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TOSHIBA IED

GR-200 Series *General catalog*



TOSHIBA

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Printed in Japan

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GR-200 Series

Product Range



The GR-200 Series is the next generation of Toshiba protection and control IEDs. GR-200 Series is designed for transmission/distribution networks to provide a platform for distributed and renewable energy systems and railway applications. Flexible adaptation is enabled using extensive hardware and modular software combinations enabling an application oriented implementation based upon independent function blocks. GR-200 is a universal platform with the capability to cover expansive and future demands encompassing advanced technologies such as process bus, synchrophasor measurement and packet-based communications. The product range enables the protection and control of multi-winding transformers, multi-terminal lines, all types of earthing system, busbar configurations, generators and rail networks.

- GBU200** Bay Control
- GRZ200** Distance Protection
- GRL200** Line Differential Protection
- GRT200** Transformer Protection
- GRB200** Busbar Protection
- GRD200** Multi-Function Protection & Control
- GRG200** Generator & Motor Protection
- GRX200** Railway DC Protection



Features

Intelligent Platform for Future Grid Applications

- Protection & Control for Transmission & Distribution Networks
- Platform for Distributed and Renewable Energy Systems
- Process bus, Synchrophasor measurement, packet-based communications
- Basis for future systems and application development

Universal platform covering expansive and future demands

Extensive Hardware Options & Flexible Adaptation

- Comprehensive Range of Hardware Components
- Main Processing/Computing Board with Enhanced Processor
- Wide variety of Binary Input & Output combinations
- Standard LCD and touch type screens together with mimic option
- Plug-in Communication module
- Flexible hardware combinations to meet specific applications

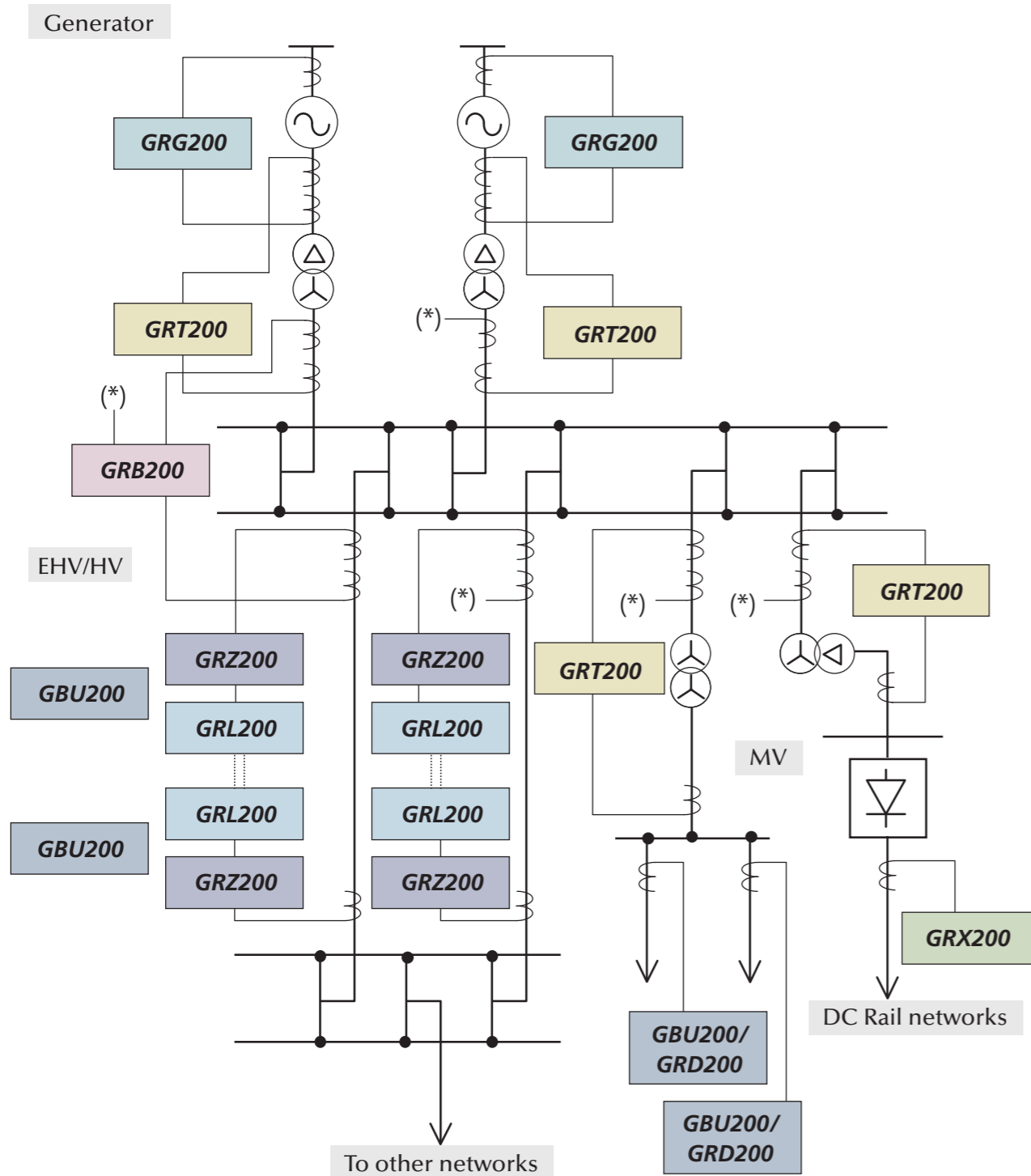
IED configuration achieved using flexible/multiple hardware options

Function-wise Implementation

- Library of Function blocks enables wide application for protection, control, measurement and other functions
- Protection elements and schemes
- Control schemes
- Metering and Recording functions
- Individual function blocks work independently
- Easy IED customisation to add/delete particular function blocks
- Flexible implementation of new functions or to modify a specific function

IED fully adaptable to user functional requirements

Example Application



Function List

Bay control IED

Function / device no.	Description	GBU200
Control function		
Control	Select-control with sychro-check	●
Interlock	Interlock	●
AutoSEQ	Automatic sequential control	●
DMYCB	Dummy CB control	●
Monitoring	Monitoring	●
TAP	TAP control	●
BCD control	BCD measurement and control	●
DCAI	DC analog input measurement	○
DCAO	DC analog output control	○
Manual override	Manual override	●
Load shedding	Load shedding	○
PWRQTY	Power quality measurement (harmonics, snag and swell)	○
Protection		
50/67, 51/67	Non-directional / directional phase overcurrent protection (4 steps)	○
50HS/51HS	High-speed overcurrent protection (1 step)	○
50N/67N, 51N/67N	Non-directional / directional earth fault overcurrent protection (4 steps)	○
50NHS/51NHS	High-speed earth fault overcurrent protection (1 step)	○
50SEF/51SEF	Non-directional / directional sensitive earth fault overcurrent protection (2 steps)	○
46/67	Non-Directional / directional negative phase sequence over-current protection (2 steps)	○
50BF	Circuit breaker failure protection (2 stages)	○
37	Phase under-current protection (2 steps)	○
46BC	Broken conductor protection	○
49	Thermal overload protection	○
32	Directional power protection	○
59P	Positive phase sequence over-voltage protection (4 steps)	○
59N	Earth fault over-voltage protection (4 steps)	○
47	Negative phase sequence over-voltage protection (2 steps)	○
27	Phase under-voltage protection (4 steps)	○
81	Frequency protection (6 steps)	○
ROCOF	Rate of change of frequency (df/dt) (6 steps)	○
51V	Voltage restricted overcurrent	○
85-50N/51N/67N	Command protection for OC/EF and DOC/DEF schemes	○
50SOTF	Switch on to fault protection	○
21FL	Fault locator	○
ICD	Inrush current detection function	○
CLP	Cold load protection function	○
79	Auto-reclosing function (up to 4 shots)	○
25	Voltage check for auto-reclosing	○
Common		
74TC	Trip circuit supervision	●
VTF	VT Fail detection function	●
CTF	CT Fail detection function	●
Event	Events, alarms and statistics	●
Measurement	Measurement	●
PQRQTY	Power quality monitoring	○
Counter	Counter	●
PLC	Programmable logic controller	●

● : Standard, ○ : Dependent upon hardware configuration and model configuration

Function List

Line protection and control

Function / device no.	Description	GRZ200	GRL200
21/21N(4Z)	Distance protection (for phase and ground fault) with 4zone	●	○
21/21N(6Z)	Distance protection (for phase and ground fault) with 6zone	○	○
85-21	Command protection for distance schemes	●	○
85-50N/51N/67N	Command protection for EF and DEF schemes	○	○
87L	Phase-segregated current differential protection		●
87N	Zero phase current differential protection		●
R87	Remote differential trip		●
DTT	Direct transfer trip function		●
50/67, 51/67	Non-directional / directional Phase over-current protection	●	●
50N/67N, 51N/67N	Non-directional / directional Earth fault over-current protection	●	●
46/67	Non-Directional / directional Negative phase sequence over-current protection	○	○
37	Phase under-current protection	○	○
49	Thermal overload protection	●	●
46BC	Broken conductor protection	●	●
50BF	Circuit breaker failure protection	●	●
50SOTF	Switch on to fault protection	●	●
50STUB	Stub protection	○	○
59	Phase over-voltage protection	●	●
59P	Phase-phase over-voltage protection	○	○
59N	Earth fault over-voltage protection	○	○
59	Positive phase sequence over-voltage protection	○	
47	Negative phase sequence over-voltage protection	○	○
27	Phase under-voltage protection	●	●
27P	Phase-phase under-voltage protection	○	○
27	Positive phase sequence under-voltage protection	○	
81	Frequency protection	●	○
68	Power swing blocking	●	○
56Z	Out-of-step tripping by distance relay	●	○
ICD	Inrush current detection function	●	●
CLP	Cold load protection function	○	○
VTF	VT Fail detection function	●	●
CTF	CT Fail detection function	●	●
21FL	Fault locator	●	●
79	Auto-reclosing function	●	●
79multi	Multi-phase auto-reclosing function		○
25	Sync check for auto-reclosing	●	●
74TC	Trip circuit supervision	●	●
Control	Control	○	○

● : Standard, ○ : Dependent upon hardware configuration and model configuration

Function List

Multi-Function Protection & Control

Function / device no.	Description	GRD200
Protection		
50/67,51/67	Non-directional / directional phase overcurrent protection (4 steps)	●
50HS/51HS	High-speed overcurrent protection (1 step)	●
50N/67N,51N/67N	Non-directional / directional earth fault overcurrent protection (4 steps)	●
50NHS/51NHS	High-speed earth fault overcurrent protection (1 step)	●
50SEF/51SEF	Non-directional / directional sensitive earth fault overcurrent protection (2 steps)	○
46/67	Non-Directional / directional negative phase sequence over-current protection (2 steps)	●
50BF	Circuit breaker failure protection (2 stages)	●
37	Phase under-current protection (2 steps)	●
46BC	Broken conductor protection	●
49	Thermal overload protection	●
32	Directional power protection	●
59P	Positive phase sequence over-voltage protection (4 steps)	●
59N	Earth fault over-voltage protection (4 steps)	●
47	Negative phase sequence over-voltage protection (2 steps)	●
27	Phase under-voltage protection (4 steps)	●
81	Frequency protection (6 steps)	●
ROCOF	Rate of change of frequency (df/dt) (6 steps)	●
51V	Voltage restricted overcurrent	●
21FL	Fault locator	●
ICD	Inrush current detection function	●
CLP	Cold load protection function	●
79	Auto-reclosing function (up to 4 shots)	●
25	Voltage check for auto-reclosing	●
Control function		
Control	Select-control with sychro-check	○
Common		
74TC	Trip circuit supervision	●
VTF	VT Fail detection function	●
CTF	CT Fail detection function	●
Event	Events, alarms and statistics	●
Measurement	Measurement	●
PLC	Programmable logic controller	●

● : Standard, ○ : Dependent upon hardware configuration and model configuration

Function List

Machine protection and control

Function / device no.	Description	GRT200	GRG200
87T	Biased transformer differential relay	●	
87H	High-set differential overcurrent	●	
87G	Biased generator differential relay		●
AutoComp	Automatic compensation for tap change	●	
64/87N	Restricted Earth Fault Protection (REF)	○	
50/51	Non-directional phase overcurrent protection	○	
50N/51N	Non-directional earth fault protection	○	
50PG	Overcurrent protection		●
50PGN	Ground fault protection for startup		●
51GN	Ground fault protection		●
50	Overcurrent protection		●
67/67N	Directional phase overcurrent and earth fault protection	○	
46	Negative phase sequence overcurrent protection		●
50BF	Circuit breaker failure protection	●	●
50SOTF	Switch on to fault protection	●	
21	Distance protection (for backup)	○	●
40	Loss of field protection		●
78	Out-of-step relay		●
49	Thermal overload protection	●	
27	Under-voltage protection	○	●
27TN	3f under-voltage protection with load current compensation		●
59	Overvoltage protection	○	●
64	Ground detector protection		●
64PG	Ground overvoltage protection for startup		●
60	Voltage phase balance protection		●
32R	Reverse power protection		●
81	Frequency protection	○	●
24	Overexcitation	○	●
51V	Voltage restricted overcurrent	○	●
ICD	Inrush current detection function (2f/3f/5f)	●	●
VTF	VT Fail detection function	●	●
CTF	CT Fail detection function	●	●
Control	Control	○	○

● : Standard, ○ : Dependent upon hardware configuration and model configuration

Function List

Busbar protection

Function / device no.	Description	GRB200
87B	Biased differential relay	●
87H	High-set differential overcurrent	●
Comp	Compensation for CT ratio mismatch	●
50/51	Non-directional phase overcurrent protection	●
50N/51N	Non-directional earth fault protection	●
50BF	Circuit breaker failure protection (2 stage)	○
27	Under-voltage protection	○
VTF	VT Fail detection function	○
CTF	CT Fail detection function	●
Control	Control	○

● : Standard, ○ : Dependent upon hardware configuration and model configuration

Rail network protection

Function / device no.	Description	GRX200
87	Differential current protection	●
49	Thermal overload protection	●
27	Under-voltage protection	●
59	Overvoltage protection	●
50/51	Non-directional phase overcurrent protection	●
VTF	VT Fail detection function	○
CTF	CT Fail detection function	○
Control	Control	○

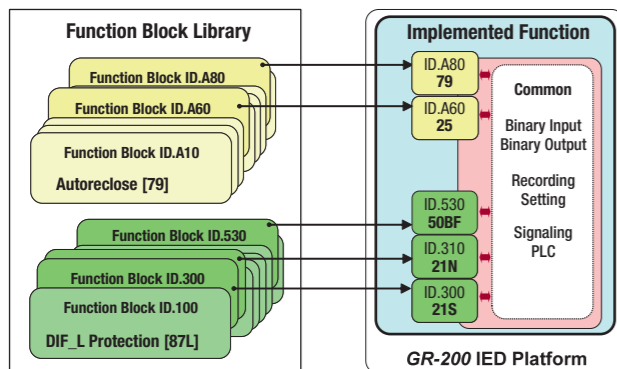
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GR-200 Series-Platform

GR-200 has been designed to meet the wide variation in functionality demanded by the global P&C market whilst avoiding the need for end-users having to undertake complex configurations of functions not required in a particular application. Toshiba has introduced the following four design measures to overcome the common problem of the user having to configure multiple unused functions:

- Fully modularized hardware architecture
- Flexible firmware platform enabling easy addition of functions
- Introduction of a new software management system
- New high performance Programmable Logic Controller

Hardware requirements vary depending upon operating conditions, application etc. and in particular with respect to binary inputs and outputs, analog inputs and communication ports. The realization of an optimal hardware structure providing increased modularization enables the provision of optimal hardware configurations to support a particular functional requirement. GR-200 Series IEDs have a multiple microprocessor design. The microprocessors perform software functions such as signal processing, protection algorithms, scheme logic, output control and management of the human machine interface. The GR-200 Series IEDs comprise a number of printed circuit boards, typically a CT/VT module, input/output modules, a communication module as well as the microprocessor board. The printed circuit boards have been standardized and can be utilized within any of the GR-200 Series IEDs thus providing a common platform. In addition to the hardware platforms, software modules such as applications, protection elements, and communication protocol packages have been standardized and are managed as functional blocks. The function blocks are available in a library such that modules that are required for a particular user application can be adopted using the TOSHIBA IED Engineering & Monitoring Software. (GR-TIEMS)



Feature separation of fixed/common elements from variable application functions supports customization to meet specific user requests throughout the lifetime of the product. A standardized interface between common parts and application functions assures the highest quality.

Hardware

Case size

The GR-200 series IEDs are 6U in height and can be configured from a selection of unit size in terms of width from 1/3 x 19", 1/2 x 19", 3/4 x 19" or 1/1 x 19". The maximum number of modules mounted in a particular case size is summarized below. (Note: If an additional CPU module is required, the maximum number of I/O modules becomes one less than that shown in the list below. The number of CT/VT modules is independent of the maximum number of I/O modules.)

Case size (Width)	CT/VT module	I/O module
1/3 x 19"	1	1
1/2 x 19"	1	3
3/4 x 19"	1	6
1/1 x 19"	2	8

CT/VT module

Various CT/VT modules can be selected in accordance with the requirements of the user application. A maximum of two modules can be mounted in a case of 1/1 x 19" width. (See Table 1)

Input and output modules

Binary input and output modules, DC analog input and output modules are provided to enable flexible configuration based upon user requirements. Table 2 illustrates the available range of input and output modules.

Communication module

A maximum number of 5 communication modules can be accommodated in a case. Typically, the ports can be used for communication within a Substation Automation System or for communication with a remote end protection IED.

HMI function

- Touch type screen provided with standard or large LCD display.
- 24 configurable tri-state LEDs selectable red/green/yellow provided at the local human-machine interface
- 7 programmable function keys and direct control buttons for open/close (O/I) and control authority (43R/L)

Communication

- Data communication for IEC 61850 station bus, IEC 60870-5-103, DNP3 and Modbus® RTU
- Line differential and teleprotection communications interfaces include direct optical fiber, X.21, RS530, CCITT G703 and IEEE Std. C37.94.
- Local setting and testing facility using a front fascia mounted USB port with software engineering tool GR-TIEMS

Table 1. CT/VT modules

Module No.	Configuration	Description
11	9 x I + 5 x V	For mainly 2CT application of line protection
12	5 x I + 5 x V	For mainly line protection
21	12 x V	For central unit of busbar protection
22	4 x I	For bay unit of busbar protection
23	12 x I	For busbar protection
31	6 x I + 5 x V	For feeder protection
32	6 x I	For single function relay (only 1/3 x 19" size rack)
33	5 x V	For single function relay (only 1/3 x 19" size rack)
34	5 x I + 3 x V	For single function relay (only 1/3 x 19" size rack)
41	9 x I + 4 x V	For mainly transformer protection
42	6 x I + 7 x V	For mainly transformer protection
43	13 x I	For mainly transformer protection
51	5 x I + 6 x V	For mainly bay control and protection unit
52	4 x I + 5 x V	For mainly bay control unit
53	4 x I + 7 x V	For mainly bay control unit

Table 2. Input and output modules

Module No.	Configuration	Description
BI1	18 x BIs	Independent connections
BI2	12 x BIs	Variable threshold settings
BI3	32 x BIs	Common polarity
BO1	18 x BOs	6 x semi-fast BO and 12 auxiliary BO
BO2	16 x 10A breaking capacity BOs	10A breaking capacity
BIO1	7 x BIs and 10 x BOs	Independent common input (including 6 x semi-fast BO, 3 auxiliary BO and 1 x 1a1b output contact)
BIO2	12 x BIs and 5 x BOs	Independent common input (including 3 x semi-fast BO, 1 auxiliary BO and 1 x 1a1b output contact)
BIO3	8 x BIs, 6 x high-speed BOs and 2 x BOs	Independent connections
BIO4	6 x BIs, 6 x 10A breaking capacity BOs and 2 x BOs	Independent connections
DCAI2	10 x DCAI	
DCAO1	4 x DCAO	
D/D	2 x form-c relay fail contacts	On power supply module

General function

In addition to the typical protection and control applications found within an IED the following additional functions have been provided in the GR-200 Series of IEDs.

Recording

- Alarms and events (each with 1,024 records) can be recorded with 1ms resolution
- The 8 most recent time-tagged fault records including pre-fault and fault values for currents and voltages in text format
- Disturbance record acquired using sampled data from all analog inputs and binary signals selected

Time synchronization

Time synchronization can be achieved over the IEC 61850 station bus with SNTP (Simple Network Time Protocol) or by using the GPS signal available via an IRIG-B port.

Setting groups

8 settings groups are provided, allowing the user to set one group for normal conditions, while other groups may be set to cover alternative operating conditions.

Simulation and test

The GR-200 series IED provides simulation and test functions to enable a check to be made of control functions without the need to make hardwired connections. This facility is provided by the provision of a 'virtual' dummy circuit breaker in the IED. It is also possible to test communication signals by forced signal status change. The simulation and test facility is available in Test mode only.

Test terminal

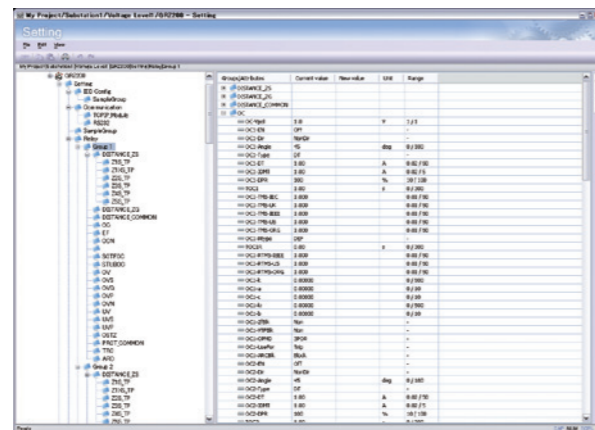
GR-200 series IEDs are equipped with three signal monitoring terminals on the front fascia panel for testing protection and control characteristics. Using these ports, the user can conduct testing from the front panel by assigning signals or logic without the need to make hardwired connections at the rear of the IED or within the protection and control panel.

Engineering Tool

The PC interface tool, GR-TIEMS enables users to access GR-200 series IEDs from a local personal computer (PC) in order to view on-line data i.e. real-time status monitoring as well as to view stored data, make settings changes, edit the LCD screen and configure sequential logic. The tool can also be used for logical node and signal mapping for substation automation integration. The user can configure and parameterize the IED to provide a customized solution to meet their specific requirements.

Remote Setting and Monitoring

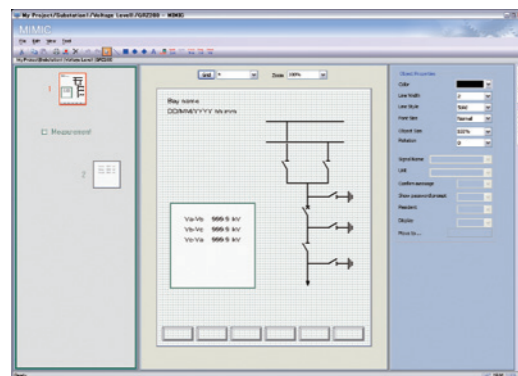
GR-TIEMS supports functions that allow the user to upload/download settings and to view and analyze fault and disturbance records captured and stored in GR-200 series IEDs. Waveform data contained within the disturbance records can be displayed, edited, measured and analyzed in detail. An optional advanced version of the GR-TIEMS provides additional and powerful analysis tools and setting calculation support functions.



PC Display of GR-TIEMS

LCD Configuration

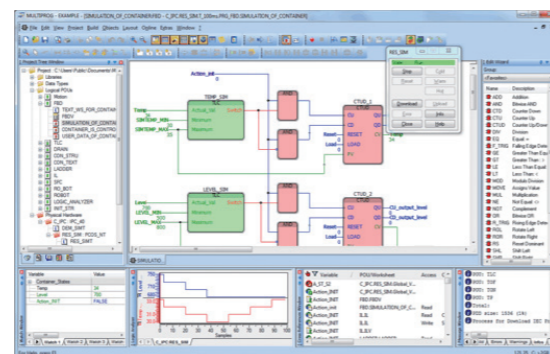
The user can configure and customize the MIMIC data displayed on the LCD of GR-200 series IEDs using the GR-TIEMS



PC Display of SLD configuration

Programmable Logic Editor

The programmable logic controller is compliant with IEC 61131-3. The PLC Editor enables the user to configure flexible logic allowing customized application and operation. Logic can be prepared using a graphical PC tool to allow special applications such as automatic disconnection of a feeder from a busbar, automatic busbar changeover and automatic Close/Open of a bus coupler/section. In addition mathematical calculation logic using analog values can be included. The status of configured logic can be monitored using the tool software and the logic calculation cycle can be executed in 1ms steps.



PC display of PLC editor

Technical Data

HARDWARE

Analog Inputs		
Rated current I_n	1A / 5A (selectable by user)	
Rated voltage V_n	100V to 120V	
Rated Frequency	50Hz / 60Hz (selectable by user)	
Overload Rating	Current inputs	4 times rated current continuous, 5 times rated current for 3 minutes, 6 times rated current for 2 minutes, 30 times rated current for 10 seconds, 100 times rated current for 1 second, 250 times rated current for one power cycle (20 or 16.6ms)
	Voltage inputs	2 times rated voltage continuous 2.5 times rated voltage for 1 second
Burden	Phase current inputs	$\leq 0.1VA$ at $I_n = 1A$, $\leq 0.2VA$ at $I_n = 5A$
	Earth current inputs	$\leq 0.3VA$ at $I_n = 1A$, $\leq 0.4VA$ at $I_n = 5A$
	Sensitive earth fault inputs	$\leq 0.3VA$ at $I_n = 1A$, $\leq 0.4VA$ at $I_n = 5A$
	Voltage inputs	$\leq 0.1VA$ at V_n
Power Supply		
Rated auxiliary voltage	24/48/60Vdc (Operative range: 19.2 – 72Vdc), 48/110Vdc (Operative range: 38.4 – 132Vdc), 110/250Vdc or 115/220Vac (Operative range: 88 – 300Vdc or 80 – 230Vac)	
Superimposed AC ripple on DC supply	$\leq 15\%$	
Supply interruption	$\leq 20ms$ at 110Vdc	
Restart time	$< 5ms$	
Power consumption	$\leq 15W$ (quiescent), $\leq 25W$ (maximum)	
Binary Inputs		
Input circuit DC voltage	24/48/60Vdc (Operating range: 19.2 – 72Vdc), 48/110Vdc (Operating range: 38.4 – 132Vdc), 110/125/220/250Vdc (Operating range: 88 – 300Vdc) Note: Variable threshold settings are available for BI2 from 14V to 154V in various steps.	
Capacitive discharge immunity	10 μ F charged to maximum supply voltage and discharged into the input terminals, according to ENA TS 48-4 with an external resistor	
Maximum permitted voltage	72Vdc for 24/48/60Vdc rating, 300Vdc for 110/250Vdc rating	
Minimum impulse duration	40ms	
Power consumption	$\leq 0.5W$ per input at 220Vdc	
Binary Outputs		
Fast operating contacts	Make and carry	5A continuously, 30A, 290Vdc for 0.2s (L/R=5ms)
	Break	0.15A, 290Vdc (L/R=40ms)
	Operating time	2 ms
Semi-fast operating contacts	Make and carry	8A continuously, 10A, 110Vdc for 0.5s (L/R=5ms)
	Break	0.13A, 110Vdc (L/R=40ms)
	Operating time	4 ms
Auxiliary contacts	Make and carry	8A continuously, 10A, 110Vdc for 0.5s (L/R=5ms)
	Break	0.13A, 110Vdc (L/R=40ms)
	Operating time	9 ms
Hybrid contacts (10 A breaking)	Make and carry	8A continuously, 10A, 220Vdc for 0.5s (L/R=5ms)
	Break	10A, 220Vdc (L/R=20ms), 10A, 110Vdc (L/R=40ms)
	Operating time	1 ms
Durability	$\geq 10,000$ operations (loaded contact), $\geq 100,000$ operations (unloaded contact)	

Technical Data

HARDWARE

DC-AI (analog inputs)		
Measurement range	DC 0±1mA, 0±20mA, 4–20mA, 0–10mA, 0–20mA, ±10mA DC -1 – 0 – +1V, -5 – 0 – +5V, -10 – 0 – +10V	
Accuracy	±1% of full scale	
Maximum permitted continuous current	2 times for maximum measurement range	
Input resistance	250Ω(0 – ±20mA), 3,000Ω(0±1mA)	
DC-AO (analog outputs)		
Measurement range	DC 0 – ±20mA DC 0 – ±10V	
Accuracy	±1% of full scale	
Measuring input capability		
Measuring accuracy	Standard current input	±1% x In or 10mA
	Sensitive current input	±1% x In or 0.5mA
	Voltage input	±1% or 0.5V
Full scale	Standard current input	≥ 60A (1A rating) or 300A (5A rating)
	Sensitive current input	≥ 3A (1A rating) or 15 A (5A rating)
	Voltage input	≥ 200V
Sampling rate	48 samples / cycle	
Frequency response	< 5% deviation over range 16.7Hz to 600Hz	
Mechanical Design		
Installation	Flush mounting or rack mounting	
Weight	Approx. 10kg (1/3 size), 12kg (1/2 size), 15kg (3/4 size), 25kg (1/1 size)	
Case colour	2.5Y7.5/1 (approximation to Munsell value)	
LED		
Number	26 (Fixed for "In service" and "ERROR")	
Color	Red / Yellow / Green (configurable) except In service (green) and Error (red)	
Function keys		
Number	7	
Local Interface		
USB	Type B	
Maximum cable length	2m (max.)	
System Interface (rear port)		
100BASE-TX Physical medium	Fast Ethernet Twisted pair cable, RJ-45 connector	
100BASE-FX Physical medium	Fast Ethernet 50/125 or 62.5/125µm fibre, SC connector	
Protocol	IEC61850 or DNP3 or Modbus® RTU	
Serial communication (rear port)		
RS485	Protocol IEC 60870-5-103 or DNP3 or Modbus® RTU	
Fiber optical	Protocol IEC 60870-5-103	
Terminal Block		
CT/VT input	M3.5 Ring terminal	
Binary input, Binary output	M3.5 terminal with 15mm stripping length (for compression type terminal) M3.5 Ring terminal (for ring lug type terminal)	

Environmental Performance


Atmospheric Environment		
Temperature	IEC 60068-2-1/2 IEC 60068-2-14	Operating range: -10°C to +55°C. Storage / Transit: -25°C to +70°C. Cyclic temperature test as per IEC 60068-2-14
Humidity	IEC 60068-2-30 IEC 60068-2-78	56 days at 40°C and 93% relative humidity. Cyclic temperature with humidity test as per IEC 60068-2-30
Enclosure Protection	IEC 60529	IP52 - Dust and Dripping Water Proof IP20 for rear panel
Mechanical Environment		
Vibration	IEC 60255-21-1	Response - Class 1 Endurance - Class 1
Shock and Bump	IEC 60255-21-2	Shock Response Class 1 Shock Withstand Class 1 Bump Class 1
Seismic	IEC 60255-21-3	Class 1
Electrical Environment		
Dielectric Withstand	IEC 60255-5	2kVrms for 1 minute between all terminals and earth. 2kVrms for 1 minute between independent circuits. 1kVrms for 1 minute across normally open contacts.
High Voltage Impulse	IEC 60255-5 IEEE C37.90	Three positive and three negative impulses of 5kV(peak), 1.2/50µs, 0.5J between all terminals and between all terminals and earth.
Voltage Dips, Interruptions, Variations and Ripple on DC supply	IEC 60255-11, IEC 61000-4-29, IEC 61000-4-17 IEC 60255-26 Ed 3	1. Voltage dips: 0 % residual voltage for 20 ms 40 % residual voltage for 200 ms 70 % residual voltage for 500 ms 2. Voltage interruptions: 0 % residual voltage for 5 s 3. Ripple: 15 % of rated d.c. value, 100 / 120 Hz 4. Gradual shut-down / start-up: 60 s shut-down ramp, 5 min power off, 60 s start-up ramp 5. Reversal of d.c. power supply polarity: 1 min
Capacitive Discharge	ENA TS 48-4	10µF charged to maximum supply voltage and discharged into the input terminals with an external resistance

Environmental Performance

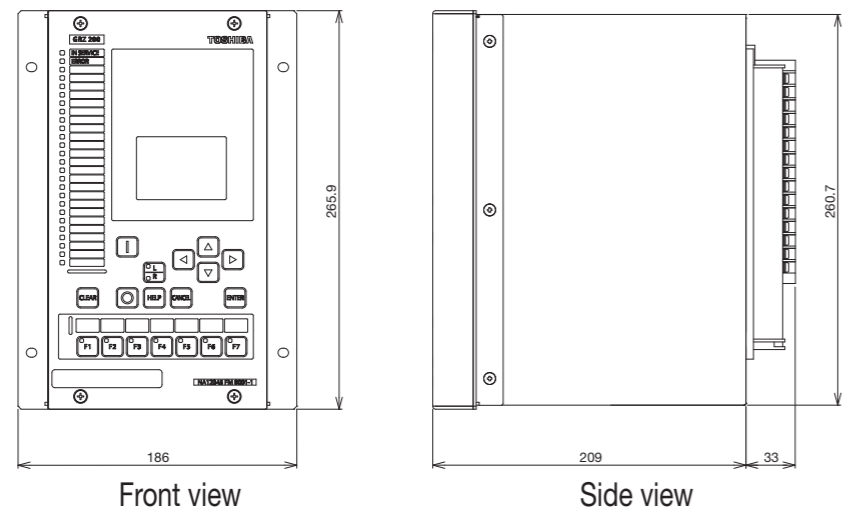
Electromagnetic Environment		
High Frequency Disturbance / Damped Oscillatory Wave	IEC 60255-22-1 Class 3, IEC 61000-4-18 IEC 60255-26 Ed 3	1 MHz burst in common / differential modes Auxiliary supply and I/O ports: 2.5 kV / 1 kV Communications ports: 1 kV / 0 kV
Electrostatic Discharge	IEC 60255-22-2 Class 4, IEC 61000-4-2 IEEE C37.90.3-2001 IEC 60255-26 Ed 3	Contact: 2, 4, 6, 8kV Air: 2, 4, 8, 15kV
Radiated RF Electromagnetic Disturbance	IEC 60255-22-3, IEC 61000-4-3 Level 3 IEC 60255-26 Ed 3	Sweep test ranges: 80 MHz to 1 GHz and 1.4 GHz to 2.7 GHz. Spot tests at 80, 160, 380, 450, 900, 1850 and 2150 MHz. Field strength: 10 V/m
Radiated RF Electromagnetic Disturbance	IEEE C37.90.2-1995	Field strength 35V/m for frequency sweep of 25MHz to 1GHz.
Fast Transient Disturbance	IEC 60255-22-4 IEC 61000-4-4 IEC 60255-26 Ed 3	5 kHz, 5/50ns disturbance Auxiliary supply and input / output ports: 4 kV Communications ports: 2 kV
Surge Immunity	IEC 60255-22-5 IEC 61000-4-5 IEC 60255-26 Ed 3	1.2/50µs surge in common/differential modes: Auxiliary supply and input / output ports: 4, 2, 1, 0.5 kV / 1, 0.5 kV Communications ports: up to 1, 0.5 kV / 0 kV
Surge Withstand	IEEE C37.90.1-2002	3kV, 1MHz damped oscillatory wave4kV, 5/50ns fast transient
Conducted RF Electromagnetic Disturbance	IEC 60255-22-6 IEC 61000-4-6 IEC 60255-26 Ed 3	Sweep test range: 150 kHz to 80MHz Spot tests at 27 and 68 MHz. Voltage level: 10 V r.m.s
Power Frequency Disturbance	IEC 60255-22-7 IEC 61000-4-16 IEC 60255-26 Ed 3	50/60 Hz disturbance for 10 s in common / differential modes Binary input ports: 300 V / 150 V
Power Frequency Magnetic Field	IEC 61000-4-8 Class 4 IEC 60255-26 Ed 3	Field applied at 50/60Hz with strengths of: 30A/m continuously, 300A/m for 1 second.
Conducted and Radiated Emissions	IEC 60255-25 EN 55022 Class A, EN 61000-6-4 IEC 60255-26 Ed 3	Conducted emissions: 0.15 to 0.50MHz: <79dB (peak) or <66dB (mean) 0.50 to 30MHz: <73dB (peak) or <60dB (mean) Radiated emissions 30 to 230 MHz: < 40 dB(µV/m) 230 to 1000 MHz: < 47 dB(µV/m) Measured at a distance of 10 m

Environmental Performance

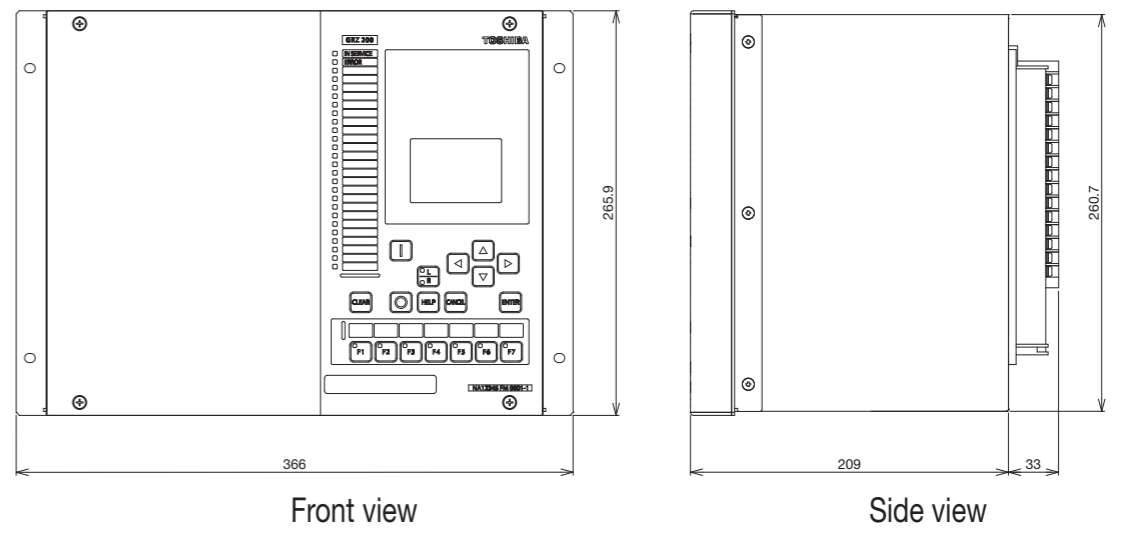
Performance and Functional Standards	
Category	Standards
General	
Common requirements	IEC 60255-1
Data Exchange	IEC 60255-24 / IEEE C37.111 (COMTRADE) / IEEE C37-239 (COMFEDE)
Product Safety	IEC 60255-27
Functional	
Distance	IEC 60255-121
Synchronizing	IEC 60255-125
Under/Over Voltage Protection	IEC 60255-127
Under/Over Power Protection	IEC 60255-132
Thermal Protection	IEC 60255-149
Over/Under Current Protection	IEC 60255-151
Directional Current Protection	IEC 60255-167
Reclosing	IEC 60255-179
Frequency Protection	IEC 60255-181
Teleprotection	IEC 60255-185

European Commission Directives		
	2004/108/EC	Compliance with the European Commission Electromagnetic Compatibility Directive is demonstrated according to generic EMC standards EN 61000-6-2 and EN 61000-6-4, and product standard IEC 60255-26.
	2006/95/EC	Compliance with the European Commission Low Voltage Directive for electrical safety is demonstrated according EN 60255-27.

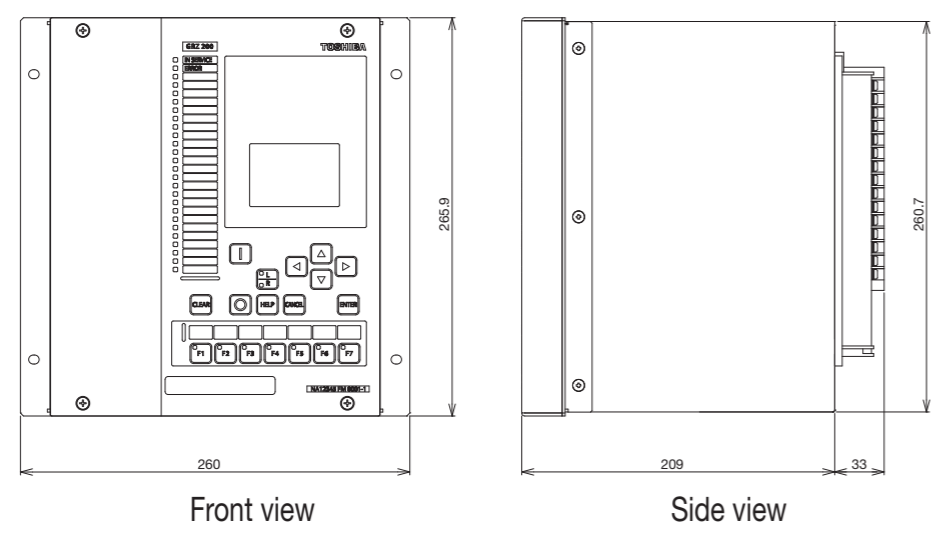
Dimension (1/3 size)



Dimension (3/4 size)



Dimension (1/2 size)



Dimensions and Panel Cut-Out (1/1 size)

