

PD442

Over current Protection Relay

PD442
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Series



Catalogue

INDEX

S.No.	Description
1.	Introduction
2.	Features
3.	Application
4.	Hardware
5.	Protection Features
6.	Functional Diagram
7.	Fault Recording
8.	Human Machine Interface
9.	Communication
10.	Setting Ranges
11.	Technical Data
12.	Model Description Table
13.	Connection Diagram
14.	Dimensional Details
15.	Panel cut out Details
16.	Ordering Information

1) Introduction

PD442 Series offers a compact Over-current protection solution for distribution/feeder segment.

Pd442 Family of protective relays are numeric relays that provides protection and monitoring with reliable and fast protection solution in a single unit with programmable digital outputs.

2) Features

- ❖ Three Phase Time Over-current Protection.
- ❖ Three Phase Instantaneous Protection.
- ❖ 1A & 5A rated CT input (programmable).
- ❖ Earth Time Over-current And Earth Instantaneous Over Current.
- ❖ Circuit Breaker Failure Protection.
- ❖ Fault Recorder.
- ❖ Programmable Digital Output.
- ❖ USB Communication.

3) Application

The PD442 relays have been designed for controlling, protecting and monitoring industrial, utility distribution networks and substations. They can also be used as part of backup protection scheme for feeders, transformers and generators.

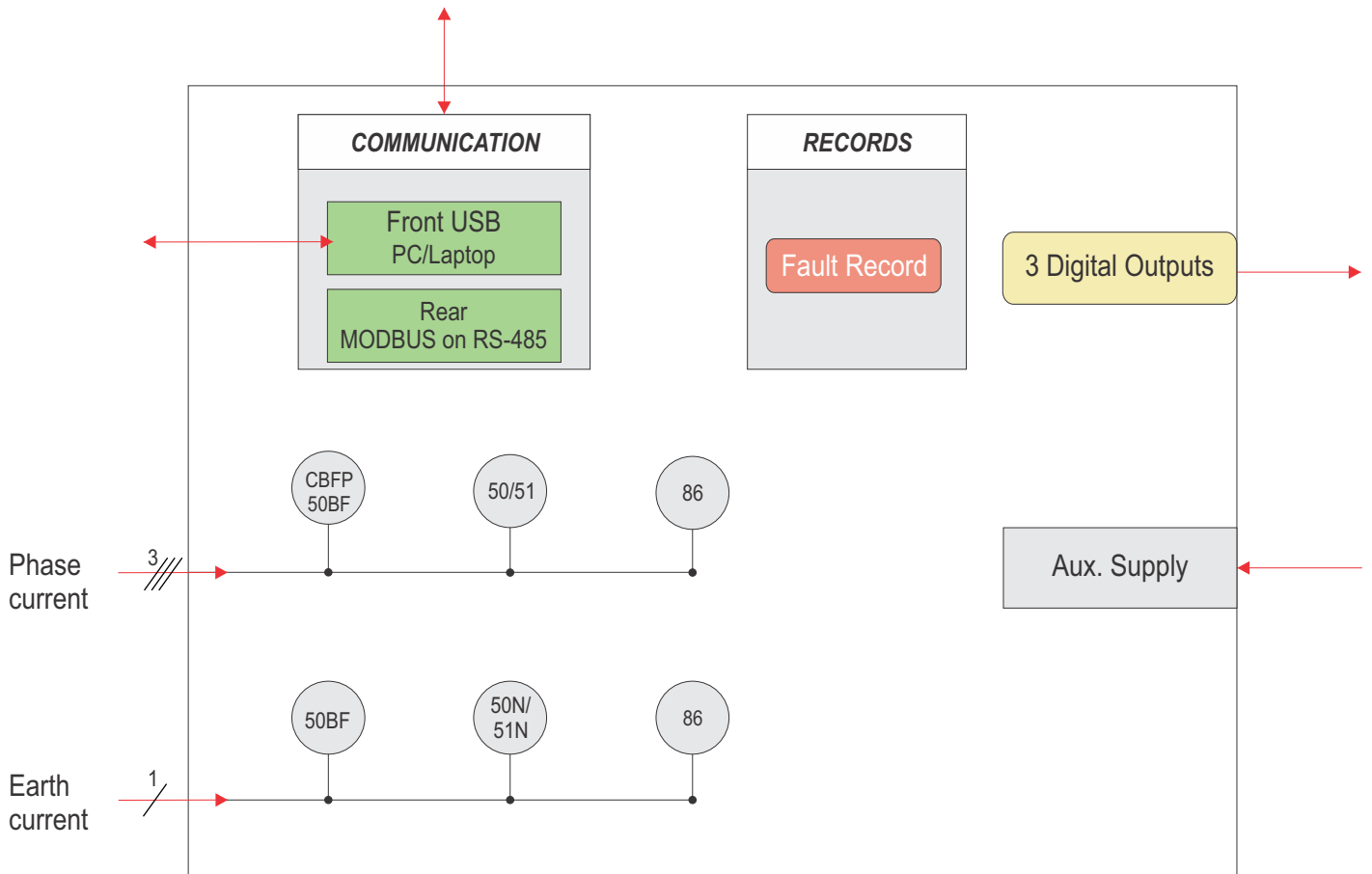
4) Hardware

- ❖ Micro Controller Based Numeric Design.
- ❖ Measures True RMS with DFT Filter .
- ❖ 4 Current Analog Inputs.
- ❖ Bright LCD Display.
- ❖ USB Communication.
- ❖ 3 Push Button on The Front For MMI.
- ❖ 15 LEDs for Annunciation.

5) Protection Features

- ❖ Three Phase Time Over Current Protection (51).
- ❖ Three Phase Instantaneous Protection (50).
- ❖ Earth Time Over-current (51N).
- ❖ Earth Instantaneous Over-current (50N).
- ❖ Circuit Breaker Failure Protection (50BF)

6) Functional Diagram



(Figure 1)

Protection Function

Three Phase Over-current Protection (50/51)

The independent two stages are available for phase fault protection. For first stage ($I>$) the user may independently select definite time delay or inverse time delay with different type of curves. The second Hi-Set stage ($I>>$) can be configured with definite time only.

Earth Fault Protection (50N/51N)

The independent two stages are available for earth fault protection. For first stage ($Ie>$) the user can select definite time delay or inverse time delay with different type of curves. The second Hi-Set stage ($Ie>>$) can be configured with definite time only.

Relay Latching (86)

Relay can be configured to Latch /Unlatch depending on configuration.
(Latching is possible in presence of Auxiliary supply voltage only)

Circuit Breaker Failure Protection (50 BF)

The CB Failure Protection is based on supervision of phase and earth currents after tripping events. The test criterion is whether all phase currents have dropped to less than 5% of I_n within t_{CBFP} . If one or more of the phase currents have not dropped to specified current within this time, CB failure is detected and the assigned output relay is activated.

Reset Delay

This parameter introduces a delay in opening of relay contacts, when the current goes below the drop out value for over current, short circuit and earth faults. This parameter will not work when manual reset mode is selected.

7) Fault Recording

PD442 records last 5 faults in its non volatile memory with it's time stamp. Each record has the following information:

Fault Format

IL1 : 00.00A
 IL2 : 00.00A
 IL3 : 00.00A
 Ie : 00.00A
 TRIP OC : L1/L2/L3/E
 TRIP SC : L1/L2/L3/E
 TRP CBF : CBFP
 TIM : HH:MM:SEC
 DAT : DD:MM:YY

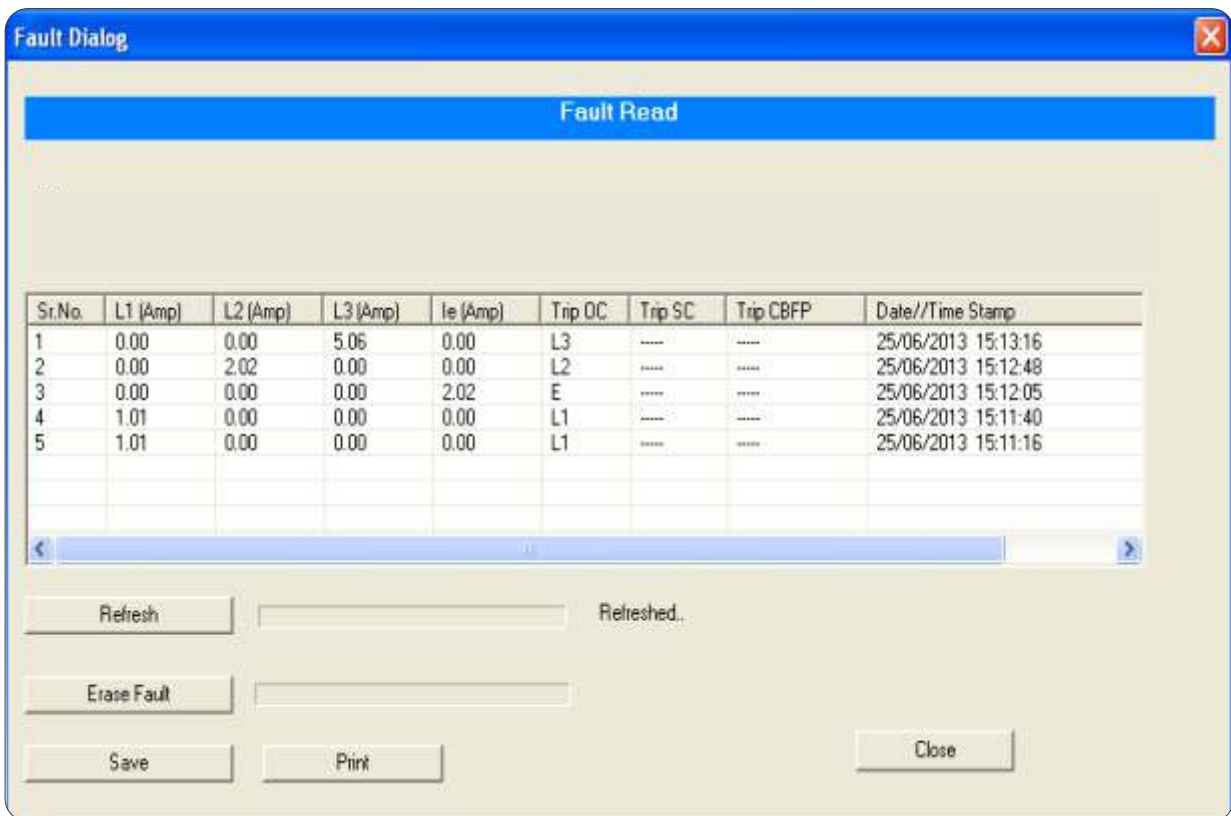
Where

[ILx] Magnitude of phase current's.

Ie Magnitude earth fault current's

FLT1 indicates the latest fault.

The user can view the fault record via the front USB interface software or remotely via RS-485 communication (See Figure 2).



(Figure 2) (Fault Data Recording on PC software)




Output Contact

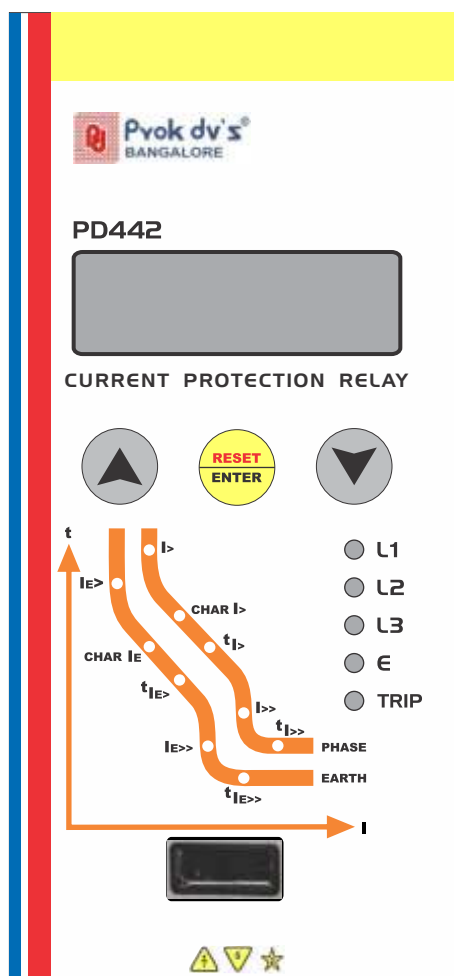
No. of Digital Outputs : 3 (DO1, DO2, DO3)
 Type of Outputs : Relay
 Programmable (DO Assignment) : Yes
 Relay Reset Type : Programmable (Auto/Manual)

8) Human Machine Interface

It comprises of bright LCD display

- ❖ Two push switches for setting values of normal tripping characteristics and other operations for local access.
- ❖ One 'RESET/ENTER' push switch.
- ❖ Fifteen LEDs.

Keys	Manual Key
	is used to manual reset (after pressing for 3 sec) and also works as ENTER key.
	is used to scroll in backward direction.
	is used to scroll in forward direction.



(Figure 3) (HMI)

9) Communication

The unit has:

- ❖ 1 Front USB port for direct connection to a PC
 - The entire setting, Fault is available on 'A to A' type USB (female) interface with saving & printing option. This unit also has Front-end simulation support for testing of relay even without any three phase injection source.
- ❖ Rear RS-485 Communication Port
 - Protocol for Rear port is MODBUS-RTU

10) Setting Ranges

PD442 Setting

S. No	Parameter	Display	Setting Range		Step Size	Default Setting
			Min.	Max.		
1	Phase over-current characteristics	P-Char			DEFT/EINV/VINV/ NINV1.3/NINV3.0 NINV0.6	DEFT
2	Earth over-current Characteristics	E-Char			DEFT/EINV/VINV /NINV1.3/NINV3.0/ NINV0.6	DEFT
3	Phase over-current low set pickup setting Phase over-current definite timing Phase over-current inverse timing	I> t> ti>	0.20xIp 0.1 Sec 0.01	2.5xIp 150 Sec 1.500	0.05xIp 0.01Sec 0.005	EXIT 0.10 Sec 0.05
4	Phase over-current hi-set pickup setting Phase over-current hi-set definite timing	I>> t>>	0.5xIp 0.03 Sec	25xIp 20 Sec	0.5xIp 0.01Sec	EXIT 0.10 Sec
5	Earth over-current low set pickup setting Earth over-current low set definite timing Earth over-current low set inverse timing	E> te> tie>	0.05xIn 0.03 Sec 0.01	2.5xIn 150 Sec 1.500	0.05xIn 0.01Sec 0.005	EXIT 0.10 Sec 0.05
6	Earth over-current hi-set pickup setting Earth over-current hi-set definite timing	E>> te>>	0.5xIn 0.02 Sec	15xIn 20 Sec	0.05xIn 0.01 Sec	EXIT 0.10 Sec
7	Circuit Breaker Failure protection definite timing	tCBFP	0.05 Sec	2 Sec	0.01 Sec	EXIT

$$\text{Very Inverse} \quad t = \frac{13.5}{(I/I_s) - 1} \quad t_i \text{ [s]}$$

$$\text{Extremely Inverse} \quad t = \frac{80}{(I/I_s)^2 - 1} \quad t_i \text{ [s]}$$

$$\text{Normal Inverse 3.0/1.3/0.6} \quad t = \frac{0.14/0.061/0.028}{(I/I_s)^{0.02} - 1} \quad t_i \text{ [s]}$$

Where t = Tripping time t_i = Time multiplier
 I = Fault current I_s = Setting value of current

Trip timing Accuracy : As per IEC-255-3 (2xIs to 20xIs)

DEFT / NINV 3.0 / 1.3 : $\pm 5\%$ OR $\pm 30\text{mSec}$ (whichever is higher)

VINV / NINV 0.6 /EINV : $\pm 7.5\%$ OR $\pm 40\text{mSec}$ (whichever is higher)

DO Assignment

S.No	Parameter	Display	Setting Range
1	Phase over-current low set	OC	DO1/DO2/DO3
2	Phase over-current hi-set	SC	DO1/DO2/DO3
3	Earth over-current low set	E	DO1/DO2/DO3
4	Earth over-current hi-set	EH	DO1/DO2/DO3
5	Self supervision	SelfSup	DO1/DO2/DO3
6	Circuit breaker failure protection	CBFP	DO1/DO2/DO3

DO Reset Mode

S.No.	Parameter	Display	Setting Range		Default Setting
			Min.	Max.	
1	Digital Output-1	DO 1	Auto	Manual	Auto
2	Digital Output-2	DO 2	Auto	Manual	Auto
3	Digital Output-3	DO 3	Auto	Manual	Auto

Note: DO assigned to CBFP is always manual reset.

Common Setting: (These are the settings common for all protections)

S.No.	Parameter	Display	Setting Range		Step Size	Default Setting
			Min.	Max.		
1.	Rated Phase current	Ip	1	5	-	1
2.	Rated Earth current	In	1	5	-	1
3.	Phase CT ratio	P-CTR	1	9999	1	1
4.	Earth CT ratio	E-CTR	1	9999	1	1
5.	Reset Delay	R_dly	0	20 Sec	0.1 Sec	0 Sec
6.	Fault popup	FitPpup	Enable	Disable	1	Enable

USB Communication

Protocol	:	Proprietary protocol: available with PC software
Cable required for interface	:	USB cable type (A to A)

Auxiliary Supply

Auxiliary voltage range	18-60V DC (for L Model) 85-280V AC / 100V-300V DC (for H model) 18V-150V DC (for W1 model)
Power consumption	Quiescent approx. 3W Operating <7W

RS-485 Communication

Protocol	:	MODBUS RTU
Baud rate selection (programmable)	:	9600 / 19200 / 38400 bps
Parity selection (programmable)	:	Even / Odd / None
Stop bit	:	1 Bit
Data bit	:	8 Bit data
Remote Address (programmable)	:	(1 to 247)
Cable required for interface	:	Two wire twisted shielded cable

Measurement Accuracy

S.No	Quantity	Range	Frequency Range	Accuracy
1	Current	1-20 x I _p	50 Hz	±2%

11) Technical Data

Measuring Inputs

Rated Data	Rated current I _p : 1A or 5A Rated frequency F _n : 50 Hz
Drop out to Pickup Ratio	>96%
	Power consumption in current circuit At I _p =1A 0.2 VA At I _p =5A 0.4 VA
	Thermal withstand capacity in current circuit Dynamic current withstand for 1 Sec : 100 x I _p for 10 Sec : 30 x I _p continuously : 4 x I _p
Protection-Front Panel	IP-54
Weight	Approx. 1.0 Kg

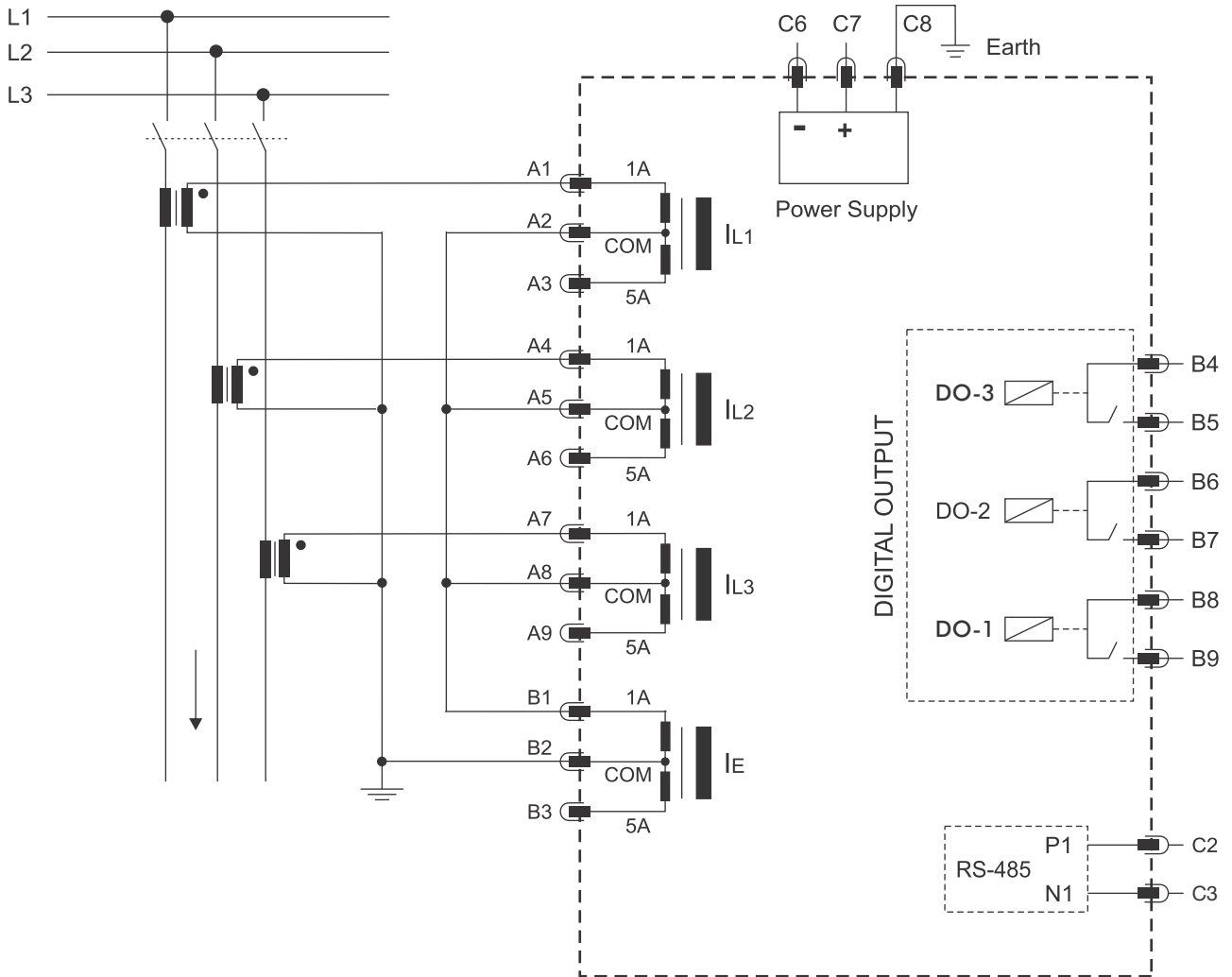
12) Model Description Table

Function	PD442
CT Inputs	4
Over Current (50/51)	✓
Earth Fault (50N/51N)	✓
CBFP (50BF)	✓
Digital Output	3
Fault Record	5
Selection of 1/5A	Site selectable
Enclosure Type	Non Draw-out
Front Communication	✓
Rear Communication	✓

13) Connection Diagram

(Three Phase & Earth Fault with Residual Connection)

PD442

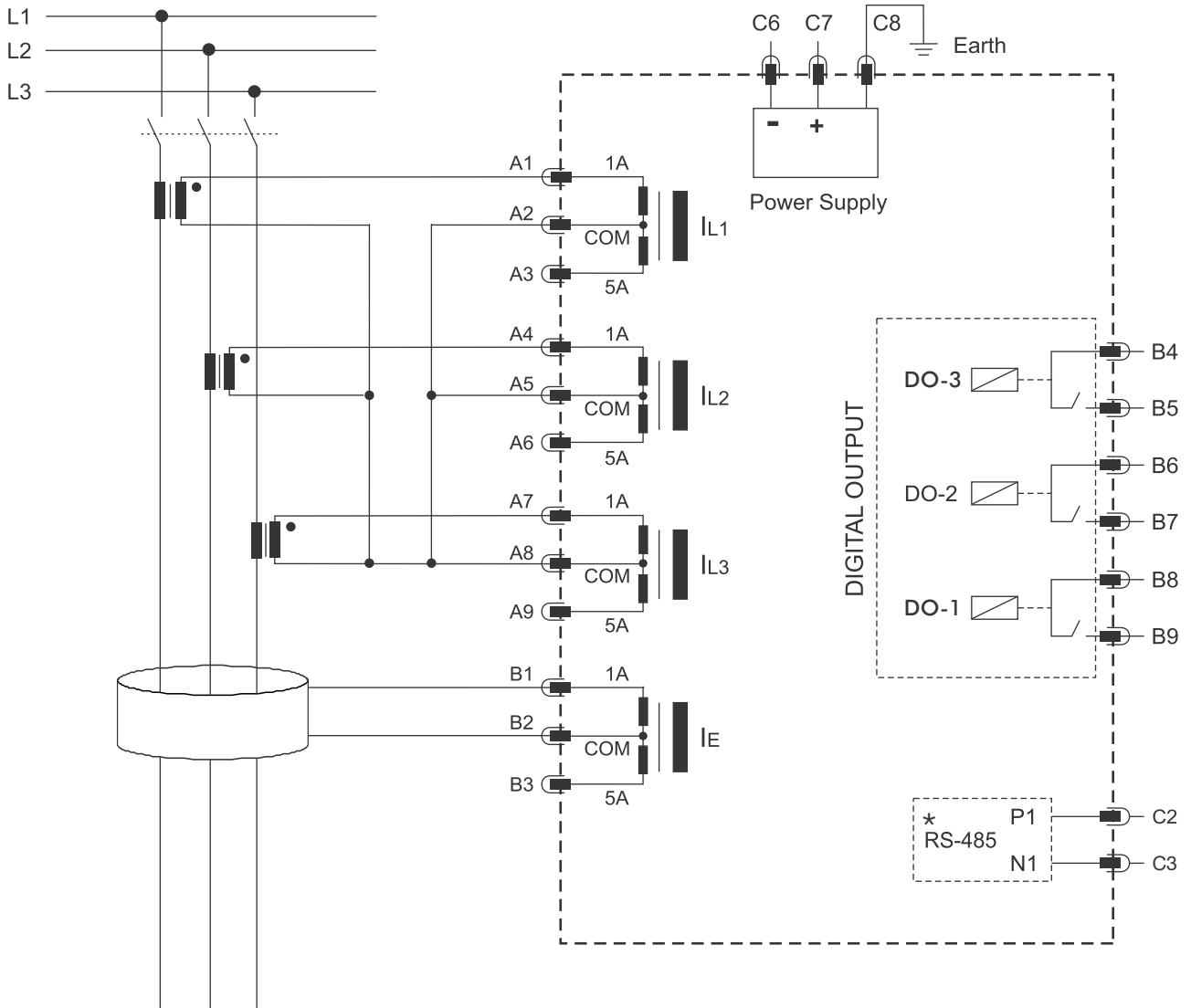


(Figure 4)

Connection Diagram

(Three Phase & Earth Fault with CBCT)

PD442



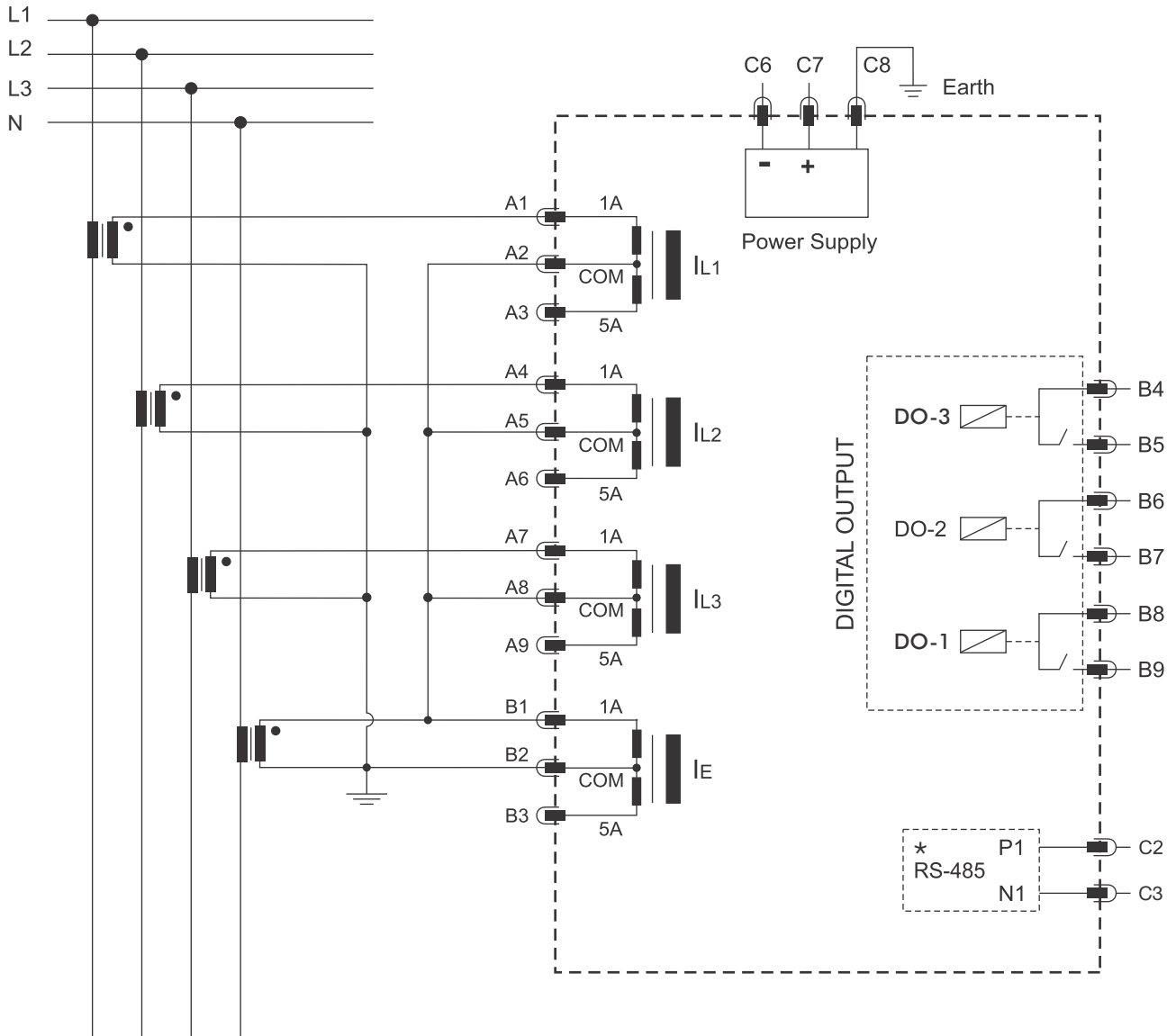
(Figure 5)

* = Model Dependent
 1A = Rated 1 Amp Model dependent
 5A = Rated 5 Amp Model dependent

Connection Diagram

(Three Phase Earth Fault with Neutral Protection)

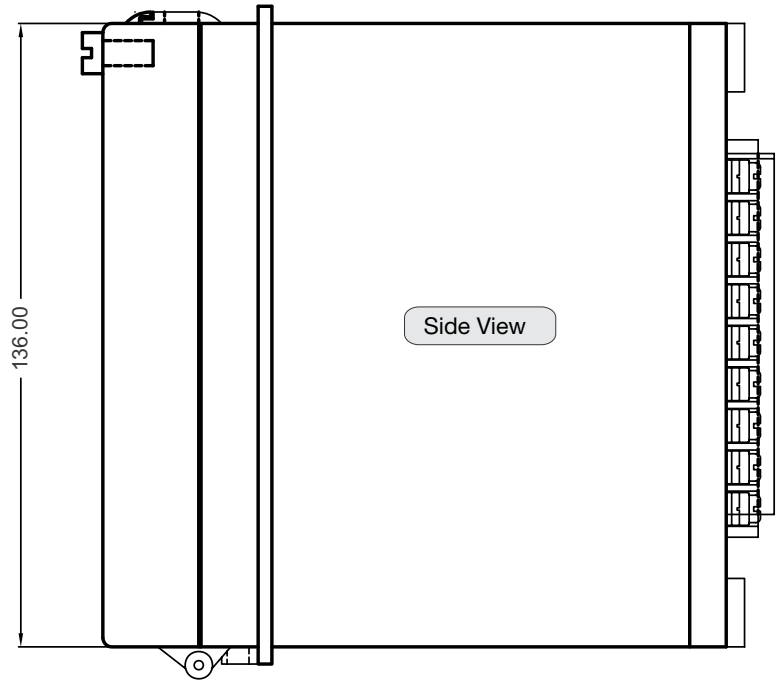
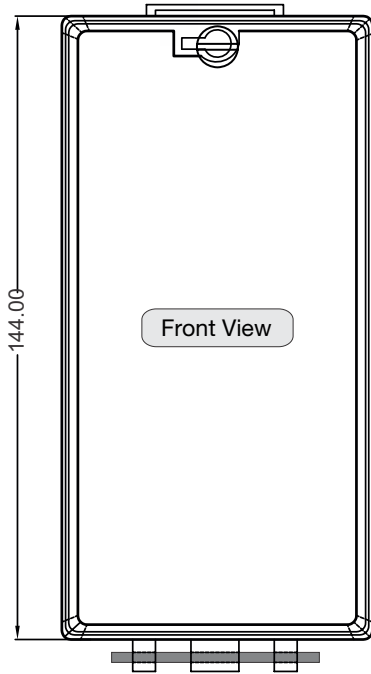
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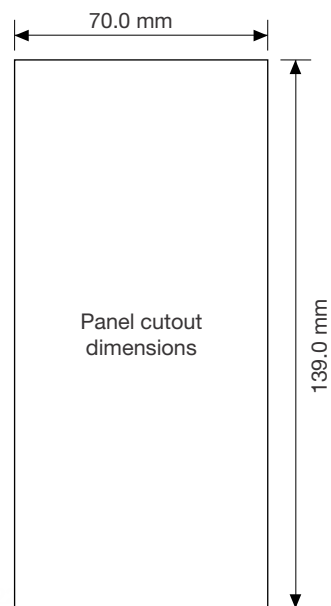
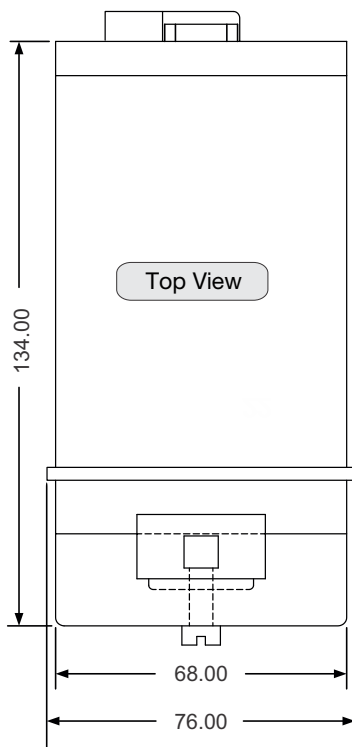
(Figure 6)

* = Model Dependent
 1A = Rated 1 Amp Model dependent
 5A = Rated 5 Amp Model dependent

14) Dimensional Details



15) Panel Cut out Details



16) Ordering Information

