



# POWERFACTORY

# PowerFactory 2021

## Technical Reference

**GE IFC**

**POWER SYSTEM SOLUTIONS**  
MADE IN GERMANY

# F2021

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## 1 Model information

**Manufacturer** GE

**Model** IFC

**Variants** This family of PowerFactory relay model types simulates the following overcurrent relays manufactured for many years by General Electric:

- 50 Hz
  - IFC51
  - IFC53
  - IFC57
  - IFC66
  - IFC77
  - IFC95
- 60 Hz
  - IFC51
  - IFC57
  - IFC66
  - IFC77
  - IFC95

## 2 General description

The GE IFC protective relays are single phase non directional ac overcurrent devices. For the user convenience the relevant PowerFactory relay models have been implemented including some 3 phase and single phase overcurrent elements which can be used to mock a set of 3 IFC devices monitoring the phase current and one IFC device monitoring the ground current. The GE IFC family of PowerFactory relay models consists of models using two different schemes:

- *Toc Ph & Earth* scheme type: one inverse time characteristic element("Toc") for both phase and ground ("Toc" and "Toc Earth" block).
- *TOC-IOC Ph & Earth* scheme type: one inverse time characteristic element("Toc") and one instantaneous element("Ioc") for both phase and ground ("Toc", "Ioc", "Toc Earth" and "Ioc Earth" block).

These relays have been manufactured for decades and many sub type have been delivered. The PowerFactory relay library cannot cover all subtypes manufactured during the long life of the GE IFC relays but a large set of subtype is available.

The following PowerFactory relay model types can be found at \Library\Relays\Relays\Overcurrent Relays\General Electric\IFC Serie:

- 50 Hz
  - IFC51 Inverse
    - \* IFC51A4A (scheme type: Toc Ph & Earth)
    - \* IFC51A5A (scheme type: Toc Ph & Earth)
    - \* IFC51AD4A (scheme type: Toc Ph & Earth)
    - \* IFC51AD5A (scheme type: Toc Ph & Earth)
    - \* IFC51BD4A (scheme type: TOC-IOC Ph & Earth)
    - \* IFC51BD5A (scheme type: TOC-IOC Ph & Earth)
  - IFC53 Very Inverse
    - \* IFC53A1A (scheme type: Toc Ph & Earth)
    - \* IFC53A2A (scheme type: Toc Ph & Earth)
    - \* IFC53A6A (scheme type: Toc Ph & Earth)
    - \* IFC53AD1A (scheme type: Toc Ph & Earth)
    - \* IFC53AD2A (scheme type: Toc Ph & Earth)
    - \* IFC53B1A (scheme type: TOC-IOC Ph & Earth)
    - \* IFC53B2A (scheme type: TOC-IOC Ph & Earth)
    - \* IFC53B3A (scheme type: TOC-IOC Ph & Earth)
    - \* IFC53BD1A (scheme type: TOC-IOC Ph & Earth)
    - \* IFC53BD2A (scheme type: TOC-IOC Ph & Earth)
    - \* IFC53BD3A (scheme type: TOC-IOC Ph & Earth)
    - \* IFC53M1A (scheme type: TOC-IOC Ph & Earth)
    - \* IFC53M2A (scheme type: TOC-IOC Ph & Earth)
    - \* IFC53M3A (scheme type: TOC-IOC Ph & Earth)
    - \* IFC53M4A (scheme type: TOC-IOC Ph & Earth)
    - \* IFC53M5A (scheme type: TOC-IOC Ph & Earth)
    - \* IFC53M6A (scheme type: TOC-IOC Ph & Earth)
    - \* IFC53M7A (scheme type: TOC-IOC Ph & Earth)
    - \* IFC53M8A (scheme type: TOC-IOC Ph & Earth)
  - IFC57 Medium Time
    - \* IFC57AD1A (scheme type: Toc Ph & Earth)
    - \* IFC57AD2A (scheme type: Toc Ph & Earth)
    - \* IFC57BD1A (scheme type: TOC-IOC Ph & Earth)
    - \* IFC57BD2A (scheme type: TOC-IOC Ph & Earth)
  - IFC66 Long Time
    - \* IFC66AD2A (scheme type: Toc Ph & Earth)
    - \* IFC66BD2A (scheme type: TOC-IOC Ph & Earth)
    - \* IFC66CD1A (scheme type: TOC-IOC Ph & Earth)
    - \* IFC66KD2A (scheme type: TOC-IOC Ph & Earth)
  - IFC77 Extremely Inverse
    - \* IFC77A1A (scheme type: Toc Ph & Earth)
    - \* IFC77A2A (scheme type: Toc Ph & Earth)
    - \* IFC77AD1A (scheme type: Toc Ph & Earth)
    - \* IFC77AD2A (scheme type: Toc Ph & Earth)
    - \* IFC77B1A (scheme type: TOC-IOC Ph & Earth)
    - \* IFC77B2A (scheme type: TOC-IOC Ph & Earth)
    - \* IFC77B3A (scheme type: TOC-IOC Ph & Earth)
    - \* IFC77BD1A (scheme type: TOC-IOC Ph & Earth)

- \* IFC77BD2A (scheme type: TOC-IOC Ph & Earth)
- \* IFC77BD3A (scheme type: TOC-IOC Ph & Earth)
- IFC95 Short Time
  - \* IFC95AD1A (scheme type: Toc Ph & Earth)
  - \* IFC95AD2A (scheme type: Toc Ph & Earth)
  - \* IFC95BD1A (scheme type: TOC-IOC Ph & Earth)
  - \* IFC95BD2A (scheme type: TOC-IOC Ph & Earth)
  - \* IFC95FD1A (scheme type: TOC-IOC Ph & Earth)
- 60 Hz
  - IFC51 Inverse
    - \* IFC51A1A (scheme type: Toc Ph & Earth)
    - \* IFC51A2A (scheme type: Toc Ph & Earth)
    - \* IFC51AD1A (scheme type: Toc Ph & Earth)
    - \* IFC51AD2A (scheme type: Toc Ph & Earth)
    - \* IFC51BD1A (scheme type: TOC-IOC Ph & Earth)
    - \* IFC51BD2A (scheme type: TOC-IOC Ph & Earth)
  - IFC57 Medium Time
    - \* IFC57AD1A (scheme type: Toc Ph & Earth)
    - \* IFC57AD2A (scheme type: Toc Ph & Earth)
    - \* IFC57BD1A (scheme type: TOC-IOC Ph & Earth)
    - \* IFC57BD2A (scheme type: TOC-IOC Ph & Earth)
  - IFC66 Long Time
    - \* IFC66AD1A (scheme type: Toc Ph & Earth)
    - \* IFC66BD1A (scheme type: TOC-IOC Ph & Earth)
    - \* IFC66CD1A (scheme type: TOC-IOC Ph & Earth)
    - \* IFC66KD1A (scheme type: TOC-IOC Ph & Earth)
  - IFC77 Extremely Inverse
    - \* IFC77A2A (scheme type: Toc Ph & Earth)
    - \* IFC77AD1A (scheme type: Toc Ph & Earth)
    - \* IFC77AD2A (scheme type: Toc Ph & Earth)
    - \* IFC77BD1A (scheme type: TOC-IOC Ph & Earth)
    - \* IFC77BD2A (scheme type: TOC-IOC Ph & Earth)
    - \* IFC77BD3A (scheme type: TOC-IOC Ph & Earth)
  - IFC95 Short Time
    - \* IFC95AD1A (scheme type: Toc Ph & Earth)
    - \* IFC95AD2A (scheme type: Toc Ph & Earth)
    - \* IFC95BD1A (scheme type: TOC-IOC Ph & Earth)
    - \* IFC95BD2A (scheme type: TOC-IOC Ph & Earth)
    - \* IFC95FD1A (scheme type: TOC-IOC Ph & Earth)

The model implementation has been based on the information available in the relay documentation [1] [2] [3] [4].

## 3 Supported features

### 3.1 Measurement and acquisition

It represents the interface between the power system and the relay protective elements. The currents flowing in the power system are converted by an element simulating a 3 phase CT.

#### 3.1.1 Available Units

- one 3 phase current transformer ( "Ct" block)
- one 3 phase measurement element ("Measurement Type" block)

#### 3.1.2 Functionality

The "Ct" block represents an ideal CT. Using the CT default configuration the current at the primary side are converted to the secondary side using the CT ratio. The CT saturation and/or its magnetizing characteristic are not considered. Please set the "Detailed Model" check box in the "Detailed Data" tab page of the CT dialog and insert the data regarding the CT burden, the CT secondary resistance and the CT excitation parameter if more accurate simulation results are required. The measurement block simulate a second order low pass analog filter with DC component filter; its time constant is 1 ms.

#### 3.1.3 Data input

No user input is required

### 3.2 Protective elements

A set of inverse time and instantaneous overcurrent elements is modeling the relay protective functions. The inverse characteristics available in the relays are available as well in the inverse time model blocks.

#### 3.2.1 Available Units

- *Toc Ph & Earth* scheme type
  - one 3 phase inverse time overcurrent element("Toc" block)
  - one zero sequence inverse time overcurrent element("Toc Earth" block)
- *TOC-IOC Ph & Earth* scheme type
  - one 3 phase inverse time overcurrent element("Toc" block)
  - one zero sequence inverse time overcurrent element("Toc Earth" block)
  - one 3 phase instantaneous overcurrent element("Ioc" block)
  - one zero sequence instantaneous overcurrent elements("Ioc Earth" block)

### 3.2.2 Functionality

Each protective relay of the GE IFC family support an unique tripping characteristics. The following tripping characteristics are available in the PowerFactory relay model types:

- IFC51 curve GES 7014A (Inverse)
- IFC53 curve GES 7015B (Very Inverse)
- IFC57 curve GES 7017 (Medium Time)
- IFC66 curve GES 7018A (Long Time)
- IFC77 curve GES 7016A (Extremely Inverse)
- IFC95 curve GES 7019 (Short Time)

### 3.2.3 Data input

The relationships between the relay settings and the model parameters can be found in the following tables.

*Toc Ph & Earth* scheme type:

Address	Relay Setting	Model block	Model setting	Note
	Pickup (Tap)	Toc	Current Setting	
		Toc Earth	Current Setting	
	Time Dial	Toc	Time Dial	
		Toc Earth	Time Dial	

*TOC-IOC Ph & Earth* scheme type:

Address	Relay Setting	Model block	Model setting	Note
	Pickup (Tap)	Toc	Current Setting	
		Toc Earth	Current Setting	
	Time Dial	Toc	Time Dial	
		Toc Earth	Time Dial	
	Instantaneous Pickup	Ioc	Pickup Current	
		Ioc Earth	Pickup Current	



### **3.3 Output logic**

It represents the output stage of the relay; it's the interface between the relay and the power breaker.

#### **3.3.1 Available Units**

- one output logic element ("Logic Type" block)

#### **3.3.2 Functionality**

The "Logic Type" block is collecting the trip signals coming from the protective elements and is operating the relay output contact. The output contact is named "yout".

#### **3.3.3 Data input**

No user input is required. To disable the relay model ability to open the power circuit breaker simply disable the "Logic Type" block.

## **4 Features not supported**

The following features are not supported:

- Delayed reset time of the inverse time characteristic

## 5 References

- [1] GE Power Management, 215 Anderson Avenue, Markham, Ontario, Canada L6E 1B3. *INSTRUCTIONS TIME OVERCURRENT RELAYS TYPES IFC95AD AND IFC95BD (GEK-49950A)*.
- [2] GE Power Management, 215 Anderson Avenue, Markham, Ontario, Canada L6E 1B3. *INSTRUCTIONS TIME OVERCURRENT RELAYS TYPES IFC66AD IFC66BD IFC66KD (GEK-49949C)*, 1989.
- [3] GE Protection and Control, 205 Great Valley Parkway, Malvern, PA 19355-1337. *INSTRUCTIONS TIME OVERCURRENT RELAYS Types IFC51A and 51B IFC53A and 53B IFC77A and 77B (GEK-45375J)*.
- [4] GENERAL ELECTRIC METER AND CONTROL BUSINESS DEPT., 205 Great Valley Parkway, Malvern, PA 19355-1337. *INSTRUCTIONS TIME OVERCURRENT RELAYS TYPES IFC57AD AND IFC57BD (GEK-49948A)*, 1989.