



POWERFACTORY

PowerFactory 2021

Technical Reference

Toshiba GRL100

PF2021

POWER SYSTEM SOLUTIONS
MADE IN GERMANY

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1 Model information

Manufacturer Toshiba

Model GRL100

Variants The Toshiba GRL100 PowerFactory relay models can be used to simulate the firmware versions of the Toshiba GRL100 relay up to revision 0.5.

2 General description

The Toshiba GRL100 is a line differential protection relay with additional overcurrent protective elements.

The Toshiba GRL100 PowerFactory relay model consists of a main relay model and the "Over-current elements" sub relay. Two versions are available: one for the 1A rated input current relay model and one for the 5A rated input current relay model.

The Toshiba GRL100 PowerFactory relay model has been implemented trying to simulate the protective functions more commonly used.

The main relay contains the measurement and acquisition units, the differential units ("Differential", and "Zero- Phase Differential" block), the output logic and the sub relay.

The model implementation has been based on the information available in the relay manual [1].

3 Supported features

3.1 Measurement and acquisition

The current are measured by two current transformers ("Phase Ct", and "Neutral Ct" block). One measurement unit ("Measurement" block) is fed by these CTs. Two relay slots contains the references to the remote Toshiba GRL100 relay models which provides the current values at the other line terminals.

3.1.1 Available Units

- One three phase current transformer element ("Ct" block).
- One single phase current transformer converting the ground current ("Neutral Ct" block).
- One three phase measurement element fed by the 'Ct' current transformer ("Measurement" block).
- Two relay slots ("Remote Relay 1", and "Remote Relay 2 (Three Terminal appl)" block).

3.1.2 Functionality

The input signals are sampled at 48 samples/cycle; a DFT filter operating over a cycle calculates then the voltage and current values used by the protective elements.

3.1.3 Data input

No data input is required but the correct relay model version (accordingly with the CT secondary rated current) must be used.

3.2 Main relay protective functions

The differential protective elements and the reclosing can be found in the Toshiba GRL100 main relay.

3.2.1 Available Units

- One 3 phase (segregated phase) magnitude differential element ("Differential" block).
- One single phase earth current magnitude differential element ("Zero-Phase Differential" block).
- One reclosing element ("Reclosing" block).
- One current input dialog ("DIFIC" block).
- One logic block ("Charging Current Compensation" block).
- Two ancillary measurement elements associated to the differential elements ("Phase Differential RMS", and "Earth Differential RMS" block).

3.2.2 Functionality

The relay model performs master/master type current differential protection using the current data from all terminals. For this reason another instance of the Toshiba GRL100 relay model must be created at the other side of the protected line and a reference to this relay model must be set in the *Remote Relay 1* slot. If three terminals are present the reference to the second remote relay must be set in the *Remote Relay 2 (Three Terminal appl)* slot.

The compensation current can be inserted in the "DIFIC" block and is subtracted from the currents used by the differential elements by the "Charging Current Compensation" block.

3.2.3 Data input

The relationships between the relay settings and the model parameters can be found in the following table (the relay model parameter names are listed between brackets, the addresses are the setting numbers as listed at pag 293 of [1]):

Address	Relay Setting	Model block	Model setting	Note
104	DIF1	Differential	DIF1(DIF1)	
105	DIF2	Differential	DIF2(DIF2)	
106	DIFGI	Zero-Phase Differential	DIFGI(DIFGI)	
107	DIFIC	DIFIC	Pickup Current (Ipsetr)	
150	TRDY1	Reclosing	Reset Time (resetime)	
151	TSPR	Reclosing	Reclosing int 1 1Ph-Grnd faults (recltime1ph)	
152	TTPR1	Reclosing	Reclosing interval 1 (re-cltime1)	
154	TW1	Reclosing	Closing command duration (closingcomtime)	
159	TS2	Reclosing	Reclosing interval 2 (re-cltime2)	
161	TS3	Reclosing	Reclosing interval 3 (re-cltime2)	

3 Supported features

Address	Relay Setting	Model block	Model setting	Note
163	TS4	Reclosing	Reclosing interval 4 (re-cltime2)	

3.3 Overcurrent elements (F50 - F51 - F46) subrelay

3.3.1 Available Units

- One 3 phase inverse time non directional overcurrent elements ("OCI" block).
- One 3 phase definite time non directional overcurrent elements ("OC" block).
- One earth current inverse time directional overcurrent elements ("EFI" block).
- One earth current definite time directional overcurrent elements ("EF" block).
- One thermal image element ("Thermal" block).
- One output logic element("Output Logic" block).

3.3.2 Functionality

The model contains the relay phase and ground overcurrent protective elements and the thermal image element.

An additional alarm signal activated by the thermal image status is available.

The inverse time overcurrent elements support the following trip characteristics:

- "Standard Inverse"
- "Very Inverse"
- "Extremely Inverse"
- "Long Time Inverse"

3.3.3 Data input

The relationships between the relay settings and the model parameters can be found in the following table (the relay model parameter names are listed between brackets, the addresses are the setting numbers as listed at pag 293 of [1]):

Address	Relay Setting	Model block	Model setting	Note
79	OCBT	OC	Out of Service (outserv)	
80	OCIBT	OCI	Out of Service (outserv)	
81	MOCI	OCI	Characteristic (pcharac)	
82	EFBT	EF	Out of Service (outserv)	
84	EFIBT	EFI	Out of Service (outserv)	
85	MEFI	EFI	Characteristic (pcharac)	
89	THMT	Thermal	Out of Service (outserv)	
115	OC	OC	Pickup Current (Ipsetr)	
116	TOC	OC	Time Setting (Tset)	
119	OCI	OCI	Current Setting (Ipsetr)	
120	TOCI	OCI	Time Dial (Tpset)	
121	TOCIR	OCI	Reset Delay (ResetT)	
122	EF	EF	Pickup Current (Ipsetr)	
123	TEF	EF	Time Setting (Tset)	
125	EFI	EFI	Current Setting (Ipsetr)	

3 Supported features

Address	Relay Setting	Model block	Model setting	Note
126	TEFI	EFI	Time Dial (Tpset)	
127	TEFIR	EFI	Reset Delay (ResetT)	
128	THM	Thermal	Current Setting (Ipsetr)	
130	TTHM	Thermal	Time Dial (Tpset)	
131	THMA	Thermal Alarm	Current Setting (Ipsetr)	

3.4 Output logic

3.4.1 Available Units

The output logic is implemented by the "Output Logic " block located in the main relay.

3.4.2 Functionality

Each *Output Logic* block can operate the power breaker. Please disable the "Output Logic" block to disable the relay model ability to open the power circuit.

The "Output Logic" block can trigger a 3 phase trip or a single phase trip for phase ground faults or a two phase trip for phase-phase faults. The block behavior can be configured setting the *Tripping signals* combo box. The output signals are *yout* (3 phase trip), *yout_A* (phase A trip), *yout_B* (phase B trip), *yout_C* (phase C trip).

3.4.3 Data input

The "Output Logic" block can be configured to trigger a 3 phase trip selecting the *yout* trip signal in the "Tripping signals" (sTripsig) combo box in the "Basic Data" tab page .

The single phase trip can be enabled selecting the *y_A*, or the *y_B* , or the *y_C* phase trip signal. Please notice that in this case the relay will trip only if a fault has been detected in the selected phase.

4 Features not supported

The following features are not supported:

- Out-of-Step Element OST.
- Voltage and Synchronism Check Elements OVL, UVL, OVB, UVB and SYN.
- Current change detection element OCD.
- Level Detectors.
- Fault Detector Elements.
- Breaker Failure.
- Transfer Trip Function.
- Fault Locator.

5 References

- [1] Toshiba Corporation Fuchu Operations - Industrial and Power Systems and Services, 1, Toshiba-cho, Fuchu-shi, Tokyo, Japan. *INSTRUCTION MANUAL LINE DIFFERENTIAL RELAY GRL100 - B6 F 2 S 0 8 3 5 Ver.0.4*, 2005.