Digital protection relay with various protection elements for fault monitoring, protection and monitoring of high-voltage motors

DPR1000

DPR1000

Digital Protection Relay

It Is a digital protection relay with various protection elements for fault monitoring, protection and monitoring of receiving/distribution system feeders, in particular for high-voltage motor.

- 11 protection elements are integrated for high-voltage motor protection
- Saving of 128 Events, 32 Faults and Fault Waves (up to 32 accident records)
- Used for the protection, monitoring and control systems for high/low voltage medium capacity motors
- MODBUS and RS485 communications
- Compact protection relay with various additional functions

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Features

Characteristics of Digital Protection Relay DPR1000

Protection and Control Function

Overcurrent(50/51) and Earth-fault Overcurrent(50/51N)
Thermal(49) and Reverse-Phase current(46)
Ground Directional Overcurrent(67G) and Neutral Directional Overcurrent(67N)
Undercurrent(37) and Locked / Stalled(48/51LR)
Notching Device(66) and Bearing Protective Device(38)
Lock-out(86)
5 output contacts(DO) including Circuit Breaker Control, etc.
3 input contacts(DI) including Circuit Breaker Status, etc.

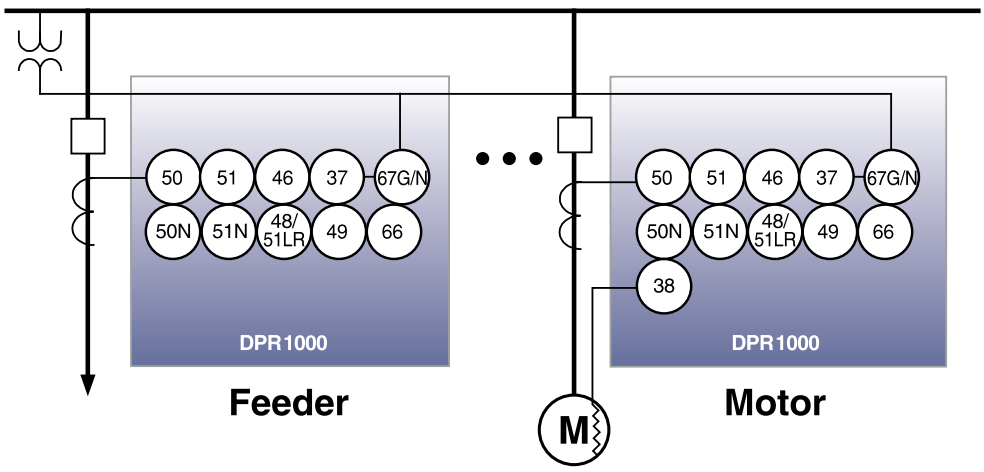
Monitoring and Measuring Function

Cable/Load current, zero phase current, zero phase voltage, reverse phase current, Analog Input DC4 ~ 20mA (2ch.)
Motor start history management event triggered the wave recording including operation current, start time, FLC, thermal, etc.
15 traces including (Ry PU/OP, COS): Ir, Is, It, Io, Vo, Al1, Al2, DI/DO, etc.
CBF, CB/DO operation count, CB/MOTOR operation time recording available

User Interface

20×4 Character LCD
Various communication protocol support (MODBUS)
PC software (GIPAM Manager) available through front panel IrDA (infrared) port

Function Block Diagram



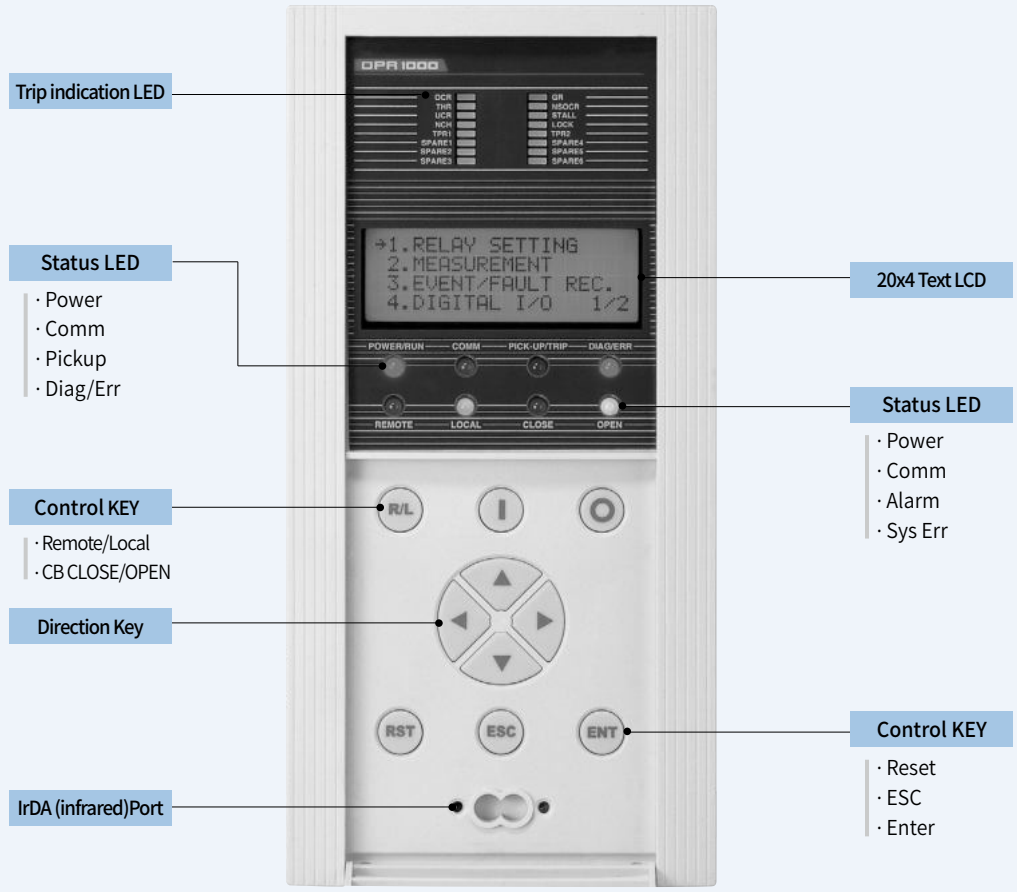
Rating

Type			Specification
Wiring			3P3W, 3P4W
Input	Frequency		60Hz, 50Hz
	Voltage	PT	-
		GPT	190, 190/√3
	Current	CT	5A
		ZCT	1.5mA
	Power		AC/DC 110, DC 125V
	Power consumption		30W or less : Stanby 70W or less : Operation
	Burden		0.5VA or less : PT 0.5VA or less : CT
Input contacts	for general		Digital Input AC/DC 110V
Output contact	for trip		Rated Capacity: AC 250V 16A/DC 30V 16A, Resistive Load Opening Capacity: AC 2500VA, DC 300W
	for alarm		Closed Capacity: AC 250V 5A/DC 30V 5A, Resistive Load Opening Capacity: AC 750VA, DC 90W
Insulation Resistance			DC 500V 10MΩ or more
Insulation Voltage			AC 2kV(1kV)/1min
Lightning impulse voltage			AC 5kV(3kV) or more, 1.2x50μs standard waveform supplied
Overload withstand	Current circuit		Withstand 2 times of rated current for 3 hours. Withstand 20 times of rated current for 2 seconds.
	Voltage circuit		Withstand 1.15 times of rated voltage for 3 hours.
Fast Transient Disturbance			4kV : power input 2kV : other input 1kV : analog input
Electrostatic Discharge(ESD)			8kV : Air, 6kV : Contact
Temperature	Operation		-10°C ~ 55°C
	Storage		-25°C ~ 70°C
Humidity			RH 80% or less (non-condensing)
Altitude			1,000m or less
Environment			A place not subject to abnormal vibration and shock. A place where the surrounding air pollution is not remarkable.
Applied Standards			IEC 60255, IEC 61000-4, KEMC 1120
Dimension (W×H×D)			120×245×185 (mm)
Weight			3.4kg
Communication			RS485 : Modbus

Protection element

Model	Protection element
DPR1000 FN	50/51, 50/51N, 46, 67N, 49, 48/51LR, 37, 66, 38
DPR1000 FZ	50/51, 46, 67G, 49, 48/51LR, 37, 66, 38

Appearance



Product front

Key Type	Corresponding Menu	Base Function
▲ ▼	Menu Tree	Move cursor between menus
	Correct and Setting menu	Move cursor to data to set up
	Password Setting	Change input password data
◀ ▶	Correct and Setting menu	Change data with cursor
	Password Setting	Move cursor
ENT	Correct and Setting menu	Save changed data
	Menu Tree	Move to menu with Ccursor
	Confirm Save menu	Save changed data
ESC	Correct and Setting menu	Cancel changed data
	Menu Tree	Move to upper menu
	Confirm Save menu	Cancel save changed data
RST	When relay trip operation	Reset relay trip
I O	All menus	Used to control CB. Close key is used to close CB. Open key is used to open CB.
R/L	All menus	Used to shift device control from Remote to Local or from Local to Remote.

Operation Characteristics

Protection element characteristics

Protection element	Operating part	Setting & Operating time	Remarks
OCR (50/51)	Instantaneous High	Setting: OFF. 0.5 ~ 20.0/0.1In	Operates below fixed 40ms
	Instantaneous Low	Setting: OFF. 0.5 ~ 20.0/0.1In Operating time: 0.05 ~ 60.0/0.01s	Definite
	Time delay Low	Setting: OFF. 0.1 ~ 4.0/0.02In Operating time: 0.05 ~ 1.20/0.01 (Inverse)	Time curve SI, VI, EI, LI
OCGR (50/51N)	Instantaneous	Setting: OFF. 0.1 ~ 8.0/0.02In Operating time: Inst, 0.05 ~ 60.00/0.01s	Definite
	Time delay	Setting: OFF. 0.02 ~ 2.0/0.01In Operating time: 0.05 ~ 1.20/0.01 (Inverse) 0.05 ~ 60.0/0.01s (Definite)	Time curve DT, SI, VI, EI, LI
NSOCR (46)	Time delay High	Setting: OFF. 0.1 ~ 1.0/0.02In Operating time: 0.08 ~ 60.0/0.01s	Definite
	Time delay Low	Setting: OFF. 0.1 ~ 1.0/0.01In Operating time: 0.05 ~ 1.00/0.01(Inverse) 0.08 ~ 60.0/0.01s(Definite)	Time curve DT, SI, VI, EI, LI
DGR (67N)	Time delay	Io Setting: 0.02 ~ 2.0/0.01Ion Vo Setting: 11 ~ 80/1V RCA Setting: 0 ~ 90/1° Operating time: 0.05 ~ 10.00/0.01s	Ground type Definite
SGR (67G)	Time delay	Io Setting: 0.9 ~ 6.0/0.1mA Vo Setting: 11 ~ 80/1V RCA Setting: 0 ~ 90/1° Operating time: 0.05 ~ 10.00/0.01s	Ungrounded Type Definite
THERMAL (49)	Time delay	Setting: OFF. 50 ~ 100/1% (τh, τc) ※ Effective correction: FLC×SVC×O/L	Refer to page 106 for the motor protection setting
STALL/ LOCK (48/51LR)	Stall Time delay	Setting: 0.50 ~ 10.00/0.01 FLC Operating time: 0.05 ~ 300.0/0.01s(Definite)	Refer to page 106 for the motor protection setting
	Lock Time delay	Setting: 0.50 ~ 10.00/0.01 FLC Operating time: 0.05 ~ 300.0/0.01s(Definite) 0.05 ~ 1.20/0.01 (Inverse)	Refer to page 106 for the motor protection setting Time curve: DT, VI, EI
UCR (37)	Time delay	Setting: 0.1 ~ 0.9/0.02In Operating time: 0.05 ~ 300.0/0.01s	Definite
NCH (66)	-	Starts number: OFF. 1 ~ 5/1회 Setting Time: 10 ~ 60/1분 Time between starts block: 1 ~ 60/1분 Current calorie: 10 ~ 80/1%	Maneuver restriction
TPR (38)	Time delay	Setting: OFF. 20 ~ 180/1°C Operating time: 50ms 이하	Definite

Operation Characteristics

Motor protection setting

Operating part	Setting & Operating time	Remarks
STALL/START TIME	Tss (Stall operating time): 0.05 ~ 300.00/0.01s Ts (Motor starting time): 1.0 ~ 300.0/0.1s	-
FLC/LRC	FLC: 0.20 ~ 2.00/0.01In LRC: 0.50 ~ 10.00/0.01FLC	FLC: STALL setting LRC : LOCK setting
SERVICE FACTOR	SVC: 1.00 ~ 1.20/0.05	-
THR CONST	Thermal constant (Heat): 2.0 ~ 60.0/0.5min Thermal constant (Cool): 2.0 ~ 60.0/0.5min Overload Constant (O/L): 0.80 ~ 1.20/0.05	THR (49) Setting
OCGR BLOCK TIME	B/T: 0.00 ~ 60.00/0.01s	OCGR instantaneous operation delay Applied only with INST at 50N

* THR depends on the h-factor, but the amount of heat reaches 100% when FLC is continuously introduced.

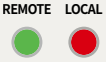
Measurement

Item		Range	Accuracy(%)	Remarks
Voltage	Zero-phase voltage	0, 2.2 ~ 200V	5%	V_o, V_o max
Current	Line / Load current	0, 0.05 ~ 200A	±0.5% (0.2 ~ 1.2 In)	I_a, I_b, I_c
	Reversed phase current	0, 0.05 ~ 200A	±5%	I_2
	Zero-phase current (I_o)	0, 0.05 ~ 40A (NCT) 0, 0.15 ~ 30mA (ZCT)	±5%	I_o, I_o max
	starting current	0, 0.05 ~ 200A	±5%	Is_avg, Is_peak
starting time		Average start time of last 5 operations, Max. start time	±5%	Ts_avg, Ts_peak
% Load factor		0, 5 ~ 999.99%	±1%	%FLC, %FLCavg, %FLCpeak
% Heat utilization		0, 5 ~ 150.0%	±5%	%Q, %Qavg, %Qpeak
Analog Input (AI) 1, 2		4 ~ 20mA DC	±0.5%	

*Voltage/current values above are based on secondary PT/CT

LED Operation Explanation

DPR1000 LED is different according to each model. In case of an AI model, there are additional LEDs TPR 1 and 2 compared to the base model.

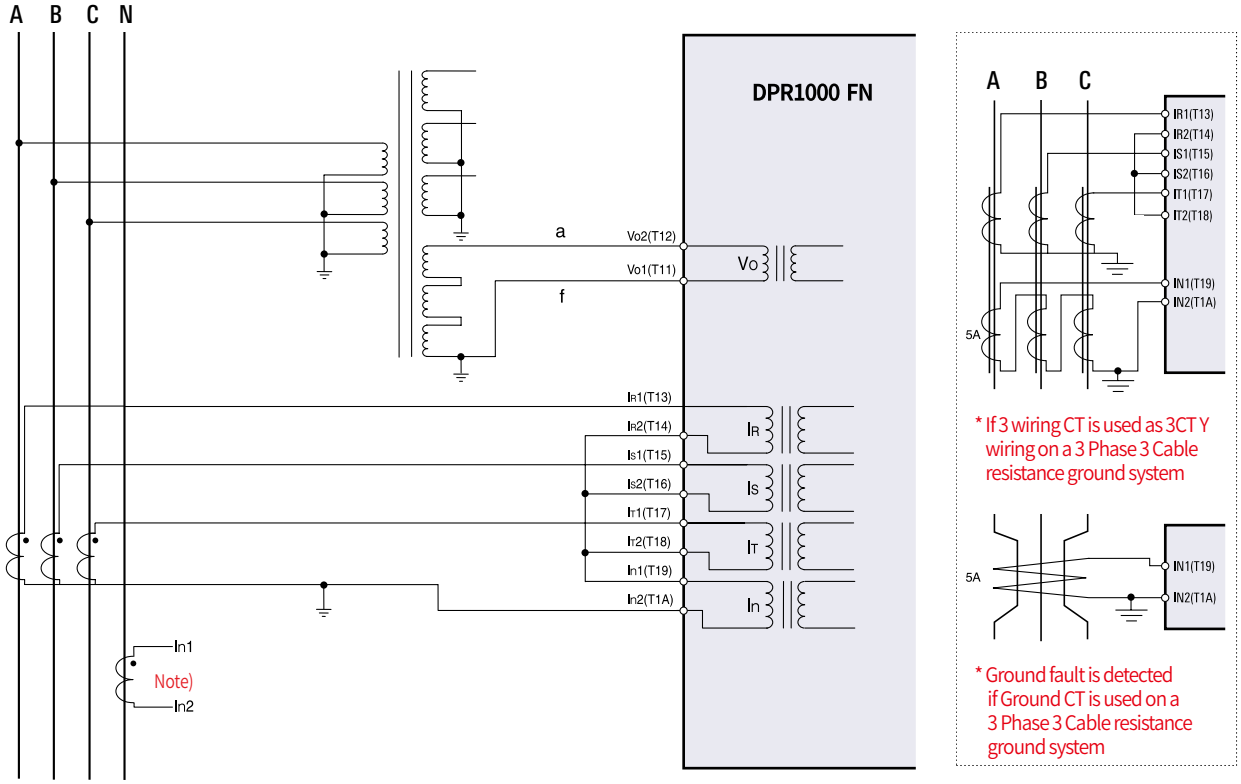
LED Types	Description
Power LED 	Displays the power status of DPR1000 (green). If the system operates properly, it maintains green. If a fault has occurred, it blinks once/second.
Communication LED 	Displays the remote communication status of DPR1000 (orange). If data is sent/received in normal communication condition, it blinks.
DIAG/ERR 	If hardware or program faults are detected during self-diagnosis of DPR1000, it blinks (yellow). It is turned off during normal condition. If this LED is blinking, please contact a designated service center.
PICK-UP/TRIP 	Displays the relay operation of DPR1000 (red). If relay is at pick-up status due to a system accident occurring, it blinks once/second. If relay operates due to a system accident or during trip, it maintains ON. This relay LED can only be released by reset.
LED for TRIP indication 	If DPR1000 executed trip operation due to a system accident, it displays the accident relay element (red). Trip display LED. In case of enforcement element, it only switches ON if the motor cannot start. Relay LED can only be released with a reset operation like pick-up/trip LED.
REMOTE/LOCAL 	They are green and red LEDs located on top of the R/L keys. They display the current control status of DPR1000. If the control is REMOTE, the green LED lights up. If the control is LOCAL, the red LED lights up. These 2 LEDs cannot be turned ON/OFF at the same time.
CB CLOSE/OPEN 	It is a green and red LED located on top of CLOSE/OPEN keys. It displays the current CB status connected to DPR1000. If CB is closed, red LED lights up. If CB is opened, green LED lights up.

Self-Diagnosis

Fault Item	Cause	Description
AUX BAT	Occurs when internal backup capacitor is discharged.	Leaving the power ON for a while will charge the capacitor and automatically resumes. If the system does not resume automatically, please contact the service department.
F/S	Happens when front IrDA (infrared) communication fault has occurred.	Please contact the service department.
R/S	Occurs when an internal communication board fault occurred.	Please contact the service department.
NO CT	Occurs when CT/PT calibration was not performed.	Please contact the service department.
NO T/S	Occurs when device time is abnormal.	Resumes if the time is set using the Manager program or through communication.
NO AI	Occurs when AI calibration was not performed.	Please contact the service department.
NO W/T	Occurs when Wave Trigger was not saved.	Resumes if Wave Trigger condition is set using the Manager program.
WATCH DOG	Occurs when the device does not boot properly.	Please contact the service department.

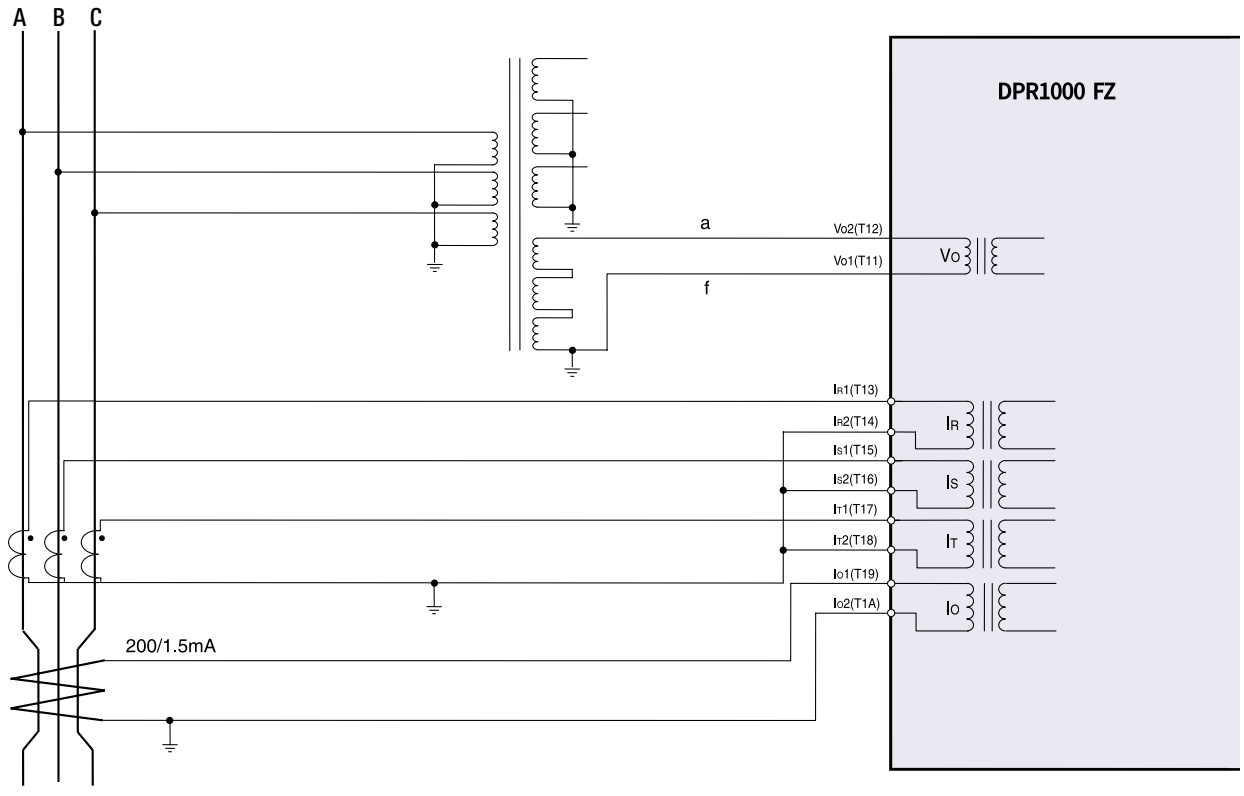
Wiring

DPR1000 FN



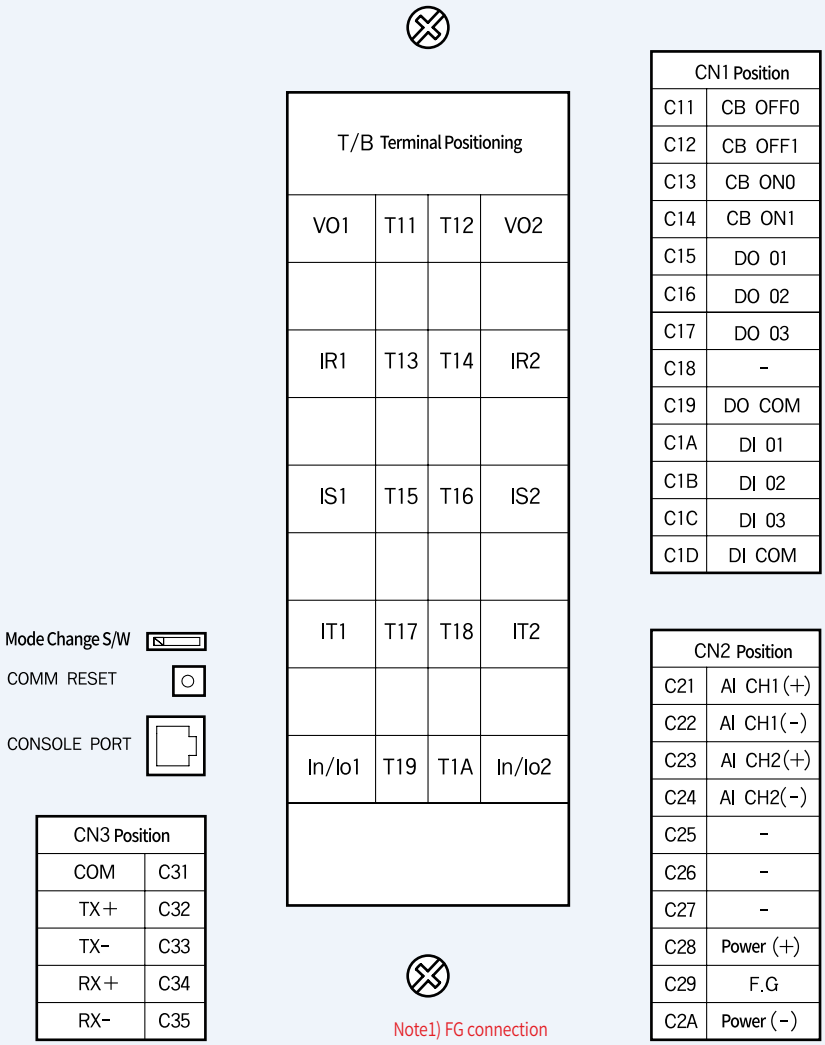
Note) When detecting ground fault using CT on the transformer neutral point ground wire, wire it with the ground wire

DPR1000 FZ



*Take caution that in order to properly measure the phase, the polarity of zero phase voltage (Vo2, Vo1) and zero phase current must be set in the opposite direction

Contact Configuration



CN1 Position	
C11	CB OFF0
C12	CB OFF1
C13	CB ON0
C14	CB ON1
C15	DO 01
C16	DO 02
C17	DO 03
C18	-
C19	DO COM
C1A	DI 01
C1B	DI 02
C1C	DI 03
C1D	DI COM

CN2 Position	
C21	AI CH1(+)
C22	AI CH1(-)
C23	AI CH2(+)
C24	AI CH2(-)
C25	-
C26	-
C27	-
C28	Power (+)
C29	F.G
C2A	Power (-)

CN3 Position	
COM	C31
TX+	C32
TX-	C33
RX+	C34
RX-	C35

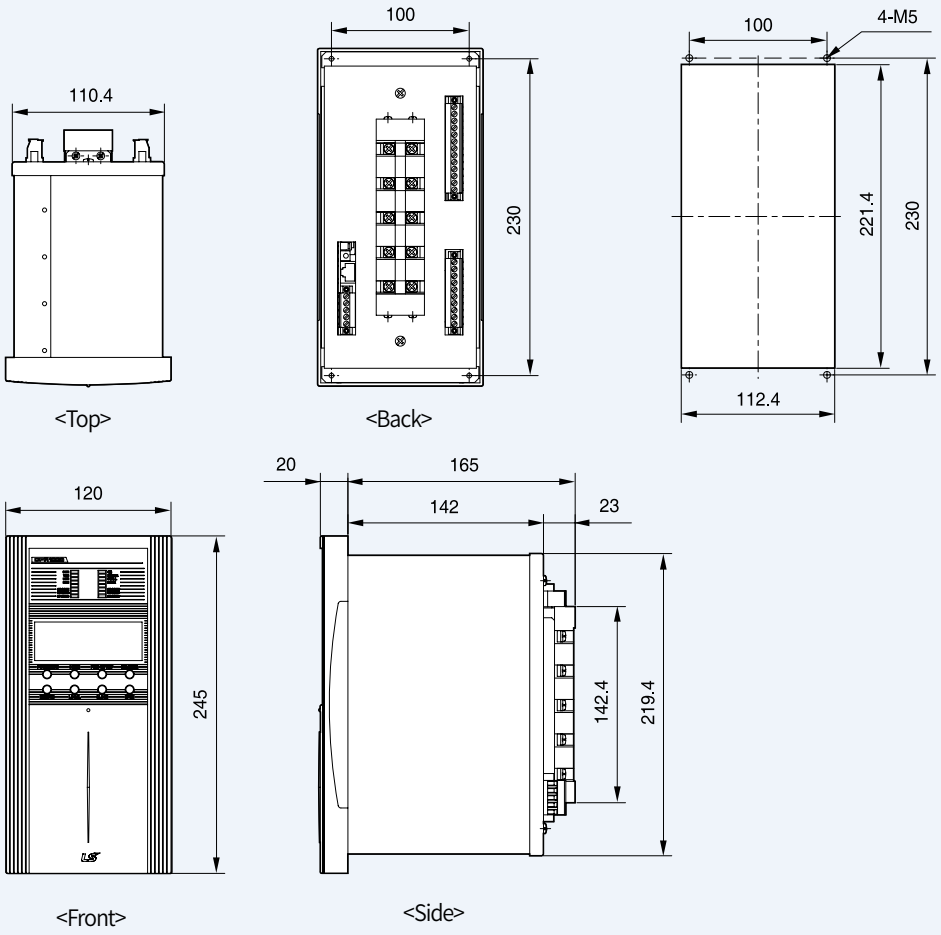
Contact Configuratione

Terminal Number	Terminal Details	Default Use	Changeable Use
C11	CB OFF0	CB Open Output	Unchangeable
C12	CB OFF1		
C13	CB ON0	CB Close Output	
C14	CB ON1		
C15	DO 01	50/51	General DO
C16	DO 02	50/51N, 67N, 67G	General DO
C17	DO 03	Relay elements except for DO 01, 02	General DO
C1A	DI 01	CB status input	Unchangeable
C1B	DI 02	General DI	General DI
C1C	DI 03	General DI	General DI

*DI 01 is CB OPEN/CLOSE status input contact, and if DI 01 does not receive input, it sets OPEN, and if it receives input, it sets CLOSE.
*DO 01-03 are CB OPEN/CLOSE control contacts, which cannot be used.

Dimensions & Ordering

Dimensions



Ordering

DPR1000

FN	RS	M	5A	60Hz
Protection Use & Transformer Input	Communication	Protocol	CT Rating	Frequency
FN Feeder, Motor/NCT	RS RS485	M MODBUS	5A	50Hz
FZ Feeder, Motor/ZCT				60Hz

AC/DC 110V	DI_AC/DC 110V	AI
Control Power	Digital Input	Analog Input
AC/DC 110V	AC/DC 110V	AI 4~20mA
		- None

Sold separately

DPR - OPTO MASTER — IrDA(infrared) Serial Port(Option)

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