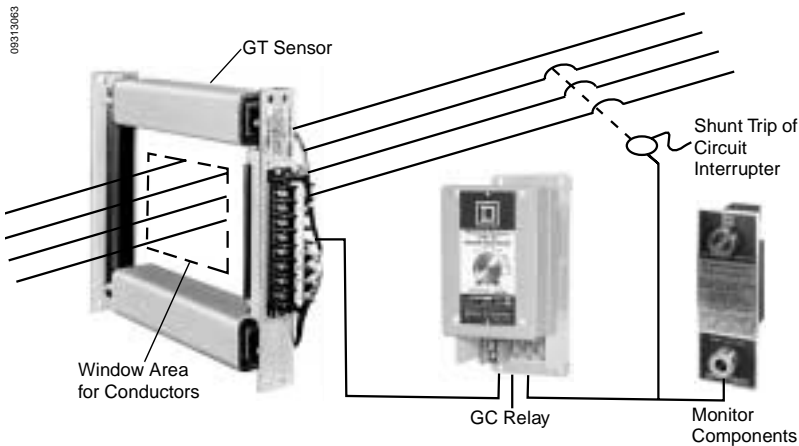


Ground-Censor® Ground-Fault
Protection System
Type GC
Class 931



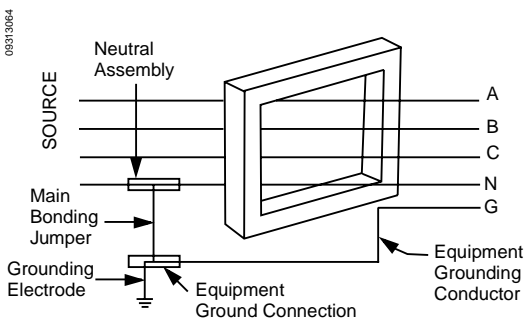
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APPLICATION DATA

Description	Equipment type ground-fault protection system. Consists of ground-fault relay, ground-fault sensor, and a nameplate for monitor-test system.
Application	The Ground-censor Type GC equipment ground-fault protection system is for use on grounded alternating current systems rated up to 600 volts ac, 60 hertz (cycle) to provide protection in accordance with National Electrical Code Paragraphs 110-10 and 230-95.
Ratings	<p>The GC-100 Ground-fault Relay is rated 600 volts ac, 60 hertz. Suitable for use on equipment connected to a source having 200,000 RMS amperes or less available ground-fault current. The GC-100 relay requires a 120 volt ac source; power of 3 watts typical in standby and 12 watts typical during trip. Each GC-100 relay can drive up to eight additional GC-100 relays for the purpose of zone selective interlocking (ZSI).</p> <p>The components are UL listed in File E-48368 as Ground-fault Sensing and Relaying Equipment.</p>

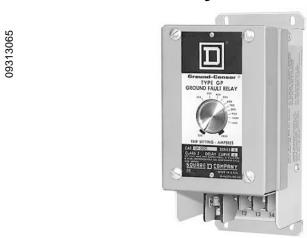
Operation



Under normal load conditions, the vector summation of all phase and neutral (if used) currents approaches zero. However, under ground-fault conditions, these currents do not add to zero. A sensor (differential current transformer) around the phase and neutral conductors detects the current imbalance when a ground fault occurs. The output of the sensor is proportional to the magnitude of the ground-fault current. This output is fed to a ground-fault relay. When the ground-fault current exceeds a pre-selected level, the relay will activate the circuit interrupting device.

Figure 1: Operation

Ground-fault Relay



The GC-100 relay continuously monitors the output of the sensor and initiates the opening of the circuit. The ground-fault current pick-up is field adjustable from 100 to 1,200 amperes. The restrained time delay is field adjustable for 0.1, 0.2, 0.3, or 0.5 seconds. Two or more relays may be zone selective interlocked to provide instantaneous operation (0.03 seconds) in each zone and system coordination.

Figure 2: GC-100Relay

Sensor



The sensor consists of a laminated iron core with two main windings on opposite sides. The windings are connected in parallel so that the effects of local saturation of the iron core are minimized and greater reliability is gained due to the redundancy of the windings. Should one winding be opened or shorted, the other would continue to operate satisfactorily (but with less accuracy or sensitivity). The iron core is bolted at the corners and a leg may be removed to facilitate installation of the sensor around the conductors in existing equipment. A special test winding is super-imposed on one of the main windings and when energized, induces a current in the main winding, simulating a ground-fault condition.

Figure 3: GT Sensor

Monitor-test System

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Figure 4: Monitor Components

A red light indicates tripping due to a ground-fault condition. A nameplate with instructions for test with or without trip is provided with each GC-100 relay. For test with or without trip (per nameplate provided), the following components are required:

- One green illuminated push button with contact block.
- One red illuminated push button with contact block.
- One miniature or general purpose relay with socket.

For test with trip only (no nameplate provided), the following components are required:

- Non-illuminated push button with contact block.
- Red illuminated push button with contact block.

Electrical Conditions

All components have screw terminal connections. Wires from sensor to relay should not be longer than 25 feet and no smaller than No. 14 AWG. Wires from the test-monitor components should not be longer than 50 feet and no smaller than No. 18 AWG. Interconnecting wires between relays should be in accordance with the following:

- 1–150 feet one way #16 AWG
- 151–250 feet one way #14 AWG
- 251–400 feet one way #12 AWG
- 401–650 feet one way #10 AWG
- 651–1000 feet one way #8 AWG

Circuit Interrupting Device

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Figure 5: Molded Case Circuit Breaker

Any circuit interrupting device suitably rated for the duty, and incorporating a 120 volt ac shunt trip or electric tripping mechanism with less than 50 amperes inrush and less than 10 amperes continuous current requirements.

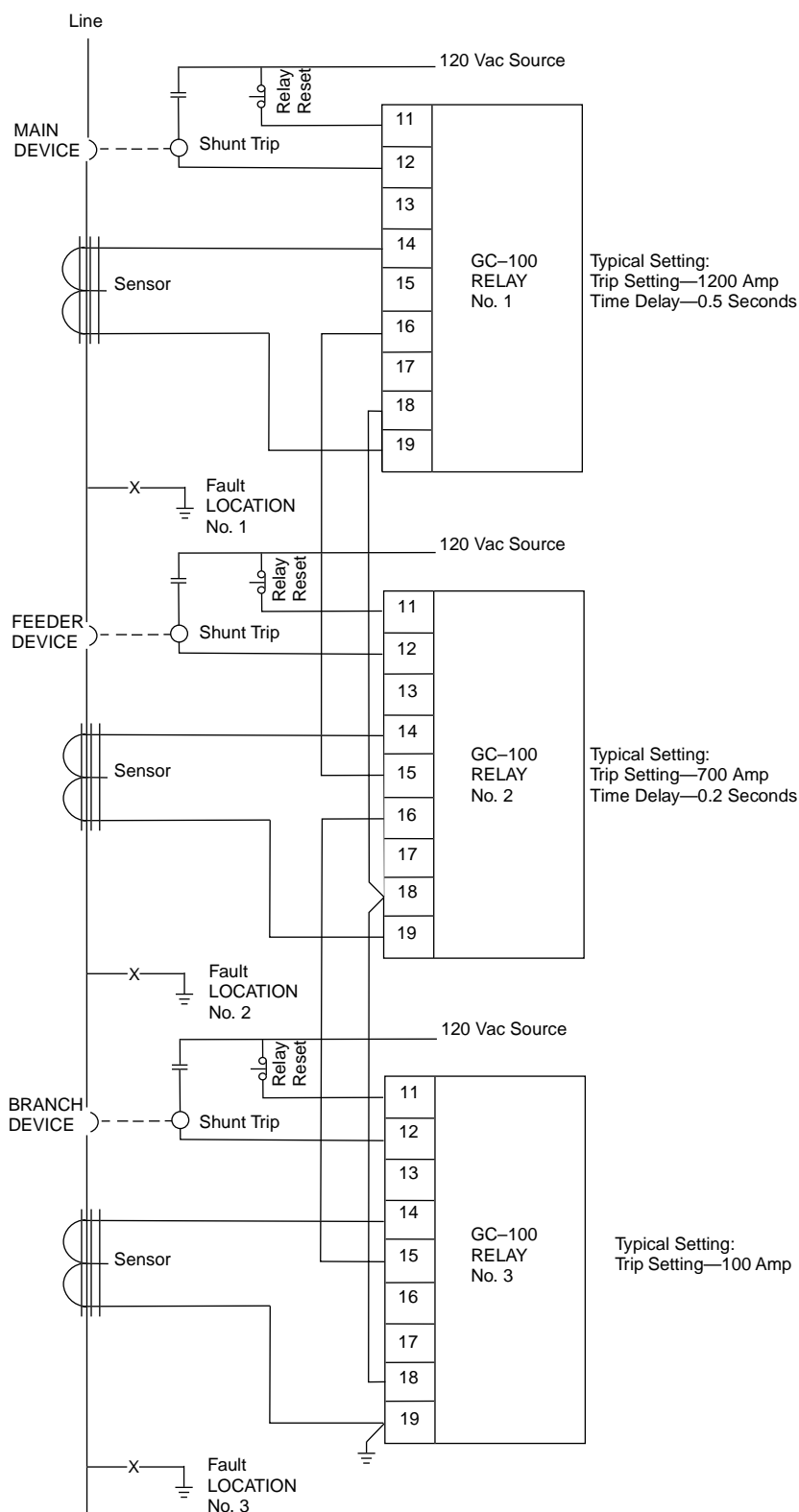
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Figure 6: Bolted Pressure Switch

System Coordination

Refer to Figure 7 for a typical coordination arrangement. Relay No. 3 will restrain in a time-delay mode Relay No. 2 which in turn restrains Relay No. 1; Relay No. 2 restrains Relay No. 1. For example, with a ground-fault of 1500 amperes at Location No. 3, Relay No. 3 will initiate a signal in 0.03 seconds to the Branch Device to open the circuit. At time of the fault, Relay No. 3 also sends a restraining signal to Relay No. 2 which in turn sends a restraining signal to Relay No. 1 causing these two relays to start timing duration of the fault. Relay No. 2 will initiate a signal to Feeder Device only if Branch Device fails to open circuit 0.2 seconds after ground-fault occurred. Relay No. 1 will initiate a signal to Main Device only if Branch Device and Feeder Device fail to open circuit 0.5 seconds after ground-fault occurred. If a 1500 ampere ground-fault occurs at Location No. 2, Relay No. 2 will initiate a signal in 0.03 seconds to Feeder Device to open circuit. At time of the fault, Relay No. 2 also sends a restraining signal to Relay No. 1. Relay No. 1 will initiate a signal to Main Device only if Feeder Device fails to open circuit 0.5 seconds after ground fault occurred. If a 1500 ampere ground fault occurs at Location No. 1, Relay No. 1 will initiate signal in 0.03 seconds to Main Device to open circuit. This type system coordination allows the circuit interrupting device nearest the ground-fault to receive an operation signal instantaneously (0.03 seconds) and provide time delay in only the back-up devices. Clearing time of circuit interrupting device must also be considered in complete system coordination.



NOTE: For clarity, not, all power supply and test circuit connections are shown.

Figure 7: System Coordination

SUGGESTED SPECIFICATIONS

General

A ground-fault protection system shall be included when indicated in switchboard schedule and where otherwise indicated on the plans. It shall consist of a current sensor enclosing all phase (and neutral, if present) conductors of the circuit to be monitored, appropriate relaying equipment to provide the desired ground-fault current sensitivity and time-current response characteristics, and (an appropriately sized molded case circuit breaker) (an appropriately sized fusible bolted pressure contact switch) (an appropriately sized low-voltage power breaker) equipped to function in conjunction with the other elements of the ground-fault protection system. Installation of equipment shall in all respects be in accordance to manufacturer's recommendations.

Current Sensor

A sensitive current sensor shall be provided to sufficient size to encircle phase conductors and, where used, neutral conductor of circuit to be monitored. Current sensor output shall be coordinated with required input to the relay. A test winding shall be included to simulate flow of ground-fault current through current sensor in order to test operation of the ground-fault protection system including pick-up, relay and circuit protective device operation. The frame of the current sensor shall be so constructed that one leg can be opened to allow removal or installation around cable or bus without disturbing the cable or requiring drop-links on the bus.

Ground-fault Relay

The relay shall be solid state construction for maximum reliability and shall provide zone-selective interlocking for instantaneous (0.03 seconds) operation in each zone. The relay shall require only 120 volt power to operate associated molded case circuit breaker, fusible bolted pressure contact switch or low-voltage power breaker.

Adjustable pickup current sensitivity for ground-fault currents from 100 amperes to 1,200 amperes shall be provided. A calibrated dial shall be provided for setting the current pickup point in the field. Settings for individual relays shall be (as shown on the plans) (_____ amperes).

The restrained time delay provided by the relay zone selective interlock circuitry shall be nominally (0.1, 0.2, 0.3 or 0.5 seconds) for main, (0.1, 0.2, 0.3 or 0.5 seconds) for feeder, (0.1, 0.2, 0.3, or 0.5 seconds) for branch, and shall be field adjustable.

- A self-contained test circuit utilizing the test coil provided in the current sensor shall be incorporated for testing with and without tripping of the circuit interrupting device.
- A self-contained test circuit utilizing the test coil provided in the current sensor shall be incorporated for testing with tripping and the circuit interrupting device.

Circuit Breaker

A molded case circuit breaker rated at _____ amperes and having an interrupting rating of _____ amperes RMS symmetrical at _____ volts shall be provided to open the circuit. It shall incorporate thermal and magnetic elements for conventional overload and fault current protection as well as a ground-fault trip mechanism activated by the ground-fault relay causing it to open the circuit in the event of ground-fault conditions sufficient to operate ground protection system.

**Fusible Bolted Pressure Contact Switch
(Alternate)**

A fusible bolted pressure contact switch rated at _____ amperes, _____ volts, and equipped with _____ fuses shall be provided to open the circuit for normal switching, overload, short circuit, or ground-fault current sufficient to operate the relay. It shall include ground-fault trip mechanism activated by the ground-fault relay which, operating in conjunction with an interposing relay and auxiliary power source, will release a stored-energy device to open the switch. The ground-fault trip mechanism must be capable of operating satisfactorily at 55% of rated voltage to provide satisfactory operation under the reduced voltage that might accompany a ground-fault condition. The switch interrupting rating shall be coordinated with the time delay of the relay to insure that the switch is capable of interrupting any current it may be required to open.

Low Voltage Power Breaker (Alternate)

A low voltage power breaker rated at _____ amperes, _____ volts shall be provided to open the circuit for normal switching, overload, short circuit, or ground-fault current sufficient to operate the relay. This power breaker shall include ground-fault trip mechanism activated by the ground-fault relay which, operating in conjunction with an interposing relay and auxiliary power source, will release a stored-energy device to open the breaker. The shunt trip release must be capable of operating satisfactorily at 55% of normal operating voltage to provide satisfactory operation under the reduced voltage that might accompany a ground-fault condition.

CHARACTERISTIC TRIPPING CURVE

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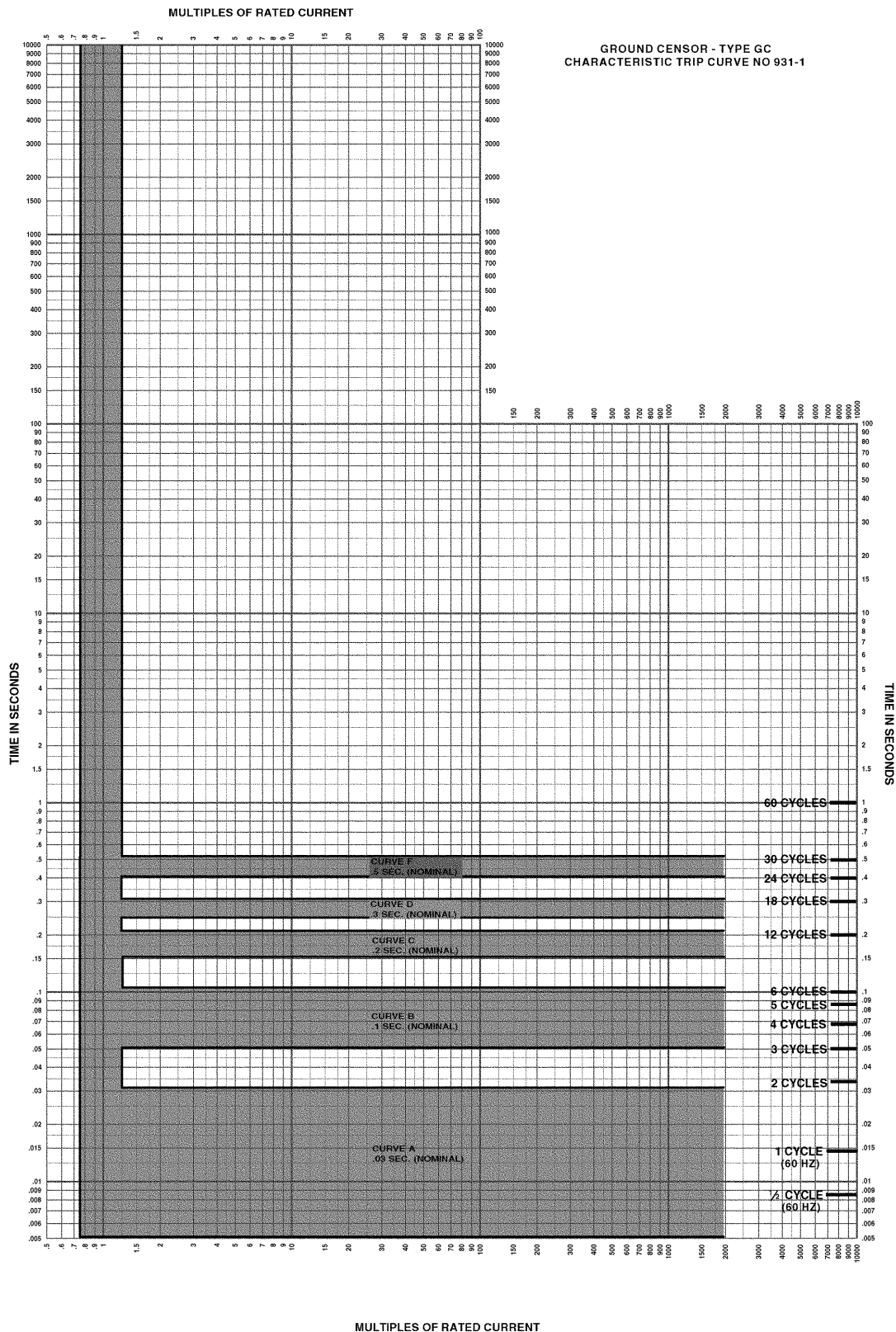
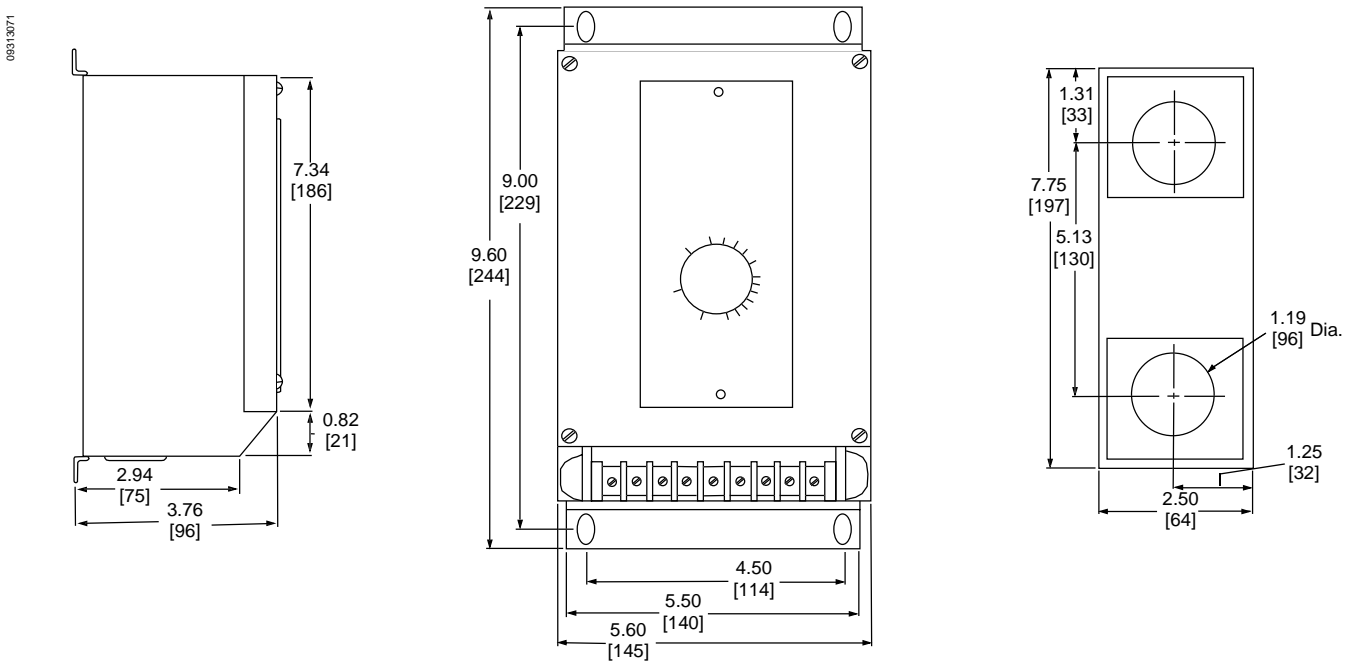
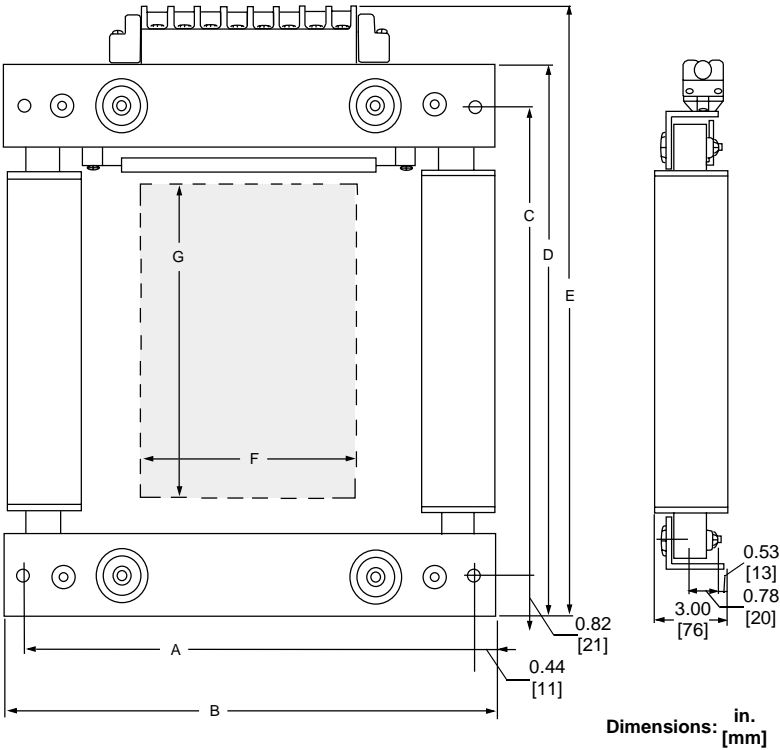


Figure 8: Characteristic Tripping Curve

DIMENSIONS



Cat. No.	A	B	C	D	E	F	G
GT-912	12.12 [308]	13.00 [330]	13.00 [330]	14.60 [371]	16.05 [408]	5.00 [127]	8.00 [203]
GT-918	12.12 [308]	13.00 [330]	19.00 [483]	20.60 [523]	22.05 [560]	5.00 [127]	14.00 [356]
GT-930	12.12 [308]	13.00 [330]	31.00 [787]	32.60 [828]	34.05 [865]	5.00 [127]	26.00 [660]
GT-1218	15.12 [384]	16.00 [406]	19.00 [483]	20.60 [523]	22.05 [560]	8.00 [203]	14.00 [356]
GT-1224	15.12 [384]	16.00 [406]	25.00 [635]	26.60 [676]	28.05 [712]	8.00 [203]	20.00 [508]
GT-1230	15.12 [384]	16.00 [406]	31.00 [787]	32.60 [828]	34.05 [865]	8.00 [203]	26.00 [660]
GT-1530	18.12 [460]	19.00 [483]	31.00 [787]	32.60 [828]	34.05 [865]	11.00 [279]	26.00 [660]



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