Technical Webinar Series 2021

"The I-Gard Difference"

Presented by: **Sergio Panetta**
Vice President of Engineering, I-Gard Corporation

Case 1

A client wants to use HRG technology in their next project BUT is not sure whether to purchase from a relay supplier who partners with a resistor company or a resistor supplier who uses someone else's relay or PLC and THEREFORE wants to know if I-Gard is any different.

GARD

NGRs Production Area

Relay/Electronics Production Area

GARD

- We make resistors
- We make relays
- We develop new relays
- Everything under one roof
- Integrated solutions

"I-Gard stands behind the design, manufacturing and the functionality of the whole HRG system"

Case 2

A consultant is looking to include resistor monitoring in the project specification as required by CEC 2021 BUT the resistor in question is rated 2400V 400A and the sensing resistor needs to be able to detect a fault at 6 ohms THEREFORE they are considering the I-Gard SIGMA 3 relay for the project. What makes the SIGMA 3 relay different?

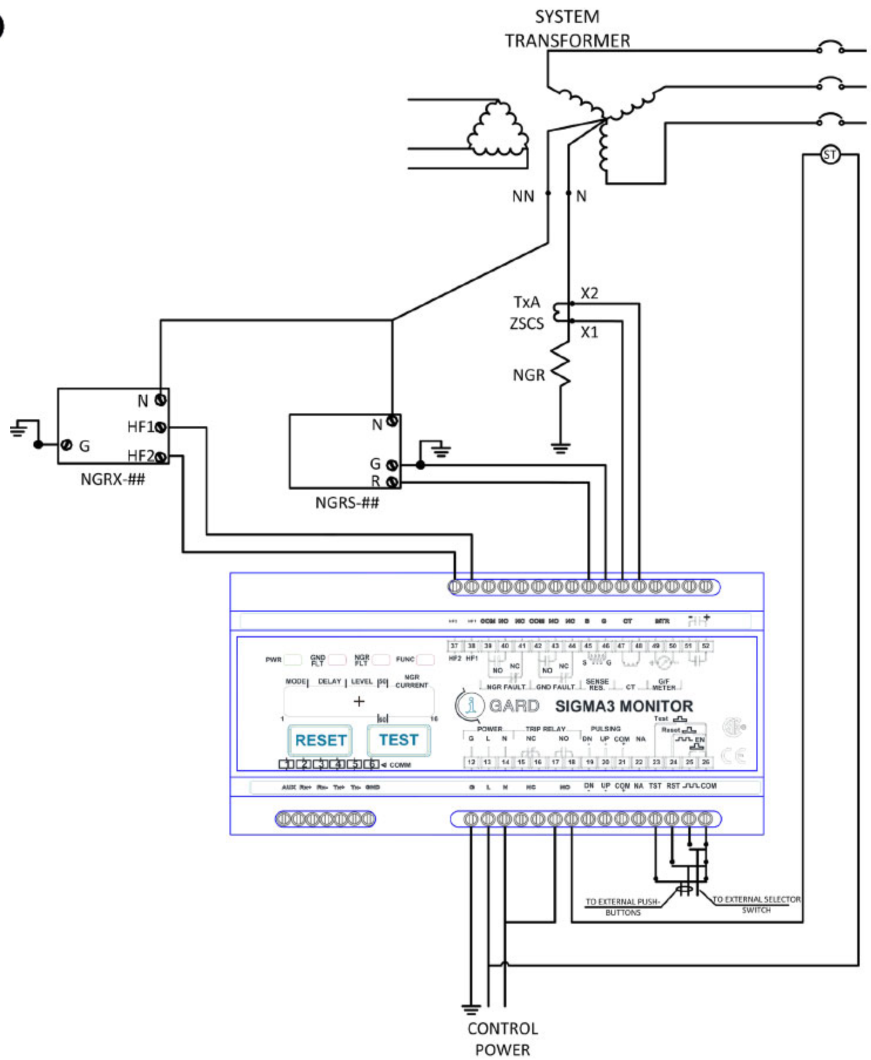
CEC 2021 Table 17

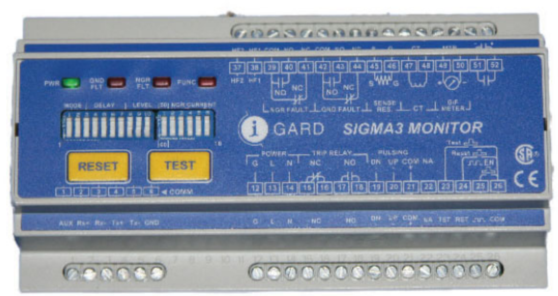
Table 17
Impedance grounded systems — Conditions for initiation of automatic alarm and de-energization of the system
(See Rule 10-302.)

Impedance grounded system configuration		Conditions for initiation of automatic alarm and de-energization of system		
		Ground fault on current-carrying conductors	**Ground fault on conductor from source to impedance grounding device**	**Loss of continuity from the source through the impedance grounding device to the grounded conductive parts of equipment**
Line-to-neutral loads are served (4-wire), all voltages/currents		Alarm and de-energize system immediately	Alarm and de-energize system immediately	Alarm and de-energize system immediately
Line-to-neutral loads are not served (3-wire) System is • 5 kV or less; and • ground fault is limited to 10 A or less	Scenario 1 [see Note a)]	Alarm and de-energize system within the time rating of the impedance grounding device	Alarm and de-energize system within 48 h	Alarm
	Scenario 2 [see Note b)]	Alarm and de-energize system within the time rating of the impedance grounding device	Alarm and de-energize system within 48 h	Alarm and de-energize system within 48 h
Line-to-neutral loads are not served (3-wire) System is • greater than 5 kV; or • ground fault is greater than 10 A	Scenario 1 [see Note a)]	Alarm and de-energize system within the lesser of 48 h or the time rating of the impedance grounding device	Alarm and de-energize system within 48 h	Alarm
	Scenario 2 [see Note b)]	Alarm and de-energize system within the lesser of 48 h or the time rating of the impedance grounding device	Alarm and de-energize system within 48 h	Alarm and de-energize system within 48 h

Note: *On the occurrence of a loss of continuity of the impedance grounding circuit from the system source through the impedance grounding device to the grounded non-current-carrying conductive parts of the electrical system, the device monitoring the system can operate in one of two ways:*
a) *it can continue to detect a ground fault on an ungrounded system; or*
b) *it can no longer detect a ground fault on an ungrounded system.*

GARD





Sigma3

- Ground Fault Relay
- Resistor Monitoring as per CEC 2021

Suitable for:

- LRG systems
- HRG systems

Other relays from competitors

System Voltage	400	600	690	1000	2400	4200	6000	6600	7200	11000	13800	14400	25000
Current													
1	231 Ω	346.5 Ω	398.4 Ω	577.4 Ω	1385.7 Ω	2424.9 Ω							
5	46.2 Ω	69.3 Ω	79.7 Ω	115.5 Ω	277.2 Ω	485 Ω	692.9 Ω	762.2 Ω	831.4 Ω	1270.2 Ω	1593.5 Ω	1662.8 Ω	
10	23.1 Ω	34.7 Ω	39.9 Ω	57.8 Ω	138.6 Ω	242.5 Ω	346.5 Ω	381.1 Ω	415.7 Ω	635.1 Ω	796.8 Ω	831.4 Ω	1443.4 Ω
15	15.4 Ω	23.1 Ω	26.6 Ω	38.5 Ω	92.4 Ω	161.7 Ω	231 Ω	254.1 Ω	277.2 Ω	423.4 Ω	531.2 Ω	554.3 Ω	962.3 Ω
20		17.4 Ω	20 Ω	28.9 Ω	69.3 Ω	121.3 Ω	173.3 Ω	191 Ω	208 Ω	318 Ω	399 Ω	416 Ω	722 Ω
25			16 Ω	23.1 Ω	55.5 Ω	97 Ω	138.6 Ω	153 Ω	167 Ω	255 Ω	319 Ω	333 Ω	578 Ω
30				19.3 Ω	46.2 Ω	80.9 Ω	115.5 Ω	128 Ω	139 Ω	212 Ω	266 Ω	278 Ω	482 Ω
40					34.7 Ω	60.7 Ω	86.7 Ω	96 Ω	104 Ω	159 Ω	200 Ω	208 Ω	361 Ω
50					27.8 Ω	48.5 Ω		77 Ω	84 Ω	128 Ω	160 Ω	167 Ω	289 Ω
100						24.3 Ω			42 Ω		80 Ω	84 Ω	145 Ω
200													
300													
400													

** Values highlighted in yellow

Limited temperature Range 0-40^{o}C

I-Gard Monitoring

System Voltage		400	600	690	1000	2400	4200	6000	6600	7200	11000	13800	14400	25000
Current														
1		231 Ω	346.5 Ω	398.4 Ω	577.4 Ω	1385.7 Ω	2424.9 Ω							
5		46.2 Ω	69.3 Ω	79.7 Ω	115.5 Ω	277.2 Ω	485 Ω	692.9 Ω	762.2 Ω					
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15		15.4 Ω	23.1 Ω	26.6 Ω	38.5 Ω	92.4 Ω	161.7 Ω	231 Ω	254.1 Ω	277.2 Ω	423.4 Ω	531.2 Ω	554.3 Ω	962.3 Ω
20		11.6 Ω	17.4 Ω	20 Ω	28.9 Ω	69.3 Ω	121.3 Ω	173.3 Ω	190.6 Ω	207.9 Ω	317.6 Ω	398.4 Ω	415.7 Ω	721.7 Ω
25		9.3 Ω	13.9 Ω	16 Ω	23.1 Ω	55.5 Ω	97 Ω	138.6 Ω	152.5 Ω	166.3 Ω	254.1 Ω	318.7 Ω	332.6 Ω	577.4 Ω
30		7.7 Ω	11.6 Ω	13.3 Ω	19.3 Ω	46.2 Ω	80.9 Ω	115.5 Ω	127.1 Ω	138.6 Ω	211.7 Ω	265.6 Ω	277.2 Ω	481.2 Ω
40		5.8 Ω	8.7 Ω	10 Ω	14.5 Ω	34.7 Ω	60.7 Ω	86.7 Ω	95.3 Ω	104 Ω	158.8 Ω	199.2 Ω	207.9 Ω	360.9 Ω
50			7 Ω	8 Ω	11.6 Ω	27.8 Ω	48.5 Ω	69.3 Ω	76.3 Ω	83.2 Ω	127.1 Ω	159.4 Ω	166.3 Ω	288.7 Ω
100					5.8 Ω	13.9 Ω	24.3 Ω	34.7 Ω	38.2 Ω	41.6 Ω	63.6 Ω	79.7 Ω	83.2 Ω	144.4 Ω
200						7 Ω	12.2 Ω	17.4 Ω	19.1 Ω	20.8 Ω	31.8 Ω	39.9 Ω	41.6 Ω	72.2 Ω
300							8.1 Ω	11.6 Ω	12.8 Ω	13.9 Ω	21.2 Ω	26.6 Ω	27.8 Ω	48.2 Ω
400							6.1 Ω	8.7 Ω	9.6 Ω	10.4 Ω	15.9 Ω	20 Ω	20.8 Ω	36.1 Ω
800											8 Ω	10 Ω	10.4 Ω	18.1 Ω

GARD

I-Gard vs competitors

	400		600		690		1000		2400		4200	
	I-GARD	Comp	I-GARD	Comp	I-GARD	Comp	I-GARD	Comp	I-GARD	Comp	I-GARD	Comp
Current												
1	231 Ω	231 Ω	346.5 Ω	346.5 Ω	398.4 Ω	398.4 Ω	577.4 Ω	577.4 Ω	1385.7 Ω	1385.7 Ω	2424.9 Ω	2424.9 Ω
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20	11.6 Ω		17.4 Ω	17.4 Ω	20 Ω	20 Ω	28.9 Ω	28.9 Ω	69.3 Ω	69.3 Ω	121.3 Ω	121.3 Ω
25	9.3 Ω		13.9 Ω		16 Ω	16 Ω	23.1 Ω	23.1 Ω	55.5 Ω	55.5 Ω	97 Ω	97 Ω
30	7.7 Ω		11.6 Ω		13.3 Ω		19.3 Ω	19.3 Ω	46.2 Ω	46.2 Ω	80.9 Ω	80.9 Ω
40	5.8 Ω		8.7 Ω		10 Ω		14.5 Ω		34.7 Ω	34.7 Ω	60.7 Ω	60.7 Ω
50			7 Ω		8 Ω		11.6 Ω		27.8 Ω	27.8 Ω	48.5 Ω	48.5 Ω
100							5.8 Ω		13.9 Ω		24.3 Ω	24.3 Ω
200									7 Ω		12.2 Ω	
300											8.1 Ω	
400											6.1 Ω	
800												

	6000		6600		7200		11000		13800		14400		25000	
	I-GARD	Comp	I-GARD	Comp	I-GARD	Comp	I-GARD	Comp	I-GARD	Comp	I-GARD	Comp	I-GARD	Comp
Current														
1														
5	692.9 Ω	692.9 Ω	762.2 Ω	762.2 Ω		831.4 Ω		1270.2 Ω		1593.5 Ω				
10	346.5 Ω	346.5 Ω	381.1 Ω	381.1 Ω	415.7 Ω	415.7 Ω	635.1 Ω	635.1 Ω	796.8 Ω	796.8 Ω	1443.4 Ω	1443.4 Ω	1443.4 Ω	1443.4 Ω
15	231 Ω	231 Ω	254.1 Ω	254.1 Ω	277.2 Ω	277.2 Ω	423.4 Ω	423.4 Ω	531.2 Ω	531.2 Ω	962.3 Ω	962.3 Ω	962.3 Ω	962.3 Ω
20	173.3 Ω	173.3 Ω	190.6 Ω	191 Ω	207.9 Ω	208 Ω	317.6 Ω	318 Ω	398.4 Ω	399 Ω	721.7 Ω	722 Ω	721.7 Ω	722 Ω
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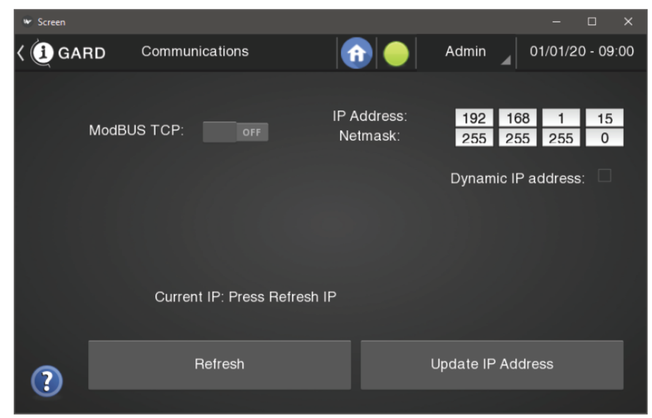
300	11.6 Ω		12.8 Ω		13.9 Ω		21.2 Ω		26.6 Ω		48.2 Ω		48.2 Ω	
400	8.7 Ω		9.6 Ω		10.4 Ω		15.9 Ω		20 Ω		36.1 Ω		36.1 Ω	
800							8 Ω		10 Ω		18.1 Ω			

I-Gard Sigma3 - TDM
Touchscreen Display

- **Pulsing activation via display**
- Control and calibration
- Event recording

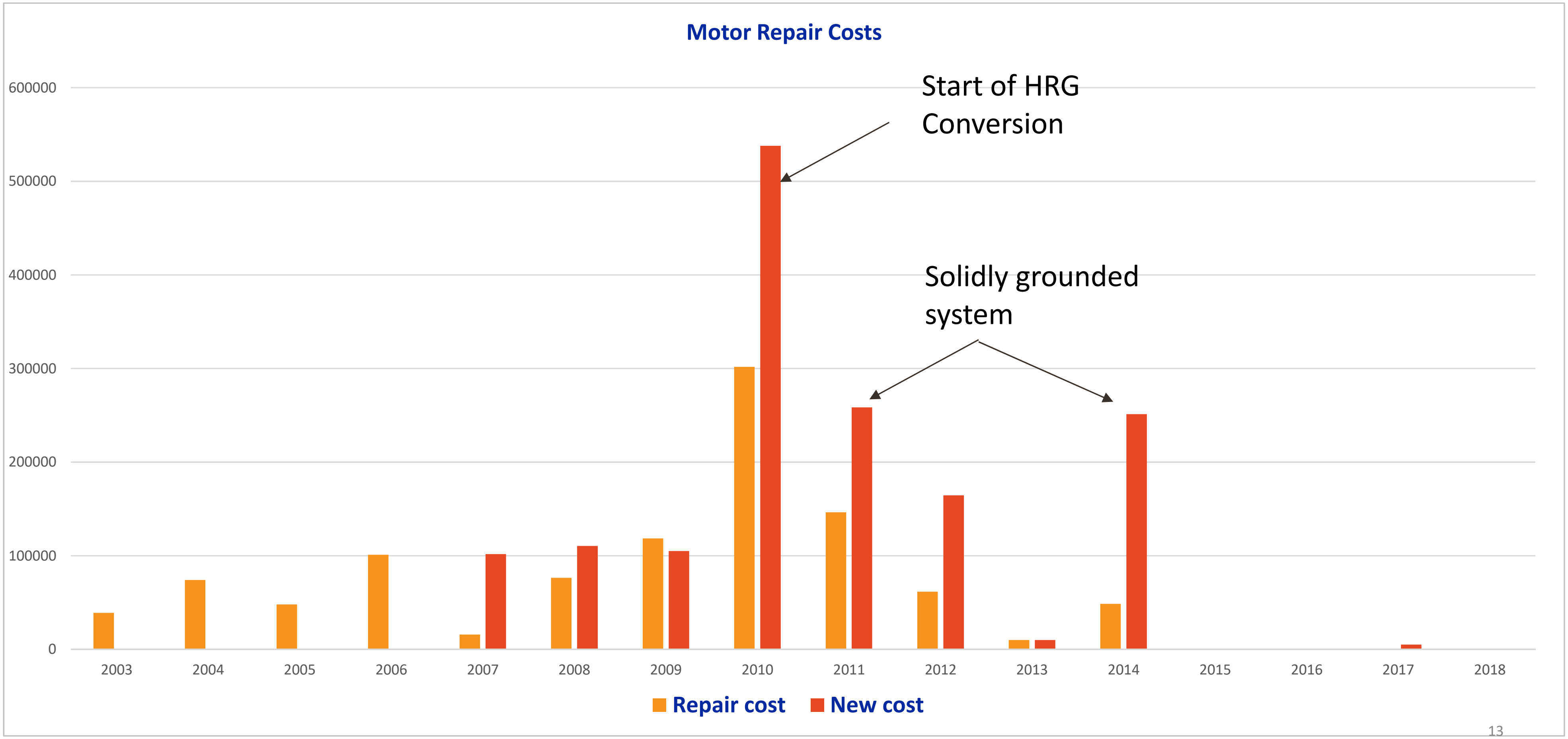
- **Communication Settings**
- Modbus RTU
- Modbus TCP/IP



Case 3

Facility operator has a solidly grounded system since this system trips when there is a ground fault BUT the trip level is so high that motors are being damaged and THEREFORE they are considering switching to High Resistance Grounded. What is the major difference with respect to motor damage between these two grounding systems?

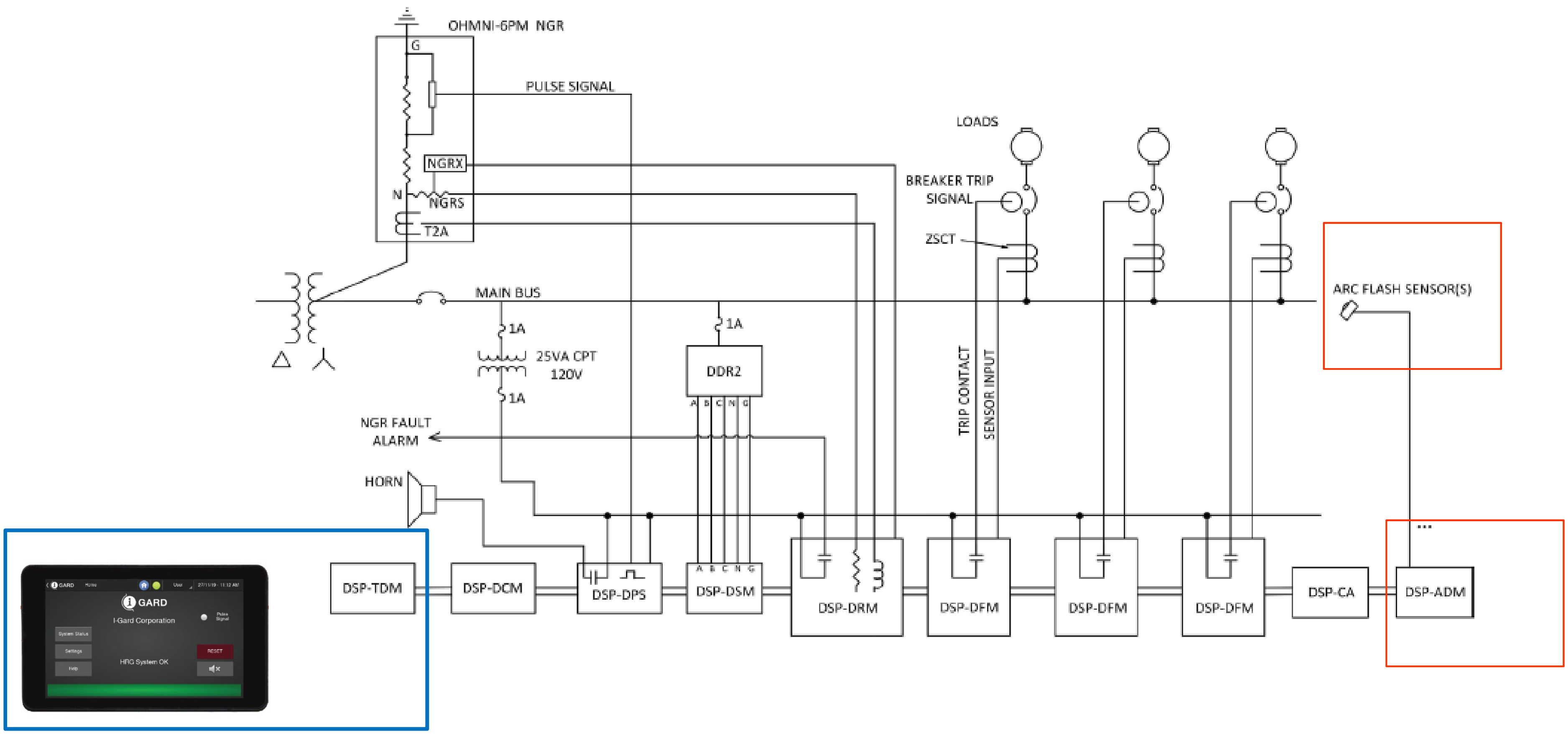
Pulp and Paper Mill case
Converting Solidly Grounded to HRG



Case 4

A long term proponent of HRG technology was pushing for their facility to be upgraded BUT the decision maker was concerned that HRG reduces the probability of an arc flash BUT not the incident energy levels THEREFORE the proposal is to consider Advanced HRG. What makes Advanced HRG different from standard HRG with respect to incident energy levels?

I-Gard DSP- System
Advanced HRG system



NFPA70E Annex O
Advanced HRG system

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

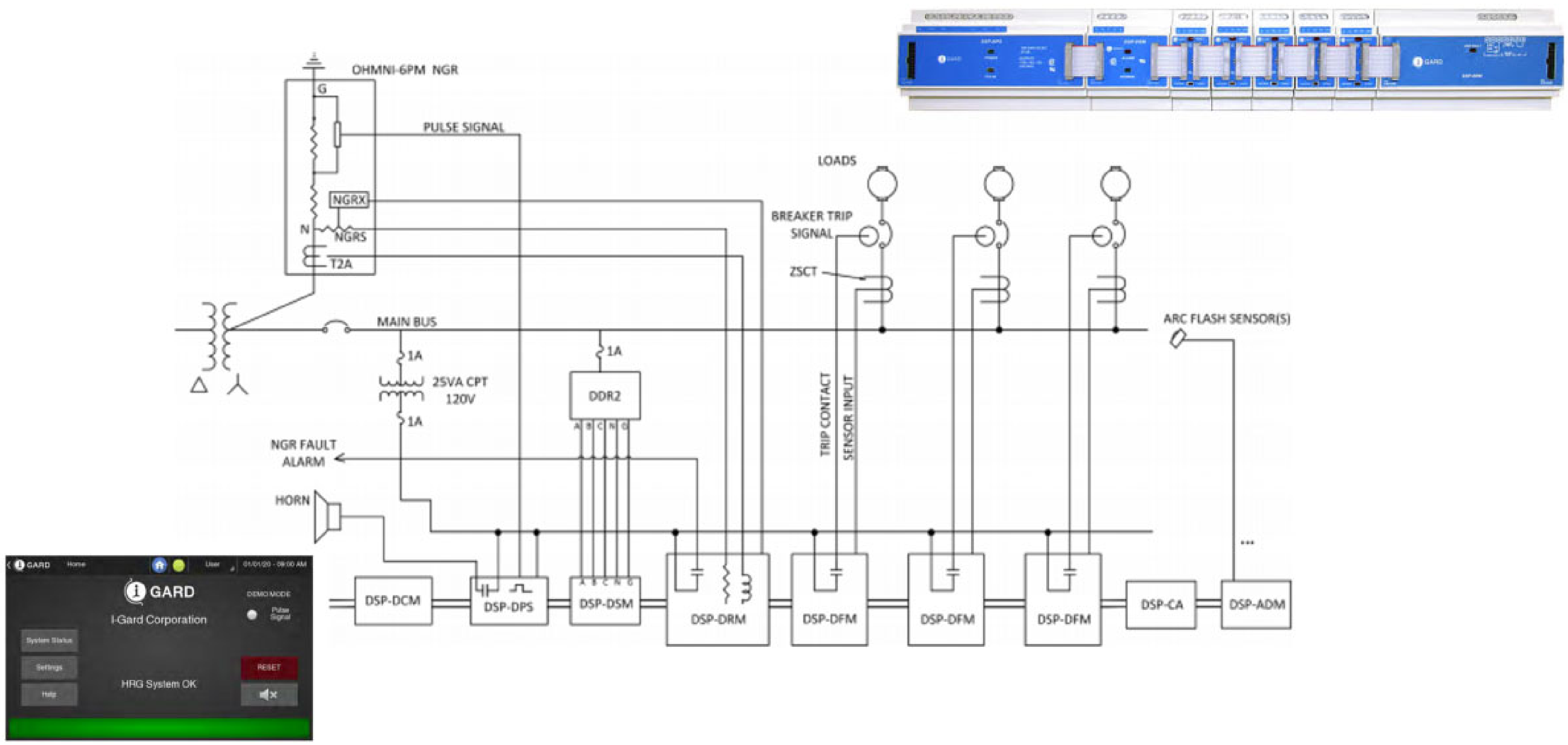
1. Reducing the likelihood of exposure, and
2. Reducing the magnitude of exposure
3. Enabling achievement of an electrically safe work condition

“ I-Gard’s Advanced HRG system (DSP-OHMNI relay) is the only in the market that reduces the likelihood and the severity of any arc flash event. All in one single relay”

Case 5

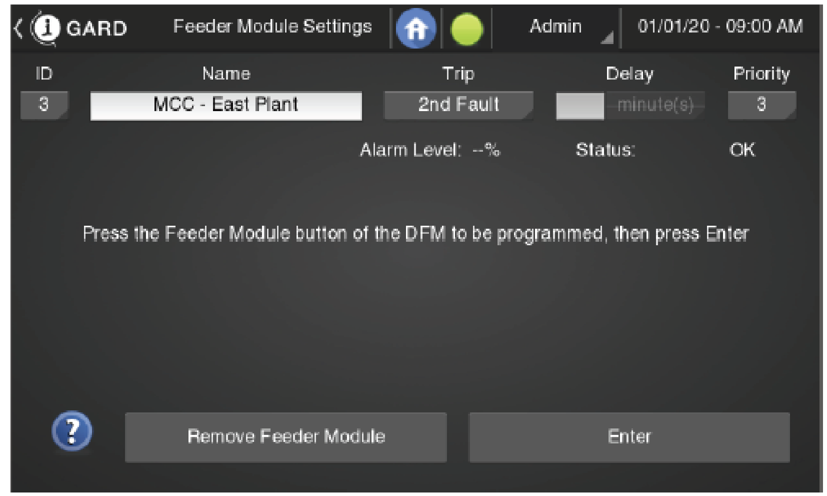
The maintenance manager at a large petrochemical facility valued the process continuity aspect of using HRG BUT was concerned that maintenance personnel would not look for the fault in a timely manner THEREFORE she wanted to consider Advanced HRG?

I-Gard DSP- System
(Advanced HRG system)



Standard HRG vs Advanced HRG

Trip on 1st fault with delay



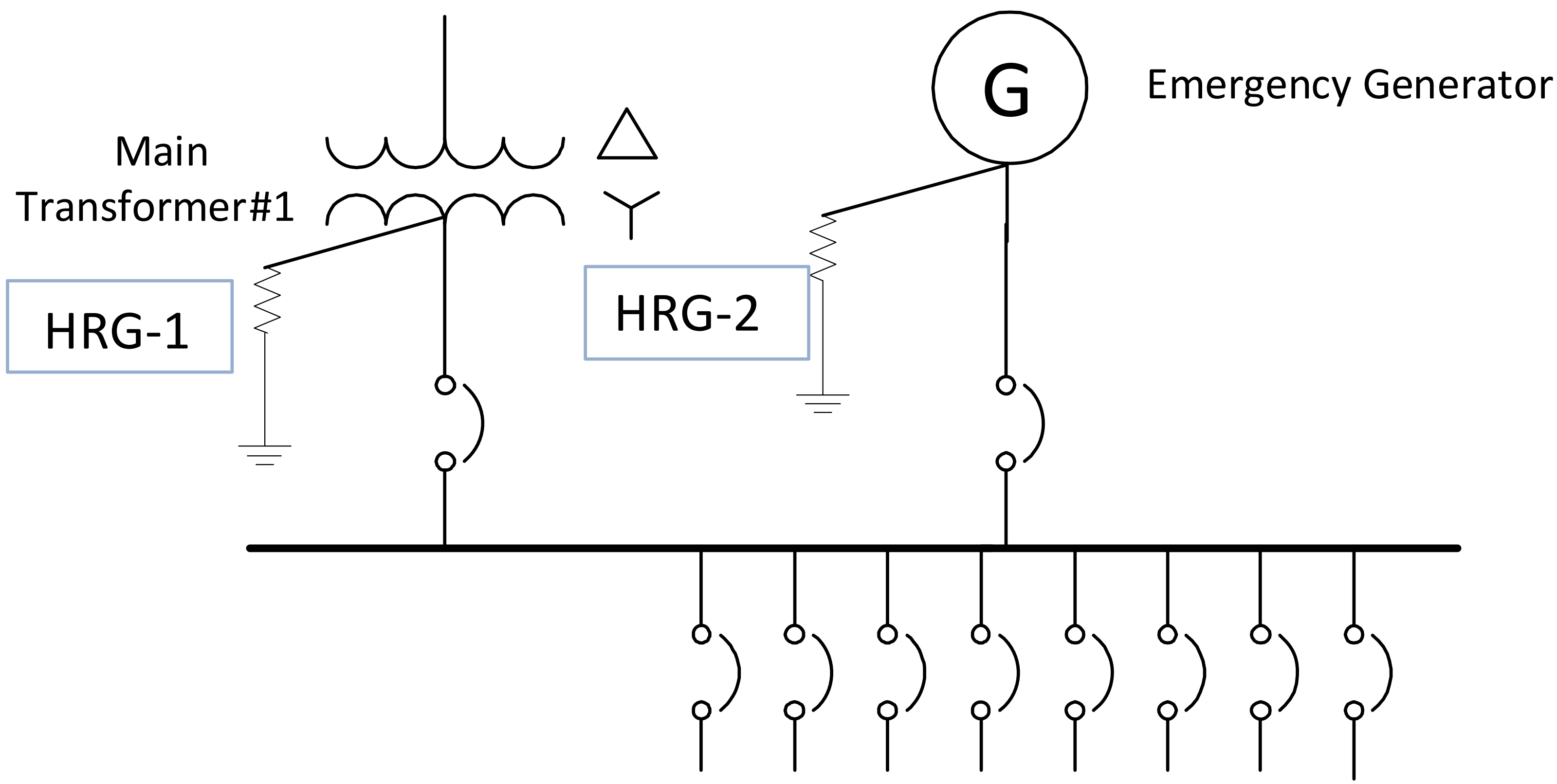
Trip on 2nd fault & Priority Level

Setting Ig and Priority Levels

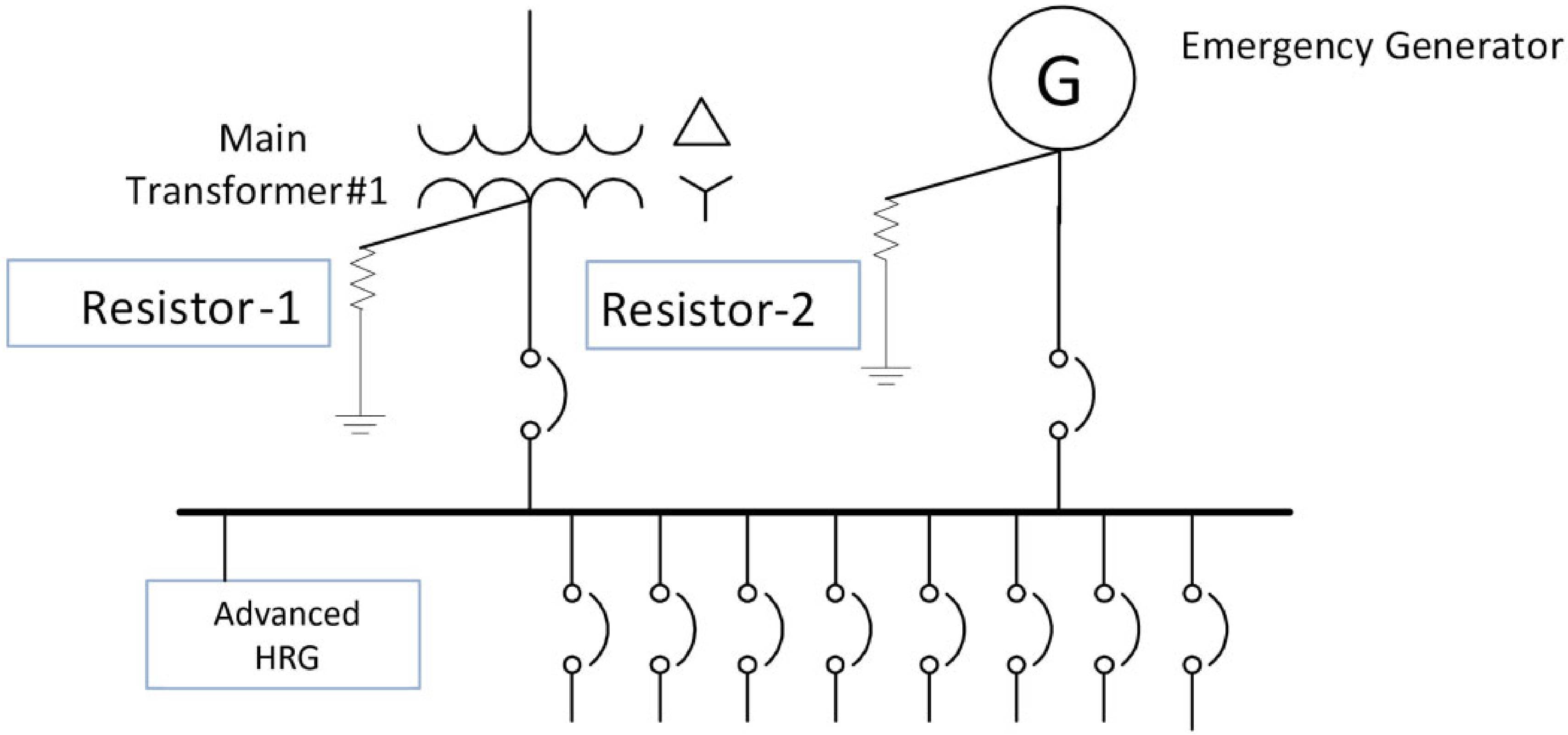
Case 6

A consultant is considering HRG for a data center BUT is unclear whether there is a need for two HRG systems, one on the transformer and one on the generator THEREFORE is considering asking I-Gard for application support. Is there anything different about the I-Gard approach to this application?

Typical Datacenter Topology



New Datacenter Topology



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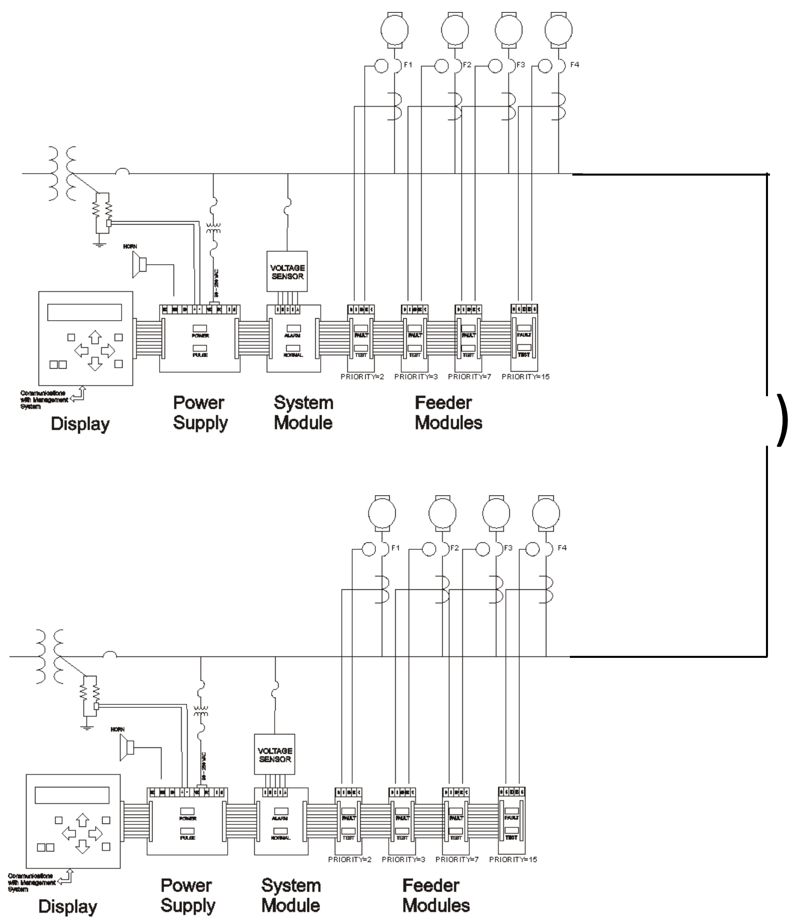
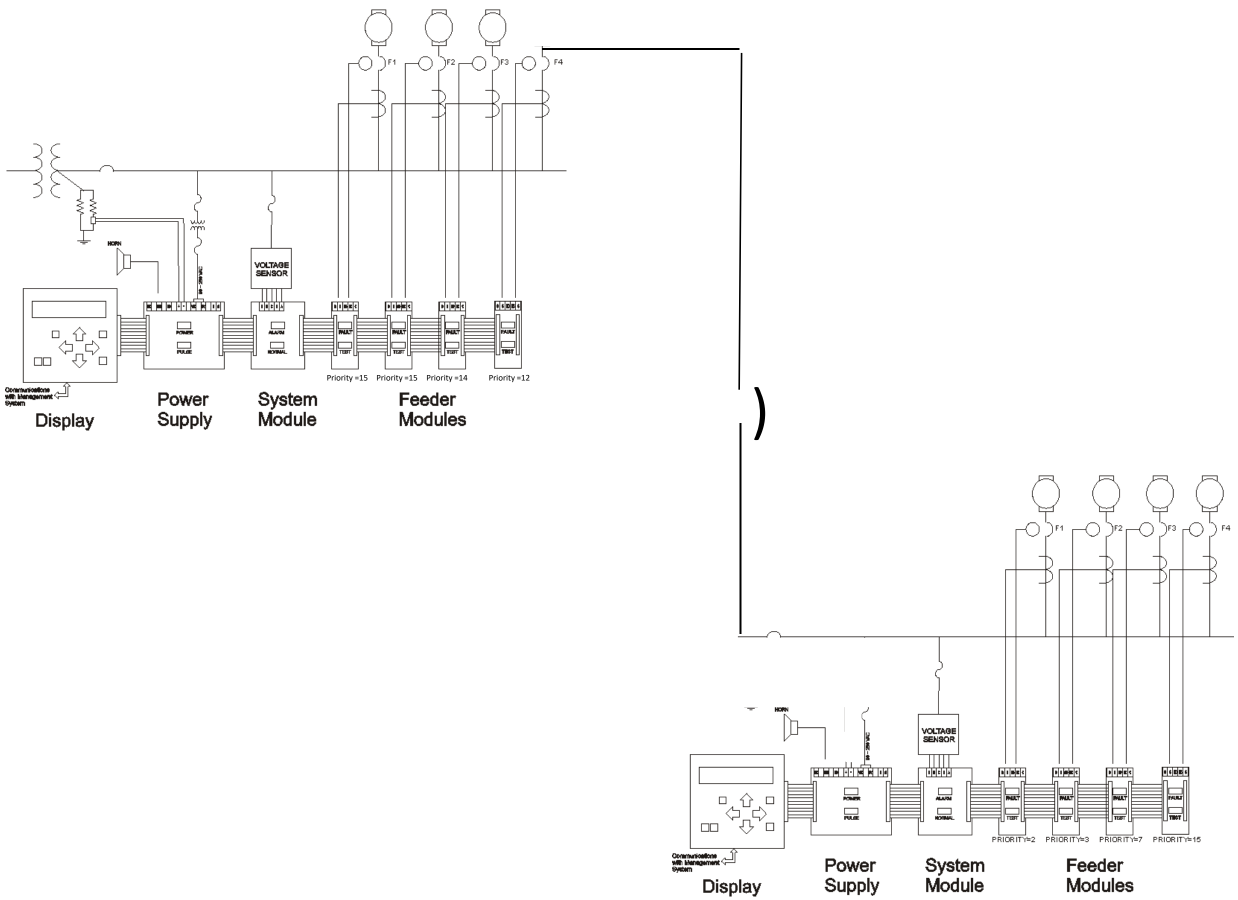
Case 7

A mining company has used standard HRG in the past BUT is looking to upgrade to feeder protection THEREFORE needs to understand what are the limits on number of feeders and tripping time.


F1
F2
F3
F4
VOLTAGE SENSOR
PRIORITY=2
PRIORITY=3
PRIORITY=7
PRIORITY=15
Display
Power Supply
System Module
Feeder Modules
F1
F2
F3
F4
VOLTAGE SENSOR
PRIORITY=2
PRIORITY=3
PRIORITY=7
PRIORITY=15
Display
Power Supply
System Module
Feeder Modules

GARD



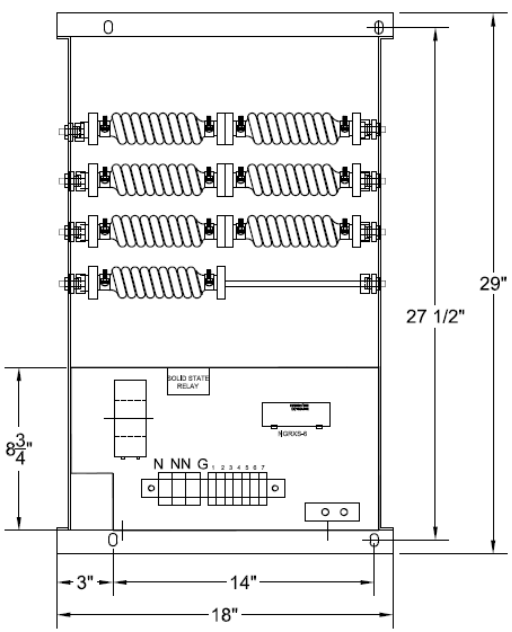
F1
F2
F3
F4
VOLTAGE SENSOR
Priority =15
Priority =15
Priority =14
Priority =12
Display
Power Supply
System Module
Feeder Modules
F1
F2
F3
F4
VOLTAGE SENSOR
PRIORITY=2
PRIORITY=3
PRIORITY=7
PRIORITY=15
Display
Power Supply
System Module
Feeder Modules

Case 8

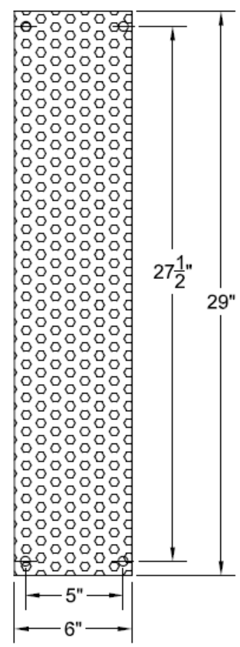
An OEM is looking to integrate HRG technology BUT space is a limitation and THEREFORE need the smallest possible footprint. What makes the I-Gard HRG different?

I-Gard High Resistance Grounding
HRG-OEM Kit

(1. Resistor)

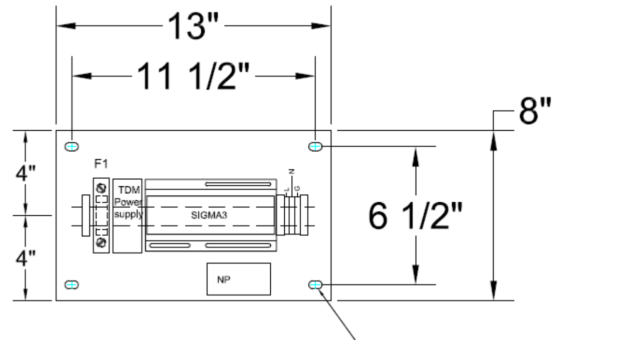


TOP VIEW
COVERS REMOVED



SIDE VIEW

(2. Sigma3 back plate)



SIGMA3 BACK PLATE

I-Gard HRG Systems

HRG- OEM kit

Wall mounted HRG

(3. Sigma3-TDM)

1. Resistor
2. Sigma3 back plate
3. Sigma3-TDM Touchscreen Display Module

Sleuth with Pulsing Capability & Sigma3 - TDM

Case 9

A consultant is specifying a NGR and typically references IEEE C57.32 BUT the project is in Canada and THEREFORE the reference standard will be CSA 22.2-295, what is the difference between the standards?

GARD

Standards in Use

- **IEEE 32-1972 (R 1990)** “IEEE Standard Requirements, Terminology, and Test Procedures for Neutral Grounding Devices”
- **IEEE C57.32-2015** “IEEE Standard for Requirements, Terminology, and Test Procedures for Neutral Grounding Devices”
- **IEEE C57.32a-2020** “IEEE Standard for Requirements, Terminology, and Test Procedures for Neutral Grounding Devices”
- **CSA C22.2 No. 295-15** “Neutral grounding devices”
- **IEC 60076 25** In Process

Terminology

- Rated Voltage
- Rated Current
- Rated Time
- Maximum Temperature
- Temperature Coefficient of Resistance

Rated Voltage

Since the active material used in resistors has an appreciable temperature coefficient, the resistance is materially changed during the time of operation causing the current to decrease. When the product of the fault current and resistance at 30 °C exceeds 80% of the line-to-neutral voltage of the circuit, the resistor shall be rated for constant voltage and the rated voltage shall be taken equal to the line-to-neutral voltage.

Rated Current

- The initial current through the resistor.

Rated Time

- Rated time shall be 10 seconds, 1 minute, 10 minutes, extended time, or continuous(steady-state).
- Extended time shall not exceed an average of 90 days per year.

10 s and 1 min. ratings

- The rated-time temperature rise of 10-second and 1-minute devices shall be taken as the sum of the steady-state rise and the additional rise caused by the application of rated voltage for rated time.

GARD

Ten-Minute Ratings

- The rated-time temperature rise of 10-minute devices shall be taken as the sum of the steady-state rise, if specified, otherwise 0°C rise if not specified, and the additional rise caused by the application of rated voltage for rated time.

Maximum Temperature Rise

Temperature Rise K				
		IEEE	**CSA**	**IEC**
Steady State for continuous current ratings	**Steady state (hot-spot)**	385	375	385
Rated Time for thermal current ratings less than Steady-State	**Extended-time (hot-spot)**	610	600	610
	Ten-minute (hot-spot)	610	600	610
	Less than 10 min (hot-spot)	760	750	760

Temperature Coefficient of Resistance

$$\alpha = \frac{R_2 - R_1}{R_1(\theta_2 - \theta_1)}$$

$$R_2 = R_1\left[1 + \alpha(\theta_2 - \theta_1)\right]$$

- Where;
  - R_1 is the initial resistance(Ω)
  - R_2 is the final resistance(Ω)
  - θ_1 is the Initial Temperature (^oC)
  - θ_2 is the final Temperature(^oC)
  - α is the Temperature coefficient of resistance(1/ ^oC)

GARD

Mill Test Certificate – Resistors

Electrical resistivity	Type 1	Type 2	Type 4
ohm-cir mil/ft at 68°F microhm-cm at 20°C	720 120	680 113	656 109

Mean Temperature Coefficient of Electrical Resistivity

Temperature		Coefficient	
68°F to	20°C to	per °F	per °C
200	93	0.000068	0.000101
400	204	0.000070	0.000126
600	316	0.000085	0.000153
800	427	0.000091	0.000164
1000	538	0.000104	0.000187
1200	649	0.000121	0.000218
1400	760	0.000134	0.000241

Example 1

277 V, 5 A, Continuous resistor.

Rated Voltage= 277 V

Rated Current = 5 A

Rated Time = Continuous

Max Temperature Rise = 385°C

Temperature Coefficient of Resistance = Not Specified

GARD

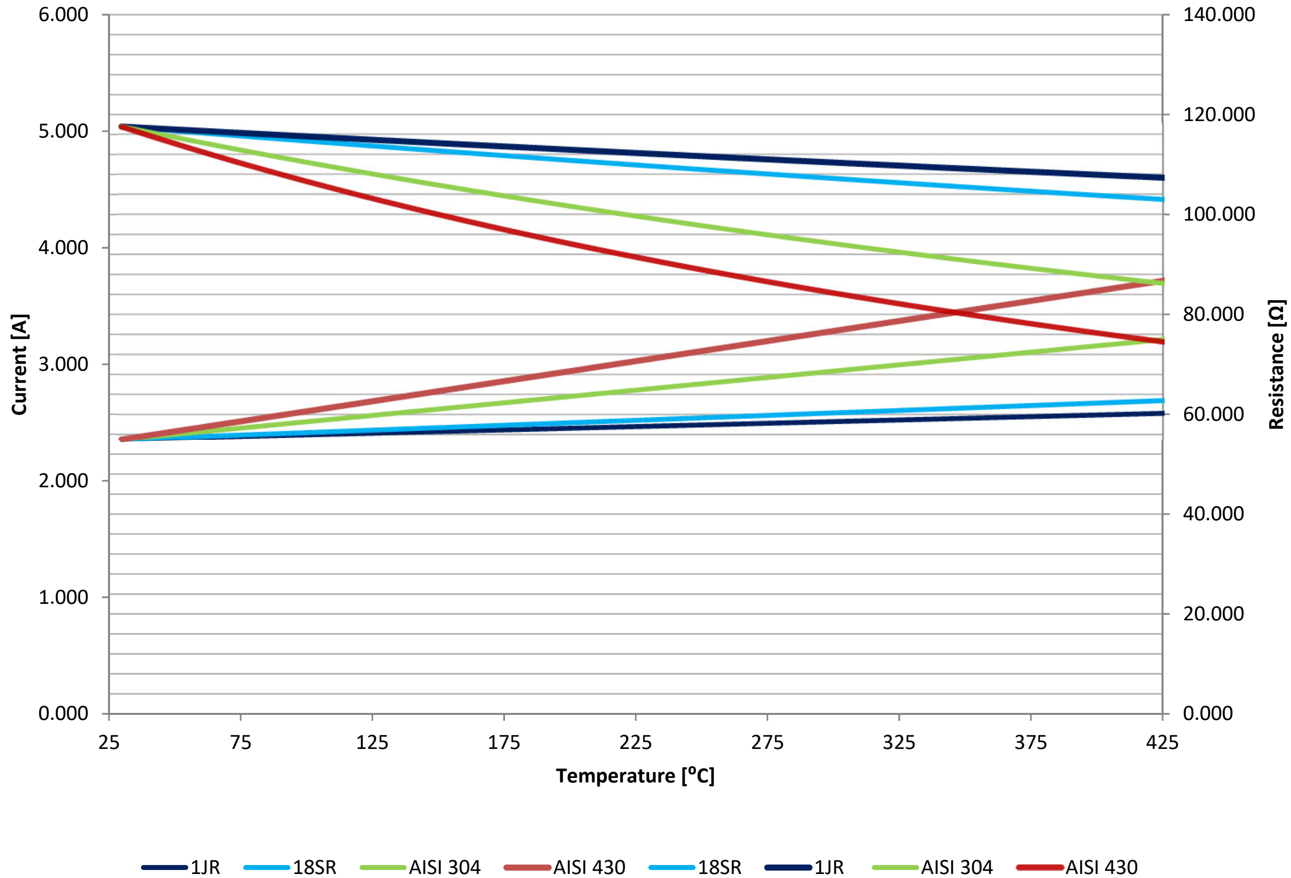
Resistance Change

55.4 Ω   385 ^{o}C

$$R_2 = R_1\left[1 + \alpha\left(\theta_2 - \theta_1\right)\right]$$

Alloy	Temperature Coefficient of Resistance (1/^{o}C) α	Percent change in Resistance	Current decrease as a percentage
AISI 304	0.00092	35% Increase to 74.79 Ω	26.15% to 3.7 A
AISI 430	0.00146	56 % Increase to 86.42 Ω	36% to 3.2 A
18SR	0.000358	13.7 % Increase to 62.989 Ω	12% to 4.39 A
1JR	0.000241	9 % Increase to 60.39 Ω	9.1 % to 4.6 A

** First 2 rows violate CSA Standard as the current decreases by more than 20% but no IEEE standard.


6.000
5.000
4.000
3.000
2.000
1.000
0.000
Current [A]
140.000
120.000
100.000
80.000
60.000
40.000
20.000
0.000
Resistance [Ω]
25
75
125
175
225
275
325
375
425
Temperature [°C]
1JR
18SR
AISI 304
AISI 430
18SR
1JR
AISI 304
AISI 430

Example 2

2400 V, 400 A, 10 seconds resistor.

Rated Voltage= 2400 V

Rated Current = 400 A, continuous portion not specified

Rated Time = 10 s.

Max Temperature Rise = 760^{o}C

Temperature Coefficient of Resistance = Not Specified

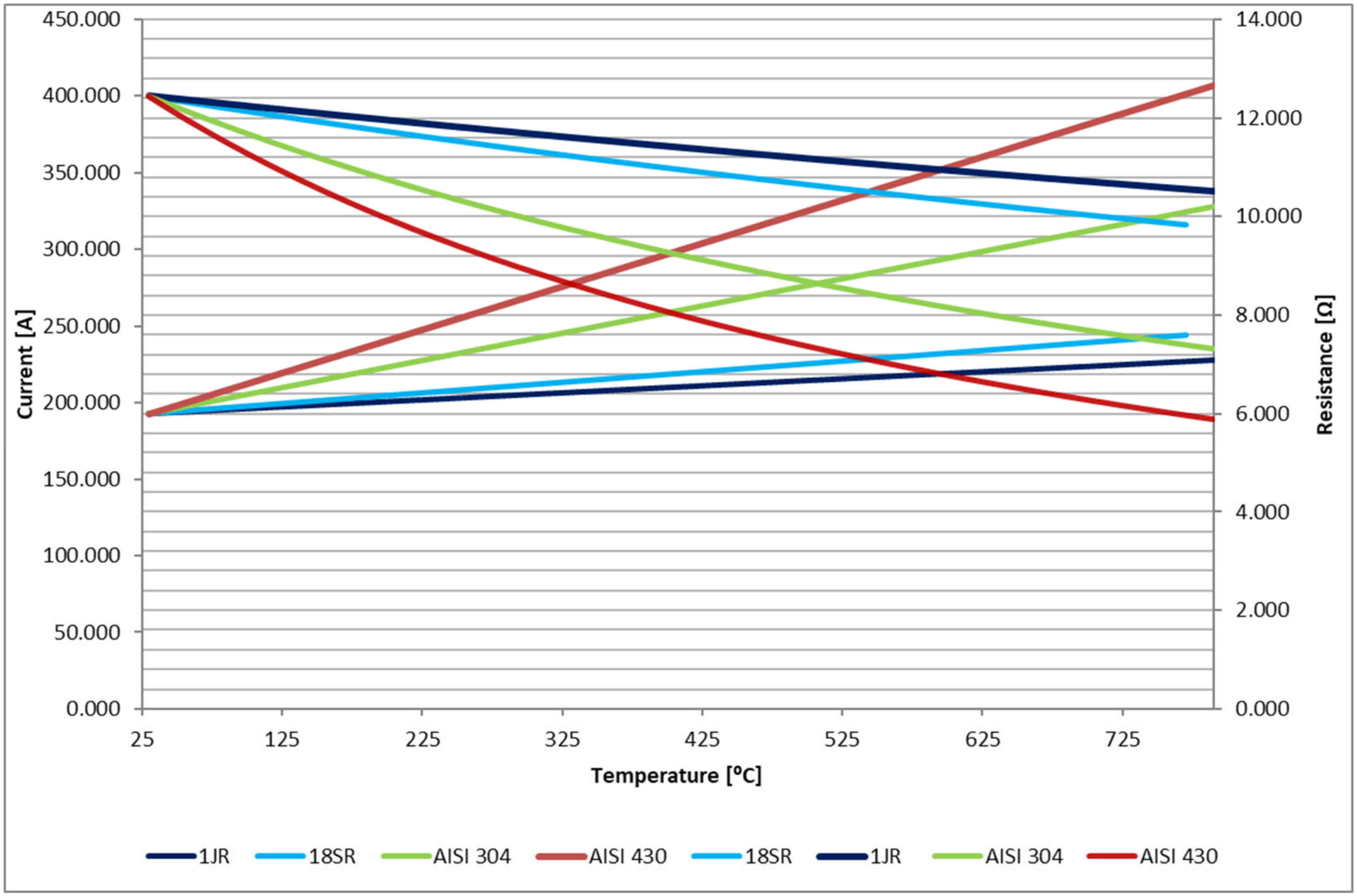
Resistance change

6 Ω   760°C

$$R_2 = R_1\left[1 + \alpha\left(\theta_2 - \theta_1\right)\right]$$

Alloy	Temperature Coefficient of Resistance (1/°C) α	Percent change in Resistance	Current decrease as a percentage
AISI 304	0.00092	70% Increase to 10.2 Ω	41.1% to 235 A
AISI 430	0.00146	110 % Increase to 12.65 Ω	52.5% to 189 A
18SR	0.000358	27 % Increase to 7.63 Ω	21% to 314 A
1JR	0.000241	18 % Increase to 7.1 Ω	15.4 % to 338 A

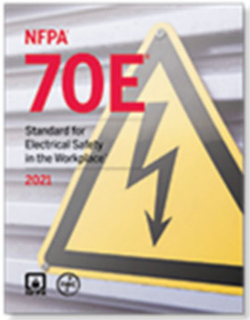
** First 3 rows violate **CSA** Standard as the current decreases by more than 20%
** First 2 rows violate **IEEE C57.32** as resistance increases by more than 67%


450.000
400.000
350.000
300.000
250.000
200.000
150.000
100.000
50.000
0.000
Current [A]
14.000
12.000
10.000
8.000
6.000
4.000
2.000
0.000
Resistance [Ω]
25
125
225
325
425
525
625
725
Temperature [ºC]
1JR
18SR
AISI 304
AISI 430
18SR
1JR
AISI 304
AISI 430

Case 10

A customer is looking to conduct absence of voltage testing BUT their current product isn't labeled to UL 1436 which is required by NFPA 70E 120.5 THEREFORE they are looking at the I-Gard i-AVT.

Exception No. 1 to 7:
An adequately rated permanently mounted ***absence of voltage tester*** *shall be permitted to be used to test for the absence of voltage of the conductors or circuit parts at the work location, provided it meets all of the following requirements:*



NFPA 70E 2021-120.5 (7) Exception 1.			
Description	**Voltage Indicator**	**Voltage Test Station**	**Absence of Voltage Tester**
(1) It is permanently mounted and installed in accordance with the manufacturer's instructions	YES	YES	YES
(1) and tests the conductors and circuit parts at the point of work;	NO Test Function	NO - hand held tester is in contact with the test port, no verification that test port is in contact with circuit.	YES
(2) It is listed and labeled for the purpose of testing for the Absence of Voltage	NO	NO	YES
(3) It tests each phase conductor or circuit part both phase-to-phase and phase-to-ground	Only Phase to Ground	YES - with hand held tester	YES
(4) The test device is verified as operating satisfactorily on any known voltage source before and after testing for the Absence of Voltage	NO	NO - no means to verify the test port, the hand held meter requires access to a known voltage source	YES
Note 1: Meets rating and desgin requirements for absence of voltage testers described in UL 1436	NO	NO	YES

	I-Gard	Grace Technologies
	Absence of Voltage Tester **i-AVT**	**Voltage Test Station** **P-S10S**
		
UL 1436 Requirements		
A permanently-mounted test device that is used to verify that a circuit is de-energized prior to opening an electrical enclosure that contains energized electrical conductors or circuit paths	**YES**	**YES**
12.1.2 - An AVT shall be provided with the means for the user to initiate the test for absence of voltage.	**YES**	**NO**
12.1.3 - An AVT shall provide the user with a visual indicator to confirm the absence of voltage after the absence of voltage test has been performed. The visual indication shall be green.	**YES**	**NO**
12.1.5 - The AVT shall incorporate a supervisory test circuit to verify that the tester is functioning properly before and after the AVT performs voltage measurements.	**YES**	**NO**
12.1.4 - The AVT supervisory circuit has incorporated a secondary power source and shall have no internal failure that would affect performance.	**YES, SUPER CAPACITOR**	**NO**
12.1.6 - The AVT visual indicator shall only illuminate green when all phase-to-phase and phase-to-ground voltages measure less than 3VAC or 3VDC.	**YES**	**NO**
12.1.7 The AVT visual indicators shall not illuminate green unless the phase and ground leads are in direct contact with the circuit conductors being tested	**Yes, product architecture and operation ensures green lights can only illuminate once continuity check is complete.**	**No means of verifying that leads are connected.**
12.1.8 - The AVT visual indicator shall not illuminate green if a phase lead is connected to ground or the ground lead is connected to a phase conductor.	**Yes, product architecture and operation ensures green lights cannot illuminate if any lead is misconnected**	**No means of verifying that leads are properly connected**
12.1.9 12.1.9 The visual indicator shall not illuminate green unless the secondary power source is operational	**Yes, product architecture and operation ensures green lights can only illuminate if the secondary power source is operational**	**No secondary power source available**
12.2.1 - The AVT shall comply with the Standard for Functional Safety IEC 61508 and achieve a SIL 3 rating.	**Yes, product is tested and approved to SIL3 safety rating**	**No the voltage test port is not tested to SIL 3 rating and failsafe in operation**

What makes I-Gard i-AVT different?

Simple, intuitive, better.

- The i-AVT provides visual indication of the presence of voltage via 3 phase voltage red lights connected directly to the circuit conductors, thereby indicating that hazardous voltage is present.

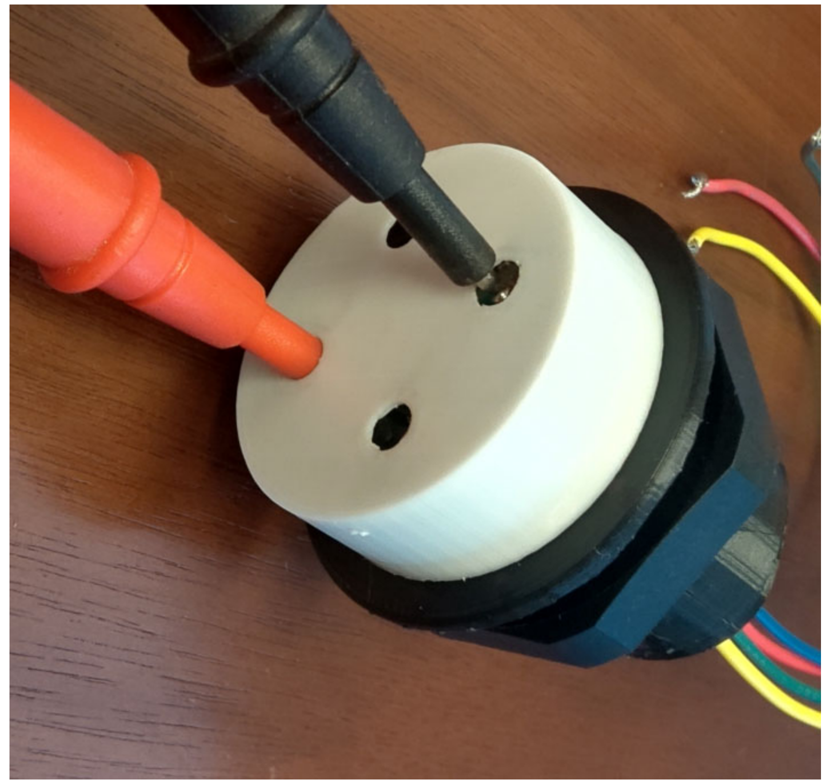
- The i-AVT provides positive indication of the Absence of Voltage via 3 Green LED lights.

- The i-AVT provides a continuity check to ensure that all leads are connected and connected properly.

- The i-AVT is maintenance free with secondary power source built-in to the control module.
- The i-AVT is SIL-3 rated ensuring that it will not provide a false positive.

I-Gard VTi

I-Gard VTi



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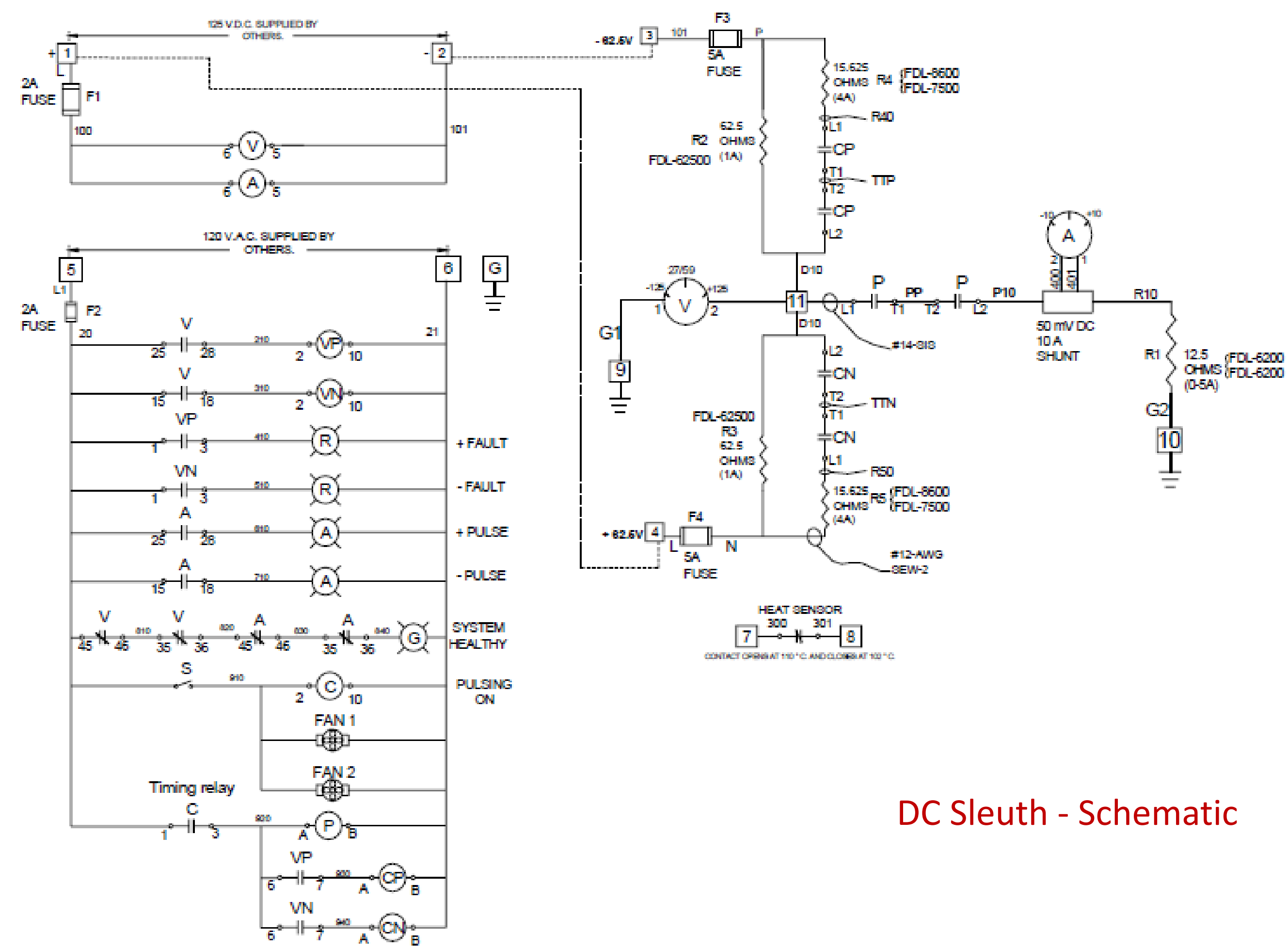
Case 11

A chemical processing facility is upgrading from ungrounded to high resistance grounded BUT has multiple variable frequency drives and is concerned about DC faults THEREFORE needs a solution that detects both AC and DC faults.

DC Faults

- I-Gard was the first company to produce a DC HRG system.



DC Sleuth - Schematic

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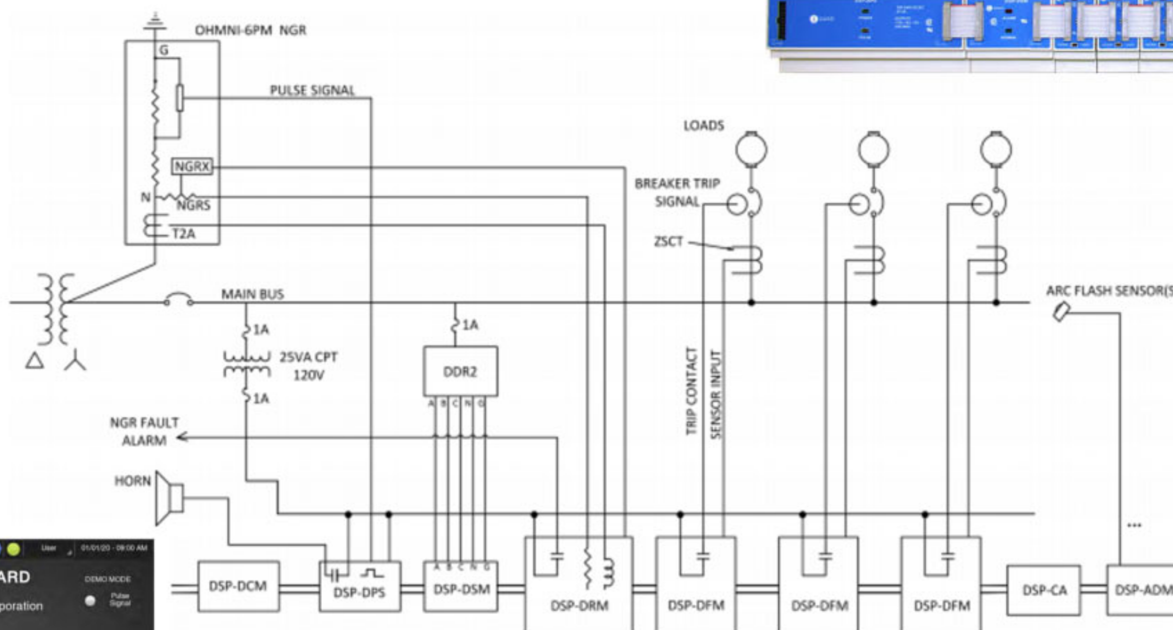
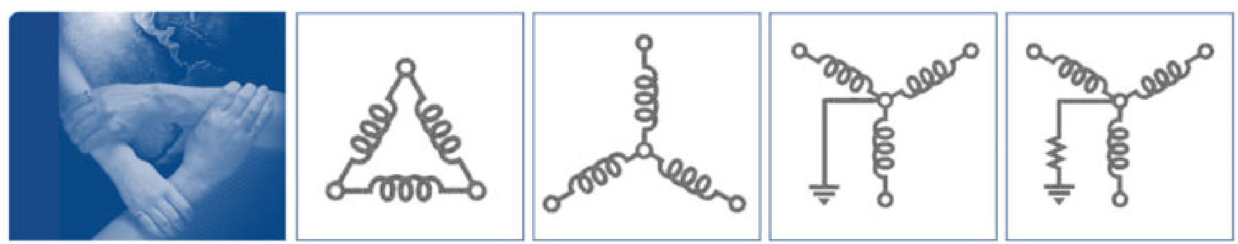


OHMNI-6PM NGR
G
PULSE SIGNAL
NGRX
N
NGRS
T2A
LOADS
BREAKER TRIP SIGNAL
ZSCT
MAIN BUS
ARC FLASH SENSOR(S)
1A
25VA CPT 120V
1A
1A
DDR2
A B C N G
NGR FAULT ALARM
HORN
TRIP CONTACT
SENSOR INPUT
...
DSP-DCM
DSP-DPS
DSP-DSM
DSP-DRM
DSP-DFM
DSP-DFM
DSP-DFM
DSP-CA
DSP-ADM

GARD
I-Gard Corporation
HRG System OK
RESET

GARD

Questions?



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