

## General Data Sheet

# GIC (Geomagnetically Induced Currents) Current Sensor

Geomagnetically induced currents (GICs) are low-frequency electric currents that flow on the Earth's surface and through man-made conductive infrastructure—such as power grids, pipelines, and railway tracks—during solar-induced magnetic storms. They are caused by rapid fluctuations in the geomagnetic field.

## Index

Overview	Page 3
The GIC Phenomenon	Page 4
The Powertek Solution	Page 4
Technical Specification Table	Page 5
Installation & Mechanical Integration	Page 6
Application	Page 7
Models	Page 7
Case Dimensions	Page 8
Connection Diagram	Page 8

# Protecting the Grid from Solar-Induced Hazards

## High-Precision Monitoring of Geomagnetically Induced Currents (GIC)

### Overview

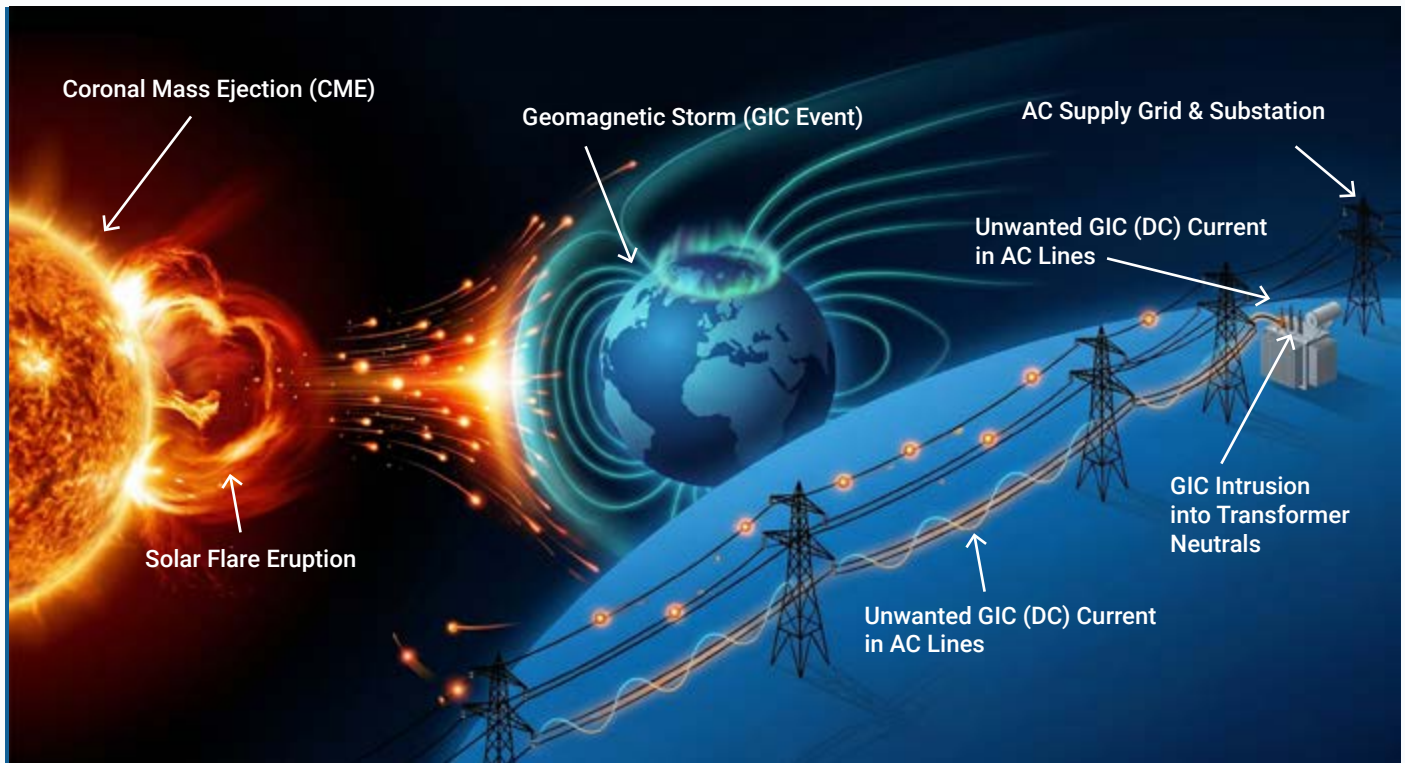
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Space weather events, such as Coronal Mass Ejections (CMEs), trigger fluctuations in the Earth's magnetic field, inducing low-frequency DC currents (GICs) into man-made conductive infrastructure. For power grids, pipelines, and railways, these currents represent a significant operational risk.

The Powertek GIC Series is specifically engineered to detect and measure these DC components even when superimposed on high-level AC currents. With a wide dynamic range and industry-leading low residual offset, the GIC sensor provides the critical data needed to protect transformers from saturation and prevent widespread grid instability.



# The GIC Phenomenon: From Solar Flare to Grid Failure



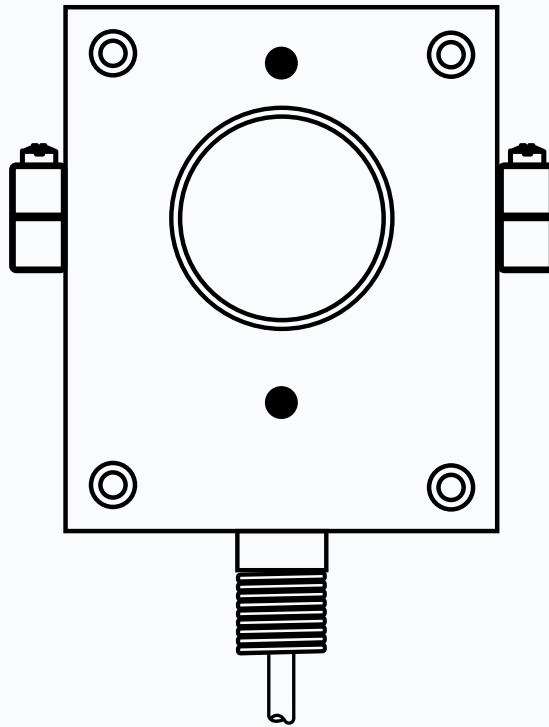
- **The Source:** A Coronal Mass Ejection (CME) from the Sun releases a massive burst of solar wind and magnetic fields into space.
- **The Interaction:** When these particles strike the Earth's magnetosphere, they cause rapid variations in the terrestrial magnetic field.
- **The Induction:** These variations create a geo-electric field at the Earth's surface, which induces low-frequency Geomagnetically Induced Currents (GIC) into long-line conductors like high-voltage transmission grids.
- **The Effect:** These unwanted DC-like currents flow through transformer neutrals, causing half-cycle saturation, increased harmonics, and potential catastrophic overheating of substation equipment.

## The Powertek Solution: Engineering for Resilience

- **Precision Isolation:** Safely measures DC components in high-voltage AC environments without circuit interruption.
- **Resilient Design:** Rugged, split-core enclosure with an IP-rated outdoor enclosure for substation and pipeline installation.
- **High Resolution (1000:1):** Detects minute fluctuations in GIC levels to provide early warning of geomagnetic disturbances.
- **Zero-Maintenance Accuracy:** Inherently low residual effects eliminate the need for frequent degaussing, maintaining accuracy even after extreme over-range events.
- **Versatile Integration:** Bi-directional sensing with industry-standard 4-20mA, Modbus, or voltage outputs for seamless PLC and SCADA integration.

# Technical Specification Table

Parameter	Specification
<b>INPUT</b>	
Current Range	(See Model Selection)
Over-range (w/o damage)	>8000A
Bandwidth (1.5Hz low-pass output)	dc to 1.5Hz
<b>DIELECTRIC TEST</b>	
Input window	2200Vac
Inst. Power to output	1kVdc
Insulation class	600Vac
<b>INSTRUMENT POWER</b>	
Standard	24Vac/24Vdc, ±10%
Option "-12"	12Vac/12Vdc, ±10%
Current (nominal)	80mA
Current (maximum)	100mA
<b>OUTPUT</b>	
Scaling (Models B, D, X5)	0 to ±FS dc in = 0 to ±FS out
Scaling (Model EM)	-FS dc/0/+FS dc in = 4/12/20mAdc out
Scaling (Model E - Unidirectional)	0-FS dc in = 4-20mAdc out
Loading (Models E and EM)	0-500Ω
Loading (Model B)	0-10kΩ
Loading (Models D and X5)	≥2kΩ
Response time (90%)	<350ms (typical)
<b>ACCURACY</b>	
Linearity, Offset, Setpoint, Repeatability	≤0.5% F.S.
Over-range Residual Offset (max 350mA)	0.0007A/A of input current
Linearity	≤0.1% F.S.
<b>TEMPERATURE</b>	
Operating range	-40°C to +85°C
Temperature effect	±0.025%/°C
Storage range	-40°C to +85°C
<b>PHYSICAL</b>	
Weight	2.0lbs



**Consideration:** Distance conductor-sensor, sleeving, environment, voltage

## Cable Insulation & Sleeving

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The GIC series is designed for use on insulated conductors. While the sensor provides high galvanic isolation, it is recommended that the primary high-voltage cable maintains its own secondary insulation or protective sleeving at the point of contact with the sensor window.

Ensure that the cable sleeve is rated for the specific environmental temperature and voltage of the application to prevent mechanical abrasion over time.

## Sensor Mounting & Captive Hardware

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The split-core design features captive hardware, ensuring that no nuts or bolts are lost during field installation—a critical safety feature for technicians working in substations.

**Rigid Mounting:** The sensor body includes integrated mounting points (Rigid 1/2" NPT) to allow for secure attachment to conduit or support structures, preventing vibration or movement on the conductor.

**Orientation:** For maximum accuracy, ensure the conductor is centered within the sensor window and that the "Direction of Flow" arrow aligns with the system's primary current path.

# Application Use-Cases

- **Power Transmission:** Monitoring neutral-to-ground currents in high-voltage transformers to prevent thermal damage and saturation.
- **Pipelines:** Measuring induced currents in oil and gas pipelines to mitigate enhanced corrosion risks.
- **Railway Infrastructure:** Protecting signaling systems from low-frequency interference during solar storms.

## Model Selection

MODEL NUMBER

GIC - XXX Z

XXX	DC Range
051	±0-50Adc
101	±0-100Adc
151	±0-150Adc
201	±0-200Adc
301	±0-300Adc
401	±0-400Adc
501	±0-500Adc
601	±0-600Adc
801	±0-800Adc
102	±0-1000Adc
122	±0-1200Adc
152	±0-1500Adc

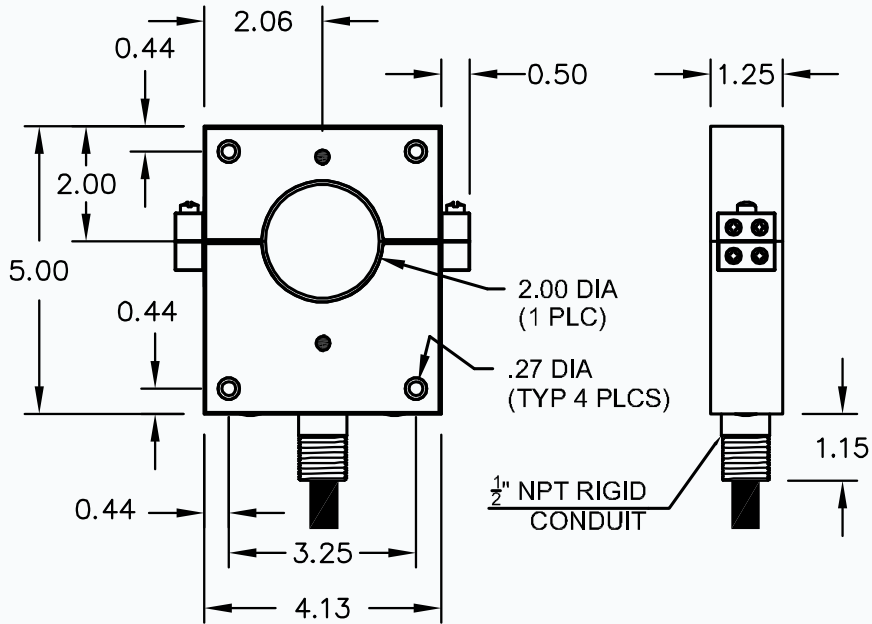
Z	Output Type
B	0-±1mAdc
D	0-±10Vdc
X5	0-±5Vdc
E	4-20mAdc
EM	4/12/20mAdc

### ORDERING INFORMATION

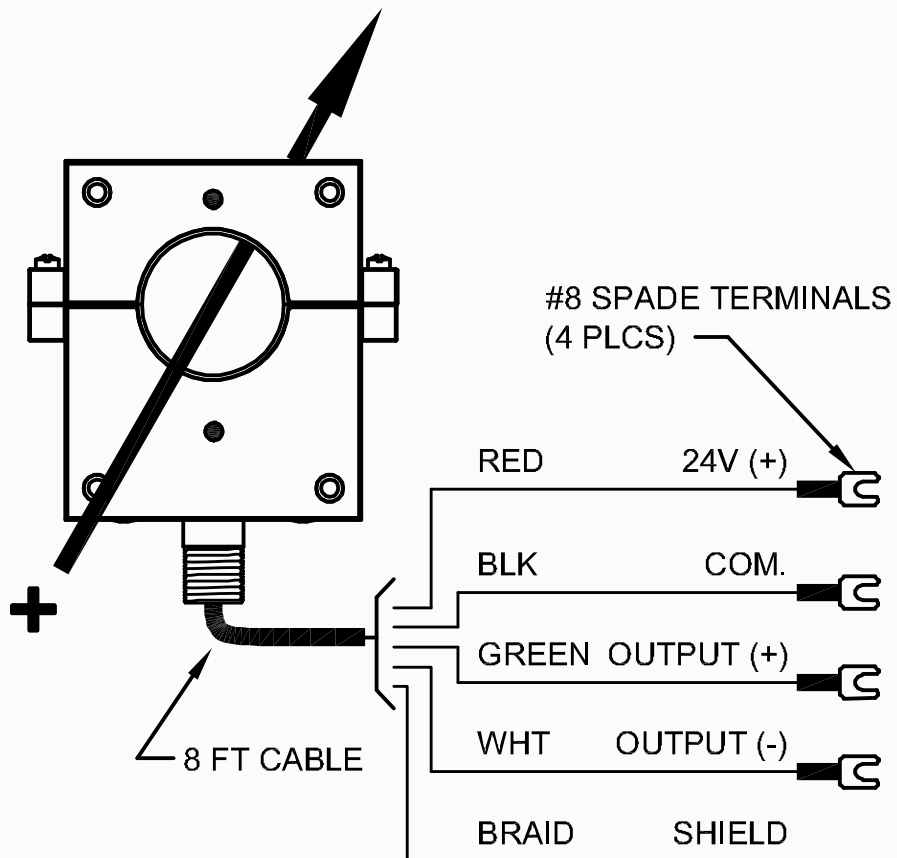
Example:  
600Adc Input 0-±1mAdc Outputs  
GIC-601B

# Case Dimensions

Dimensions are in inches  
Tolerance is  $\pm 0.03$  inches



## Connection Diagram



## Company Profile

Powertek has two divisions; Powertek US Inc Holbrook NY USA, Powertek UK Ltd Reading United Kingdom. These offices support a network of worldwide service centers, distributors and representatives.

Powertek specializes in the design and manufacture of electrical power, voltage and current measuring instrumentation: Measurement Transducers, Current Probes, Wattmeters, Power Analyzers, phase measuring measurement equipment along with multifunction calibration standards. The Sensor Division offers a range of ac/dc current/voltage sensors, current shunts, wideband current probes, current transformers and ac/dc power related transducers. PC based software solutions allow the Powertek measuring instruments and transducers to be controlled via Ethernet, RS232, RS485 and IEEE-488 interfaces. Various display and storage options are available to suit the customer need. An "in house" software customization service is available.

Powertek's customer base includes heavy industrial plants, avionics, positional control, military systems, power electronics & power conversion (inverters, switching power supplies, UPS, variable speed motor drives), single/three phase ac motors, ac generators, power transformers, electrical process control equipment, office and household appliance testing, electrical supply utilities and calibration.

All Powertek products are supplied CE marked with measurement uncertainties traceable to UKAS (UK) or NIST (USA) in accordance with ISO9001 2015. Our support includes application support, technical advice, servicing, repair and calibration. Flexible Current Sensing Rogowski coils with 5A output in accordance with ISO9001 2015, Z540, ISO/IEC 17025.

Powertek US Inc is a CAGE coded Military supplier, Cage code 4S5P4. Read more about our activities with US Defense on <https://www.sam.gov>

# Powertek

**Powertek UK Ltd.**  
13b Southview Park,  
Marsack Street,  
Reading  
Berkshire  
RG4 5AF  
United Kingdom

**Tel: +44 118 370 2004**  
**Email: [info@powertekuk.com](mailto:info@powertekuk.com)**  
**Website: <https://www.powertekuk.com>**

# Powertek<sup>US</sup>

**Powertek US Inc.**  
7 3rd Street,  
Holbrook,  
NY 11741  
USA

**US Tel: +1 631 824 4666**  
**Email: [info@powertekus.com](mailto:info@powertekus.com)**  
**Website: <https://www.powertekuk.com>**