

We touch your **electricity** everyday!

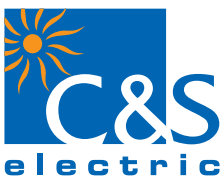
CSDPR-V2-400

Intelligent measuring & protection device



Catalogue

Draw out Relay



PMD Division

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1) Introduction

In the family of protection relay, CSDPR-V2-400 is numeric multi powered Over-current relay specially designed for ring main units & feeder protection. It combines the following functions in one unit:

- ❖ Draw-out with Self CT shorting
- ❖ Relay get energize either from Current, Aux. voltage, front USB or internal battery (whichever is available)
- ❖ O/C, S/C, E/F and E/F High set protection
- ❖ Cold load pickup protection
- ❖ Unbalance / Asymmetric protection
- ❖ Circuit breaker failure protection (50BF)
- ❖ Remote trip & Remote protection block input DI
- ❖ Two set of setting group
- ❖ DEFT & Inverse characteristics for O/C & E/F, individually selected for phase & earth fault
- ❖ Potential pulse output for direct triggering the circuit breaker coil. Potential free alarm contacts also available
- ❖ Wide operating ranges of Aux. supply voltage (AC/DC)
- ❖ Last 5 Fault and 10 Event record with Date & Time stamp
- ❖ USB port for PC / Laptop interface
- ❖ Rear port communication with RS-485

2) Design

Relay will get energized from any of the following available sources:

- ❖ Aux. supply
- ❖ CT current
- ❖ Internal battery
- ❖ USB port

Relay will operate its trip contacts only when CT current is present or Aux. supply is available, with other power sources, only the relay display/HMI will be available.

In the absence of Aux supply/Battery voltage/USB, LCD will get energized, if CT current is 10% of (single phase or sum of three phases) rated current or above. Trip coil will be operated, if CT current in single phase is at least 10% of rated current or 8% of rated current in three phases. Relay is not powered from Earth CT, so for earth fault protection, phase current is mandatory.

Note: Battery works when no other supply is present i.e. in the absence of Aux Supply & Current.


2.1 Operation

The CSDPR-V2 is a CT operated protection relay with inverse time and definite time protection characteristics.

CSDPR-V2 works with standard CTs with secondary current and with defined VA burden.

CSDPR-V2 provides following protection functions:

- ❖ 3 Phase definite time over current and short circuit protection with variable tripping times (ANSI 50/51)
- ❖ 3 Phase over current protection with selectable inverse time characteristics and definite time short circuit current element (ANSI 50/51)
- ❖ Definite time and inverse time earth over current protection (ANSI 50N/51N)
- ❖ Cold Load Pickup
- ❖ Circuit Breaker Protection

Note: Relay goes into sleep mode, user has to press  key to see the display.

Design

2.2 Analog Input

The analog input signal of the CT secondary currents as per the terminal detail in Section 9, are fed to the protective device via separate input transformers. The continuously measured current values are galvanically isolated, analog & digitally filtered and finally fed to the analog/digital converter to get the True RMS value.

2.3 Front Panel

The front panel of the protective device CSDPR-V2-400 comprises the following operation and indication elements:

- ❖ Big LCD display with Bright white light
- ❖ Keypad for setting of the parameters of the relay
- ❖ 8 LEDs for fault annunciation & 1 LED for Trip Ready & hardware error annunciation

2.4 Keypads

The front panel keypad consists of six soft-touch keys. These keys are marked as “◀”, “ENTER”, “▶”, “RESET”, “💡” and “ON”. The “RESET” key provides reset function to the relay & “ENTER” act as Enter key for MMI. The keys marked “◀” and “▶” are meant for backward & forward scrolling respectively and also used for decrementing & incrementing the selected parameter value.

“💡” key is used to ON the LCD. When available source (Aux supply, CT current, USB port) is present and no key is pressed for 1 min then LCD gets off.

“ON” Key is used to ON the LCD when the available source is only battery.

NOTE: Under Self powered condition (i.e. absence of Auxiliary Supply), Back light will be available in product if current is more than 20% in all phases or 40% in single phase by pressing “💡” Key.

2.5 LEDs

There are 09 LEDs on the front panel. Their functions are indicated by the appropriate inscriptions along with them. L1, L2, L3, E, Pickup, Trip, Block & CBFP LEDs are with memory backup & they will maintain the previous status until fault is acknowledged through manual reset. The working is equivalent to a digital flag as unit contains a battery inside.

There is one bi-color LED. “Ready/Healthy / HW Error” LED flashes green when it has sufficient energy to operate the Trip coil. Red is the steady indication of the HW Error.

“BLOCK” LED indicates the protection (selected in DI block menu) is blocked, when Block Digital Input is active. It also indicates Harmonic blocking.

2.6 Fault Recording

CSDPR-V2-400 records last 5 Faults. In Fault, it saves following information:

Value at fault	:	L1, L2, L3, E in Amps
Type of fault	:	SC / OC / U0> / CBFP
Time stamp	:	HH:MM:Sec
Date stamp	:	DD:MM:YY
Trip time of fault	:	xxxxxx Sec

2.7 Event Recording

CSDPR-V2-400 records last 10 events. It saves following information:

Event Type	:	01
Date	:	DD:MM:YY
Time stamp	:	HH:MM:Sec

* Event Type = 01 (Power ON)

Design

2.8 Trip Output

In presence of Aux supply:

4 Potential Free contacts and 1 Potential O/P (24V/12V@0.2Ws/50msec ON Pulse). Duty cycle will depend upon the strength of available current.

In presence of only adequate CT current:

2 Potential free latch contact and 1 Potential Output (24V/12V@0.2Ws/50msec ON Pulse). Duty cycle will depend upon the strength of available current.

Average 10% of the rated current must required in the phases to trip the breaker.

● **NOTE: Magnetic Trip Flag can be used in parallel to trip Output Contacts Terminal (A6/A7)**

2.9 Assignment of the Output Relays

CSDPR has 4 output relays. Two latch relay (Relay-3 & Relay-4) is available in all models. Two extra programmable output relays (Relay-1 & Relay-2) available only with auxiliary supply. Relay reset operation can be configurable in automatic reset or manual reset mode from MMI. In automatic reset mode relay will be reset after the current goes below the pickup level. In manual mode relay will be reset by pressing reset button.

*Auto/Manual option is not applicable for latch relay.

NOTE: Latch Contact (Relay-3 & Relay4) will get actuate only in presence of fault current. RESET of latch contact is possible under presence of energizing current or Auxiliary supply Or presence of battery.

2.10 Potential Input

Two Potential DIs are available for control. These DIs can be used as Remote Block & Remote Trip.

DI 1 : Remote block for 50/50N/51/51N & unbalance protection (U₀>)

DI -2 : Remote trip

DI-1 : Blocking the protection functions

When this input, becomes high it will block the selected protections such as OC/SC/Earth/Earth-high set/ U₀>. The selection of protections for blocking is done from MMI. Blocking will remain active till the potential is available on DI terminal.

DI-2: Remote Trip

Irrespective of any pickup or fault user can trip the Circuit breaker, by applying voltage to Remote trip DI.

3) Communication

3.1 RS-485 Communication

The CSDPR-V2-400 includes an RS-485 communication on rear port This port is available for MODBUS protocol. CSDPR-V2-400 relay has feature to transmit the data such as settings, measurements and faults to the SCADA system. For this communication auxiliary supply is required. A communication failure dose not affects protection function.

3.2 USB Front Communication

The front USB communication port is designed for "CSE LIVELINK" for which the front end Software is provided. The S/w has features of retrieving the records and changing the settings.

Note: Relay is plug & play on USB port. It automatically get energizes from USB port itself.

4) Protection Functions

CSDPR-V2-400 offers 50/51/50N/51N/Unbalance/CBFP protections.

Over-current Characteristic: DEFT/VINV/EINV/ NINV3.0/ NINV1.3/LINV/RI/HV-FUSE

Unbalance Protection(46):

This is provided by the relay tripping in phase unbalance greater than setting % difference in terms of maximum phase current U_0 : $[(IMAX- IMIN)/ IMAX] \times 100[\%]$

Circuit Breaker Failure Protection [CBFP]

The C.B. failure protection is based on supervision of phase current during tripping events. This protective function becomes active only after tripping. The criteria is whether all phase currents are dropped to $<5\% \times I_N$ within set time of t_{CBFP} . If not, then CB failure is detected and the assigned relay is activated. Annunciation relay for CBFP only manually reset.

Cold Load Pickup

In CSDPR-V2 unit, this feature is provided to avoid non desired trips, when line de-energized for a period of time and re-energized later, the load exceed the protection setting without the presence of a fault. To avoid such condition, CSDPR-V2 switches from one protection setting group to another setting group for settable time. After expiry of settable time, it will shift back to original group.

Harmonic based Protection Blocking

To avoid any nuisance tripping, CSDPR-V2 provides harmonic detection & protection blocking feature above 25% and takes 4 cycle to sense the harmonic injection. Relay will hold the tripping for a set time, If harmonic is present with protection pickup. Blocking time & harmonic selection is configurable in the relay.

5) Display Mode

CSDPR-V2-400 works in two modes (AutoOFF/Live)

AutoOFF Mode: LCD gets on by pressing back light key & gets off after 1 minute if no key is pressed.

Live Mode: LCD remains on as long as auxiliary supply / phase current is available.

6) Battery Pack

CSDPR-V2-400 comes with internal Li battery pack, which energizes its LCD display to view and set the parameters at the time of initial installation especially when the current/voltage is not available in the RMU. This battery has a life & so it is not meant for long future use. Whenever operator is going at RMU site to fetch the fault record Or to edit/view the settings, we recommend to carry external USB power pack, which will get plugged to front USB of the relay. User can operate the relay using USB power source. We offer rechargeable USB Power Pack as accessory; however user can use any USB power source to energize the relay from USB.

Note: CSDPR-V2-400 will not charge the battery.

7) Setting Ranges

7.1 Protection Settings

Parameter	Display	Setting Range	Step
CT Ratio for primary current display	Ct Rt	1-2500	1
Frequency	Freq	50/60Hz	1
Phase Characteristics	PChr	DEFT, EINV, VINV, NINV3.0, NINV1.3 LINV, RI, HV-FUSE	1
Earth Characteristics	EChr	DEFT, EINV, VINV, NINV3.0, NINV1.3 LINV, RI, HV-FUSE	1
1 st Stage phase pickup	l>	0.1 – 2.5 x IN	0.01 x IN
DEFT Trip time for 1 st stage over-current	t>	0.1 –150 s	0.01 s
Inverse TMS for 1 st stage phase over-current	ti>	0.01 – 1.500	0.005
2 nd Stage phase pickup	l>>	0.5 – 30 x IN	0.05 x IN
2 nd Stage phase trip time	t>>	0.03 – 20 s	0.01 s
Earth fault 1 st stage pickup	le>	0.05 - 2.5 x IN	0.01 x IN
DEFT trip time for 1 st stage earth fault	te>	0.05 - 150 s	0.01s
Inverse TMS for 1 st stage earth fault over-current	tie>	0.01 – 1.500	0.005
2 nd Stage earth fault pickup	le>>	0.5 – 15 x IN	0.05 x IN
2 nd Stage earth fault trip time	te>>	0.04 – 20 s	0.01s
Phase unbalance pickup	Unb	5 - 80%	1%
Phase unbalance trip time	tUnb	0.1-150 s	0.01 s
Enable CBFP protection	CBFP	YES / NO	-
CBFP time	tCBFP	0.05-2.0 s	0.01 s

7.2 Group Setting

Parameter	Display	Setting Range
Group No.	ACT.GRP	Group1 / Group2

7.3 Cold Load pickup Setting

Parameter	Display	Setting Range	Step
Selection of Cold Load Protection	CldLdPr	DISABLE/ENABLE	-
Cold Load Active Time	tCdLd	0.1 Sec -20 Sec	0.01 Sec

7.4 Protection Harmonic Block Settings

Parameter	Display	Setting Range	Step
Selection of Harmonic in Phase	PhHrmnc	2nd, 3rd, 5th & 7th	-
Selection of Harmonic in Earth	ErtHrmn	2nd, 3rd, 5th & 7th	-
Blocking Time in Phase Harmonic	PTmBk	0.10 Sec -20.00 Sec	00.01 Sec
Blocking Time in Earth Harmonic	ETmBk	0.10 Sec -20.00 SEc	00.01 Sec

7.5 Display Mode Setting

Parameter	Display	Setting Range	Step
Display Mode	MOD	AutoOFF/Live	1

7.6 Relay Assignment

Parameter	Display	Setting Range
Over current	I>	DISABLE/RLY1/RLY2/RLY1RLY2
Short Circuit	I>>	DISABLE/RLY1/RLY2/RLY1RLY2
Earth Low set	Ie>	DISABLE/RLY1/RLY2/RLY1RLY2
Earth High set	Ie>>	DISABLE/RLY1/RLY2/RLY1RLY2
Unbalance	Unb	DISABLE/RLY1/RLY2/RLY1RLY2
Circuit Breaker Failure Protection	CBFP	DISABLE/RLY1/RLY2/RLY1RLY2
Digital Input	Remote	DISABLE/RLY1/RLY2/RLY1RLY2
All Fault	AIFIt	DISABLE/RLY1/RLY2/RLY1RLY2

7.7 Relay Reset

Parameter	Display	Setting Range
Digital output1	RLY1	Auto/Manual
Digital output2	RLY2	Auto/Manual

7.8 DI Blocking

Parameter	Display	Setting Range
Phase Over current Low set	I>	Unblock/Block
Phase Over current High set	I>>	Unblock/Block
Earth Over current Low set	Ie>	Unblock/Block
Earth Over current High set	Ie>>	Unblock/Block
Unbalance	Uo	Unblock/Block

7.9 Trip Type

Parameter	Display	Setting Range
Mode of tripping	Trip Type	TRIP COIL/LATCH RLY/DUAL

7.10 Rear Port Communication Setting

7.10.1 RS-485 Communication

Parameter	Display	Setting Range
Slave Address	SLV Add	1-32
Baud Rate	BD Rate	9600/19200
Parity	Parity	NONE/EVEN/ODD

7.10.2 Front USB Port

Front Port	CSE protocol with “CSE LIVELINK” on mini USB cable
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7.11 Technical Data

7.11.1 General Data

Rated auxiliary voltage UH	Universal:	L: (18V - 60V DC)
		H: (85V - 260V AC / 110V to 300V DC)
Voltage Range for DI-1 (Remote Block)	Normal voltage UN	Active: (35V - 260V AC/DC) Inactive: < 18V AC/DC
Voltage Range for DI-2 (Remote Trip)	Normal voltage UN	Active: (80V - 260V AC/DC) Inactive: < 30V AC/DC
Power consumption of Aux supply	Quiescent approx. 3W	Operating approx. 6W
Dropout pickup ratio	> 95 %	

7.11.2 Measuring Input

Rated data	Rated current I _N (1A)
Frequency	F _N : 50/60 Hz

VA Burden: (2.5VA @ Rated Current)

7.11.3 Thermal Withstand Capacity

Thermal withstand capacity for I _N =1A	Continuously	2.5A
	10s	15A
	1s	80A

7.11.4 Accuracy

Tripping times with pre fault	DMT : $\pm 5\%$ of the setting value or ± 40 mSec
	IDMT : Accuracy as per IEC-255-3 (2 x I _s to 20 I _s)
	For VINV / NINV/RI : $\pm 5\%$ or ± 40 mSec
	For LINV/EINV/HV-Fuse : $\pm 7.5\%$ or ± 60 mSec
Pickup accuracy	+5%
Boot up time in self powered mode	≤ 100 mSec
	(with Event Recorder ≤ 300 mSec)

7.11.5 Measurement Accuracy

Description	Range	Frequency Range	Accuracy
Current	1.0 - 30 xI _p	50 / 60 Hz	$\pm 2\%$

7.11.6 Output Contact (Relay Specs)

Number of relays	4
Relay contacts (RLY: 1, 2) configurable & available only with Auxiliary supply model	Relay 1 and 2 are user programmable for I>, I>>, Ie> and Ie>>, CBFP, Unbalance (U0>)
Relay contacts: 3, 4 (available in all models)	Latch type of relay common for all protection trip
Max. breaking capacity	1250VA / 150W resistive
	500VA / 90W inductive
Max. breaking voltage	400V AC, 125 VDC
Max. continuous AC current	5A

7.11.7 Certified Type Test

Environmental conditions

(Recommended ambient temperature range)

Operating temperature range: Continuous withstand -25°C to +60°C Limit (Note-1) -25°C to +70°C.

Storage temperature Range: -25°C to +70°C

Note: The upper limit is permissible not for continuous period.

Mechanical Environment

Vibration Test : IEC 60255-21-1, class 2. Shock : IEC 60255-21-2, class 1.

S.No	Description of Test	Standard
1	Insulation test	IEC 60255-5
2	Di-electric test	IEC 60255-5
3	5 KV impulse voltage test	IEC 60255-5
4	High freq. interference test severity class 3	IEC 60255-22-1
5	Radio interference suppression test	EN55011 cl 5.1.2
6	Radio interference suppression test	EN55011 cl 5.22.2
7	Radiated radio frequency electromagnetic field immunity test	IEC 60255-22-3
8	Conductive RF immunity test	ENV50141
9	Surge immunity	EN61000.4.5
10	ESD test severity class 3	EN61000-4-2
11	Fast transient disturbance test	IEC 60255-22-4
12	Power frequency magnetic field immunity test	IEC 61000-4-8

7.11.8 Tripping Characteristics (IEC 255-3 or BS 142)

$$\text{Normal Inverse 3.0/1.3} = \frac{0.14/0.06}{(I / I_s)^{3.0} - 1} \text{ ti [s]}$$

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

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

I: Injected current

I_s: Pickup set level

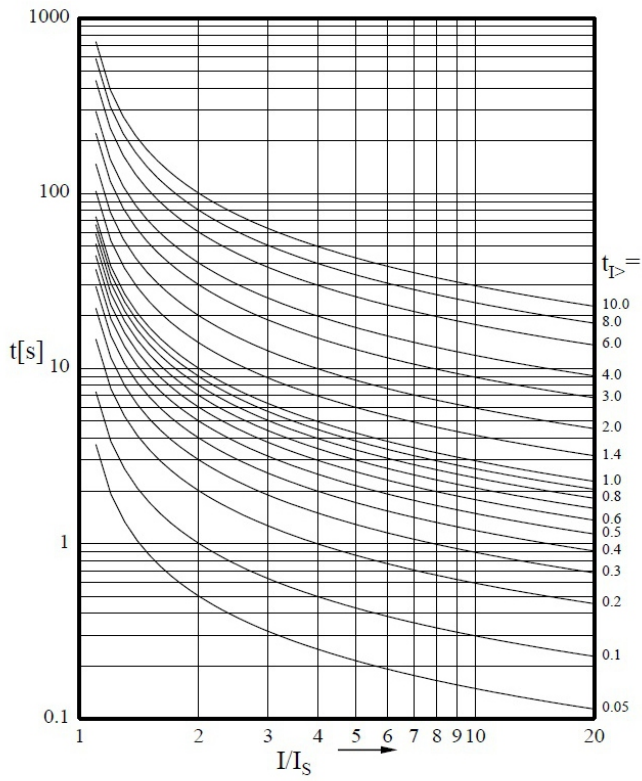
t_i: TMS for inverse characteristic

t: Definite delay in DEFT characteristic

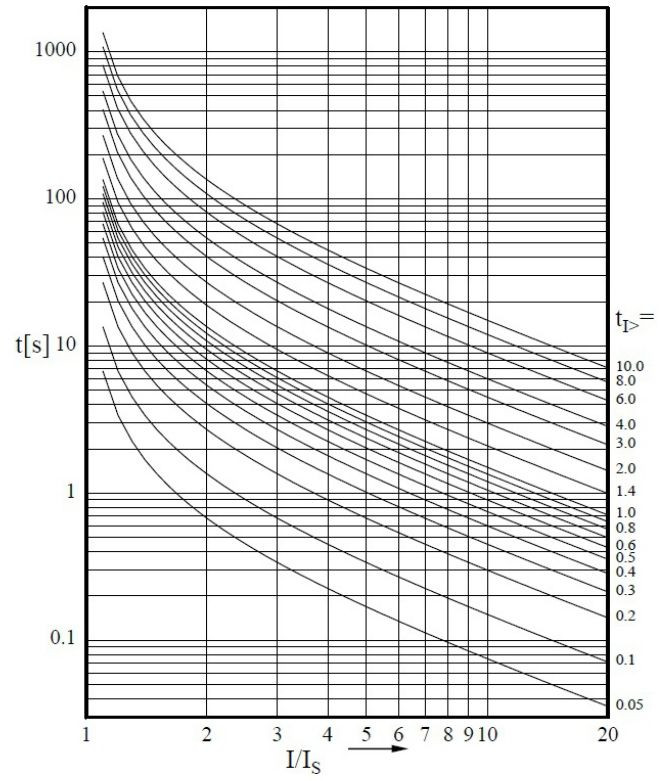


8) Inverse Graph Representation

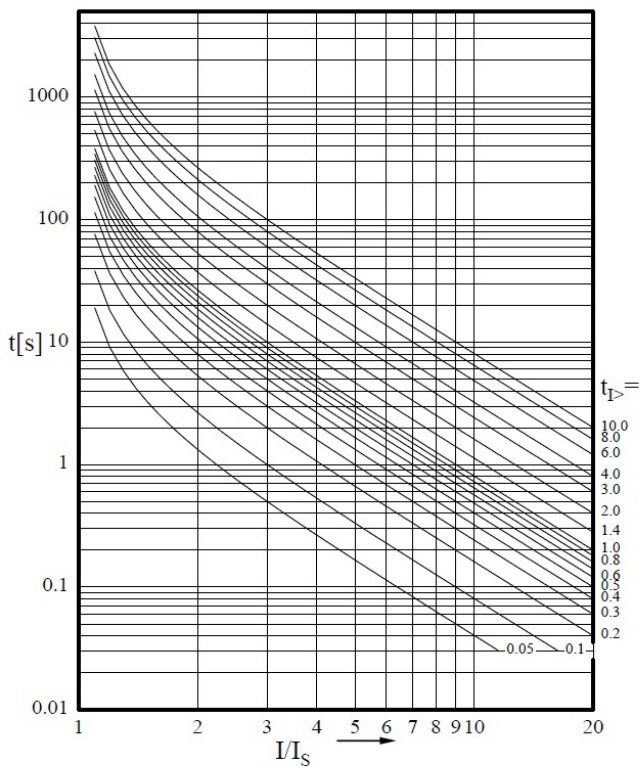
Inverse Time Characteristics



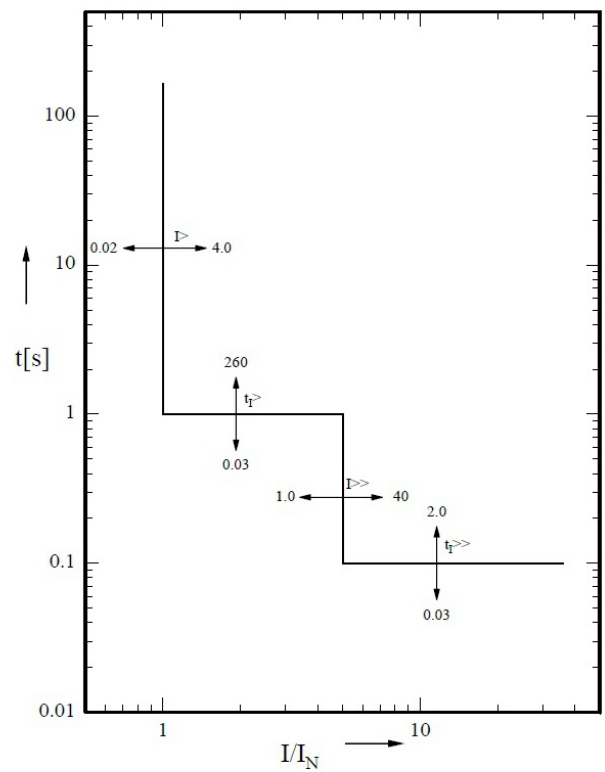
Normal Inverse



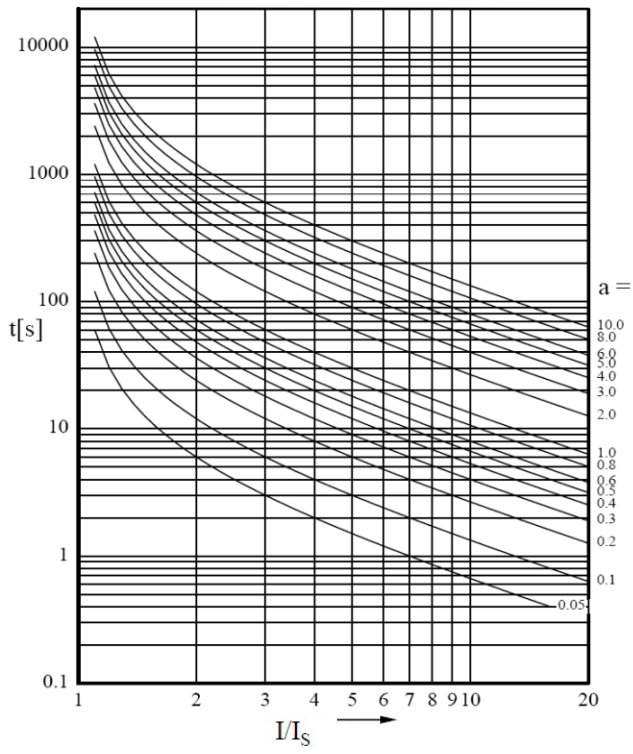
Very Inverse



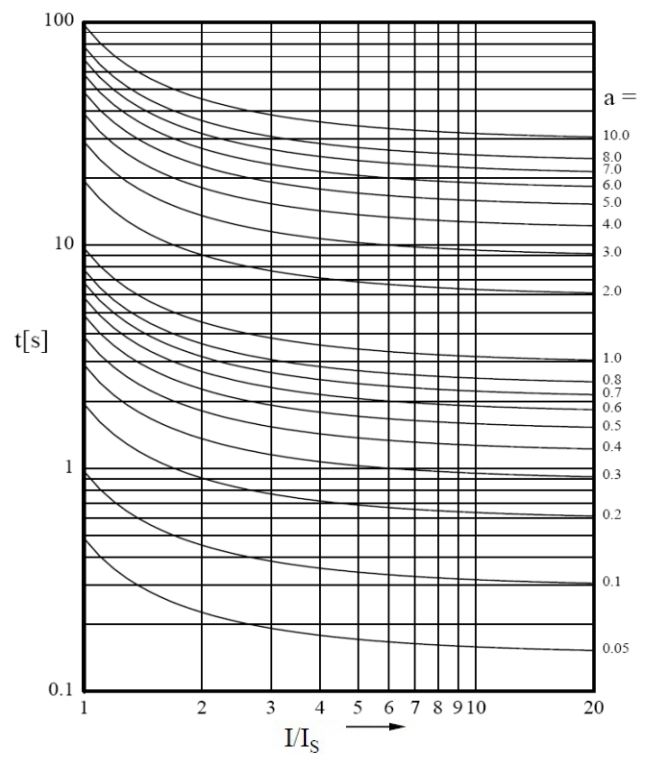
Extremely Inverse



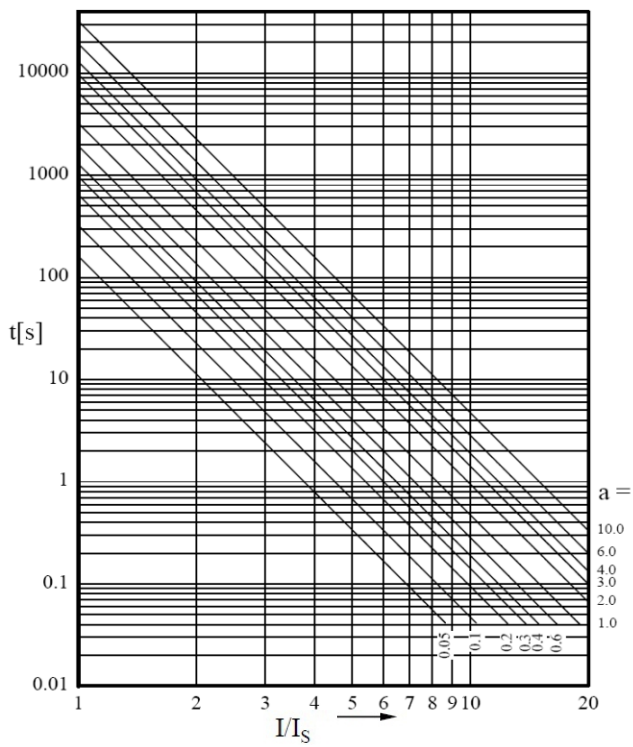
Definite time overcurrent relay



Long time inverse

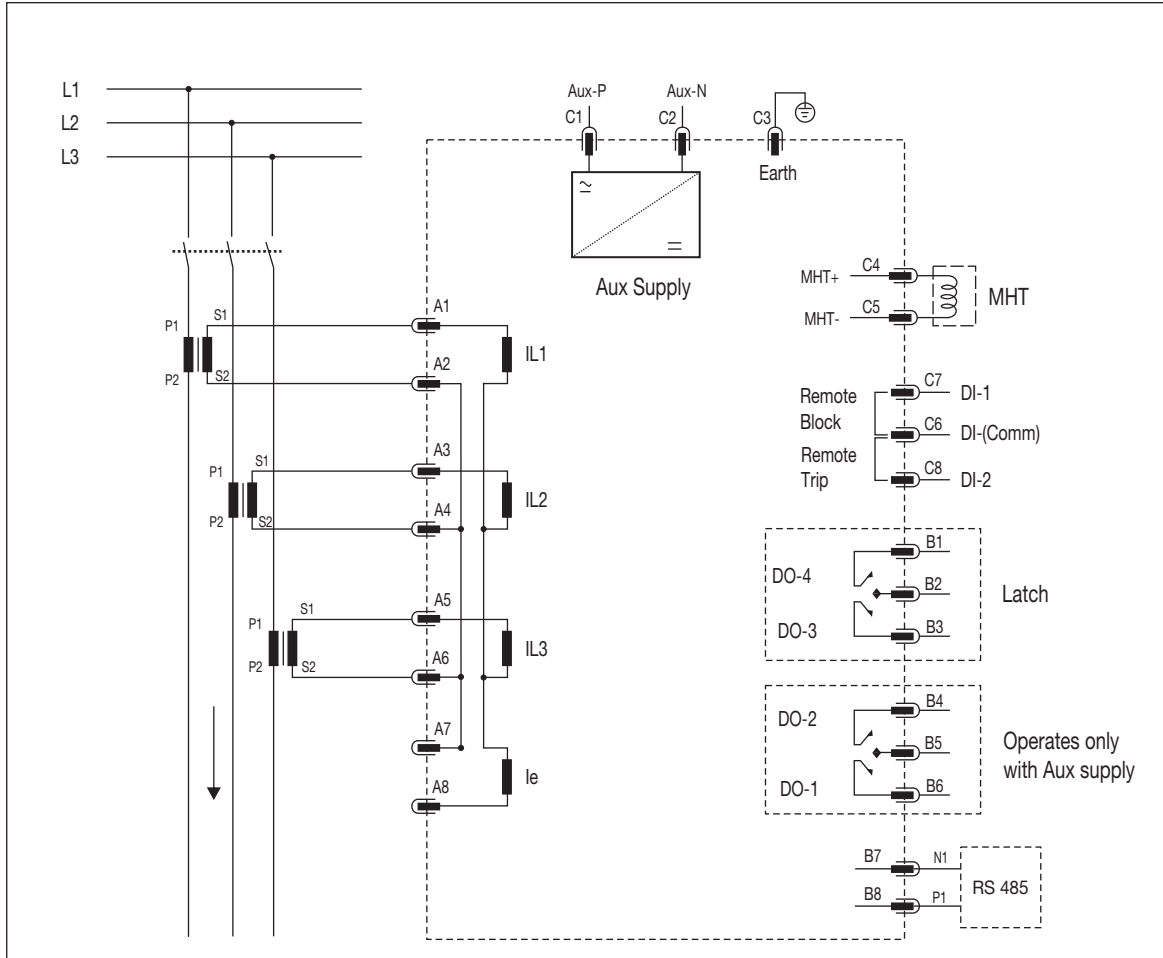


RInverse



HV-fuse

9) Connection Diagram

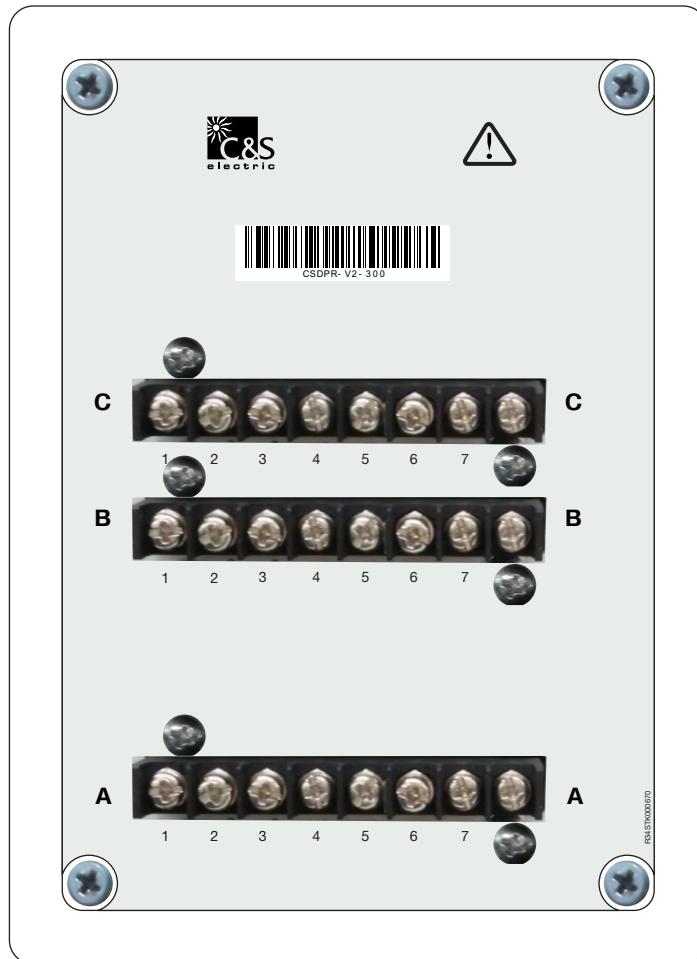


NOTE: “While doing the HV test, don’t connect the MHT terminal (C4-C5), as internal capacitor bank could be in charged state & it can harm the circuitry”.

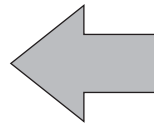
10) Terminal Description

Terminal Name	Terminal Description
A1-A2	Current Terminal for L1 Phase
A3-A4	Current Terminal for L2 Phase
A5-A6	Current Terminal for L3 Phase
A7	CT Common point
A8	Earth Terminal
B1-B2	DO-4 for all faults with (NO COM) latch contact
B3-B2	DO-3 for all faults with (NO COM) latch contact
B4-B5	DO-2 assignable relays with (NO COM) contact (with Aux Supply)
B6-B5	DO-1 assignable relays with (NO COM) contact (with Aux Supply)
B7-B8	RS-485 Modbus Terminal ((B8)P1-(B7)N1)
C1-C2-C3	Aux. Supply (Aux-P(C1), Aux-N(C2), Earth(C3))
C4-C5	MHT (C4(+) - C5(-))
C6	Digital Input (DI-(Comm.)) common for DI-1 & DI-2
C7	Digital Input (DI-1) for Remote Block
C8	Digital Input (DI-2) for Remote Trip

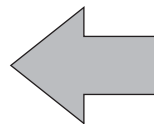
11) Back View of the Relay



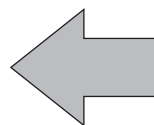
12) Battery changing Procedure



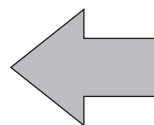
Remove the Battery cover by twisting it on the left side as shown in the Left image.



Remove the Sticker placed on Battery to start the unit with Battery.



Replace the prescribed 1/2 AA size suitable battery with the new one.

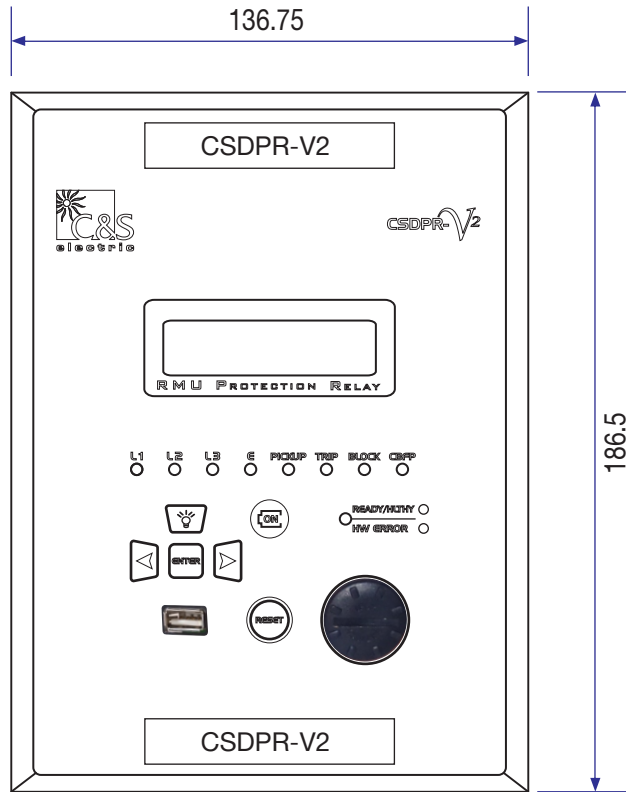


Close the Battery cover by twisting it on the right side as shown in the Left image.

13) Dimension Details of the Relay

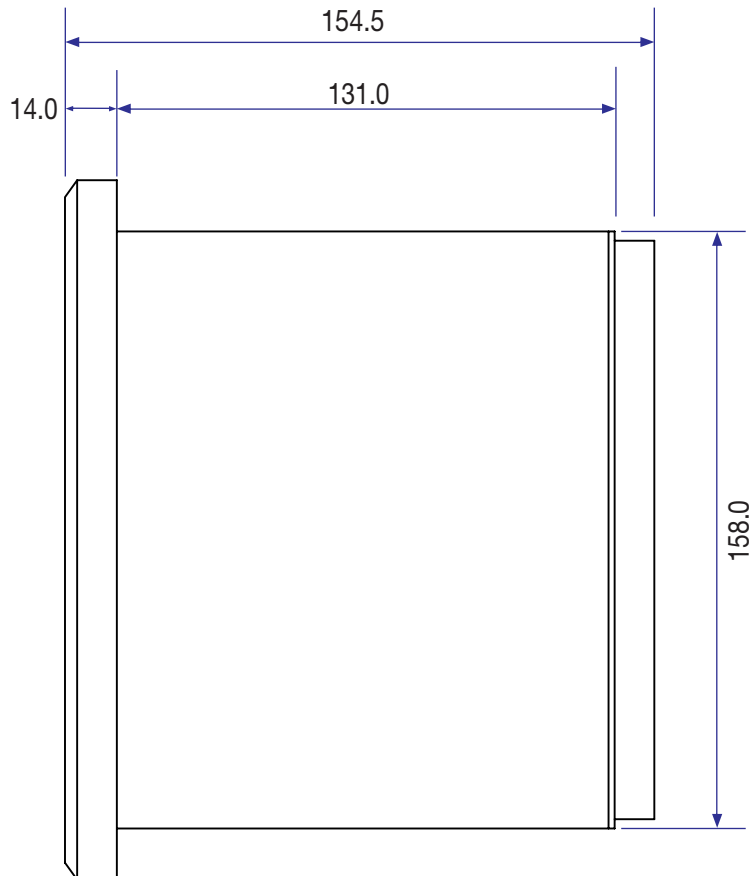
All the dim are in mm (Gen. Tol $\pm 1.0\text{mm}$)

Front View



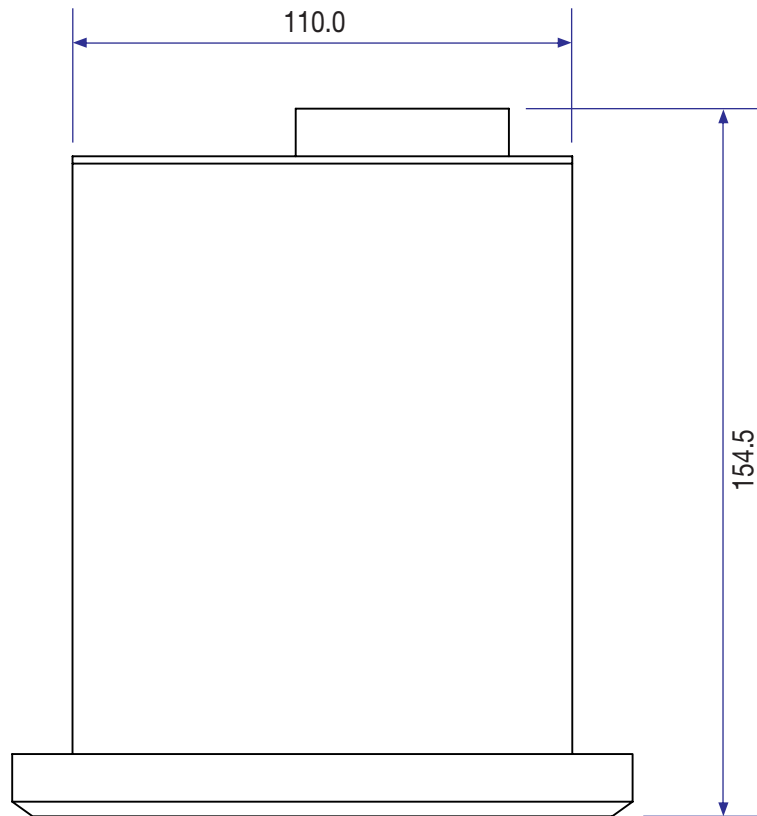
(Figure 10)

Side View



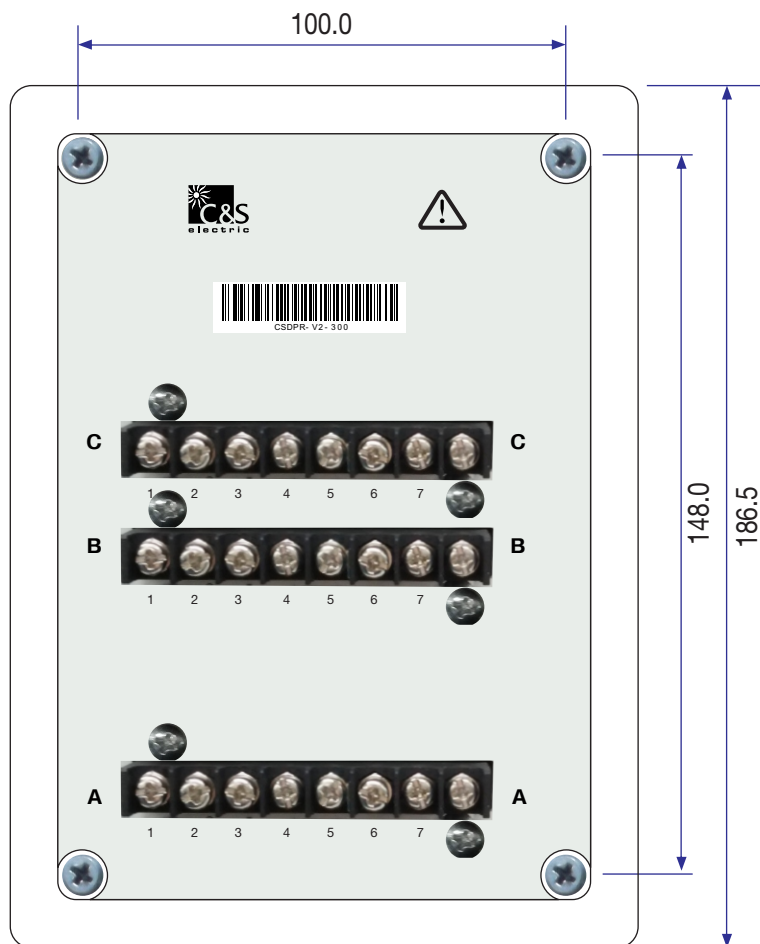
(Figure 11)

Top View



(Figure 12)

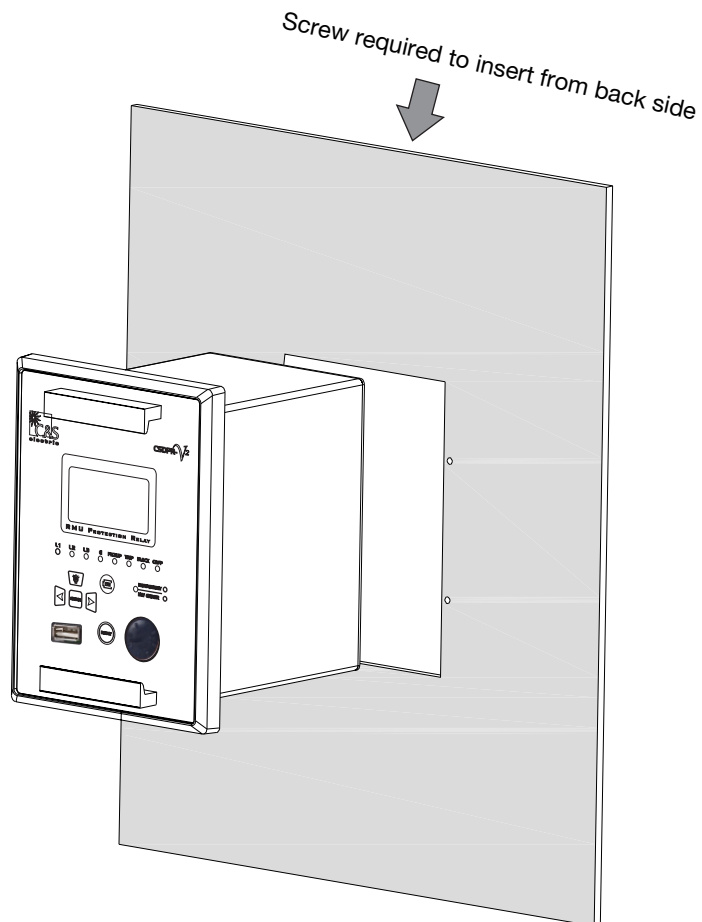
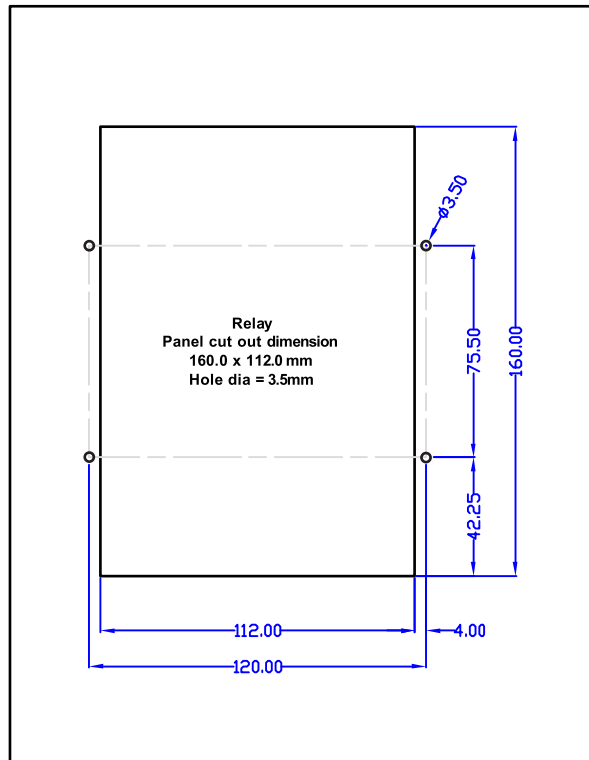
Back View



(Figure 13)

14) Panel mounting Details

Panel cut out Dimension: HeightxWidth=160x112mm Screw : M3, Qty : 04 Nos.



15) Ordering Information

