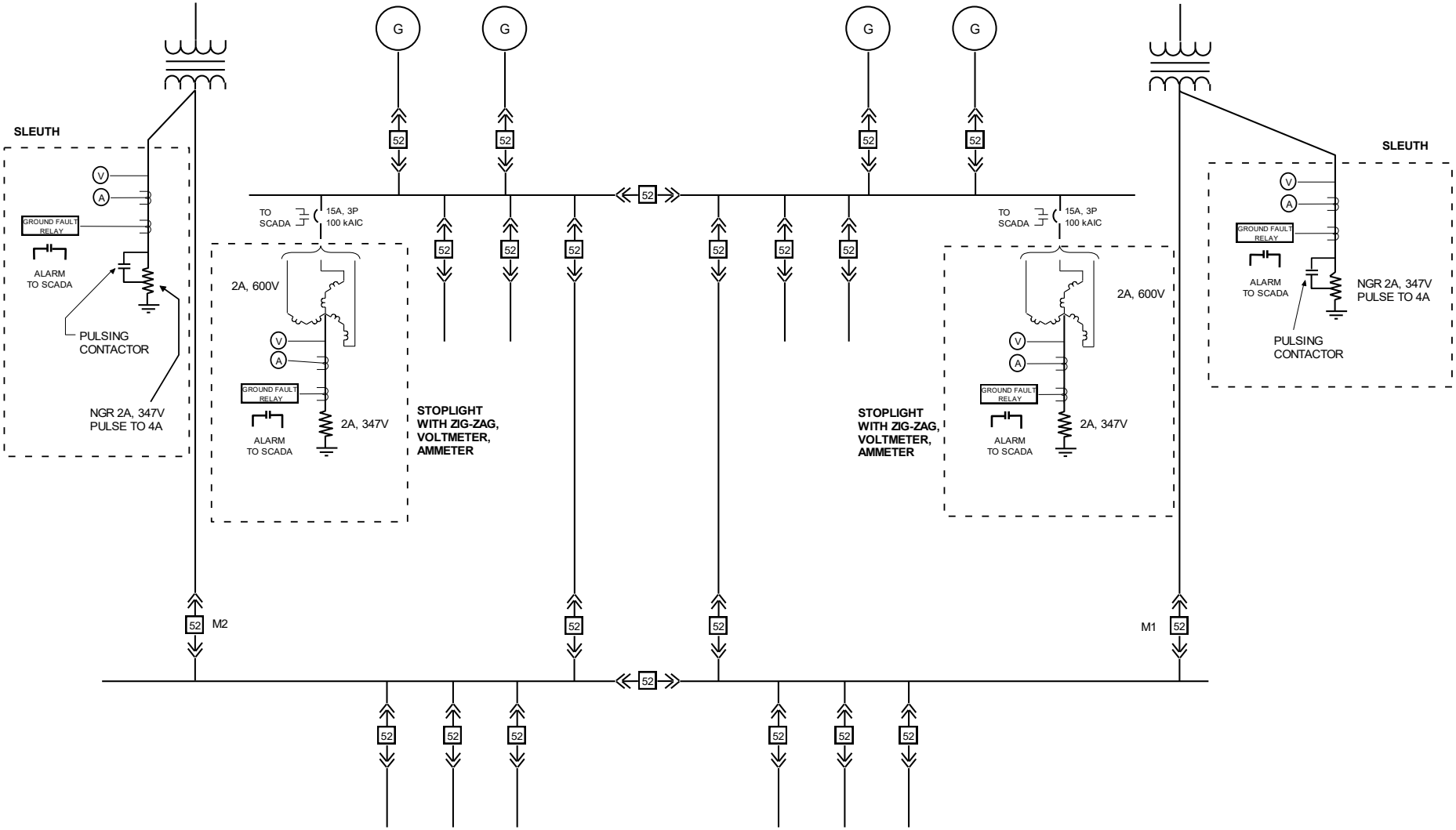
Parallel Generators

TYPICAL PARALLEL GENERATOR HIGH RESISTANCE GROUNDING SCHEME



Notes:
1. NGR/Zig-Zag assembly with pulsing resistor, IPC Part Number: OHMNI-6PM-5-ZZ
2. NGR/Zig-Zag assembly without pulsing resistor, IPC Part Number: NTR600-5-ZZ

HRG Retrofit of Parallel LV Generators

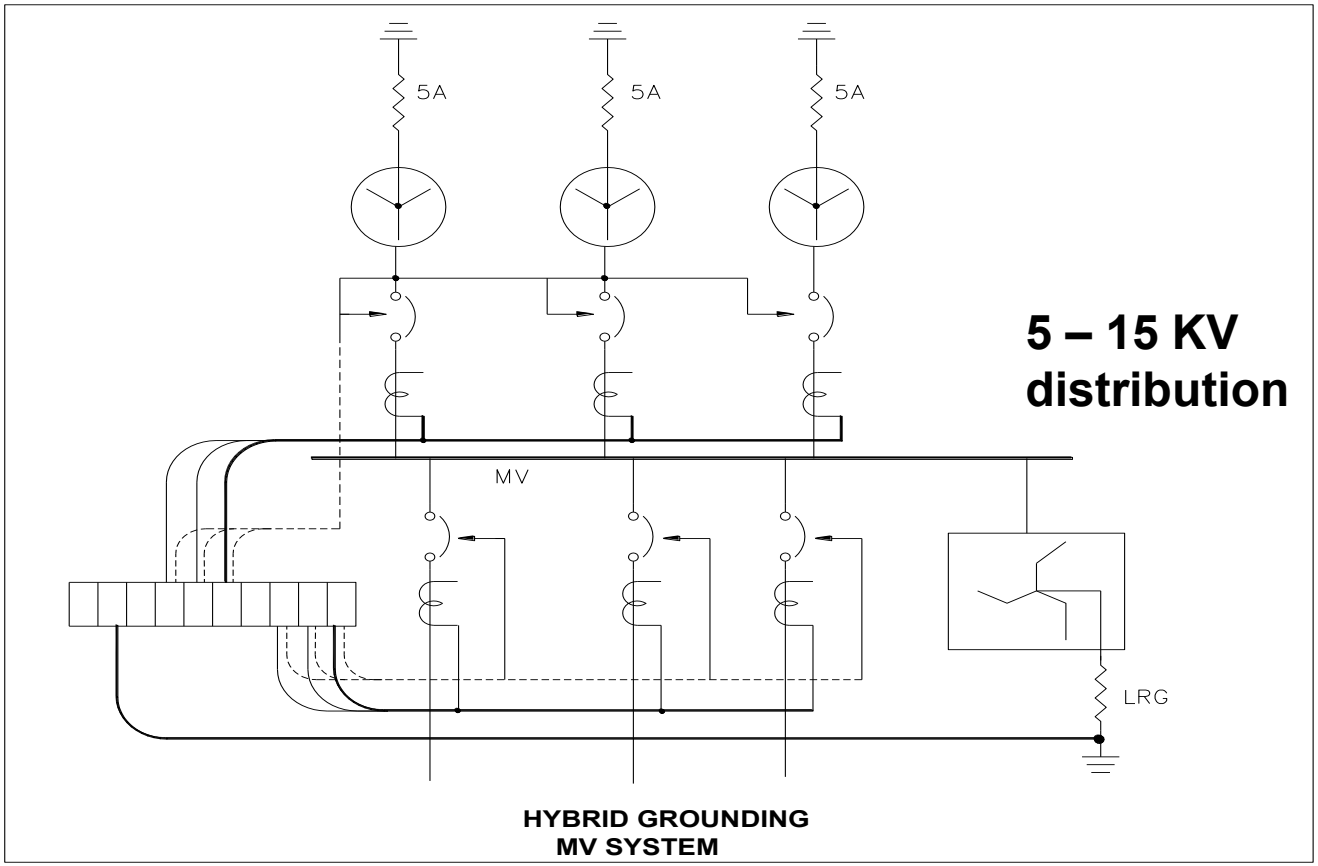


Hybrid Grounding

- Usually combination of HRG and LRG
- Applied on MV systems where charging current is more than 10 A
- Applied to protect Generator windings with HRG and monitor for stator winding fault
- In multiple sources avoids variable ground current based on what is energised and feeding power

Hybrid Grounding of MV Generators

Applied when 3Ico is larger than the current contributed by the generator NGRs



What type of Grounding System do you Employ?

Ungrounded

ViA

- Ground Fault Indication on Wye or Delta-connected, 3-phase, 3-wire
- No external hardware
- Protection Relay

Turbo Sleuth

- Portable HRG System
- Fault Limiting Resistor
- Pulsing Circuitry

Insulation Monitoring

- Automatic Operation
- Early warning of insulation problems
- Usable with variable speed drives
- Integral Self-test capability

Resistance Grounding

High

Gemini

- Dual path current limiting resistor
- Redundant fail-safe resistor circuit
- Integral ground fault relay
- Integral ground monitoring relay
- Fault location through pulsing
- Harmonic filter and time / current adjustments to reduce false trips

Sentinel

- Current limiting resistor
- Voltage and current sensing
- Integral ground fault relay
- Integral ground monitoring relay
- Fault location through pulsing
- Harmonic filter and time / current adjustments to reduce false trips
- Inrush detection restraint
- Multi-feeder protection
- Second fault protection
- MODBUS for remote monitoring

DSP-OHMNi

- Monitors and protects up to 50 feeders on one relay
- 1st Fault Alarm, 1st Fault Trip or 1st Fault Time Delay Trip
- Resistor Monitoring Module
- Selective Instantaneous Feeder Trip on 2nd ground fault

Gardian

- HRG reduces the frequency of arc flash incidents and optical detection reducing impact, all in one.

Low

Sigma

- Monitoring Relay

Solid Grounded

Sentri

- Arc Flash Mitigation
- ZSIP Selective Instantaneous Protection
- 40 trip levels from 100 mA up to 1200A

m-Gard (10;100;125,250)

- Microprocessor based ground fault relay
- Built-in zero sequence current sensor (ZSCS)
- MODBUS connection to external Network
- Monitors up to 50 devices
- Remote Data Collection
- Remote Relay Reset

ARC-i-TEC

- Fastest Arc Detection Technology
- Combines monitoring for abnormal current to avoid nuisance tripping
- 4 output relays for tripping and alarming

Pressure Arc Detector

- Fast detecting of the pressure wave generated by the arc
- Detection time in 10ms
- Easily integrates with other arc mitigation technology

Hybrid Grounding

Contact I-Gard for a system solution that works with your needs!

Thank You

Questions?