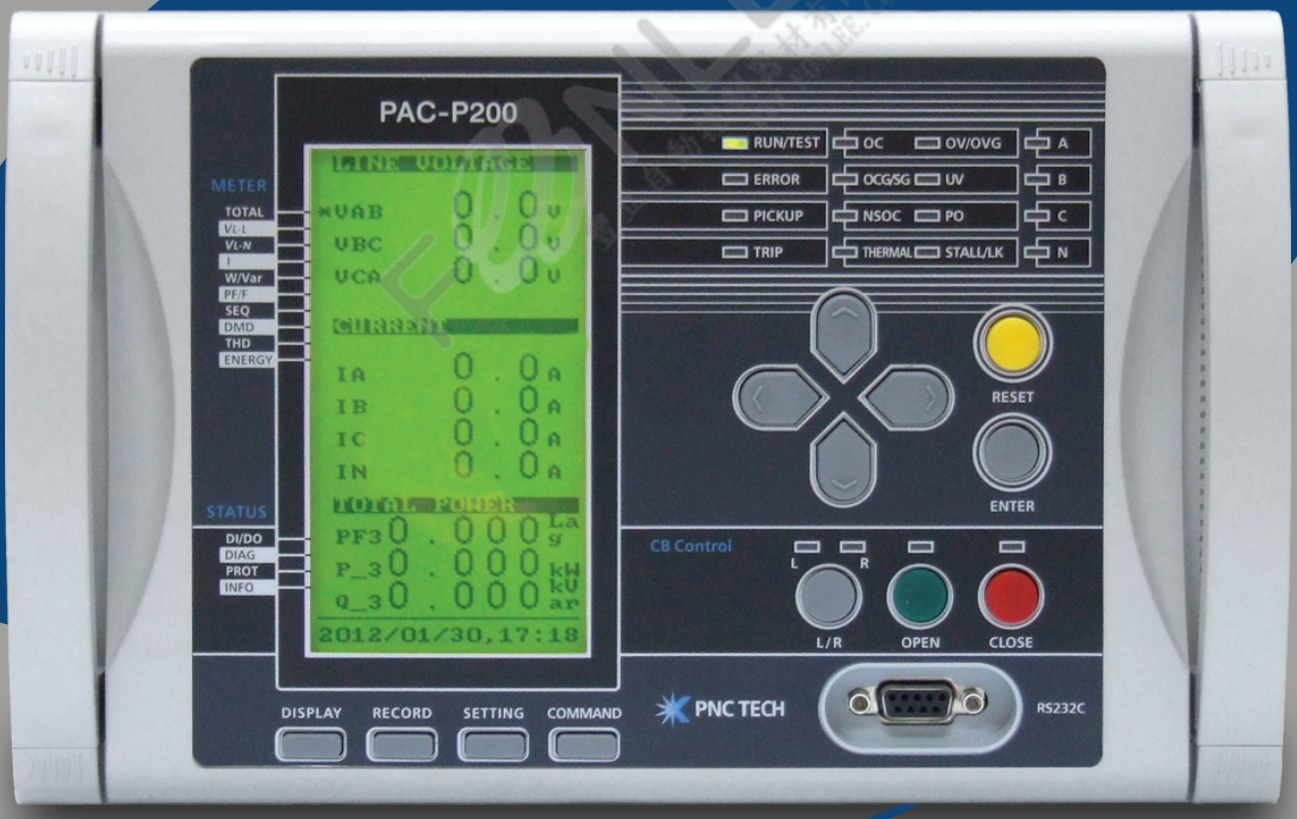
Multi function Digital Protection and Control Unit for Feeder and Motor

PAC-P200

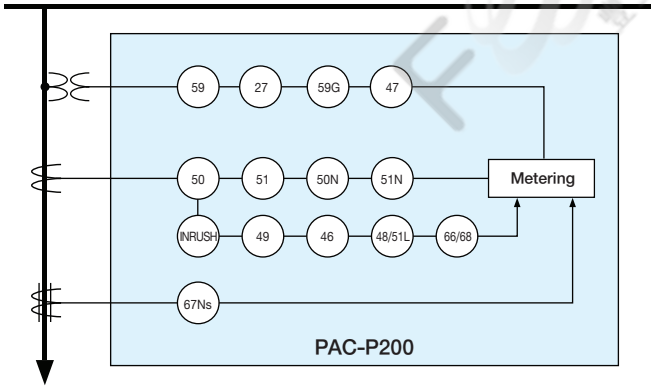


PNC Technologies Co.,Ltd.

PAC-P200 Feature

PAC-P200 is a multi function digital protection and control unit for feeder and motor. This smart device satisfies KEMC-1120(2008.6.26), IEC-60255, and CE standards. And also PAC-P200 can be applied any kind of grounding system.

Function block diagram



Protection/Detection

- Overcurrent(50/51), Ground overcurrent (50N/51N) protection
- Selective ground overcurrent(67Ns, 67G) protection
- Overvoltage(59), Undervoltage(27) protection
- Ground overvoltage(59G, 64) protection
- Negative sequence overvoltage(47) protection
- Negative sequence overcurrent(46) protection
- Thermal Overload(49) protection
- Motor Startup Monitoring/ Stall (48/51L) protection
- Motor Start Inhibit(66/68)
- Inrushcurrent Detection(I2f/I1f)

User interface

- 128×240 Graphic LCD display
- 20 x LED, 13 x Keypad
- Easy-to-use logic editor for sequence logic composition
- Communication protocol
  Front : RS-232 port 1ea
  Rear RS-232 port 1ea + RS-485 port 1ea
- Supported protocol
  Modbus RTU(TCP/IP), DNP3.0(TCP/IP),
  IEC 60870-5-103(TCP/IP)

Control

- Simple programble logic(EasyLogic™)
- CB Local/Remote control

Measurement/Monitoring/Recording

- High resolution measurement of V, A, W, Wh, Var, Varh, F, PF, and etc.
- True RMS current/voltage, 2nd harmonics current, THD, Demand
- Trip Circuit Supervision
- PT fuze monitoring, Current/voltage unbalance monitoring, CT current sum monitoring
- 512 x Fault/Event record
- Storage of fault waveform(COMTRADE file format)
  [Max : 8 x 50Cycle, Trigger : 0~99% selectable]
- Data Logging storage
  [Logging cycle : 4~12000 min]

PAC-P200 General Specifications

Item				Specification	
Winding				3P3W, 3P4W	
Rating	Frequency			50 / 60Hz	
	Control source			AC 110~220V(50/60Hz) or DC 80 ~ 300V, DC 19 ~ 130V(Option)	
	Power consumption			Normal status : less than 20W, Operating status : less than 30W	
	Voltage	PT		63.5V or 110V or 190V (50.0 ~ 250.0)	
		GPT		190V (50.0 ~ 250.0)	
	Current	CT		5A / 1A(Option)	
		ZCT		1.5mA	
	Burden	Voltage		Less than 0.3VA/Phase	
		Current		Less than 0.3VA/Phase	
Contact	Input(4ea)	Input voltage		Max. DC 250V	
		ON/OFF threshold		DC 19~130V ON : ≥19V, OFF : ≤14V	DC 80~300V ON : ≥80V, OFF : ≤60V
		COS detecting time		Less than 10msec	
	Output(12ea)	Trip	Circuit	2ea / NO	
			Making	AC 250V, 16A, Continuous	DC 125V, 30A, 0.5sec resistive
			Breaking	AC 250V, 5A, 0.1(PF)	DC 125V, 5A, L/R 25msec
		Signal	Circuit	8ea / NO, 2ea / NC	
			Making	AC 250V, 6A, continuous	DC 125V, 6A, 0.3sec, resistive
			Breaking	AC 250V, 1A, 0.1(PF)	DC 125V, 1A, L/R 25msec
Measurement				Voltage, Current, Frequency, PF, Active/Reactive/VI power, Wh/Varh/VIh, Sequence voltage/current, True RMS, THD, 2nd harmonic current, Demand, Thermal	
Communication	RS-232C			38400bps(fixed), 8bit/No Parity/1 Stop, Modbus RTU protocol	
	RS-485	Basic		Optical isolated port, 300~38400bps, 8bit/No Parity/1 Stop, Modbus RTU, DNP3.0, IEC 60870-5-103	
		Option		Modbus TCP/IP, DNP3.0 TCP/IP, optical port	
Enclosure	Construct			Draw-out type	
	Material			Steel(Fe)	
	Weight			≒ 4.4kg	
	Dimension (W×H×D)			280mm × 178mm × 160mm	
	Terminal			U(Spade)/Ring rug, Inside dia. : 5mm, Max. outside dia. : 12mm	
Environment	Specification			IEC 60068-2-1 /2	
	Service temperature range			-25 ~ 70℃	
	Storage temperature range			-30 ~ 75℃	
	Humidity			RH 30 ~ 95%	
	Altitude			Max. 1000m	
Type Test	Isolation resistance			DC 500V, 100㏁	KEMC-1120
	Dielectric test voltage			2kV, 1min	IEC 60255-5, ANSI/IEEE 37.90.0
	Impulse test voltage			5kV, 1.2/50㎲	IEC 60255-5, ANSI/IEEE 37.90.0
	Over load duration	Current circuit		Rated current ×3 : continuous, ×20 : 4sec, ×100 : 1sec	
		Voltage circuit		~ 450V : continuous	
	EMC	1MHz Burst		2.5kV, 1MHz	IEC 60255-22-1, ANSI/IEEE C37.90.1
		Compound surge		4kV, 1.2×50㎲	IEC 60255-22-5 ClassⅣ
		Fast transients		4kV, 5.0kHz, 5/50ns	IEC 60255-22-4 ClassⅣ
		Electrostatic discharge		8kV(Air), 6kV(Contact)	IEC 60255-22-2 ClassⅢ
		Radio Frequency Interference		10V/m, 30 ~ 1000MHz	IEC 60255-22-3 ClassⅢ
		Radio Frequency conductive susceptibility		10V, 150kHz ~ 80MHz	IEC 61000-4-6 ClassⅢ
	Vibration	Response		10 ~ 150Hz, 0.035mm, 8min	IEC 60255-21-1 ClassⅡ
		Duration		10 ~ 150Hz, 1G, 160min	
	Shock	Response		5G, 11ms, 3times	IEC 60255-21-2 ClassⅡ
		Duration		15G, 11ms, 3times	
		Bump		10G, 16ms, 1000times	
	Seismic test			1 ~ 35Hz, 3.5mm, 10min	IEC 60255-21-3 Class Ⅰ
Applied specification				IEC 60255, IEC 61000-4-6, KEMC-1120	

Element	Var.	Item	Setting Range	Remark
Overcurrent (50/51)	Instant aneous	Pickup current	0.50 ~ 200.00A, 0.01A Step	Two stage setting
		Operating delay	0.00 ~ 60.00sec, 0.01sec Step	
	Time delayed	Pickup current	0.50 ~ 200.00A, 0.01A Step	14 curves
		Inverse time multiplier	0.01 ~ 10.00, 0.01 Step	
		Time characteristic (TC) curve	[IEC Curve] IEC_NI, IEC_VI, IEC_EI, IEC_LI [ANSI Curve] ANSI_I, ANSI_SI, ANSI_LI, ANSI_MI, ANSI_VI, ANSI_EI, ANSI_DI [KEPCO Curve] KNI, KVI, KDNI	
Ground Overcurrent (50N/51N)	Instant aneous	Pickup current	0.10 ~ 200.00A, 0.01A Step	Two stage setting
		Operating delay	0.00 ~ 60.00sec, 0.01sec Step	
	Time delayed	Pickup current	0.10 ~ 200.00A, 0.01A Step	14 curves
		Inverse time multiplier	0.01 ~ 10.00, 0.01 Step	
		TC curve	Same with over current curve	
Selective Overcurrent (67Ns, 67G)	Time delayed	Direction	Forward, Reverse, None	
		Minimum Current	0.9 ~ 1000.0mA, 0.1mA Step	
		Minimum Voltage	10 ~ 450V, 1V Step	
		Operating delay	0.00 ~ 60.00sec, 0.01sec Step	
		Max Torque Angle(MTA)	-90° ~ +90°, 1° Step	
Thermal Overload (49)	Time delayed	K-Factor	0.10 ~ 4.00, 0.01 Step	
		Time constant(τ)	1.0 ~ 999.9min, 0.1min Step	
		Cooling Factor	1.0 ~ 10.0, 0.1 Step	
		Alarm level	50 ~ 100% of trip level, 1% Step	
Overvoltage (59)	Instant aneous	Pickup voltage	10 ~ 450V, 1V Step	
		Operating delay	0.00 ~ 60.00sec, 0.01sec Step	
	Time delayed	Pickup voltage	10 ~ 450V, 1V Step	2 curves
		Definite Time setting	0.00 ~ 60.00sec, 0.01sec Step	
		Inverse Time muliplier(TM)	0.01 ~ 10.00, 0.01 Step	
		Characteristic Curve	DT, INVERSE	
Undervoltage (27)	Instant aneous	Pickup voltage	10 ~ 450V, 1V Step	
		Operating delay	0.00 ~ 60.00sec, 0.01sec Step	
	Time delayed	Pickup voltage	10 ~ 450V, 1V Step	2 curves
		Definite Time setting	0.00 ~ 60.00sec, 0.01sec Step	
		Inverse Time muliplier(TM)	0.01 ~ 10.00, 0.01 Step	
		Characteristic Curve	DT, INVERSE	
Ground Overvoltage (59G, 64)	Instant aneous	Voltage Input select	3V0(Internal calculation), Vg(External input)	
		Pickup voltage	10 ~ 450V, 1V Step	
		Operating delay	0.00 ~ 60.00sec, 0.01sec Step	
	Time delayed	Voltage Input select	3V0(Internal calculation), Vg(External input)	3 curves
		Pickup voltage	10 ~ 450V, 1V Step	
		Definite Time setting	0.00 ~ 60.00sec, 0.01sec Step	
		Inverse Time muliplier(TM)	0.01 ~ 10.00, 0.01 Step	
		Characteristic Curve	DT, INV_TRIP, INV_ALARM	
Negative Sequence Overvoltage (47)	Time delayed	Pickup voltage(V2/V1)	5~100%, 1% Step	V_1: Pogitive V_2: Negative
		Minimum normal voltage(V1)	10~450V, 1V Step	
		Operating delay	0.00 ~ 60.00sec, 0.01sec Step	

PAC-P200 Protection

Element	Var.	Item	Setting Range	Remark
Negative Sequence Overcurrent (46)	Definite time	Normal current(I1)	0.50 ~ 5.00A, 0.01A Step	I_1: Pogitive I_2: Negative
		Pickup(I2/I1)	2 ~ 80%, 1% Step	
		Operating delay	0.00 ~ 180.00sec, 0.01sec Step	
Motor Startup Monitoring / Stall protection (48/51L)	Definite time	Start current	5.00 ~ 90.00A, 0.01A Step	
		Start time	1.0 ~ 180.0sec, 0.1sec Step	
		Operating delay	0.5 ~ 180.0sec, 0,1sec Step	
		Speed switch	None, DI1 ~ DI4	
Motor Start inhibit (66/88)	Definite time	Inhibit time delay	5 ~ 120min, 1min Step	
		Cold start number	1 ~ 5, 1 Step	
		Hot start number	0 ~ 5, 1 Step	
		Consecutive start interval	1 ~ 120min, 1min Step	
		Emergency switch	None, DI1 ~ DI4	
Inrushcurrent detection	-	Minimum normal current(I1f)	0.10 ~ 2.50A, 0.01A Step	
		Operating value(I2f/I1f)	10 ~ 100%, 1% Step	
		Operating delay	0.00 ~ 60.00sec, 0.01sec Step	

PAC-P200 Measurement

Item	Range	Remark
Current	RMS current value & phase angle per 3-phase, 0.05~250 A ±0.5%(0.05~45A), ±1.0%(〉45A)	CT Ratio 5:5
Voltage	RMS voltage value & phase angle per 3-phase, 2~450V, ±0.5%	line-line, line-ground, PT Ratio 1:1
Frequency	Phase A voltage, 40~70 Hz(±0.01Hz)	-
Power Factor	Each/3-phase PF, ±1.0%(Lead, Lag 0.00~1.00)	-
Power	Active power for each & 3-phase, ±1.0%(PF ±0.8~1.0) Reactive power for each & 3-phase, ±1.0%(PF ±0.8~1.0) Apparent power for each & 3-phase, ±1.0%	Acrive/Reactive + : forward, - : backward
Energy	3-phase Wh/Varh/VA, ±1.0% Wh : Import, Export Varh: +, -	-
Sequence Current	Positive/Negative/Zero sequence current magnitude/phase	-
Sequence Voltage	Positive/Negative/Zero sequence voltage magnitude/phase	-
Harmonics	2nd harmonic Current, Phase Current/Voltage THD	-
Demand	Current, Active power, Reactive power	Update every 15min.

Item			Data
Monitoring	PT Fuse failure	Pickup 3V0	10 ~ 450V, 1V Step
		Pickup 3I0	0.10 ~ 5.00A, 0.01A Step
		Operating delay	0.00 ~ 60.00, 0.01sec Step
	Current input circuit	Pickup 3I0-In	0.10 ~ 10.00A, 0.01A Step
		3I0-In/Imax	0.10 ~ 0.90, 0.01 Step
		Operating delay	0.00 ~ 60.00, 0.01sec Step
	Voltage unbalance	Pickup voltage	10 ~ 450V, 1V Step
		Vmin/Vmax	0.10 ~ 0.90, 0.01 Step
		Operating delay	0.00 ~ 60.00, 0.01sec Step
	Current unbalance	Pickup current	0.10 ~ 10.00A, 0.01A Step
		Imin/Imax	0.10 ~ 0.90, 0.01 Step
		Operating delay	0.00 ~ 60.00, 0.01sec Step
CB control	Open/Close Pulse		0.1 ~ 5.0sec, 0.1sec Step
	Status(52a/52b) input		None, DI1 ~ DI4
Demand	Interval		15min
	Update counter		1
	Synchronizing time		Every o'clock
Event recording	Accuracy		1msec
	Total number		512
	Items		Pickup and Operate with voltage/current, Contact input/output status, Setting change, CB operate, Power On, Record delete, CB operating counter change, WH clear, etc.
Waveform recording	Sample rate		32Sample
	Recording type		2×200, 4×100, 8×50
	Trigger position		0 ~ 99%, 1% Step
	Trigger condition		Setting with EasyLogic
	Sample data		Voltage/Current, Pickup, Operate, Contact input/output status
	File format		Comtrade File(IEEE C37.111)
Data Logging	Mode		1set / continuous
	Time		4 ~ 12000 Min
	Data		Voltage/Current/Contact output

Overcurrent/Overvoltage equation	Undervoltage equation	Variables/Constants
$t = \left[\frac{K}{\left(\frac{G}{G_s}\right)^L - 1} + C \right] \times TM(sec)$	$t = \left[\frac{K}{1 - \left(\frac{G}{G_s}\right)^L} \right] \times TM(sec)$	t : Trip time K, C, L : Characteristic coefficient G : Current(Voltage,Power) input value Gs : Current(Voltage,Power) pickup setting value TM : Time multiplier(0.01 ~ 10.00)

Element	Curves	K	L	C
Phase/Ground Overcurrent (51/51N)	IEC Normal Inverse	0.14	0.02	0.00
	IEC Very Inverse	13.50	1.00	0.00
	IEC Extremely Inverse	80.00	2.00	0.00
	IEC Long Inverse	120.00	1.00	0.00
	ANSI Inverse	8.9341	2.0938	0.17966
	ANSI Short Inverse	0.2663	1.2969	0.03393
	ANSI Long Inverse	5.6143	1	2.18592
	ANSI Moderately Inverse	0.0103	0.02	0.0228
	ANSI Very Inverse	3.922	2	0.0982
	ANSI Extremely Inverse	5.64	2	0.02434
	ANSI Definite Inverse	0.4797	1.5625	0.21359
	KEPCO Normal Inverse	0.11	0.02	0.42
	KEPCO Very Inverse	39.85	1.95	1.08
	KEPCO Definite Normal Inverse	0.0515	0.02	0.114
Phase Overvoltage(59)	Inverse	10.5	1.75	0.00
Phase Undervoltage(27)	Inverse	8.0	2.2	0.00
Ground Overvoltage(59G, 64)	Inverse Trip	12.5	2	0.35
	Inverse Alarm	24.75	2.23	4.15

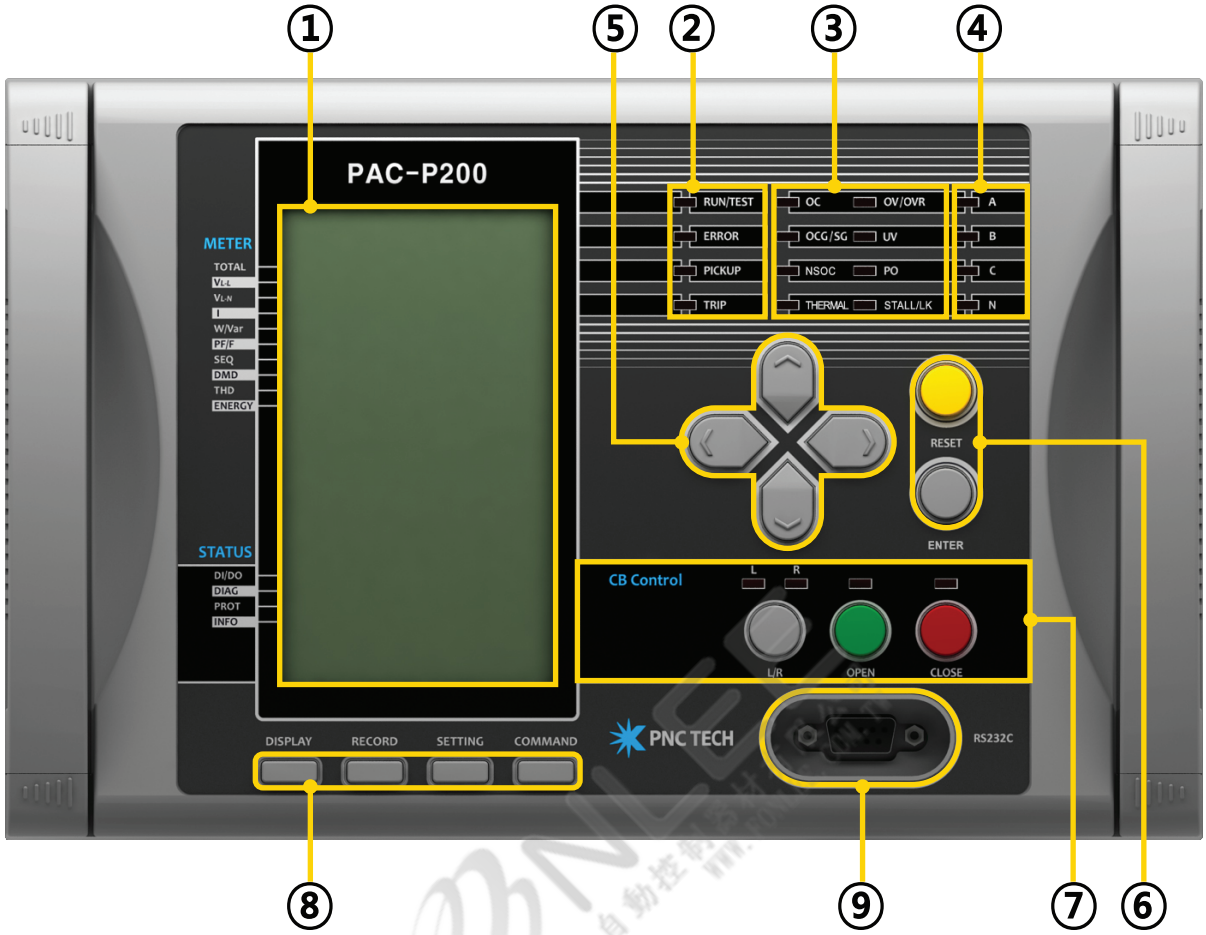
Overcurrent : Operation time is equal more 2000% and 2000% of setting value,
Overvoltage : Operation time is equal more 800% and 800% of setting value,
Ground Overvoltage : Operation time is equal more 800% and 800% of setting value,

Thermal overload protection(49) characteristic curve

HOT status	COLD status	Variables/Constants
$t = \tau \cdot ln \left[\frac{\left(\frac{I}{k \cdot I_N}\right)^2 - \left(\frac{I}{k \cdot I_N}\right)^2}{\left(\frac{I}{k \cdot I_N}\right)^2 - 1} \right] [\text{min}]$	$t = \tau \cdot ln \left[\frac{\left(\frac{I}{k \cdot I_N}\right)^2}{\left(\frac{I}{k \cdot I_N}\right)^2 - 1} \right] [\text{min}]$	t : Trip time τ : Time constant(min) I : Current input value I_N : Rated current Ip : Pre-load current k : Overload ratio

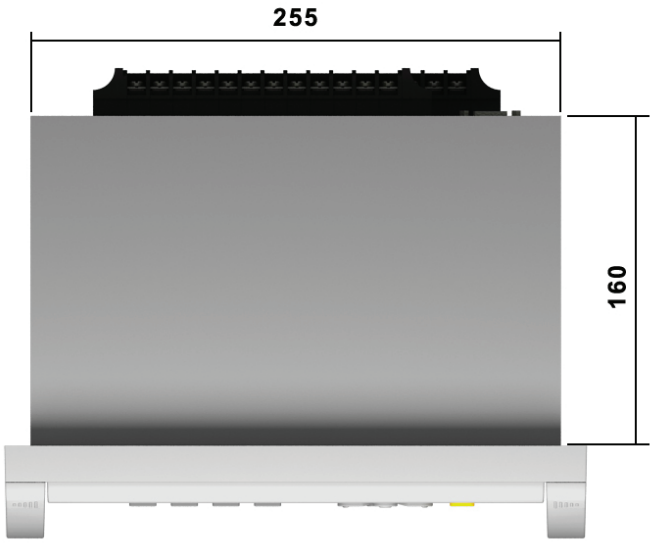
단, $\frac{I}{k \cdot I_N} > 8$ is equal operation time of $\frac{I}{k \cdot I_N} = 8$

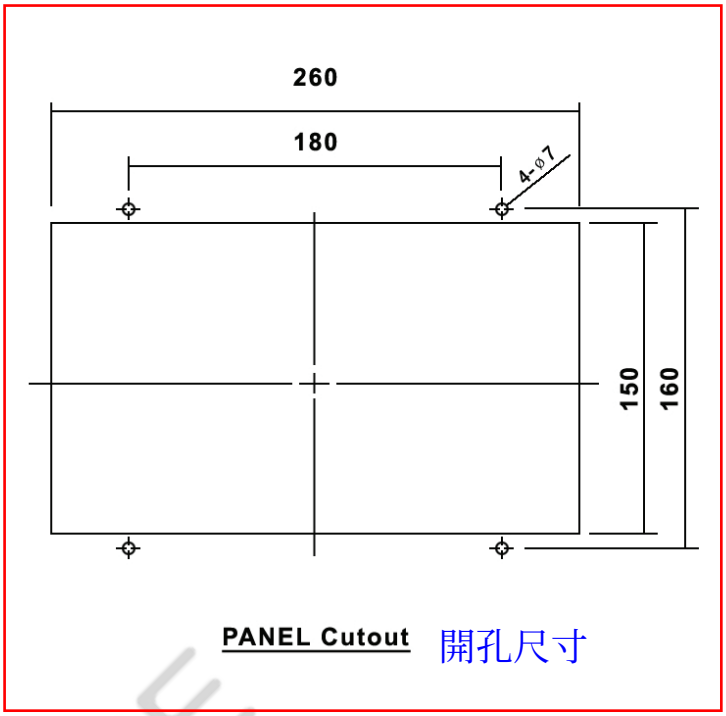
PAC-P200 Front Panel

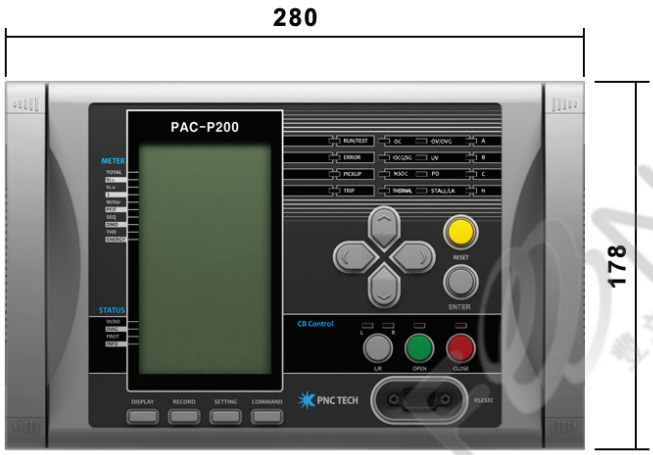


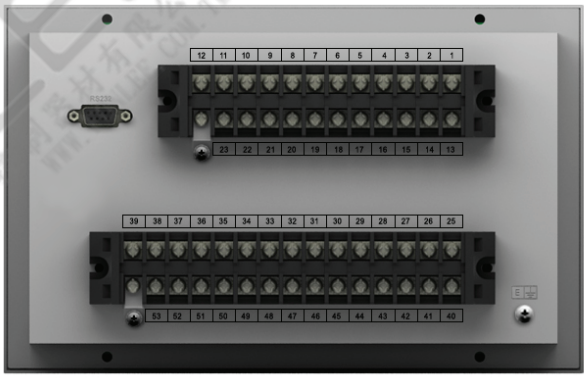
No.	Item		Function
①	128×240 Graphical LCD		Displays CB status, measurement values, and setting menu items.
②	Status LED		RUN/TEST, ERROR, PICKUP, TRIP status display
③	Protection element LED		OC, OCG, SG, NSOC, THERMAL, OV, UV, OVG, PO, STALL, Start status display
④	Phase LED		A, B, C, N each phase status display
⑤	Direction key		Menu direction control
⑥	Function	RESET	Manual Reset for protection elements and errors
		ENTER	Enters setting values and command menu
⑦	CB control	L/R	Local/Remote select
		OPEN	CB open
		CLOSE	CB close
⑧	Menu	DISPLAY	DISPLAY menu display
		RECORD	RECORD menu display
		SETTING	SETTING menu display
		COMMAND	COMMAND menu display
⑨	RS232C		Front RS232C communication port

PAC-P200 Dimensioned Drawings



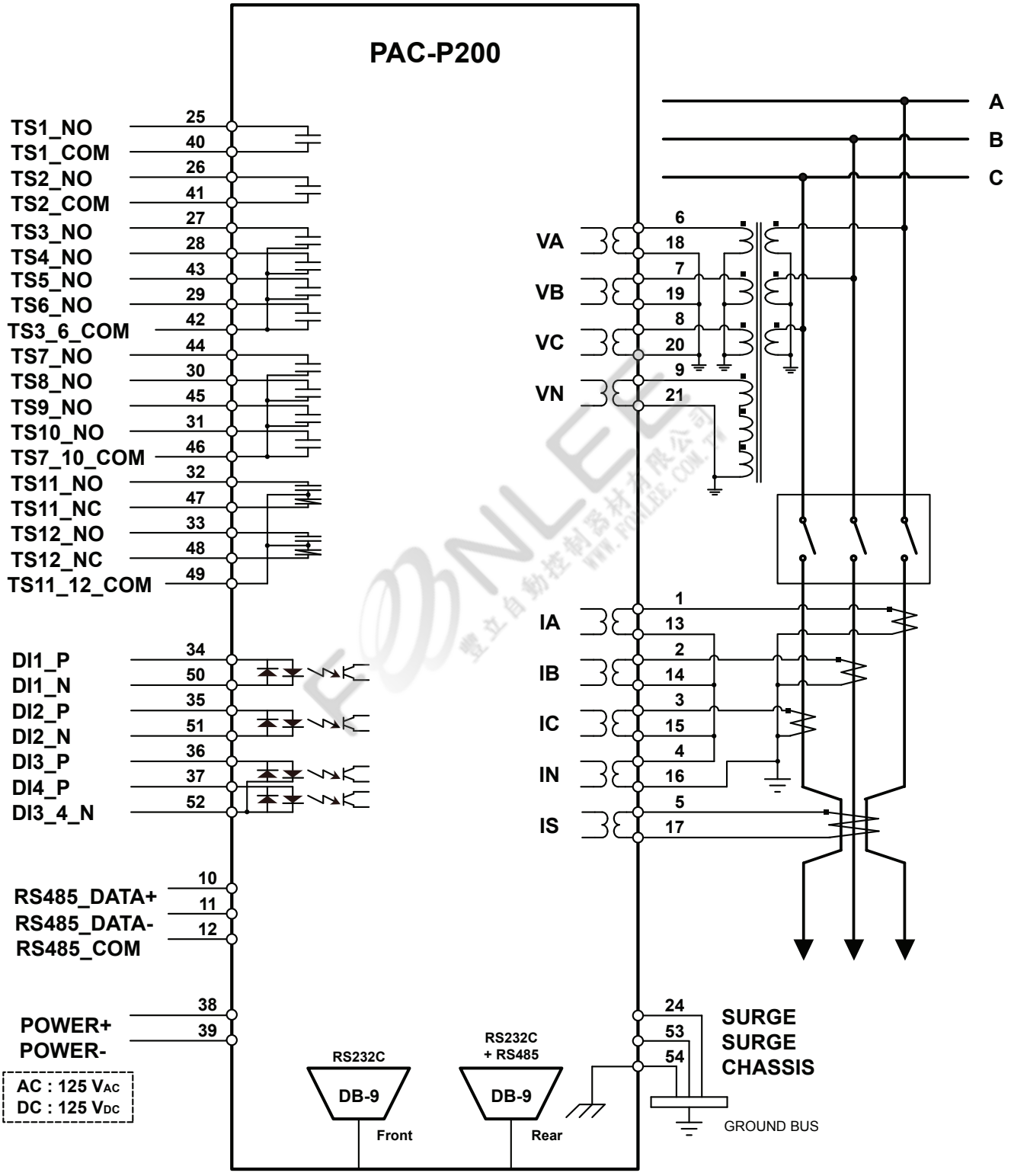






No.	Description	No.	Description
1	IA+	13	IA-
2	IB+	14	IB-
3	IC+	15	IC-
4	IN+	16	IN-
5	IS+	17	IS-
6	VA+	18	VA-
7	VB+	19	VB-
8	VC+	20	VC-
9	VN+	21	VN-
10	RS485_DATA+	22	--
11	RS485_DATA-	23	--
12	RS485_COM	24	SURGE

No.	Description	No.	Description
25	TS1_NO	40	TS1_COM
26	TS2_NO	41	TS2_COM
27	TS3_NO	42	TS3__6COM
28	TS4_NO	43	TS5_NO
29	TS6_NO	44	TS7_NO
30	TS8_NO	45	TS9_NO
31	TS10_NO	46	TS7_10_COM
32	TS11_NO	47	TS11_NC
33	TS12_NO	48	TS12_NC
34	DI1_P	49	TS11_12_COM
35	DI2_P	50	DI1_N
36	DI3_P	51	DI2_N
37	DI4_P	52	DI3_4_N
38	PWR+	53	SURGE
39	PWR-	54	CHASSIS


PAC-P200
TS1_NO
TS1_COM
TS2_NO
TS2_COM
TS3_NO
TS4_NO
TS5_NO
TS6_NO
TS3_6_COM
TS7_NO
TS8_NO
TS9_NO
TS10_NO
TS7_10_COM
TS11_NO
TS11_NC
TS12_NO
TS12_NC
TS11_12_COM
25
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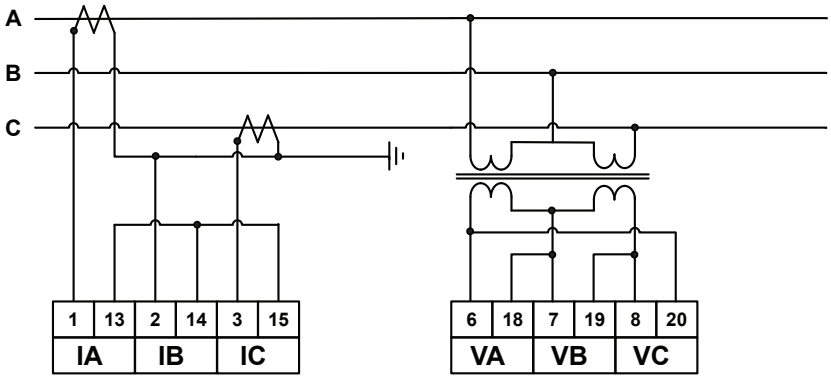
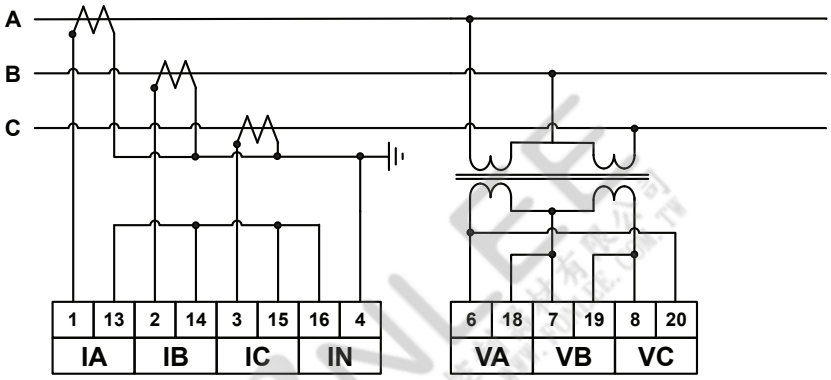
42
44
30
45
31
46
32
47
33
48
49
DI1_P
DI1_N
DI2_P
DI2_N
DI3_P
DI4_P
DI3_4_N
34
50
35
51
36
37
52
RS485_DATA+
RS485_DATA-
RS485_COM
10
11
12
POWER+
POWER-
38
39
AC : 125 VAC
DC : 125 VDC
RS232C
DB-9
Front
RS232C
+ RS485
DB-9
Rear
VA
VB
VC
VN
6
18
7
19
8
20
9
21
IA
IB
IC
IN
IS
1
13
2
14
3
15
4
16
5
17
A
B
C
24
53
54
SURGE
SURGE
CHASSIS
GROUND BUS

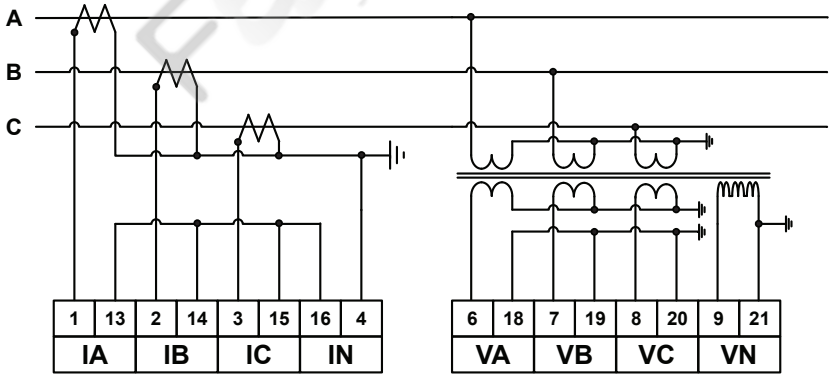
2PT2CT



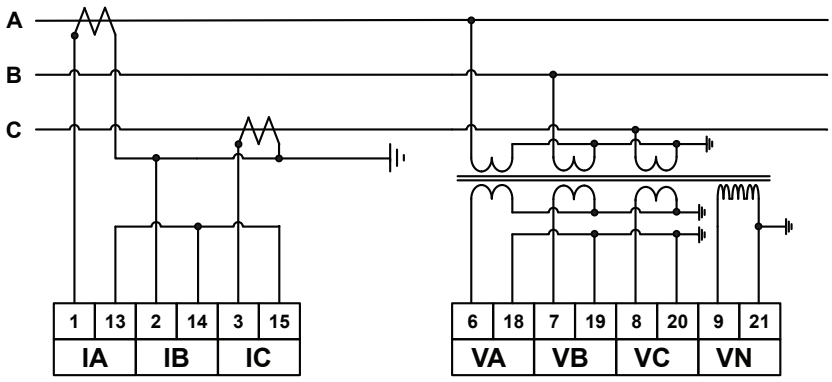
2PT3CT



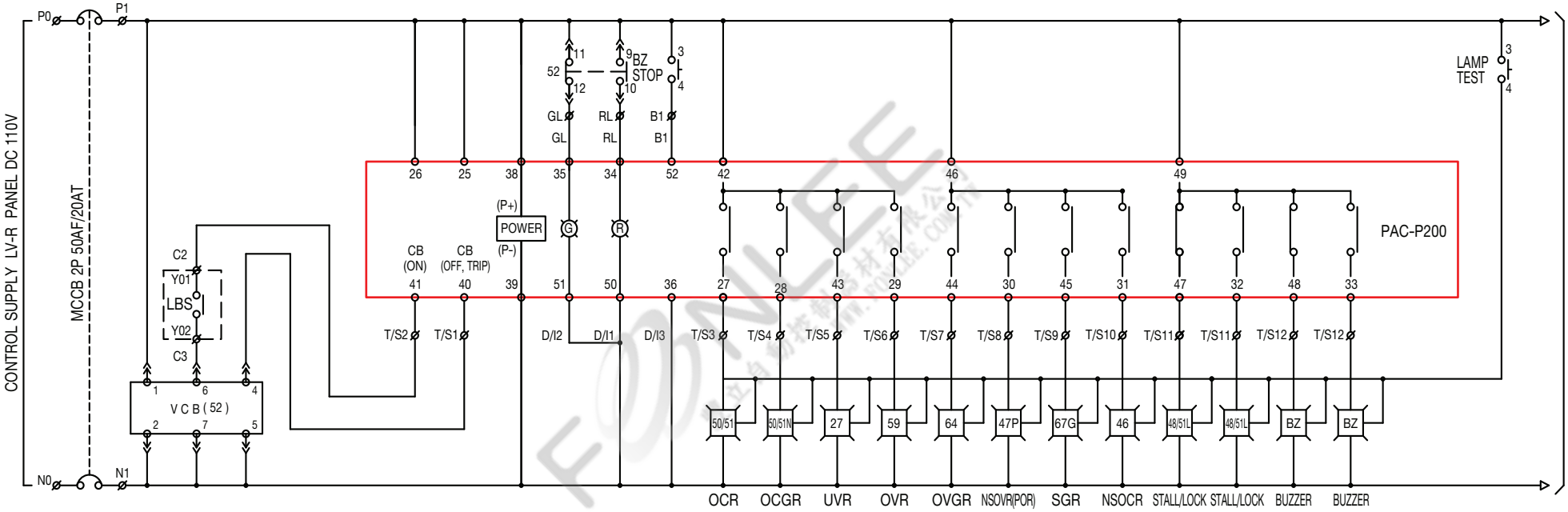
3PT3CT



3PT2CT



PAC-P200 The factory default sequence logic



1. The above is the sample drawing according to the factory default setting.
2. T/S1 is operated as CB open and the relay's total trip output.
3. Please press the 'RESSET' button to clear the panel lamp.
4. It would be changed according to the user's requirement.