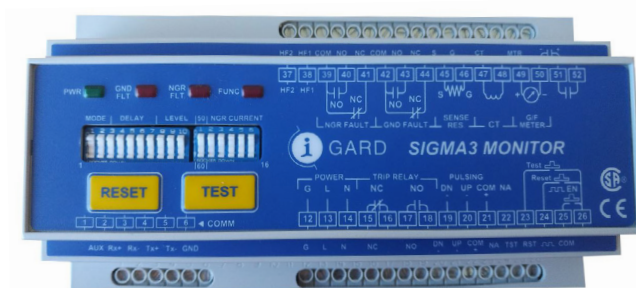


i-Gard's SIGMA 3 relay is a combination ground fault and monitoring relay with pulsing capability, that fully complies with the requirements of the *Canadian Electrical Code 2021* section 10.302 *without exception* or rating restrictions.

The SIGMA 3 is designed for application in High Resistance Grounding systems (systems typically below 5 kV where the fault current is limited to 10 A or less) and the complete range of Low Resistance Grounding systems (systems between 5 kV and 69 kV where the NGR is time rated).

The SIGMA 3 has been specially designed to ensure effective monitoring of the NGR circuit, even when de-energized.



10-302 SUBRULE 2 USE REQUIREMENTS: *The integrity of an impedance grounded system shall be monitored, and the system shall have an audible or visual alarm that corresponds to the occurrence of:*

CEC 2021 Requirements

- a) A ground fault on current-carrying conductors, including the neutral conductor where line-to-neutral loads are served
- b) A ground fault on the conductor connecting the impedance grounding device to the source; and
- c) 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



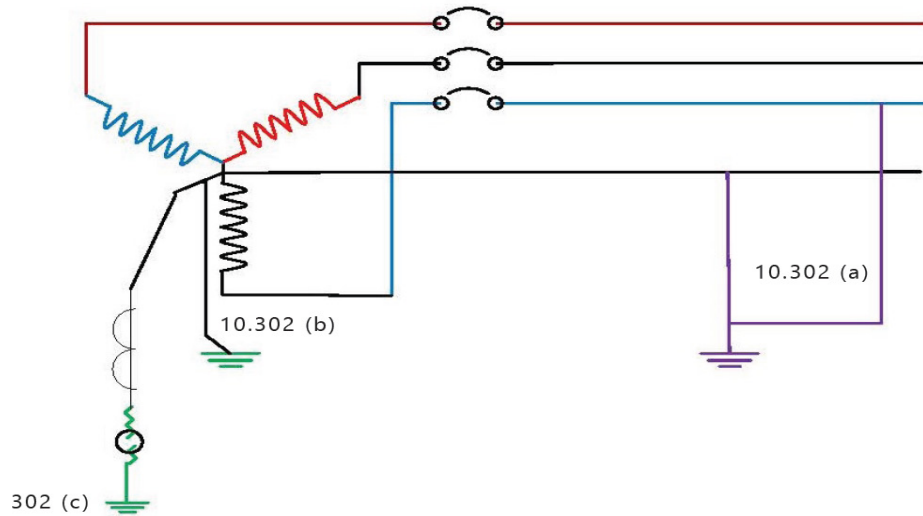
SIGMA 3

The SIGMA 3 relay is also a ground fault relay, therefore any ground fault on any current-carrying conductors will be detected and alarmed.

The SIGMA 3 measures the impedance value of the ground path from the source neutral to ground. During a short condition, the equivalent impedance of the parallel circuit formed by the NGR and the short, will be very low. The SIGMA 3 will detect this abnormal condition and alarm.

During an open circuit, the SIGMA 3 will automatically switch to *injection mode*, injecting a high frequency signal to the NGRXS (sensing resistor) circuit. There will be no return of the signal due to the open circuit. This condition will be alarmed.

SIGMA 3



10-302 Use Requirements

- 2) The integrity of an impedance grounded system shall be monitored and controlled, as required by Table 17.
- 3) Alarms required by Table 17 shall
 - a) Be clearly labelled as to their purpose;
 - b) Clearly annunciate the status of the system to persons monitoring it; and
 - c) Continue signalling until the condition is corrected

CEC 2021, Table 17. Summary of conditions (a), (b) and (c):

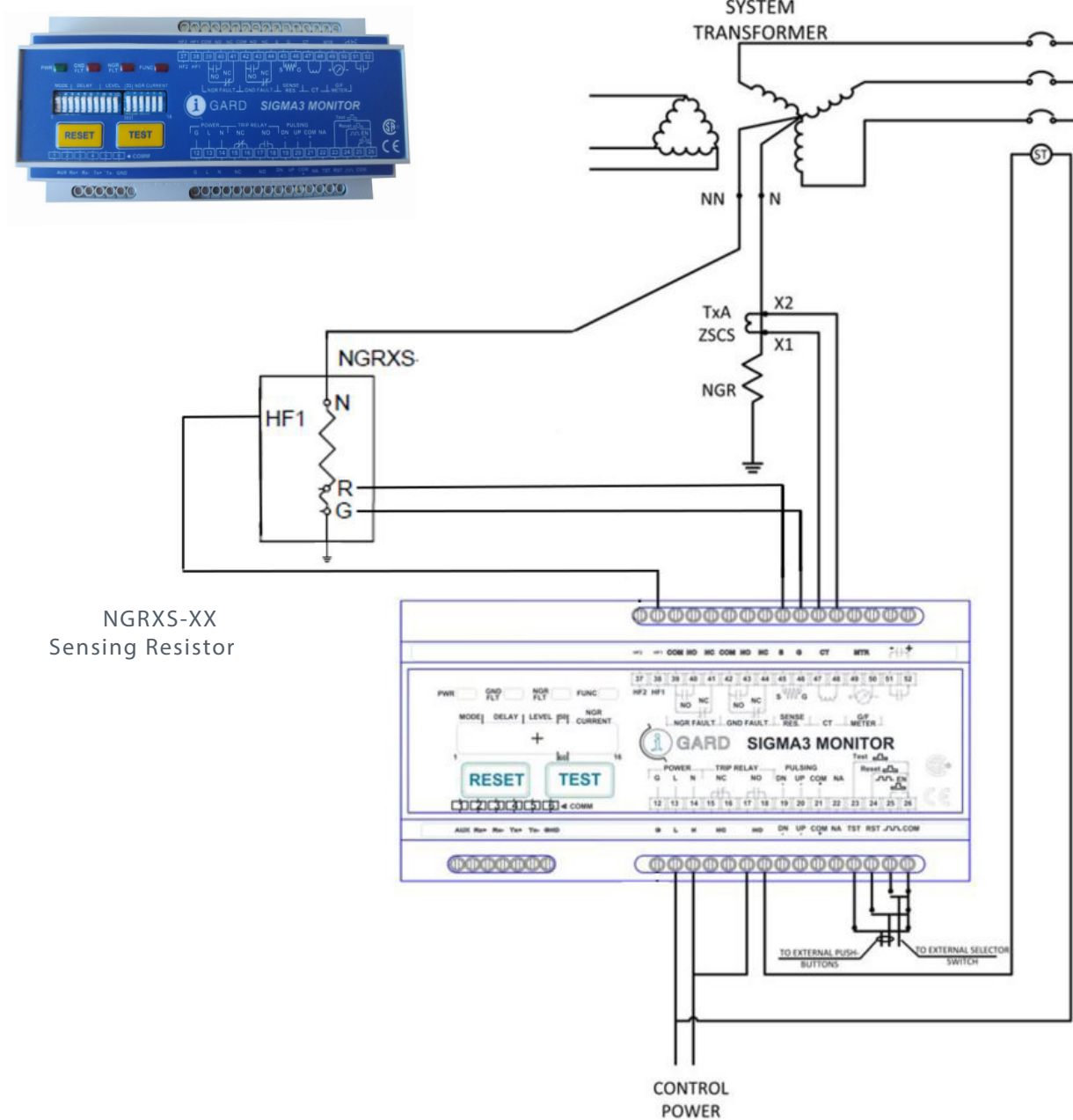
Configuration	A Ground Fault on the current carrying conductors (a)	A Ground Fault on the conductor from the source to the resistor (b)	Loss of Continuity from the source through the resistor to ground (c)
Distributed Neutral	Alarm and de-energize immediately	Alarm and de-energize immediately	Alarm and de-energize immediately
$\leq 5 \text{ kV}$ and $\leq 10 \text{ A}$	Alarm and de-energize within the time rating of NGR	Alarm and de-energize within 48 hours	Alarm
$> 5 \text{ kV}$ or $> 10 \text{ A}$	Alarm and de-energize within the time rating of NGR	Alarm and de-energize within 48 hours	Alarm

Finally, the SIGMA 3 is fully compatible with all power-circuit elements, including those that intentionally connect the power system to the ground (single-phase grounding transformers, grounded-wye-primary potential transformers, and grounded-wye-primary power transformers).



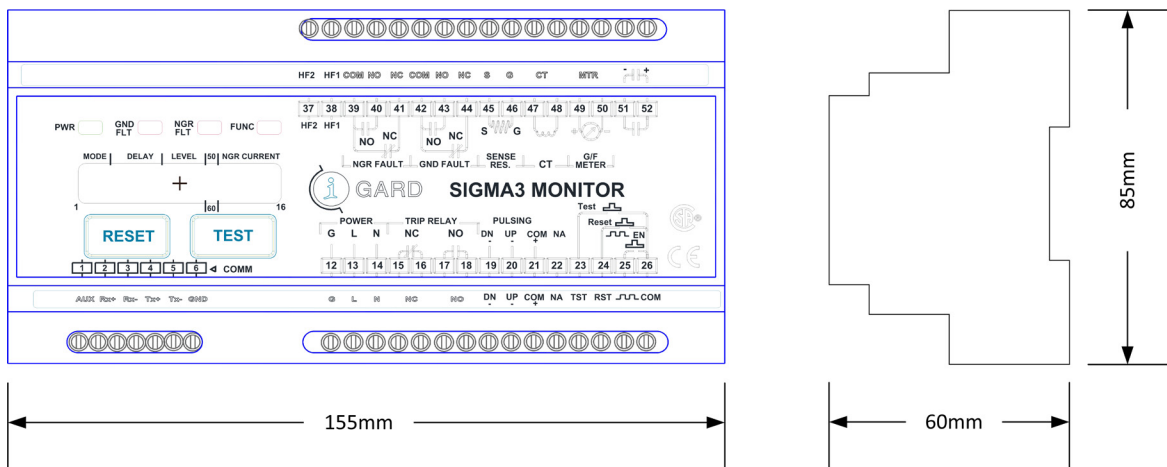
While the SIGMA 3 meets the requirements of CEC 2021 10.302 a), i-Gard strongly recommends against employing a 3 phase 4 wire HRG system where neutral loads can be served due to the inherent safety risk of this system. *i-Gard strongly recommends that all HRG systems be 3 phase 3 wire only.*

SIGMA 3



SIGMA 3 Typical System Diagram

DIMENSIONS



TECHNICAL SPECIFICATIONS

Electrical Ratings	Control Power:	110-240 VAC/DC 50/60 Hz 5 VAC or 5 W DC	
	Maximum:	-45% to +10% (60-264 VAC/DC)	
Output Relay Contacts	Main Trip Relay:	Type:	Form Z (NO and NC pair)
		Rating:	10 A@240 VAC, 10 A@30 VDC, 1/2 HP@240 VAC
	Auxiliary Ground Fault Relay:	Type:	1 Form C (NO/NC)
		Rating:	10 A@240 VAC, 8A@24 VDC, 1/2 HP@240 VAC
	Auxiliary NGR Fault Relay:	Type:	1 Form C (NO/NC)
		Rating:	10 A@240 VAC, 8A@24 VDC, 1/2 HP@240 VAC
	Pulsing NGR Fault Relay:	Type:	1 Form C (NO/NC)
		Output:	Max: 1 A @ 12 VDC
SIGMA 3 Health Monitoring Relay (Watchdog Relay):	Type:	1 Form A (NO), Fail-safe Mode	
	Rating:	1 A @ 120 VDC	
Meter Output	0-1 mA DC (0-100% of Let-through Current Setting)		
Electrical Tests	Surge test: @ 3 kV Dielectric test: @ 2 kV for 1 minute		
NGR Let-Through Current Settings	5-400 A		
Ground Fault Trip Settings	Trip Level	5%, 10%, 15%, 20%, 25%, 30%, 40%, 50%	
	Trip Time	60 - 3150 ms	
Operating Modes	Fail-safe (Under-voltage Trip) / Shunt-trip		
	Trip Memory On / Trip Memory Off		
Frequency	50 / 60 Hz		
Temperature Range	Operating: -40°C to +60°C Storage: -50°C to +70°C		

C-EG44EB SIGMA 3_2023