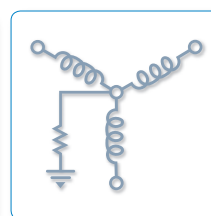
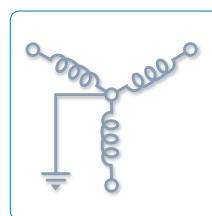
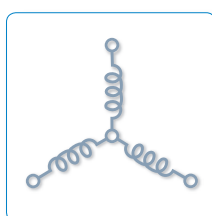
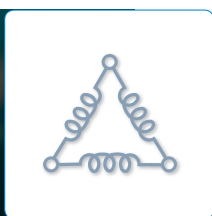




FUSION

GROUND FAULT PROTECTION SYSTEM



the power to protect

FUSION

Instruction Manual C-105

IPC

GROUND FAULT PROTECTION

Fusion is a dual purpose grounding protection system that offers the best of both worlds. All the benefits of solidly grounded systems and the protection of high resistance grounded system all in one system.

Ideal as a transition product for customers who have traditionally used solid grounding or who require a solid ground to provide a reference point for automation equipment, the **Fusion** was chosen by General Motors to provide high resistance grounding location capability during a recent facility upgrade.



IMPORTANT

DANGER

ELECTRICAL SHOCK, FIRE OR EXPLOSION HAZARD

All installation, servicing and testing referred to in this manual must be performed by qualified personnel. All power should be disconnected prior to removing covers or enclosures and where live conductors may otherwise be exposed.

Failure to observe these precautions may result in death or severe personal injury.

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1 GENERAL DESCRIPTION

I-Gard Fusion is a Hybrid neutral grounding device. The **I-Gard Fusion** limits ground fault current to non-destructive levels allowing normal operations to continue and preventing over voltage damage. The power System operates normally as solidly grounded through a suitable current limiting device. The **I-Gard Fusion** will allow low level faults to be cleared by the local protective means. High level faults will be cleared by the current limiting device with the **I-Gard Fusion**, allowing the system to covert to High Resistance Grounded. While the system is in High Resistance Mode the process will continue to operate in the mode until the fault can be detected and located and isolated.

I-Gard Fusion with Sleuth Pulsing is the ideal tool for sensing and locating ground faults quickly and easily. Ground faults are the most common form of electrical fault, accounting for a minimum of 85% of all electrical faults in a distribution system. When a ground fault occurs: **I-Gard Fusion** controls and limits the fault current, provides alarms that indicate an active fault, enabling plant electrical personnel to follow a simple sequence to locate and isolate the fault. When the fault is in smaller load which is protected by a circuit protective device which operates faster than the breaker in the Fusion Panel, it will allow it to be disconnected; but when the fault is in major equipment, the Fusion changes to High Resistance Grounding without interrupting or opening circuit breakers in the faulted feeder. This allows process equipment to continue operations uninterrupted.

I-Gard Fusion normally shows a Green “Solidly Grounded” light on the front panel. It announces the ground fault by a flashing red light marked “Blown Fuse”. In addition red light marked “High Resistance Grounded” turns on. **I-Gard Fusion** provides relay contacts which may be wired to a wide variety of alarm or annunciation devices. The Panel in the High Resistance Grounding (HRG) mode limits the ground current to 5 A and the “Ground Fault Active” red light shows if the fault is active and relay contacts are activated. The pulsing of the ground current can be initiated by turning the Pulsing Switch to “ON”. This enables quick tracing of the fault. An Amber “Ground Fault Occurred” light shows if the fault is not active and “System Healthy” green light shows if no faults have been detected since the last reset.

I-Gard Fusion is available for 480V and 600V line to line WYE systems where the Neutral is available to connect this Hybrid Grounding Device. Neutral in such systems cannot be used for load.

I-Gard Fusion panel type FS 277- 5/2.5 or FS-347- 5/2.5 are wall mounted, and comprise of two enclosures.

The numbers 277 and 347 in the part numbers refer to the system line-to-neutral voltage and correspond to the system voltages of 480V and 600V respectively. The 5/2.5 in the part number refers to the maximum let through ground fault current of 5A and the switched current of 2.5A during pulsing. After the Breaker in the Ground path operates and converts the system to High Resistance Grounding. The **I-Gard Fusion with Sleuth** pulsing system, when activated, will cyclically limit the ground fault current to 100% and 50% of the available ground fault current. The user can modify the duration of this pulse to suit the requirements of his sensing device.

The cyclic pulsing combined with the hand held current sensor, and a single line diagram can be used to rapidly locate a ground fault even in a very complex power distribution system.

1.1 High-Resistance Grounding

Both the Canadian Electrical Code, Part 1, C22.1-98 and the National Electrical Code, NFPA 70 1999, approve the use of high-impedance grounding neutral systems up to 1000 V. A.C. where the ground fault current is limited to 5 amperes or less. These new changes to the electrical code allow users of the **I-Gard Fusion** to maintain a ground fault current of 5 amperes or less on their electrical distribution system without shutting down because of a single ground fault, thereby avoiding unscheduled down times. With **Sleuth pulsing** users can locate, isolate and repair faulty equipment at convenient time.

The reason for limiting ground fault current by resistance grounding may be one or more of the following, as indicated in IEEE Std. 142-1991, IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems, pp. 25-26.

- 1) To reduce burning and melting effects in faulted electric equipment, such as switch gear, 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 ground fault.
- 5) To reduce the momentary line-voltage dip occasioned by the occurrence and clearing of a ground fault.
- 6) To secure control of transient over voltages while at the same time avoiding the shutdown of a faulty circuit on the occurrence of the first ground fault.

2 INSTALLATION

I-Gard Fusion is housed in a NEMA 2 indoor solid top drip proof enclosure and is to be mounted in accordance with local regulations.

Upon receipt, carefully open the protective shipping carton, remove all packing material and visually inspect the unit. If the unit is damaged do not proceed with installation. Contact I-Gard at the numbers listed on the final page of this document.

Loosen the two door bolts and open the front door to access the mounting holes.

The mounting dimensions are indicated in this manual as well as in drawing # 8719. The wall mounting holes are located in the rear corners of the cabinet. The distance between mounting holes is $20 \frac{3}{4}$ " in the vertical direction and $16 \frac{5}{8}$ " in the horizontal direction. Mounting holes are $\frac{3}{8}$ " wide allowing for the use of $\frac{5}{16}$ " diameter fasteners.

Mount the **I-Gard Fusion** securely to the wall in accordance with local codes and proceed to connect after securely mounting.

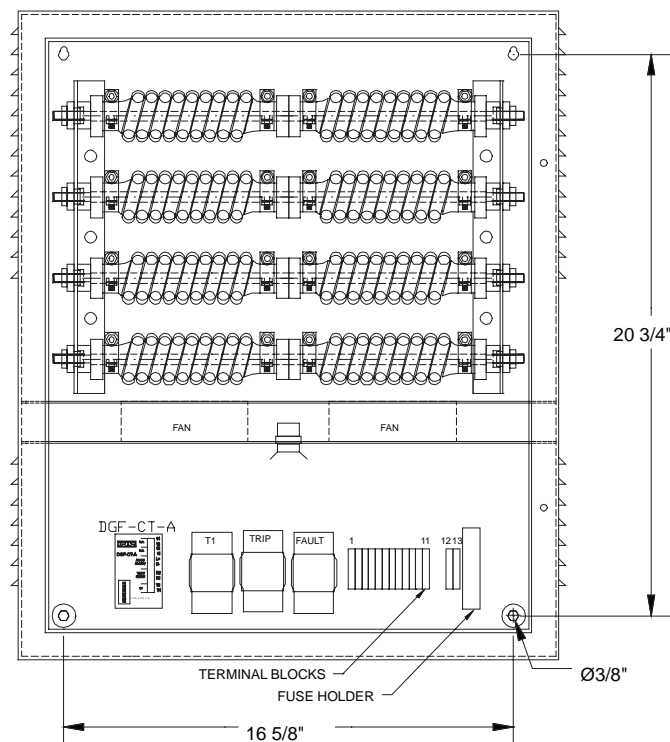


Figure 1

Electrical access to the interior is provided by means of eight knock out openings suitable for $\frac{1}{2}$ " conduit. Two are located near the bottom of each side and two are located in the bottom near each sidewall.

I-Gard Fusion requires a 120 VAC supply. Connect to the appropriately numbered terminal blocks. Connect line to terminal 1, neutral to terminal 2 and ground to terminal 3. Recommended supply cable size is 14 or 12 AWG.

Connect the system neutral (neutral bushing of the transformer) to the point identified as N (#10 on terminal block) on drawing 8179-4 and the system ground to the point identified as G (#11 on terminal block) on the same drawing. Both the Canadian Electrical Code and the National Electrical Code require a minimum size of 4 AWG if conduit is used and size 6 AWG if exposed wiring is used.

IMPORTANT NOTE: System Neutral (N) must be connected to a single point only. All conductors must be insulated to the full system voltage.

Always perform a final inspection. All foreign objects must be removed. All conductors must be secured in the proper positions before closing the door and energizing the system. **DO NOT ENERGIZE the I-Gard Fusion unless the door is closed and secured by the two bolts provided.**

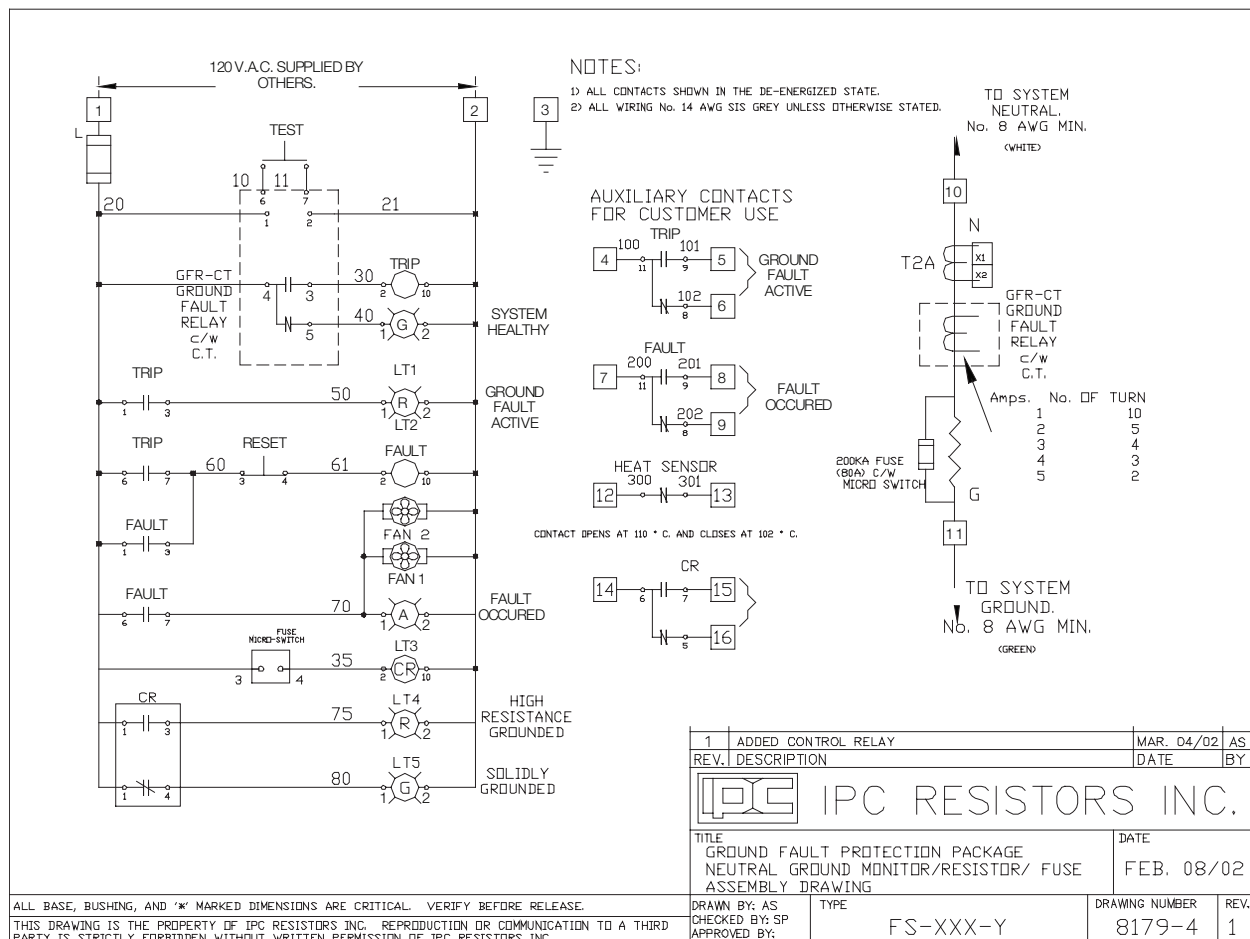


Figure 2

3 OPERATION

I-Gard Fusion solidly grounds the system through the placement of a fuse (or any other current limiting device) of suitable interrupting capacity and current rating in the fuse holder.

Upon energizing the control power the “Solidly grounded” and “System Healthy” green lights turn on signifying that no ground faults are on the system and the **I-Gard Fusion** is receiving control voltage.

Verify the **I-Gard Fusion ground detection circuit** by double clicking the “TEST” button. This causes the DGF-CT-A to trip. The green light turns off, the red “GROUND FAULT ACTIVE” light turns on and the fans activate. This confirms that control voltage is available, the DGF-CT-A is functioning and the fans are operational.

Push the “RESET” button to reset the system to normal operational status. The red “GROUND FAULT ACTIVE” light goes off, the green “SYSTEM HEALTHY” light turns on and the fans stop. The **I-Gard Fusion** is now ready to monitor the distribution system.

When a ground fault occurs and the Fuse opens to change Grounding to High Resistance allowing the potential between the system neutral and ground elevate to the line to neutral voltage. If the fault current magnitude is greater than the pick up setting of the DGF-CT-A and the duration is greater than the time delay setting on the DGF-CT-A, the DGF-CT-A will trip changing the state of the “TRIP” contacts. The green light turns off, the red light turns on and the fans activate.

The “GROUND FAULT ACTIVE” red light indicates the presence of a ground fault. The ground fault pickup level can be set from 5% to 100% of the let through current. The time delay can be adjusted from 0.7s. to 10s. This allows the user to adjust the settings to the unique requirements of his system in order to avoid nuisance alarms.

Both ground fault pickup level and time delay are adjusted using the dipswitches that are located on the front plate of the DGF-CT-A. The DGF-CT-A is located inside the **I-Gard Fusion** enclosure.

Table 1 shows the settings for DGF-CT-A.

Dipswitches 7&8 are set to R&R for MANUAL pulse operation.

TABLE 1 - DIPSWITCHES SETTINGS

Switch	Function	Set to	Meaning
123	Ground fault trip current limit	R L L	5 Percent
		R L R	10 Percent
		R R L	15 Percent
		R R R ◇	20 Percent
		L L L	25 Percent
		L L R	50 Percent
		L R L	75 Percent
		L R R	100 Percent
4 5 6	Trip time delay	R R R ◇	0.5 Seconds
		R R L	1.0 Seconds
		R L R	1.5 Seconds
		R L L	2.0 Seconds
		L R R	2.5 Seconds
		L R L	5.0 Seconds
		L L R	7.5 Seconds
		L L L	10.0 Seconds
7 8	Trip relay operation mode	R R ◇	Non-failsafe, continuous operation
		R L	Failsafe, continuous operation
		L R	Pulsed Auto reset operation (pulse turns off 3 seconds after G/F removed)
◇ FACTORY SETTING			

Note: 'R' denotes right and 'L' denotes left.

IMPORTANT NOTE: Although the ground fault pickup level can be adjusted up to 100% of the let through current, this is not recommended. Adjusting to a setting higher than 50% of the let through current may prevent the DGF-CT-A from detecting a fault.

The (optional) Pulsing circuit can only be activated when DGF-CT-A is tripped by an active ground fault. If ground fault current is available, pulses are visible on the hand held mutimeter.

To initiate pulsing, rotate the “PULSING” switch to the “ON” position. The “PULSING ACTIVE” light turns on and the ground fault current changes from 100% to 75% and 50% of available ground fault current.

SAFETY NOTE: Tracing the ground fault signal involves working with live circuits. Additional care must be exercised whenever working in the proximity of live conductors.

I-Gard Fusion with Sleuth Pulsing creates a pattern of step pulses in the ground fault current. The pulses only appear in the faulted circuit. Use the **FLEXProbe** current sensor and voltmeter to follow the pulse trail directly to the fault site.

After turning on the pulsing, trace the source of the ground fault by:

- a) Attach the **FLEXProbe** current sensor to a standard voltmeter as described below.
- b) Use a single line diagram for the electrical distribution protected by the **I-Gard Fusion**. Locate the pulsing ground fault current on the ground or neutral line as close to the **I-Gard Fusion** as possible. Familiarize yourself with the values of the pulses on the hand held meter.
- c) Check for the presence of pulses at branch points. Place the current sensor around the 3 phase conductors of each outgoing circuit. If you see no pulses this is not the faulted circuit. Move on to the next circuit.
- d) If current pulses are found, move down the circuit to the next branch point and repeat the procedure.
- e) Follow the pulses. The pulsing ground fault signal will lead to the equipment or to the section of conductor containing the ground fault.
- f) Isolate the equipment or conductor from the circuit. At this point the **I-Gard Fusion** may be reset by rotating the “PULSING ACTIVE” switch to the “OFF” position and pushing the “RESET” button.
- g) Repair or replace the equipment or conductor that was the source of the ground fault. The equipment or conductor may now be reconnected to the circuit.
- h) Confirm that the ground fault has not returned by viewing the **I-Gard Fusion** front panel.
- i) The 100A switch should now be replaced and the disconnect switch closed to solidly ground the system through the Fuse.



Figure 3 FLEXProbe

Operation of the FLEXProbe

I-Gard Fusion with Sleuth Pulsing comes complete with a Flexible current sensor loop. The Flexible current loop is supplied with a dual banana to BNC adapter for easy connection to most standard meters. The Flexible current loop will pick up and facilitate the display of the ground fault current pulses.

SAFETY NOTE: Read all safety and use information packaged with the Flexible current loop before use.

Set the selector switch on the Flexible current loop transducer to 10mV/A. The “POWER ON” light will flash on and off. A deflection of 0.25mV on the voltmeter with the transducer set to 10mV/A translates into a ground fault current of 2.5 Amps.

The Flexible current loop requires a battery. Ensure that a fully charged battery is in place. The unit incorporates a flashing “Battery Low” light to indicate the battery is too low for correct measurement results.



Figure 4

Wrap the Flexible current loop around all phases of the conductor. Any imbalance will be evident in meter deflection when the range is set to the appropriate setting. The ground fault current pulses will be visible in the meter deflection. Analogue meters provide easier reading during rapid pulsing. The pulse rate may be programmed to facilitate easier readings on digital meters.

When placing the sensor around the three phase conductors make sure that the arrow moulded into the sensor loop points downstream (toward the load) in order to provide proper readings.

Ensure that the junction point of the loop is held a minimum of 1" away from the conductors in order to minimize interference.

Pulse Duration

Pulse time duration may be varied by adjusting the time delay settings on the relays located beside the DGF-CT-A.

4 MAINTENANCE

I-Gard Fusion is designed and constructed to reduce maintenance needs to a minimum.

Test the operation annually.

Test Procedure:

Push the “TEST” button twice located on the front of the panel. The following changes take place.

- a) The red “GROUND FAULT ACTIVE” light turns on.
- b) The green “SYSTEM NORMAL” light turns off.
- c) The internal fans turn on.
- d) Auxiliary contacts change state.

This change confirms that your I-Gard Fusion is functioning normally. Return the **I-Gard Fusion** to normal operating mode by pushing the “RESET” button.

If a lamp fails to function, check the bulb. If a bulb is blown, change it.

If the fans fail to start, remove power and check the electrical connections.

If all power fails, check the internal fuse and replace it if necessary.

To clean the **I-Gard Fusion**, first disconnect the electrical control power and open the disconnect switch to isolate the neutral. Using compressed air, blow away any accumulated dust and foreign material. The exterior may be cleaned using a slightly damp cloth. Ensure that the I-Gard Sleuth is completely dry before energizing. Close the front door, reconnect control power and close the switch on the door. Test the unit again before returning to normal service.

5 ADDITIONAL INFORMATION

If you require more information or experience problems with your equipment that persist after taking the steps identified in this manual, contact I-Gard Customer Service.

6 INSTRUCTION MANUALS



C-101 Stoplight
High Resistance Grounding
System Manual



C-102 Gemini
High Resistance Grounding
System Manual



C-105 Fusion
Ground Fault Protection
System Manual



C-322 MGFR
Ground Fault Relay Manual



C-407 GCHK-100 Mining Relay
Ground Fault Protection
System Manual



C-408 Sleuth
High Resistance
Grounding System Manual



C-409 DSP OHMNI
High Resistance
Grounding System Manual



C-403 GFR-RM SIGMA
Resistor Monitoring
and Ground Fault Relay



C-107 SENTINEL
High Resistance
Grounding System

the power to protect



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